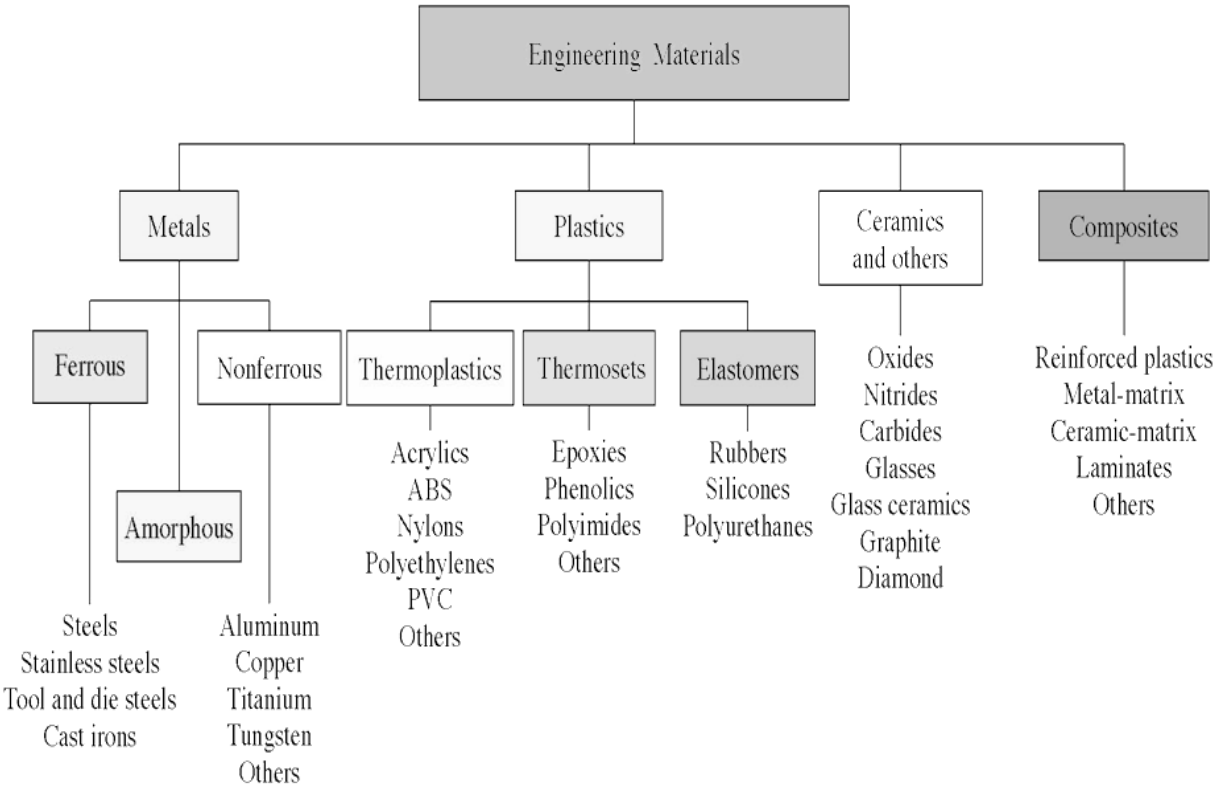
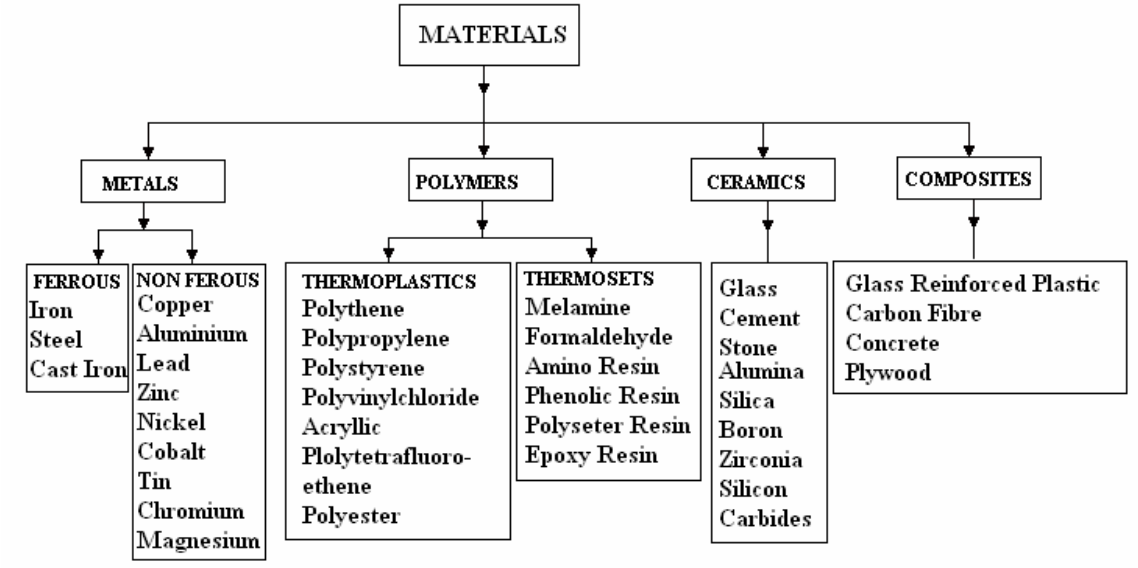
Important Instructions to examiners:
1) The answers should be examined by key words and not as word-to-word as given in themodel answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may tryto assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given moreimportance.(Not applicable for subject English and Communication Skills).
4) While assessing figures, examiner may give credit for principal components indicated in thefigure. 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 constantvalues 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 judgment 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.

