SUMMER – 19 EXAMINATION

Subject Name: MMP **Model AnswerSubject Code:** 17306

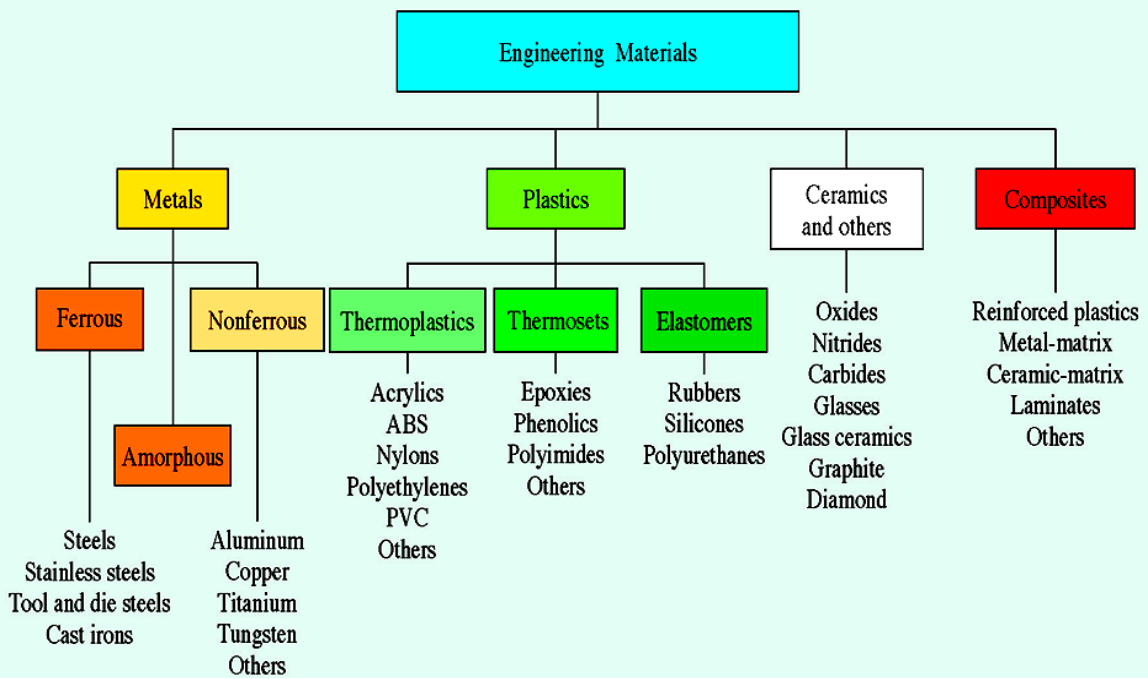
Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for anyequivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	(a)	**Attempt any SIX of the following**	**12**
	(i)	**State any four properties of Copper**	**02**
	Ans	***(Any Four Properties ½ mark each)*** **Properties :-** 1) Soft, ductile, malleable 2) Excellent resistance to corrosion 3) Non magnetic 4) Good machinability 5) Can be brazed ,soldered or welded 6) Resistance to fatigue and abrasion 7) High thermal and electrical conductivity	*Any Four Properties ½ mark each*
	(ii)	**Define Ceramic. Write its properties**	**02**
	Ans	***(Definition 01 Mark, Any Two Properties - ½ Marks Each)*** **Ceramics:** A ceramic is "an inorganic, non-metallic solid that is prepared from powdered materials and is fabricated into products through the application of heat" **Following are the properties of Ceramic Material:** I Brittle material. ii. Insulation to flow of electric current iii. Withstand at high temperature. iv. Hardness v. Corrosion resistance vi. Opaque to light	*Definition 01 Mark, Any Two Properties ½ Marks Each*
	(iii)	**Give the composition of White Cast Iron. State any two application of it.**	**02**
	Ans	***(Composition 01 Mark and any two applications ½ mark each)*** **Composition:**	*Composition 01*

		White Cast Iron- C = 1.75 - 2.3%, Si = 0.85 - 1.2%, Mn = 0.1 - 0.4%, S = 0.12 - 0.35%, P = 0.05 - 0.2% **Applications:** Wearing Plates, Road RollerSurface, Grinding Balls, Dies and ExtrusionNozzles.	*Mark and any two applications ½ mark each*
	(iv)	**State any two applications of Bronze and aluminum.**	**02**
	Ans	***(Any two application of each 01Mark)*** **Applications of Bronze:** (1)Manufacturing of Springs, Fasteners, And Bolts, (2) Valves (3) Pipe Fitting (4) Pumps (5) Gears (6)Valve Plates (7) Pump Casings **Applications of Aluminum:** (1)Cans, (2)Foils, (3)Kitchen Utensils,(4)Window Frames, (5)Beer Kegs and (6)Aero plane Parts	*Any two application of each 01 Mark*
	(v)	**Name basic types of rubbers.**	**02**
	Ans	***(Any Two – 01 Mark Each)*** **Basic Types of Rubber:** 1. Natural rubber (NR) 2. Synthetic rubber, 3. Different types of synthetic rubbers are: i. Styrene-butadiene rubber (SBR) ii. Butyl rubber iii. Nitrile rubber. iv. Silicone (SIL) v. Neoprene (CR) vi. Butadine (NBR)	*Any Two types 01 Mark Each*
	(vi)	**Differentiate between CI and Steel.**	**02**
	Ans	***(Any two Points 01 Mark each)***	*Any Two Points 01 Mark Each*

CAST IRON	STEEL
Cast Iron is an alloy made from Iron and Carbon with a weight percentage around 2-4% along with Silicon and carbide impurities.	Steel is mainly made of Iron alloying with a controlled amount Carbon roughly around 2%.
More brittle due to more carbon content	Stronger than CI
Less ductile	More ductile
Low melting point	High melting point
Cast Iron is easy to cast as it has a lower melting point.	Steel is harder to cast.
Cast Iron is cheaper.	Steel is more expensive and often comes in various grades.
Cast Iron breaks easily, and it cracks at the point of impurities.	Steel doesn't break that easily and is malleable.

		Cast Iron has higher compressive strength. | Steel has higher tensile strength.	
	(vii)	**Define thermoplastic. Give two example**	**02**
	Ans	**(Definition 01 Mark, Any Two Example - ½ Marks Each)** **Thermoplastics:** Plastics which can be easily softened again and again by heating. They can be reprocessed safely. They retain their plasticity at high temperature. They can be heated and reshaped by pressing many times. On cooling they become hard. They can be easily shaped into tubes, sheets, films and many other shapes as per the need. **Examples of Thermoplastics:** 1. Copper wire insulation 2. Water tubes 3. Polystyrene, 4. PVC 5. Polyethylene 6. Copper wire insulation, 7. Water tubes, 8. Nursing bottles, 9. Ice cube trays, 10. Toys, 11. Combs, 12. Photographic films, 13. Hose etc.	*Definition 01 Mark, Any Two Example ½ Mark Each*
	(viii)	**Write importance to study phase diagram.**	**02**
	Ans	***(Correct Answer 02 Marks)*** These diagrams are used to find out the amount of phases existing in a given alloy with theircomposition at any temperature. It also helps in understanding the phenomenon that occurs during rapidheating and cooling of the alloy.	*02 Marks*
1	(b)	**Attempt any TWO of the following**	**08**
	(i)	**Classify engineering materials. Write example of each.**	**04**
	Ans.	*(Classification 02 Marks & Examples 02 Marks)* **Engineering materials are classified as below:**  	*Classification 02 Marks & Examples 02 Marks*
	(ii)	**Describe different alloys of aluminum. Explain any two composition and applications.**	**04**

	Ans.	***(List of Aluminum Alloys – any four =01 Mark, composition any two 01 Mark each its application of ½ Mark each)*** **Different Alloys of Aluminum are:** (1) Alnico (aluminum, nickel, copper) (2) Birmabright (aluminum, magnesium) (3) Duralumin (copper, aluminum) (4) Hindalium (aluminum, magnesium, manganese, silicon) (5) Magnalium (5% magnesium) (6) Magnox (magnesium oxide, aluminum) (7) Nambe (aluminum plus seven other unspecified metals) (8) Silumin (aluminum, silicon) (9) Titanal (aluminum, zinc, magnesium, copper, zirconium) **(1) Y-alloy:** **Composition:** Aluminum with 3.5 to 4.5 %Cu, 1.8 to 2.3 %Ni and 1.2 to 1.7 %Mg.. **Application:** Piston and other components of aero engines. It is also largely used in the form of sheets and strips. **(2) Duralumin:** **Composition:** 3.5-4.5%Cu, 0.4-0.7%Mn, 0.4-0.7%Mg and aluminum the remainder **Application:** It is widely used in wrought condition for forging, stampings, bars, sheets, tubes and rivets.	*List of Aluminum Alloys Any four 01 Mark, composition any two 01 Mark Each its application of ½ Mark each*
	(iii)	**Explain alloy steel. State effect of any four alloying elements on the properties of steel.**	**04**
	Ans.	***(Meaning of Alloy Steel 01 Mark & Effect of Any Three Alloying elements On Its Properties 01 Mark Each)*** **Alloy Steel:** Alloy steel is steel that is alloyed with a variety of elements in total amounts between 1.0% and 50% by weight to improve its mechanical properties **Effect of alloying elements on the properties of steel:** **(1) Carbon (C):** The most important constituent of steel. It raises tensile strength, hardness, and resistance to wear and abrasion. It lowers ductility, toughness and machinability. **(2) Chromium (Cr):** Increases tensile strength, hardness, hardenability, toughness, resistance to wear and abrasion, resistance to corrosion, and scaling at elevated temperatures. **(3) Cobalt (Co):** Increases strength and hardness and permits higher quenching temperatures and increases the red hardness of high speed steel. It also intensifies the individual effects of other major elements in more complex steels. **(4) Columbium (Cb):** Used as stabilizing elements in stainless steels. Each has a high affinity for carbon and forms carbides, which are uniformly dispersed throughout the steel. Thus, localized precipitation of carbides at grain boundaries is prevented. **(5) Copper (Cu):** In significant amounts is detrimental to hot-working steels. Copper negatively affects forge welding, but does not seriously affect arc or oxyacetylene welding. Copper can be detrimental to surface quality. Copper is beneficial to atmospheric	*Meaning Of Alloy Steel 01 Mark & Effect of Any Three Alloying elements On Its Properties 01 Mark Each*