	Marks
1. A) Attempt any six of the following:	12
a) State the Classification of engineering materials.	02
Answer:  **OR**	02



(Note: Types of steel and cast iron should be given due credit.)

b) List any two types of synthetic rubber. Give one application of each. — 02

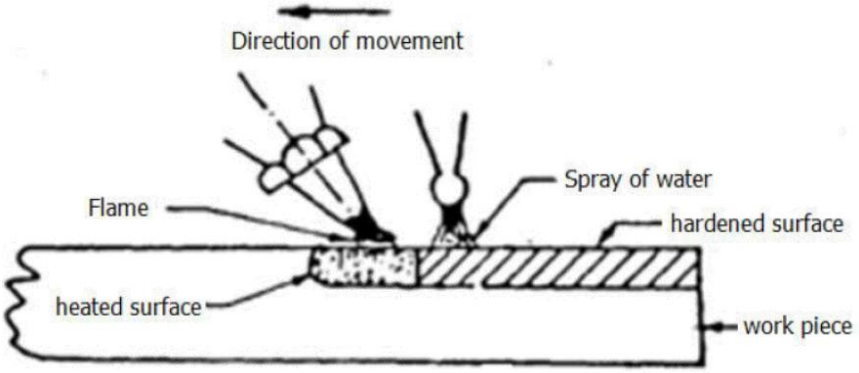
Answer: Different types of synthetic rubbers are: *(Any Two)* — 02

i. Styrene-butadiene rubber (SBR) - Automobile tyres, belts, shoe, soles, flooring, electric wire insulation.
ii. Silicone (SIL) – Wire and cable insulation, coatings, packagings, tubing for food and medical uses, seals and gaskets, diaphrams.
iii. Neoprene (CR) – Oil seals, gaskets, chemical tank linings, belts, hoses.
iv. Butadine (NBR) – chemical, gasoline and oil hoses, seals, O- rings, soles
v. Butyl rubber - Shock mounts, Sealant for rubber roof repair, Tubeless tire liners, Inner tubes, Stoppers for glass bottles, medicine bottles, and pharmaceuticals, O ring etc.
vi. Nitrile rubber -Gaskets, Seals, O-rings, Carburetor and fuel pump diaphragms , Fuel systems, Hydraulic hoses, Tubing.

c) Write any two purposes of heat treatment. — 02

Answer: Purposes of heat treatment processes: *(Any Two)* — 02

i. To soften the steel that has been hardened by the previous heat treatment or mechanical working.
ii. To harden the steel and increase its strength.
iii. To adjust its other mechanical and physical properties like ductility, malleability, permeability corrosion resistance, etc.
iv. To stabilize the dimensions of the steel instruments so that they do not expand or contract with time.
v. To refine the grain size of the steel and to reduce internal stresses.
vi. To improve machinability & weldability.
vii. To improve mechanical properties e.g. tensile strength, ductility, hardness, shock resistance, resistance to corrosion etc.
viii. To relieve internal stresses induced during hot or cold working.
ix. To improve magnetic and electrical properties.
x. To improve heat resistance, wear resistance.

d) Explain flame hardening process in brief.	02
Answer: The surface to be case hardened is heated by means of an oxyacetylene torch for sufficient time and Quenching is achieved by sprays of water which are integrally connected with the heating device.  Figure: Flame hardening process.	02
e) List four hand moulding tools used in foundry.	02
Answer: Hand moulding tools used in foundry:*(Any 04 – ½ mark each)* i) Shovel ii) Riddle iii) Rammer iv) Trowel v) Sprue pin vi) Bellow vii) Moulding boxes viii) Strike off bar ix) Mallet x) Draw spike xi) Vent rod xii) lifters	02
f) State two functions of gating system.	02
Answer: Functions of Gating system in case of casting:*(Any 02)* 1. To provide continuous, uniform feed of molten metal, with as little turbulence as possible to the mould cavity. 2. To supply the casting with liquid metal at best location to achieve proper directional solidification and optimum feeding of shrinkage cavities. 3. To fill the mould cavity with molten metal in the shortest possible time to avoid temperature gradient. 4. To provide with a minimum of excess metal in the gates and risers. Inadequate rate of metal entry, on the other hand, will result many defects in the casting. 5. To prevent erosion of the mould walls. 6. To prevent slag, sand and other foreign particles from entering the mould.	02

g) Enlist types of cutting tools.	02
Answer: A) Depending upon number of cutting points on the tool: i) Single point cutting tool – tools employed on lathes, boring machines, shaper, planer etc. ii) Multi-point cutting tool – twist drill, tap, reamer, milling cutter, broach, end mill cutters etc. B) Depending upon construction of cutting tool: i) Solid tools ii) Tipped cutting tools	02
h) List any two accessories and attachmentsused on lathe machine.	02
Answer:Accessories on lathe: *(Any 02 – ½ mark each)* i. Centre ii. Chuck iii. face plate iv. angle plate v. mandrel vi. rests vii. carriers viii. catch plates ix. collets **Attachment on lathe:** ***(Any 02 – ½ mark each)*** i. Stops ii. Ball turning rests iii. Thread chasing dials iv. Taper turning, v. Milling vi. Grinding vii. Gear cutting viii. Turret ix. Cutter x. Relieving and crank pin turning attachments xi. Copying attachment	01 01

1. B) Attempt any TWO of the following : **08**

a) Differentiate between grey cast iron and white cast iron 04

Answer: Difference between grey cast iron and white cast iron: *(Any 04)* 04

Criteria	Grey Cast Iron	White Cast Iron
Production	Obtained by melting pig iron, coke and steel scrap in cupola furnace and allowing it to cool and solidify slowly.	Obtained by melting pig iron, coke and steel scrap in cupola furnace and allowing it to cool and solidify rapidly.
Presence of Carbon	The iron contains carbon in the form of graphite flakes.	While solidifying, the iron contains carbon in the form of iron carbide
Surface colour	Dull grey crystalline or granular structure. Strong light will give a glistering effect due to reflection of free graphite flakes.	Its broken surface shows a bright white fracture. Its fractured surface appears white because of absence of graphite and hence the name white cast iron.
Machinability	It has good machinability.	It has poor machinability and mechanical properties.
Wear Resistance	High resistance to wear.	The material is having excellent wear resistance.
Hardness/Brittleness	It has excellent damping capacity. Graphite on the surface acts as lubricant	It is very hard and brittle
Applications	Used for machine structure, engine frames, drainage pipes, pistons of I.C. engines, bed of lathe machine.	Used for wearing plates, road roller surface, grinding balls, dies and extrusion nozzles.