		corrosion resistance when present in amounts exceeding 0.20%. Weathering steels are sold having greater than 0.20% Copper. **(6) Manganese (Mn):** A deoxidizer and degasifier and reacts with sulfur to improve forgeability. It increases tensile strength, hardness, hardenability and resistance to wear. It decreases tendency toward scaling and distortion. It increases the rate of carbon-penetration in carburizing. **(7) Molybdenum (Mo):** Increases strength, hardness, hardenability, and toughness, as well as creep resistance and strength at elevated temperatures. It improves machinability and resistance to corrosion and it intensifies the effects of other alloying elements. In hot-work steels and high speed steels, it increases red-hardness properties. **(8) Nickel (Ni):** Increases strength and hardness without sacrificing ductility and toughness. It also increases resistance to corrosion and scaling at elevated temperatures when introduced in suitable quantities in high-chromium (stainless) steels. **(9) Phosphorus (P):** Increases strength and hardness and improves machinability. However, it adds marked brittleness or cold-shortness to steel. **(10) Silicon (Si):** A deoxidizer and degasifier. It increases tensile and yield strength, hardness, forgeability and magnetic permeability. **(11) Sulfur (S):** Improves machinability in free-cutting steels, but without sufficient manganese it produces brittleness at red heat. It decreases weldability, impact toughness and ductility. **(12) Tantalum (Ta):** Used as stabilizing elements in stainless steels. Each has a high affinity for carbon and forms carbides, which are uniformly dispersed throughout the steel. Thus, localized precipitation of carbides at grain boundaries is prevented. **(13) Titanium (Ti):** Used as stabilizing elements in stainless steels. Each has a high affinity for carbon and forms carbides, which are uniformly dispersed throughout the steel. Thus, localized precipitation of carbides at grain boundaries is prevented. **(14) Tungsten (W):** Increases strength, wear resistance, hardness and toughness. Tungsten steels have superior hot-working and greater cutting efficiency at elevated temperatures. **(15) Vanadium (V):** Increases strength, hardness, wear resistance and resistance to shock impact. It retards grain growth, permitting higher quenching temperatures. It also enhances the red-hardness properties of high-speed metal cutting tools.	
2		**Attempt any FOUR of the following**	**16**
	(a)	**Draw Iron-Iron Carbide phase equilibrium diagram and label it with critical temperature.**	**04**
	Ans.	**(Diagram 02 Marks, Labelling 02 Marks)**	*Diagram 02 Marks, Labelling 02*

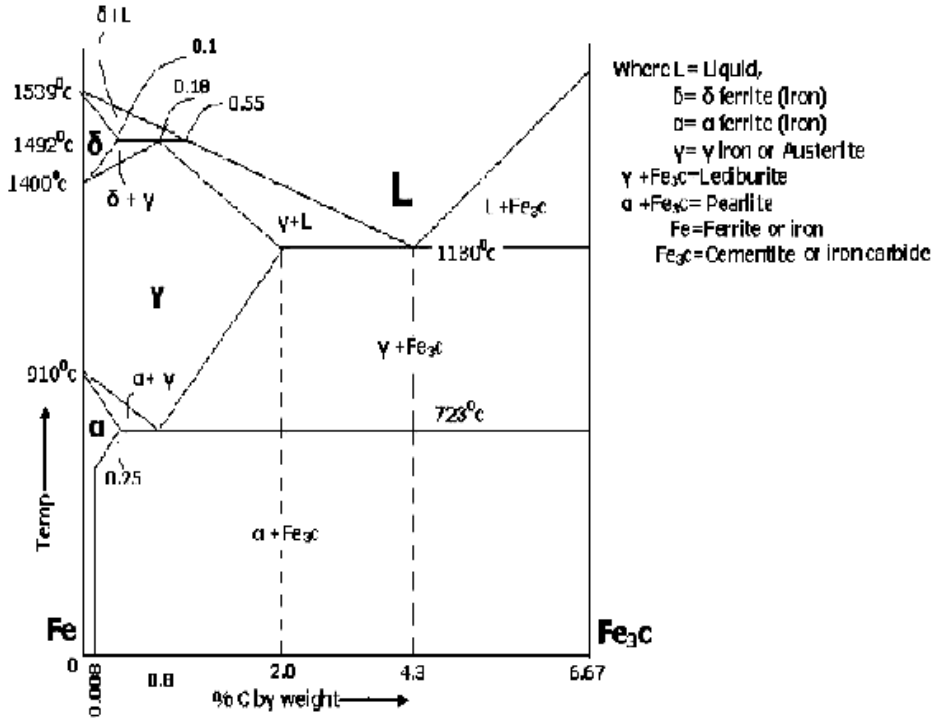


Fig. Iron-Iron Carbide Phase Equilibrium Diagram

Marks

(b) Differentiate between Annealing and Normalizing. **04**

Ans. ***(Any Four Points 01 Mark each)***

S. N	Annealing	Normalizing
1	Less hardness, toughness	Slightly more hardness, toughness
2	For plain carbon steel the microstructureshows pearlite	Microstructure shows more pearlite
3	Pearlite is coarse and usually gets resolvedby the optical microscope.	Pearlite is fine and appears unresolved withoptical microscope
4	Grain size distribution is more uniform	Grain size distribution is slightly less uniform.
5	Internal stresses are least.	Internal stresses are slightly more

Any Four Points 01 Mark each

(c) Explain heat treatment. Write any three purpose of it. **04**

Ans. ***(Definition 01 Mark, any three purpose 01 mark each)***

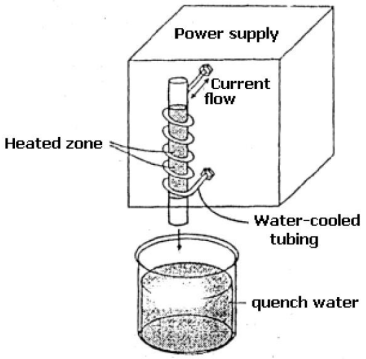
Heat Treatment:

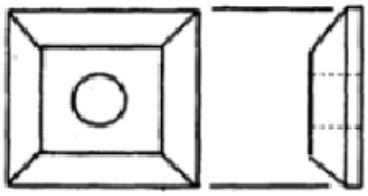
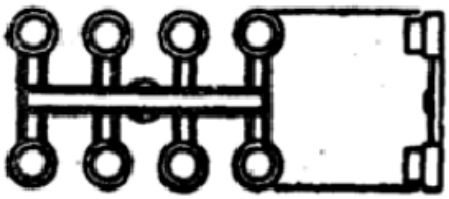
It is defined as an operation or combinations of operations involving heating and cooling of metals or alloys in its solid state with the purpose of changing the properties of the material.

OR

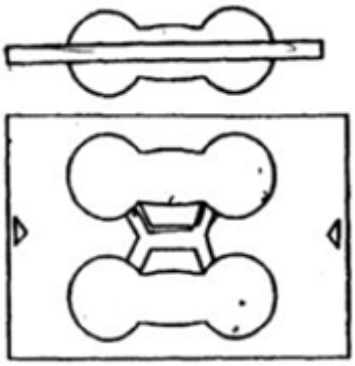
It is defined as an operation or combinations of operations involving heating and cooling of metals or alloys in its solid state to obtain desirable properties of the material.