b) Why aluminium is useful material in industry? 04

Answer: Aluminium is useful material in industry because of following useful properties: *(Any 04 – 01 mark each)* 04

i. It is light in weight (Specific gravity 2.7)
ii. It has very good thermal and electrical conductivity. On weight to weight basis, it carries more electricity than copper.
iii. It has excellent corrosion and oxidation resistance.
iv. It is ductile and malleable.
v. Its tensile strength varies from 95 to 157 MN/m^2.
vi. It may be blanked, formed, drawn, turned, cast, forged and die cast.
vii. In proportion to its weight it is quite strong.
viii. Pure aluminium has silvery colour and luster.

c) State thermosetting plastic and thermoplastics. Write two applications of each. 04

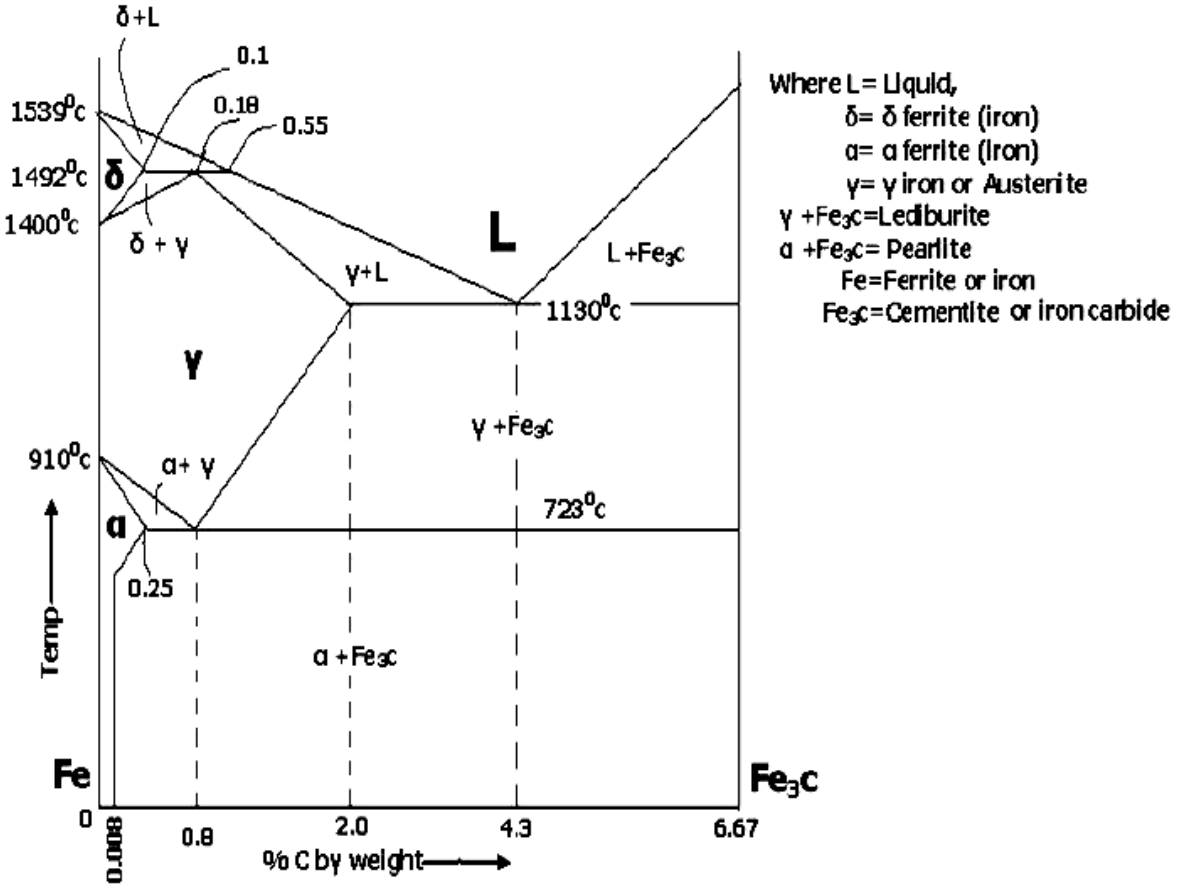
Answer:

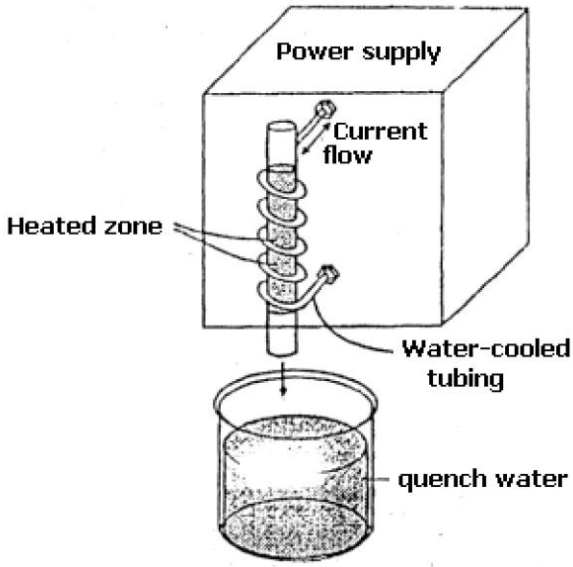
Thermosetting plastic:

These have three dimensional networks of molecules and will not soften when heated and thereby it can not be reused again. Alternatively these plastics materials acquire a permanent shape when heated and pressed and thus cannot be easily softened by reheating. 01

Applications of thermosetting plastic materials:(Any 02 – ½ mark each) 1. It is used in foundry and in transformer as an insulating material 2. Radio cabinets 3. Knife handles 4. Vacuum cleaner parts	01
Thermoplastics: The plastics which can be easily softened again and again by heating are called thermoplastics. They can be reprocessed safely. They retain their plasticity at high temperature i.e. they preserve an ability to be repeatedly formed by heat and pressure.	01
Applications of thermoplastic materials:(Any 02 – ½ mark each) 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.	01
2. Attempt any FOUR of the following :	16
a) Write composition of materials: (any Two) (i) CS 50 Cr 1 V 20 (ii)FG 35 Si 15 (iii) Fe 410 CuK (iv) 15 C 8 Pb 25 T 14	04
Answer: **i) CS 50 Cr 1 V 20** Alloy steel castings containing Carbon - 0.45 to 0.551%, Silicon - 0.10 to 0.35%, Manganese - 0.50 to 0.80%, Chromium – 0.90 to l.20%, Vanadium, Min - 0.15%	01
ii) FG 35 Si 15 Special Grey Iron casting with minimum total carbon - 3.5 % and average Silicon - 1.5 %	01
iii) Fe 410 CuK Killed steel containing copper as alloying element with minimum tensile strength of 410 N/mm^2	01
iv) 15 C 8 Pb 25 T 14 Carbon: 0.15 %, Manganese: 0.8 % and 0.25 % lead, hardened and tempered.	01

b) State composition and applications of Babbitt metal.	04
Answer: **Composition of Babbitt metal:** It is a tin base white metal and it contains : **Tin (Sn)** - 88%, **Antimony (Sb) -** 8% and **Copper(Cu)** -4% **Application of Babbitt metal:***(Any 02)* i. Fine Bearings for light & medium load rail road freight cars. ii. bush Bearings iii. bearings in railway iv. Locomotive slide valves. v. Aircraft industries vi. Turbine bushings	02 02
c) State four properties and applications of ceramic material.	04
Answer:Propertiesof Ceramic Material:*(Any 04 – ½ mark each)* 1. Ceramics are inorganic in nature & non-metallic material. 2. Brittle material. 3. Insulation to flow of electric current 4. Withstand high temperature. 5. Rock like appearance 6. Hardness 7. Corrosion resistance 8. Opaque to light **Applications of Ceramic Material:***(Any 04 – ½ mark each)* 1. Insulators, 2. Semiconductors, 3. Catalytic converter 4. Safety glass windshield 5. Ceramic filters 6. Ceramic rotors 7. Thermistors 8. Piston rings 9. Spark plugs 10. Airbag sensors	02 02