Definition 01 Mark, any three purpose 01 mark each

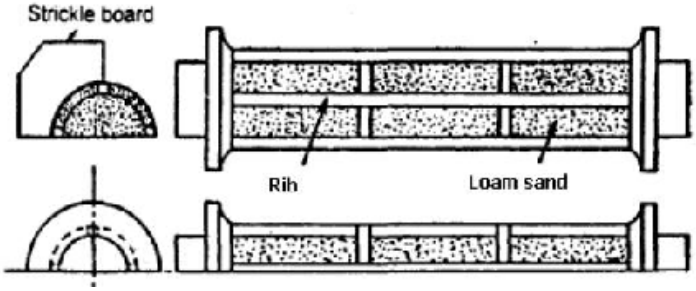
		Following are the objectives of Heat Treatment: i. To improve machinability ii. To improve mechanical properties e.g. tensile strength, ductility, hardness, shock resistance, resistance to corrosion etc. iii. To relieve internal stresses induced during hot or cold working. iv. To change or refine grain size. v. To improve magnetic and electrical properties. vi. To improve heat resistance, wear resistance. vii. To improve weldability.	
	(d)	**Explain induction hardening process.**	**04**
	Ans.	***(Explanation of induction hardening process 03 Marks and sketch 01 Mark)*** **Induction hardening process:** The process of the surface hardening by inductive heating is known as induction hardening. A high frequency current is passed through the inductor blocks which surround the surface to be hardened without actually touching it. The inductor block current induces current in the surface of the metal which the block surrounds. The induced eddy current and hysterisis losses in surface material effect the heat required. When the surface, to be hardened, is heated upto a proper length of time, the circuit is opened and water is sprayed immediately on the surface for quenching.  **Figure: Induction hardening.**	*Explanation 03 Marks and sketch 01 Mark*
	(e)	**State the advantages and disadvantages of foundry process.**	**04**
	Ans.	**(Any Two Advantages 01 Mark each, Any Two Dis advantages 01 mark each)** **Advantages of foundry process:** i. Final finishing is possible on manufactured parts. ii. Castings provide uniform directional properties. iii. Intricate shaped parts can be produced. iv. Suitable for Complicated Shapes **Disadvantages of foundry process:** i. It is not economical for batch/unit production. ii. Sand casting process cannot produce parts in accurate sizes. iii. Special casting processes are expensive. iv. In some casting process, skilled operators are required. v. Internal defects are not identified easily.	*Any Two Advantages 01 Mark each, Any Two Dis advantages 01 mark each*
	(f)	**List any four pattern materials. State any four factors for the selection of pattern material.**	**04**
	Ans.	***(List of Pattern Material ½ Mark each, Factors ½ mark each)*** **Various Materials used for making Patterns:** i. Wood ii. Metal iii. Plastic iv. Waxes	*List of Pattern*

		The selection of pattern material depends on following factors: i. Design of Casting ii. Quality of Casting iii. Shape (Intricacy) of Casting iv. Types of Moulding Process v. Types of Production of Castings vi. Moulding Material To Be Used vii. Possibility of Design Changes viii. Possibility of Repeat Orders. ix. Casting Design Parameters x. Number of Castings to be Produced xi. Shape ,Complexity & Size of Casting xii. Type of Moulding Materials xiii. Service Requirements, e.g. Quantity, Quality and Intricacy Of Castings, Minimum Thickness Desired, Degree of Accuracy and Finish Required	*Material ½ Mark each, Factors ½ mark each*
3		**Attempt any FOUR of the following**	**16**
	(a)	**Explain any two types of patterns with neat sketch.**	**04**
	Ans.	***(Explanation of Any two types with neat sketch 02 Mark each)*** **Types of patterns** 1. Single piece pattern 2. Split pattern 3. Match plate pattern 4. Cope and drag pattern 5. Gated pattern 6. Sweep pattern 7. Loose piece 8. Follow board pattern Skeleton pattern 9. Segmental pattern 10. Shell pattern 11. Built-up pattern 12. Box-up pattern 13. Lagged-up pattern 14. Left & right hand **1. Solid or single piece pattern:** It is made in one piece and carries no joints, partition or loose pieces.  **2. Split or two piece patterns:** They are made in two parts and these two parts of the pattern are joined together with the help of dowel pins.  **3. Gated pattern:** They are used in mass production for such castings multi – cavity moulds are prepared by gate former.  **4. Match plate pattern:** A match plate pattern is a split pattern having the cope and drags portions mounted on opposite sides of a plate (usually metallic),	*Explanation of Any one type 01 Mark And its neat sketch 01 Mark each*

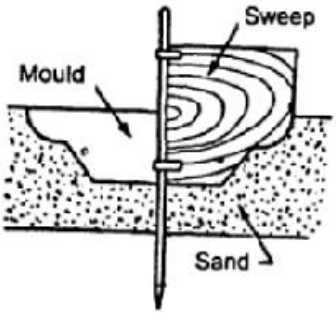
called the “match plate”.



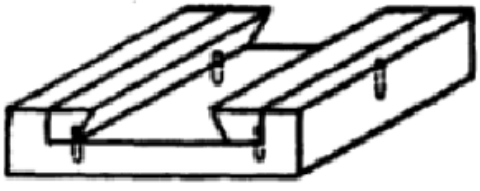
5. Skeleton pattern: These are simple wooden frames that outline the shape of the part to be cast.



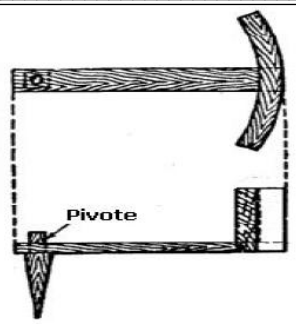
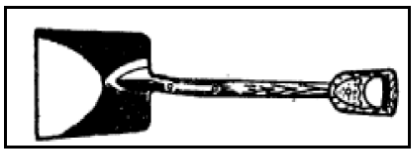
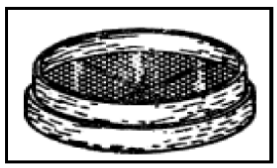
6. Sweep pattern: A sweep is a section or board (wooden) of proper contour that is rotated about one edge

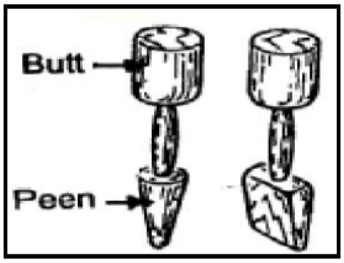


7. Loose piece pattern: Some patterns usually single piece are made to have loose pieces in order to enable their easy with drawl from the mould.

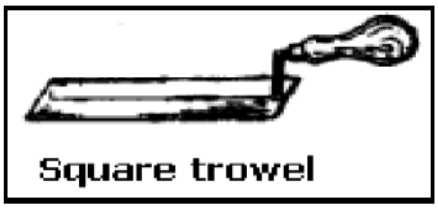


8. Segmental pattern: The segmental pattern is in the form of a segment, and is used for Molding parts having circular shapes

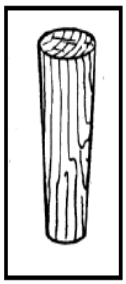
			
	(b)	**Write the colour coding of the patterns.**	**04**
	Ans.	***(Correct Meaning of any four codes : 01 Mark each)*** The colour codes are given for identification of the parts of patterns and core boxes. 1. Surface to be left unfinished are to be painted black 2. Surfaces to be finished are painted by red colour. 3. Seats for loose pieces are marked by red strips on yellow background 4. Core prints are painted by yellow colour. 5. Stop-offs is marked by diagonal black strips on yellow background.	*Correct Meaning 01 Mark each*
	(c)	**Draw any two moulding tools. Write their application.**	**04**
	Ans.	**(Any 2 moulding tools – sketch– 2 marks (1mark each), Applications - 2 marks (1mark each)** Foundry tool & equipment may be classified into three groups namely, hand tools, flasks and mechanical tools. **MouldingTools:** The hand tools a moulder uses are fairly numerous. A brief description of the most important tools is given here. **Shovel:** A shovel (Fig.1) is used for mixing and tempering moulding sand and for moving the sand from the pile to the flask.  (Fig. 1)  (Fig. 2) **Riddle:** A riddle, sometimes called a screen, consists of a circular or square wooden frame fitted with a standard wire mesh at the bottom as shown in Fig. 2. It is used for removing foreign materials such as nails, shot metal, splinters of wood, etc., from the moulding sand. **Rammer:** A hand rammer (Fig.3) is a wooden tool used for packing or ramming the sand into the mould. One end, called the peen, is wedge shaped, and the opposite end, called the butt, has a flat surface.	*Any two moulding tools sketch 02 marks* ***(01mark each)*** *Applications 02 marks* ***(01mark each)***



(Fig. 3)



(Fig. 4)



(Fig. 5)

Trowel: A trowel consists of a metal blade fitted with a wooden handle (Fig.4). Trowels are employed in order to smooth or sleek over the surfaces of moulds. A moulder also uses them in repairing the damaged portions of a mould.

Sprue pin: A sprue is a tapered peg (Fig.5) pushed through the cope to the joint of the mould. As the peg is withdrawn it removes the sand, leaving an opening for the metal. This opening is called the sprue through which the metal is poured. The sprue pin forms the riser pin.

Bellow: Bellows are used to blow loose particles of sand from the pattern and the mould cavity. A hand blower is shown in (Fig.6). Moulding machines are also provided with a compressed air

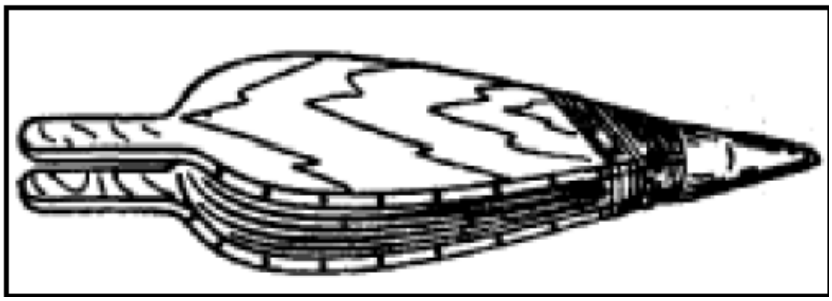


Fig 6

Moulding boxes:

Sand moulds are prepared in specially constructed boxes called flasks. The purpose of the flask is to impart the necessary rigidity and strength to the sand in moulding. They are usually made in two parts, held in alignment by dowel pins. The top part is called the cope and the lower part the drag. If the flask is made in three sections, the centre is called the cheek. These flasks can be made of either wood or metals depending upon the size required. Two types of flasks are used in a foundry: (1) the snap flask, and (2) the tight or box flask. A snap flask (Fig.7) is made with the hinge on one corner and a lock on the opposite corner so that the flask may be removed from the mould before it is poured. The snap flask is of advantage in that many moulds can be made for the same pouring from a single flask.

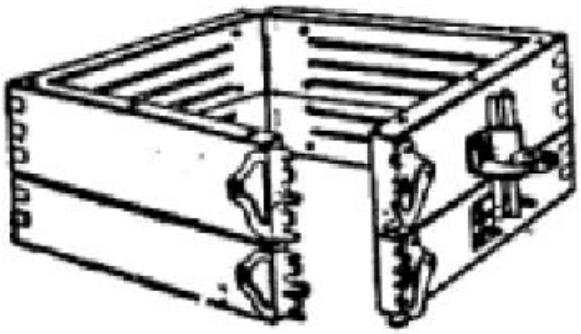


Fig. &

	(d)	**List different types of moulding sands. Explain any one in brief.**	**04**
	Ans.	***(Any four types of sand – ½ Marks each and explanation of any one 02 Marks)***	

According to Composition:

Natural or Green sand: It is obtained from river bed, dug from pits, crushing & milling of rocks etc. The requirements of these sands are satisfied by IS: 3343-1965, which has classified them into three grades A, B and C according to their clay content and sintering temperature.

Clay Percentage	Grade A	Grade B	Grade C
	5-10	10-15	15-20
Sintering Temp. in ^{0} C	1350-1450	1200-1350	1100-1200

Synthetic or high silica sand:
It is obtained from crushing quartzite sandstone and then washing to get requisite shape and grain distribution. It is also obtained from sedimentary origin. Bentonite and water can be added to get desired strength and bonding properties.

Special sand:
Zircon, Olivine, Chromite and Chrome-magnesite are often used as special sands. Zircon sands are suitable for cores of brass and bronze casting. Olivine sands are suitable for non- ferrous castings of an intricate shape. Chamotte is suitable for heavy steel casting.

According to Use:

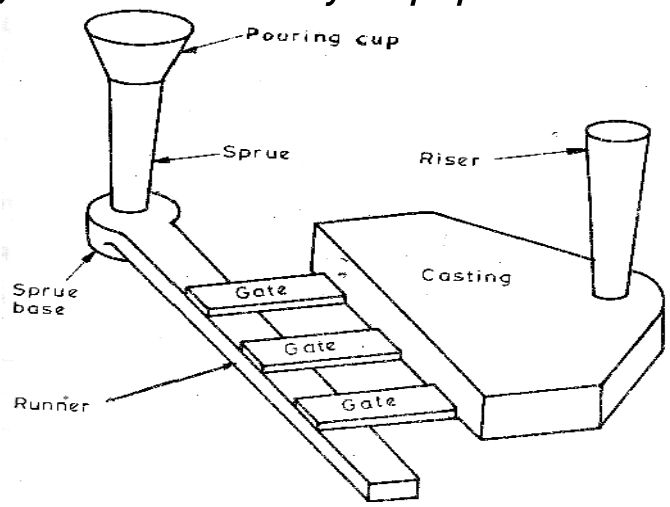
Green sand:
It is a mixture of silica sand with 18 to 30 per cent clay, having a total water of from 6 to 8 per cent. The clay and water furnish the bond for green sand. Moulds prepared in this sand are known as green sand moulds.

Dry sand:
Green sand that has been dried or baked after the mould is made is called dry sand. They are suitable for larger castings. Moulds prepared in this sand are known as dry sand moulds.

Loam sand:
Loam sand is high in clay, as much as 50 per cent or so, and dries hard. This is particularly employed for loam moulding usually for large castings.

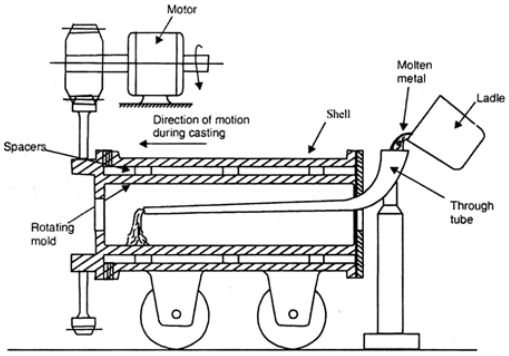
Facing sand:
Facing sand forms the face of the mould. It is used directly next to the surface of

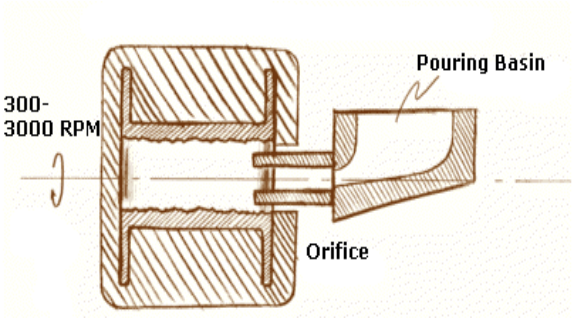
Any Four types of sand ½ Mark each and *explanation of any one Sand 02 Marks*

		the pattern and it comes into contact with the molten metal when the mould is poured. It is made of silica sand and clay, without the addition of used sand. **Backing sand:** Backing sand or floor sand is used to back up the facing sand and to fill the whole volume of the flask. Old, repeatedly used moulding sand is mainly employed for this purpose. The backing sand is sometimes called black sand because of the fact that old, repeatedly used moulding sand is black in colour due to the addition of coal dust and burning on coming m contact with molten metal. **System sand:** The used-sand is cleaned and reactivated by the addition of water, binders and special additives. This is known as system sand. Since the whole mould is made of this system sand the strength, permeability and refractoriness of the sand must be higher than those of backing sand. **Parting sand:** Parting sand is used to keep the green sand from sticking to the pattern and also to allow the sand on the parting surface of the cope and drag to separate without clinging. This is clean clay-free silica sand which serves the same purpose as parting dust. **Core sand:** Sand used for making cores is called core sand, sometimes called, oil sand. This is silica sand mixed with core oil which is composed of linseed oil, resin, light mineral oil and other binding materials. Pitch or flours and water may be used in large cores for the sake of economy.	
	(e)	**Draw neat sketch of Gating System and label it. Write any two purpose of gating system.**	**04**
	Ans.	***(Sketch 02 Mark, labels 01 Mark and any two purposes ½ Mark each)***  **Fig: Gating System** **Purpose of gating & risers in sand casting:** 1) The velocity of molten metal entering into the mould cavity should be as low as possible, so that there is no erosion of mould. 2) It should ensure the complete filling of the mould cavity. 3) It should prevent the molten metal from absorbing air or other gases while flowing through it. 4) It should prevent the formation of oxides. 5) It should prevent the entry of oxides, slag, and dross. 6) It's design should be practicable and economical	*Sketch 02 Mark, labels 01 Mark and any two purposes ½ Mark each*