d) Draw Fe-C Phase transformation diagram and show critical temperatures on it.	04
Answer: *(Credit should be given to suitable figure showing all details such as temperature percentage of carbon and state)*  Figure: Fe-C Phase transformation	04
e) List types of annealing process. Write four purposes of annealing.	04
Answer:Types of annealing processes:*(Any 02 – 01 mark each)* 1. Full annealing 2. Process annealing 3. Isothermal annealing 4. Spheroidize annealing 5. Homogenizing	02
Following are purposes of annealing processes:*(Any 04 – ½ mark each)* 1. To soften the metal to improve machinability. 2. To refine grain size and structure to improve mechanical properties. 3. To relieve internal stresses. 4. To improve gases. 5. To modify electrical, magnetic and physical properties. 6. To increase ductility of metal. 7. To prepare the steel for further treatment.	02

f) Explain induction hardening process with two advantages and applications.	04
Answer: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. **Advantages:** *(Any 02 – ½ mark each)* i. Time required for this process is less ii. Deformation is reduced. iii. Hardening can be controlled by controlling the current iv. Depth of hardening can be controlled. **Applications:** *(Any 02 – ½ mark each)* i. Cam shafts ii. Drive shafts iii. Steering knuckles. iv. Crank shaft v. Axle shaft	02 01 01
3. Attempt any fourof the following:	16
a) What are different types of foundries? Enlist two advantages and disadvantages of foundry process.	04
Answer: Types of Foundries:*(Any 02 – 01 mark each)* **1.** Jobbing foundry: It is the foundry based on job orders. It produces a small number of castings of a given type by customers. **2.** Production foundry: It produces casting on a mass scale. It is a highly mechanized foundry.	02

3. Semi-production foundry: It is a combination of jobbing foundry and production foundry. It accepts both production and job work. **4.** Captive foundry: This type of foundry is an integral part of some manufacturing organization and produces casting for the organizational setup for further processing only. **5.** Ferrous foundries: These are the foundries in which components are cast with iron as the main constituent. **6.** Non-Ferrous foundries: In addition to ferrous metal, many nonferrous materials are also cast. Nonferrous materials that are cast are copper & its alloys. Advantages of foundry process: *(Any 02 – ½ mark each)* i. It one of the most versatile manufacturing process. ii. Castings provide uniform directional properties. iii. Intricate shaped parts can be produced. iv. Very complicated parts can be cast in one piece. Disadvantages of foundry process: *(Any 02 – ½ mark each)* i. It is only economical for mass 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.	01 01
b) State four types of patterns. Draw a neat sketch of multipiece pattern.	04
Answer: Types of Patterns:*(Any 04 – ½ marks each)* **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), 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 to shape mould cavities having shapes of rotational symmetry. **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. Cope and drag pattern:**When very large casting are to be made, the complete pattern becomes too heavy to be handled by a single operator, such pattern is made in two parts which are separately moulded in different moulding boxes. **9. Follow board pattern:**A follow board is a wooden board used for support a pattern during moulding. It acts as a seat for the pattern. **10. Segmental pattern:** The segmental pattern is in the form of a segment, and is used for moulding parts having circular shapes.	02

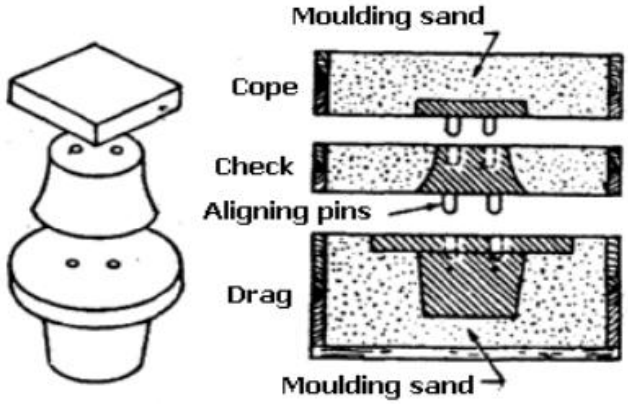


Figure: Multipiece pattern. — 02

(Note: List of types of patterns should be considered.)

c) State different types of allowances provided on patterns. Explain distortion allowance with neat sketch. — 04

Answer: Allowances provided on pattern: *(Any 02- 01mark each)*

1. Shrinkage allowance: As metal solidifies and cools, it shrinks and contracts in size. To compensate for this, a pattern is made larger than the finished casting by means of a shrinkage or contraction allowance.
2. Draft allowance provided on pattern: When a pattern is drawn from a mould, there is always some possibility of injuring the edges of the mould. This danger is greatly decreased if the vertical surfaces of a pattern are tapered- inward slightly. This slight taper inward on the vertical surfaces of a pattern is known as the draft. — 02
3. Machining allowance:The extra amount of metal provided on the surfaces to be machined is called machine finish allowance.
4. Raping or shake allowance: When pattern is rapped in the mould before it is withdrawn, the cavity in the mould is slightly increased so shake allowance is provided by making the patterns slightly smaller than actual size.

Distortion or camber allowance:

Some castings, because of their size, shape and type of metal, tend to warp or distort during the cooling period. This is a result of uneven shrinkage and is due to uneven metal thickness or to one surface being more exposed than another, causing it to cool more rapidly. The shape of the pattern is thus bent in the opposite direction to overcome this distortion. This feature is called distortion or camber allowance. — 01

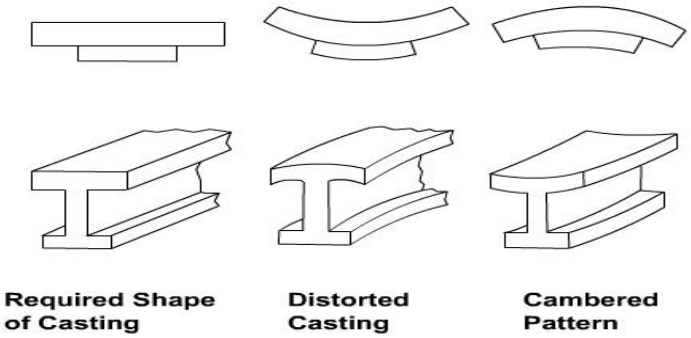


Figure: Distortion Allowance. — 01

d) Enlist with meaning the standard accepted colour codes used for pattern.	04
Answer: Standard accepted colour coding used for pattern: *(Any 04-01 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. Surface to 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.	04
e) List properties of moulding sand. Explain cohesiveness.	04
Answer: : Properties of moulding sand: *(Any 04- ½ mark each)* 1. Porosity/Permeability 2. Flow ability 3. Collapsibility 4. Adhesiveness 5. Cohesiveness or strength 6. Refractoriness	02
Cohesiveness or strength: This is the ability of sand particles to stick together. It is the property of the sand due to which rammed particles bind together firmly,so that pattern withdrawn from mould without damaging the mould surfaces or edges.	02
f) State types of cores. Explain balanced core with neat sketch.	04
Answer: **Types of cores:***(Any 02 – 01 mark each)* **1. Horizontal cores:** The most common type is the horizontal core. The core is usually cylindrical in form and is laid horizontally at the parting line of the mould. **2. Vertical core:** This is placed in a vertical position both in cope and drag halves of the mould. Usually top and bottom of the core are provided with a taper, but the amount of taper on the top is greater than that at the bottom. **3. Hanging and cover core:** If the core hangs from the cope and does not have any support at the bottom of the drag, it is referred to as a hanging core. In this case, it may be necessary to fasten the core with a wire or rod that may extend through the cope. **4. Wing core:** To obtain hole or recess in casting below or above parting line. **5. Ram-up core:** It is some time necessary to set a core with the pattern before mould is rammed up. **6. Kiss core:** When pattern is not provided with core print, core is held in position between cope and drag by pressure of cope.	02
Balanced core: When the casting is to have an opening only one side and only one core print is available on the pattern a balanced core is suitable. The core print in such cases should be large enough to give proper bearing to the core. In case the core is sufficiently long, it may be supported at the free end by means of a chaplet	01 01