		7) It is to feed the metal to the solidify casting so that shrinkage cavities are get rid of. 8) It permits the escape of air and mould gases as the mould cavity is being filled with the molten metal. 9) Full of molten metal indicates that the mould cavity has already been completely filled up with the same 10) A casting solidifying under the liquid metal pressure of the riser is comparatively sound. 11) It promotes directional solidification. 12) Fill the mould cavity completely before freezing. 13) Introduce the liquid metal into the mould cavity with low viscosity and little turbulence, so that mould erosion, metal oxidation and gas pick up is prevented 14) Help to promote temperature gradient favourable for proper directional solidification. 15) Incorporate traps for separation of non-metallic inclusions which are either introduced with the molten metal or are disclose in the gating system. 16) Regulate the rate at which liquid metal enters into the mould. 17) Be practicable and economical to make and consume least metal.	
	(f)	**Describe core and core print and their uses in foundry.**	**04**
	Ans.	***(Explanation of Core 02 Marks and Explanation of Core Prints 02 Marks)*** **Core:** A core is a device used in casting and moulding processes to produce internal cavities **Uses of Core** (1)Core is used to produce cavity or hollow portion in the casting. (2) It is also used in die casting and injection moulding. (3) It is used to produce recesses in casted parts. (4) it is used to produce an interior angle that is greater than 180° **Core print:** For supporting the cores in the mould cavity, an impression in the form of a recess is madein the mould with the help of a projection suitably placed on the pattern. This projection on the patternis known as the core print. A core print is, therefore, an added projection on a pattern, and it forms aseat which is used to support and locate the core in the mould. **Uses of core prints:** (1) It is used to support and locate the core in the mould. (2) Itis used to support the weight of the core during the casting operation.	*Explanation of Core and Core Prints 01 Mark Each and it's any two uses ½ Mark each*
4		**Attempt any FOUR of the following**	**16**
	(a)	**Explain centrifugal casting with neat sketch.**	**04**
	Ans.	***(Sketch 02 Marks and Explanation 02 Marks)*** **Centrifugal Casting:** In centrifugal casting, centrifugal force plays a major role in shaping and feeding of the casting. Inthis process mould is rotated rapidly about its central axis as the metal is poured into it.Centrifugal force is utilized to distribute liquid metal over the outer surface of the mould. Hollowcylinders and other annular shapes are formed in this way. Centrifugal force tends the poured metal andthe freezing metal to fly outward, away from the axis of rotation, and this tendency creates highpressure on the metal or casting while the lighter slag, oxides, and other inclusions being lighter, getpushed towards the centre.	*Sketch 02 Marks and Explanation 02 Marks*

The axis may be horizontal, vertical, or inclined. Casting cools and solidifies from outside towards theaxis of rotation; so it results in good directional solidification. Hence castings are free from shrinkage.It may be produced in metal or sand lined mould, depending largely upon the quantity desired.





OR

Fig. Centrifugal Casting

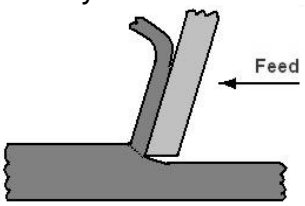
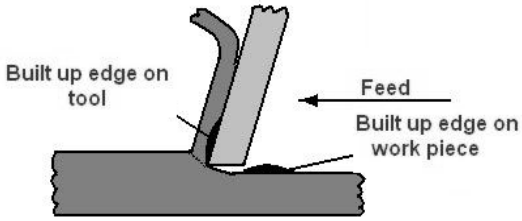
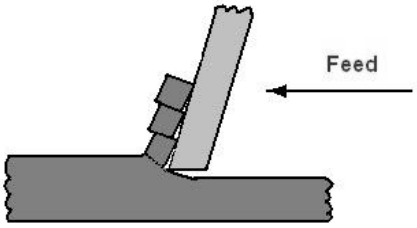
(b) Write any two defects in casting with their causes and remedies. **04**

Ans. ***(Any two defect 01Mark Each and its any two causes1/2 Mark Each and its any two remedies 1/2 Mark each)***

S. N.	Casting Defects	Causes	Remedies
1	**Shifts:**	Core misplacement or mismatching of top and bottom parts of the casting usually at a parting line. Misalignment of flasks is another likely cause of shift.	By ensuring proper alignment of the pattern or die part, moulding boxes, correct mounting of patterns on pattern plates, and checking of flasks, locating pins, etc. before use.
2	**Warpage:**	Different rates of solidification different sections of a casting, stresses are set up in adjoining walls resulting in warpage in these areas. Large and flat sections or intersecting sections such as ribs are particularly prone to warpage.	Is to produce large areas with wavy, corrugated construction, or add sufficient ribs or rib-like shapes, to provide equal cooling rates in all areas; a proper casting design can go a long way in reducing the warpage of the casting.
3	**Swell:**	Improper or defective ramming of the mould.	To avoid swells, the sand should be rammed properly and evenly.
4	**Blowholes:**	Excessive moisture in the sand, or when permeability of sand is low, sand grains are too fine, sand is rammed too hard, or when venting is insufficient.	To prevent blowholes, the moisture content in sand must be well adjusted, sand of proper grain size should be used, ramming should not be too hard and venting should be

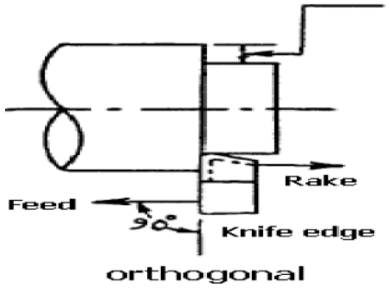
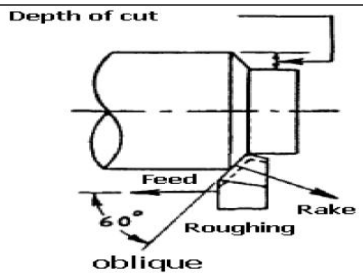
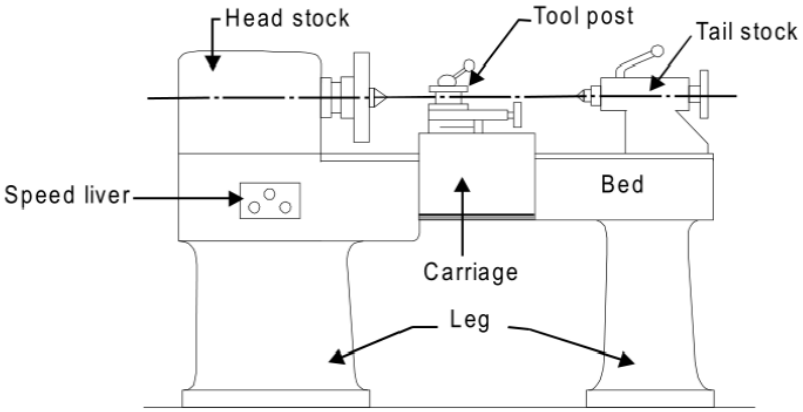
Any two defect 01 Mark Each and its any two causes 1/2 Mark Each and its any two remedies 1/2 Mark each

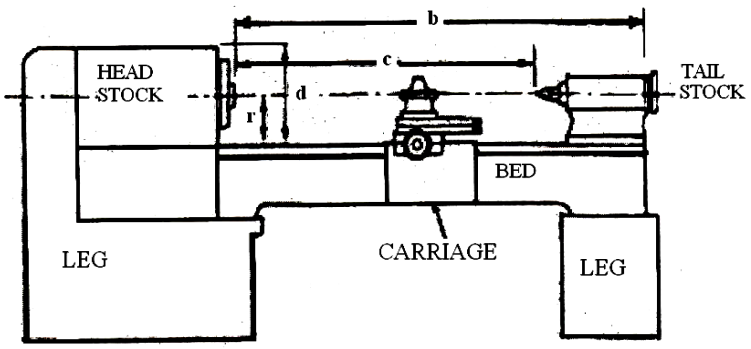
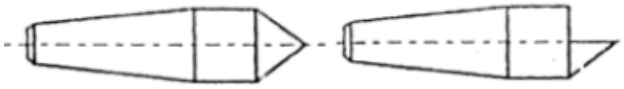
			adequate.
5	**Drop:**	Low strength and soft ramming of the sand, insufficient fluxing of molten metal and insufficient reinforcement of sandprojections in the cope.	The given factors are eliminated to avoid drop.
6	**Shrinkage:**	Wrong Risering and chilling	Ensure proper directional solidification by modifying risering and chilling.
7	**Misruns and cold shuts**	Improper pouring temperature, Wrong design of gating system.	Adjust proper pouring temperature, Modify design, Modify gating system.
8	**Inclusions**	Wrong design of gating system, Improper sand, loose ramming, inadequate flux.	Improve or modify gating and pouring, Use a superior sand, Provide harder ramming, Use proper flux
9	**Hot Tears**	Improper Collapsibility of sand, Avoid hard ramming	Improve collapsibility, Modify design, Provide soft ramming
10	**Cuts and Washes**	Improper Collapsibility of sand, Avoid hard ramming	Improve collapsibility, Modify design, Provided soft ramming
11	**Metal Penetration**	Coarse grain of sand, Loose ramming, low strength of sand, improper pouring temperature.	Use sand having finer grain size, Provide harder ramming, Increase the strength of sand, Adjust the proper pouring temperature
12	**Fusion**	Improper refractoriness, high pouring temperature, coarser grain of facing sand	Modify refractoriness, Use lower pouring temperature, Improve quality of facing sand
13	**Shot Metal**	Low pouring temp., improper gating system, more sulphur content in molten metal.	Use higher pouring temperature, Reduce sulphur content, Modify gating system
14	**Shard Spots** .	Incorrect metal composition, Wrong Casting design	Suitable change in the metal composition, Modify the casting design
15	**Run outs**	Defective molding boxes, wrong techniques used	Improve moulding technique, Change the defective moulding boxes.
1	**Crushes**	Damaged core boxes, core	Repairs or replace core

		6		prints and cores	boxes Repairs or replace core prints, Proper setting of cores.
	(c)	**State different types of chips. Explain any one with sketch.**			**04**
	Ans.	***(Types of chips –01 mark , chips sketch – 1 ½ marks, explanation -1 ½ mark)*** 1. The continuous or ribbon type 2. The continuous with built-up edge. 3. The discontinuous or segmental form. **Continuous chips** Machining of ductile materials produce these types of chips. Continuous fragments are produced because of high ductility of material. Chips are difficult to handle.  **Continuous chips with built-up edge (BUE)** When machining ductile material, conditions of high local temperature and extreme pressure in the cutting zone and also high friction in the tool-chip interface, may cause the work material to adhere or weld to the cutting edge of the tool forming BUE. BUE changes its size during cutting operation. It protects the cutting edge but it changes the geometry of the tool.  **Discontinuous or segmental chips** Machining of brittle materials **like cast iron** produce these types of chips. Small fragments are produced because of lack in ductility of material. Friction between tool and chip reduces, resulting in better surface finish.  **Fig. Segmental chips / discontinuous chips**		*Types of chips 01 mark , & Any one chips sketch 1 ½ marks, & its explanation -1 ½ mark*
	(d)	**Distinguish the following as Single Point Cutting Tool or Multi- Point Cutting Tool** **(i)Boring Tool (ii)Turning Tool (iii)Grinding Wheel (iv)Milling Cutters**			**04**
	Ans.	(i)Boring Tool : Single Point Cutting Tool (ii)Turning Tool : Single Point Cutting Tool (iii)Grinding Wheel : Multi Point Cutting Tool (iv)Milling Cutters : Multi Point Cutting Tool			*01 Mark Each*

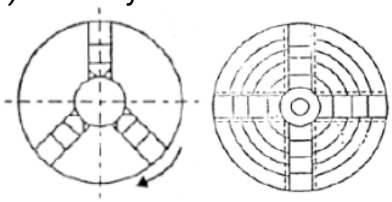
	(e)	**List any four cutting fluids. State any four properties of cutting fluids.**	**04**
	Ans.	***(Any Four - ½ mark eachand any four properties ½ Mark each)*** **Types of Cutting fluids used in machining are:-(Any four ½ mark each)** (1) Water (2) Soluble oils (3) Straight oils (4) Chemical compounds (5) Solid lubricants (6) Chemical additive oil. **Properties of Cutting Fluid:** 1. High heat absorption 2. Good lubricating qualities to produce low coefficient of friction 3. Low viscosity to permit free flow of liquid 4. Non-corrosive to the work or the machine 5. High flash point so as the eliminate the hazards of fire 6. Odorless ,so as not to produce any bad smell 7. Harmless to the skin of operator 8. Transparency so that the cutting action of the tool may be observed	*Any Four Names ½ mark each and any four properties ½ Mark each*
	(f)	**Why cemented carbide is considered as an useful tool material?**	**04**
	Ans.	***(Any four reasons 01 Mark each)*** Cemented carbide is considered as an useful tool material becau**se** **(1) Its Hot hardness is high** i.e. it remain harder than the work material at elevated operating temperatures. **(2) Its Wear resistance is more i. e.** It can withstand excessive wear even though the relative hardness of the tool-work materials changes. **(3) Its Toughness is sufficient** i.e. it can withstand shocks and vibrations and prevent breakage. **(4) Its Cost is low and it is easy for fabrication**	*Any four reasons 01 Mark each*
5		**Attempt any FOUR of the following**	**16**
	(a)	**Differentiate between Orthogonal Cutting and Oblique Cutting.**	**04**
	Ans.	***(Any Four Points 01 Mark each)***	*Any Four Points 01 Mark Each*

Orthogonal Cutting	Oblique Cutting
The cutting edge of the tool is perpendicular to the cutting velocity factor	The cutting edge is inclined at an angle 'i' with the normal to the cutting velocity factor
The cutting edge clears the width of theworkpiece on either ends.	The cutting edge may not clear the width ofthe workpiece on either ends.
The chip flows over the tool face.	The chip flows on the tool face.
Only two components of the cutting forcesare acting on the tool.	Only three components of the cutting forcesare acting on the tool.

		Tool is perfectly sharp	Tool is not perfectly sharp
		Tool contacts the chip on rake face only.	The tool may not generate a surface parallelto workface.
		The maximum chip thickness occurs at themiddle.	The maximum chip thickness may not occurat the middle.
		Only one cutting edge in action	More than one cutting edges are in action
			
	(b)	**Draw a neat sketch of lathe machine and name its parts.**	**04**
	Ans.	***(Sketch 02 Marks and Labels 02 Marks)***  **Fig. Lathe Machine**	*Sketch 02 Marks and Labels 02 Marks*
	(c)	**Describe the working principle of lathe machine. Write main parameter for lathe machine specification.**	**04**
	Ans.	***(Working Principle 01 Mark And any three specification parameters 01 Mark each)*** **Working Principle:** The lathe is a machine tool which holds the workpiece between two rigid and strong supports called centers or in a chuck or face plate which revolves. ... It carries the headstock and tail stock for supporting the workpiece and provides a base for the movement of carriage assembly which carries the tool. **Lathe specification:-(3 mark)** 1. The height of the centers measured from the lathe bed. 2. The swing diameter over bed. This is the largest diameter of work that will revolve without touching the bed and is twice the height of the centre measured from the bed of the lathe.	*Working Principle 01 Mark And Any three specification parameters 01 Mark*

		3. The length between centers. This is the maximum length of work that can be mounted between the lathe centers. 4. The swing diameter over carriage. This is the largest diameter of work that will revolve over the lathe saddle, and is always less than the swing diameter over bed. 5. The maximum bar diameter. This is the maximum diameter of bar stock that will pass through hole of the headstock spindle. 6 .The length of bed. This indicates the approximate floor space occupied by the lathe **OR**  r- Centre height c- Length between centres d- Swing diameter over bed b- Length of bed	*Each*
	(d)	**Enlist any four accessories of lathe. Explain any one with sketch.**	**04**
	Ans.	***(Listing any four accessories 2 mark (½ mark each) and Explanation and sketch of any one 01 mark each)*** **Accessories of lathe:** 1. Centre 2. Chuck 3. Face plate 4. Angle plate 5. Mandrel 6. Rests 7. Carriers 8. Catch plates 9.Collets **1. Centre:** a. There are two types of centre i.e., live centre and dead centre. b. A centre which fits into the headstock spindle and revolves with the work is called live centre. c. The centre which is used in a tailstock spindle and does not revolve is called dead centre.  (a) Standard Centre (b) Half Centre **2. Chucks:** a. It is an important device used for holding and rotating the workpiece in lathes. b. The work pieces which are too short to be held between centre are clamped in a chuck. c. It is attached to the lathe spindle by means of two bolts with the back plate screwed on to the spindle nose. d. There are many types of the chuck, but the following two are commonly used. **i) Three Jaw Universal Chuck:** The three jaw universal chuck, as shown in Fig. (a) is also called self-centering chuck or scroll chuck. Thus chuck is used for holding round and hexagonal work.	*Listing Any Four accessories 02 mark (½ mark each) and Explanation and sketch of any one 01 mark each*

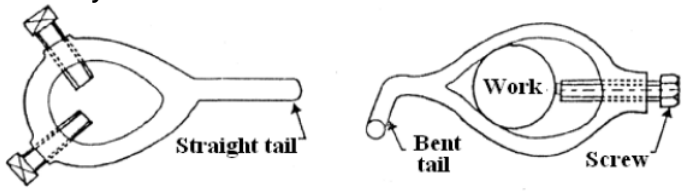
ii) Four Jaw Independent Chuck: 1. The four jaw independent chuck, as shown in Fig. (b) has four reversible jaws, each of which may be independently adjusted to accommodate the work it supports. 2. This type of chuck can hold square, round and irregular shape of work in either a concentric or eccentric position. The other types of the chucks are iii) combination chucks, iv) magnetic chuck, v) collect chuck, vi) drill chuck, and vii) air or hydraulic chuck



(a)Three Jaw Chuck (b) Four Jaw Chuck

3. Lathe Dog or Carrier:

a. The work placed on a mandrel or held between centres is rotated positively by clamping the dog or carrier to the end of the work.
b. This is engaged with a pin attached to the drive plate or face plate.
c. The lathe dog or carrier may be of straight type or bent type as shown in Fig. (a) and (b) respectively.



(a) Straight tail pipe (b) Bent tail pipe

4. Drive Plate:

a. The drive plate, as shown in Fig. is a circular plate which is bored out and threaded so that it can be attached to the spindle nose.
b. It also carries a hole for the pin which is used only when the work is held in a lathe dog having straight tail. When bent-tail dog is used, this pin is taken out and the bent portion of the tail is inserted into the hole

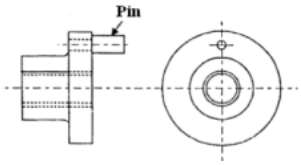


Figure: Drive Plate

5. Face Plate:

a) The face plate, as shown in Fig. is similar to drive plate except that it is larger in diameter.
b) It contains more open slots or T-slots so that bolts may be used to clamp the workpiece to the face of the plate.
c) The face plate is used for holding work pieces which can't be conveniently held in a chuck.

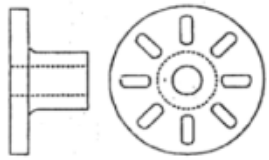


Figure: Face Plate

6. Angle Plate:

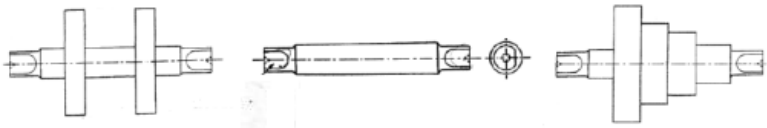
a. An angle plate is simply a cast iron plate with to faces planed at right angles to each other and having slots in various positions for the clamping bolts.

b. It. is always used with the face plate for holding such parts which can not be clamped against the vertical surface of the face plate.

7. Mandrels:

a. The lathe mandrel is a cylindrical bar with centre hole at each end. It is used to hold hollow work pieces to machine their external surface.

b. The work revolves with the mandrel which is mounted between the centres of the lathe. The various types of mandrels used for different classes of work are shown in Fig.



(1) Collar Mandrel (2) Plain Mandrel (3) Step Mandrel

	(e)	**State any four operations performed on lathe machine. Explain any one.**	**04**
	Ans.	***(Name of any four operations 02 Marks(1/2 each) and Sketch and explanation of any one 02 Marks)***	

Operations performed on lathe machine

1. Facing,
2. Plain turning,
3. Step turning,
4. Taper turning,
5. Drilling,
6. Reaming,
7. Boring,
8. Undercutting,
9. Threading,
10. Knurling.

Name of any four operations 02 Marks (1/2 each) and Sketch and explanation of any one 02 Marks

1) Facing

This operation is almost essential for all works. In this operation, as shown in Fig. the workpiece is held in the chuck and the facing tool is fed from the centre of the workpiece towards the outer surface or from the outer surface to the centre, with the help of a cross-slide.

2) Plain turning

It is an operation of removing excess amount of material from the surface of the cylindrical workpiece. In this operation, as shown in Fig. the work is held either in (lie chuck or between centres and the longitudinal feed is given to the tool either by hand or power.

3) Step turning

It is an operation of producing various steps of different diameters in the workpiece, as shown in Fig. This operation is carried out in the similar way as plain turning.

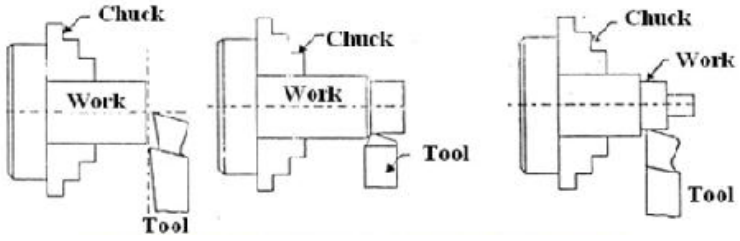


Fig. Facing Fig. Plain Turning Fig. Step Turning

4) Taper turning

It is an operation of producing an external conical surface on a workpiece. A small taper may be produced with the help of a forming tool or chamfering tool, but the larger tapers are produced by swiveling the compound rest, as shown in Fig. at the required angle or by offsetting the tailstock or by taper turning attachment.

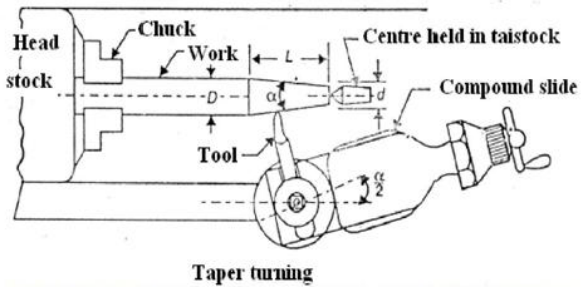


Fig. Taper Turning

5) Drilling

It is an operation of making a hole in a workpiece with the help of a drill. In this operation, as shown in Fig. the workpiece is held in a chuck and the drill is held in the tailstock. The drill is fed manually, into the rotating workpiece, by rotating the tailstock hand wheel.

6) Reaming

It is an operation of finishing the previously drilled hole. In this operation, as shown in Fig. a reamer is held in the tailstock and it is fed into the hole in the similar way as for drilling.

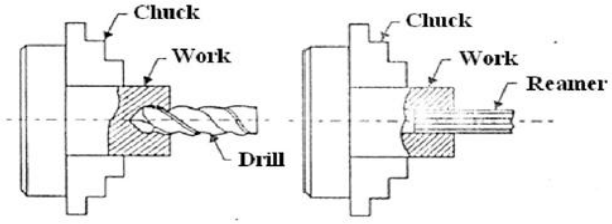


Fig. Drilling Fig. Reaming

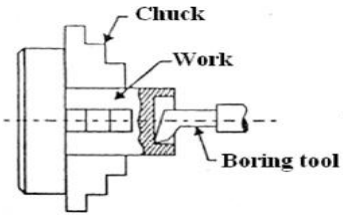
7) Boring

It is an operation of enlarging of a hole already made in a workpiece. In this operation, as shown in Fig. boring tool or a bit mounted on a rigid bar is held in the tool post and fed into the work by hand or power in the similar way as for turning.

8) Undercutting or Grooving

It is an operation of reducing the diameter of a workpiece over a very narrow

surface. In this operation, as shown in Fig. a tool of appropriate shape is fed into the revolving work up to the desired depth at right angles to the centre line of the workpiece



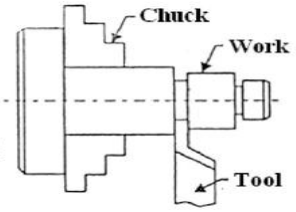


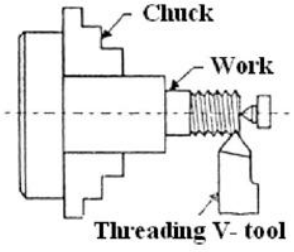
Fig. Boring **Fig. Under Cutting or Grooving**

9) Threading

It is an operation of cutting helical grooves on the external cylindrical surface of workpiece. In this operation, as shown in Fig. the work is held in a chuck or between centers and the threading is fed longitudinally to the revolving work. The longitudinal feed is equal to the pitch of the thread be cut.

10) Knurling

It is an operation of providing knurled surface on the workpiece. In this operation, as shown in Fig. a knurled tool is moved longitudinally to a revolving workpiece surface. The projections on the knurled tool reproduce depressions on the work surface.



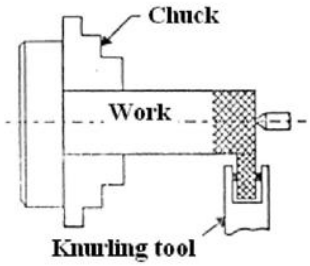
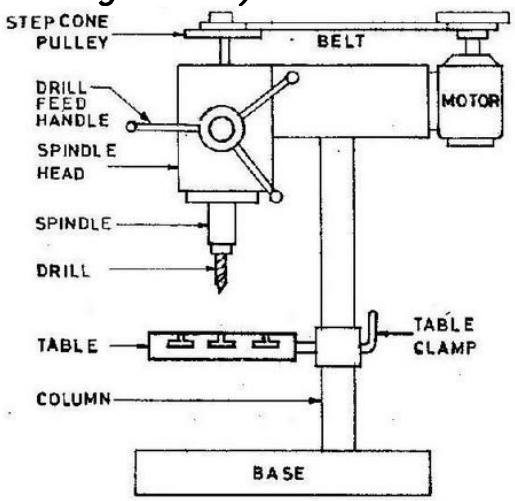


Fig. Threading **Fig. Knurling**

	(f)	**Draw a neat labelled sketch of bench drilling machine.**	**04**
	Ans.	***(Sketch 03 Marks and labelling 01 Mark)***  **Fig. Bench Drilling Machine**	*Sketch 03 Marks and labelling 01 Mark*
6		**Attempt any FOUR of the following**	**16**
	(a)	**List any four operations performed on drilling machine. Explain any one.**	**04**
	Ans.	***(Name of any four operations 02 Marks and sketch 01 Mark and explanation of any***	*Name*

one operation 01 Mark)

Operations performed on drilling machine: *(Any 04 - ½ mark each)*

1. Drilling
2. Tapping
3. Counter sinking
4. Counter boring
5. Spot facing
6. Boring
7. Reaming

1. Drilling

It is an operation of producing a circular hole in a work piece by forcing a rotating drill against it.

Fig. Drilling

2. Tapping:

The operation of producing internal thread in a predrilled hole using the tool called tap is known as tapping. Drill Size for Metric Thread = OD of Tap – Pitch of Threads.

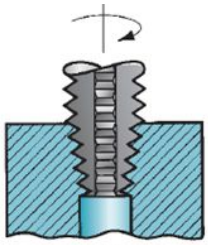


Fig. Tapping

3. Counter Sinking:

It is the operation of enlarging the end of a Predrilled hole cylindrically, for the recess for a counter-sunk rivet.

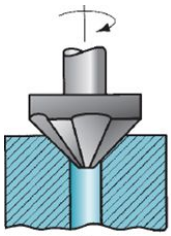


Fig. Counter Sinking

4. Counter boring:

The tool used is known as counter-bore. The enlarged hole forms a square shoulder with the original hole to accommodate the heads of bolts, studs and pins.

of any four operations 02 Marks and sketch 01 Mark and explanation of any one operation 01 Mark

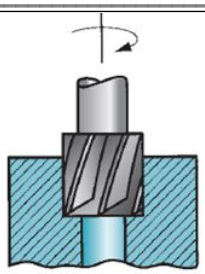


Fig. Counter Boring

5. Spot Facing:

The operation of producing a flat surface around the pre drilled hole for proper resting of washer or bolt head.

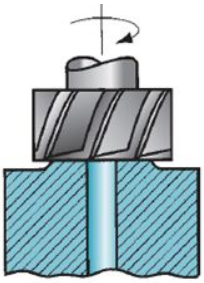


Fig. Spot Facing

6. Boring:

The operation of enlarging the diameter of predrilled or cored hole using boring tool is call boring

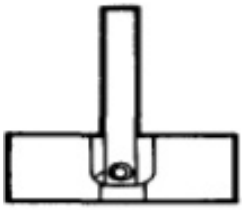


Fig. Boring

7. Reaming:

It is accurate way of sizing and finishing of a pre drilled hole using tool known as reamer

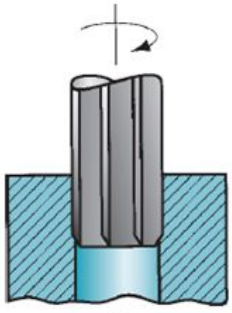
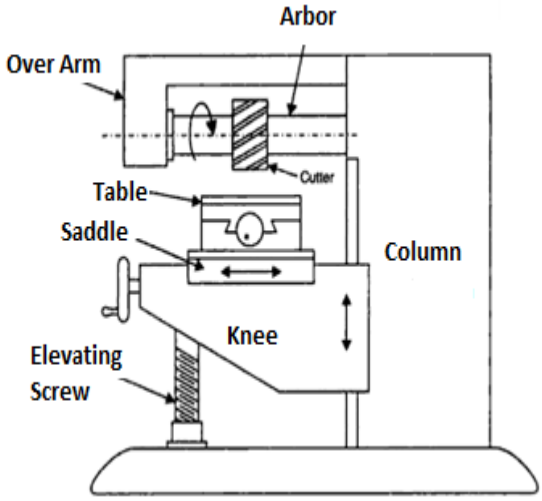
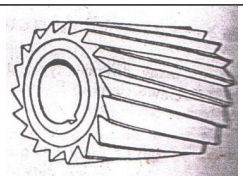
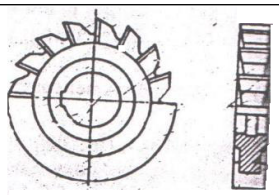
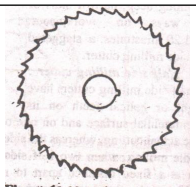
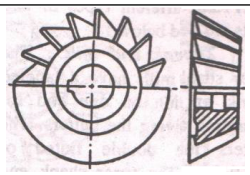
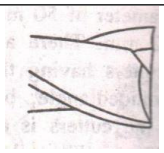
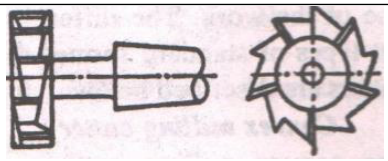
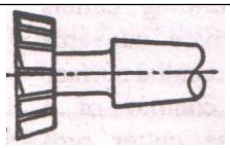
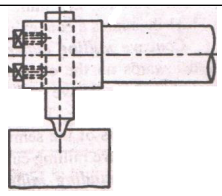
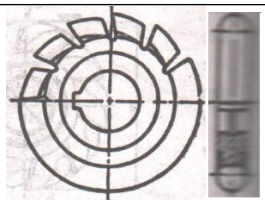


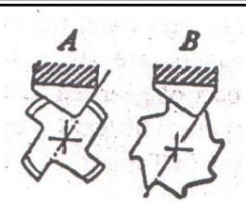
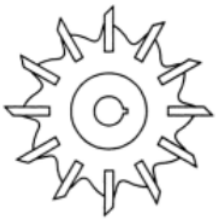
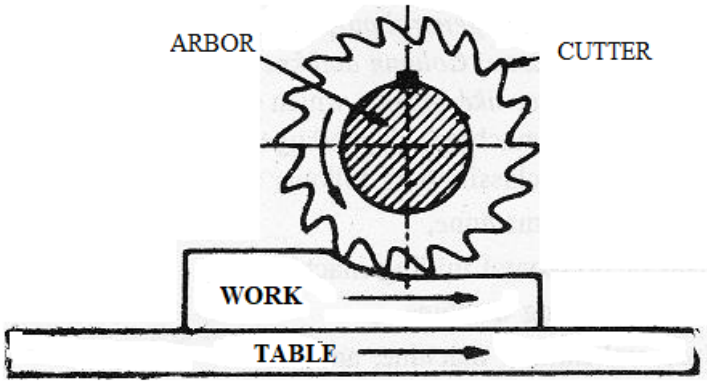
Fig. Reaming

	(b)	**Write the classification of drilling machine.**	**04**
	Ans.	***(Name of any eight Drilling Machines ½ Mark each)*** **Classification of drilling machine (any four)** 1. Portable drilling machine 2. Bench drilling machine 3. Sensitive drilling machine	*Name of*

		4. Upright or column drilling machine 5. Radial drilling machine 6. Gang drilling machine 7. Multi-spindle drilling machine 8. Vertical drilling machine 9. Automatic drilling machine 10. Deep hole drilling mac	*any eight Drilling Machines ½ Mark each*
	(c)	**Draw a neat sketch of column and knee type milling machine. Explain function of any two parts.**	**04**
	Ans.	***(A neat labelled sketch 02 Marks and function of any two parts 01 Mark each)***  **Figure : Column and Knee Type Milling Machine** 1) **Base:** To support all the parts of milling machine. 2) **Column:** To support Spindle and drive mechanism. 3) **Knee:** Can be moved vertically up and down on column by using elevating screw 4) **Over-Arm:** To support other end of the arbor. 5) **Saddle:** To move horizontally towards the column and away from column. 6) **Table:** To move towards the left and right of operator and to clamp the work-piece with T- slots on it. 7) **Spindle:** To hold rotary milling cutter.	*A neat labelled sketch 02 Marks and function of any two parts 01 Mark each*
	(d)	**State different types of milling cutters. Draw a sketch of any one with its application.**	**04**
	Ans.	***(Any Four Types of milling cutters ½ Mark each, Sketch of any one 01 Mark and its application 01 Mark)*** **Type of cutter** | **Sketch** | **Applications** **Plain Milling Cutter** |  | Production of flat surfaces parallel to the axis of rotation	

			of spindle
	Side Milling Cutter		Intended to removing metals from side of the work
	Metal Slitting Saw		Parting off or slotting operations
	Angle Milling Cutter		These cutters are used for machine angles
	End Mill		End mills are used for light milling operations
	T Slot Milling Cutters		Special form of end mills for producing T slots
	Woodruff Key Slot Milling Cutters		Production of Woodruff key slot
	Fly Cutters		Used in experimental works or tool rooms
	Formed Cutters		Used to generate irregular outline of work

Any Four Types of Milling Cutters ½ Mark each, Sketch of Any One 01 Mark And its application 01 Mark

		Tap And Reamer Cutters		Intended for producing grooves or flutes in taps or reamers
		Face Milling Cutter		Used for Surface Milling of Work.
	(e)	**Explain with neat sketch, the working principle of milling machine.**		**04**
	Ans.	***(Working Principle 02 Marks and Neat labelled sketch 02 Marks)*** **Working Principle Of Milling Machine:-** In this work is rigidly clamped on the table of the machine or between centers, and revolving multi teeth cutter mounted either on spindle or on arbor. The cutter revolves at high speed and the work fed slowly past the cutter. The work can be fed vertical, longitudinal or cross direction. As the work advances, the cutter-teeth remove the metal from the work surface to produce desired shape.  **Fig. Working Principle of Milling Machine**	*Working Principle 02 Marks and Neat labelled sketch 02 Marks*
	(f)	**Suggest appropriate milling cutters for the following operations:** **(i)T slot (ii) Gear Tooth (iii) Key way (iv) Rounding of Corners**		**04**
	Ans.	(***CorrectAns.01MarkEach***) **(i)T slot**:End Mill and T- Slot Cutter. **(ii) Gear Tooth**: Form Milling Cutter. **(iii) Key way** : Staggered teeth side milling cutter, End mill cutter, key way cutter **(iv) Rounding of Corners**: Ball Nose or Bull Nose End Mills.		*Correct Ans. 01 Mark Each*