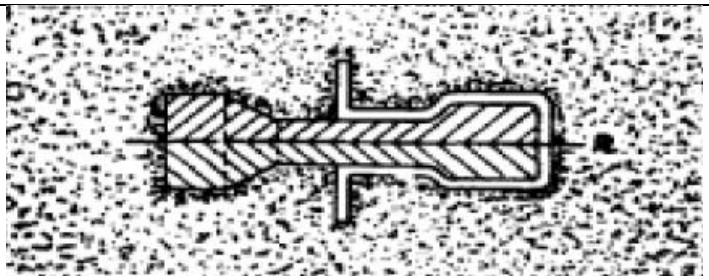
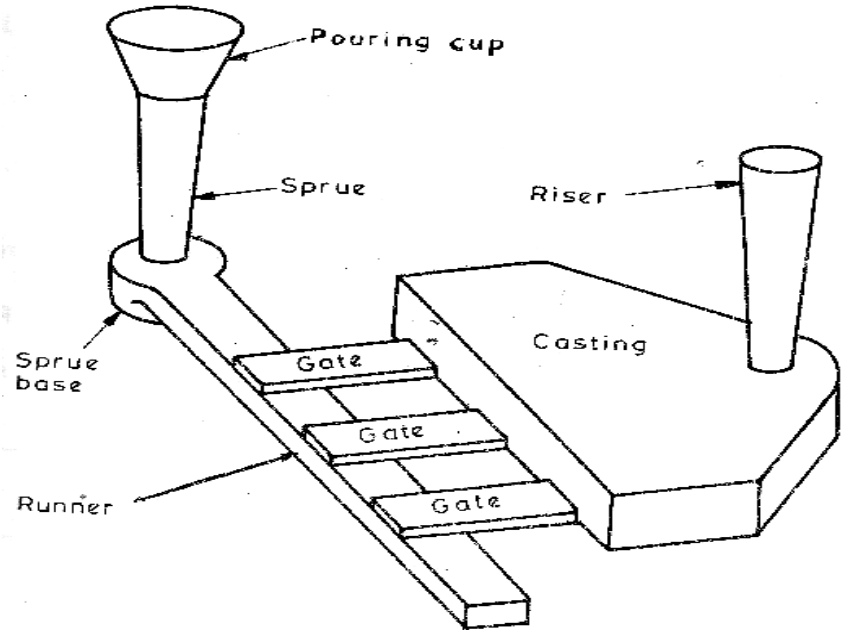


Figure: Balanced core.

4. Attempt any four of the following : **16**

a) Draw a neat sketch of Gating System. State following terms: (i) Runner (ii) Pouring basin 04

Answer: **Gating system:**



02

Figure: Gating system in casting.

i. **Runner:** In large castings, molten metal is usually carried from the sprue base to several gates around the cavity through a passageway called the runner. The runner is generally preferred in the drag, but it may sometimes be located in the cope, depending on the shape of the casting. 01

ii. **Pouring basin:** This part of the gating system is made on or in the top of the mould. Sometimes, a funnel-shaped opening which serves as pouring basin is made at the top of the sprue in the cope. 01

b) Explain with neat sketch true centrifugal casting. 04

Answer:True centrifugal casting:

In this 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. Centrifugal force tends the poured metal and the freezing metal to fly outward, away from the axis of rotation, and this tendency creates high pressure on the metal or casting while the lighter slag, oxides, and other inclusions being lighter, get pushed towards the centre. The axis may be horizontal, vertical, or inclined. Casting cools and solidifies from outside towards the axis of rotation; so it results in good directional solidification. 02

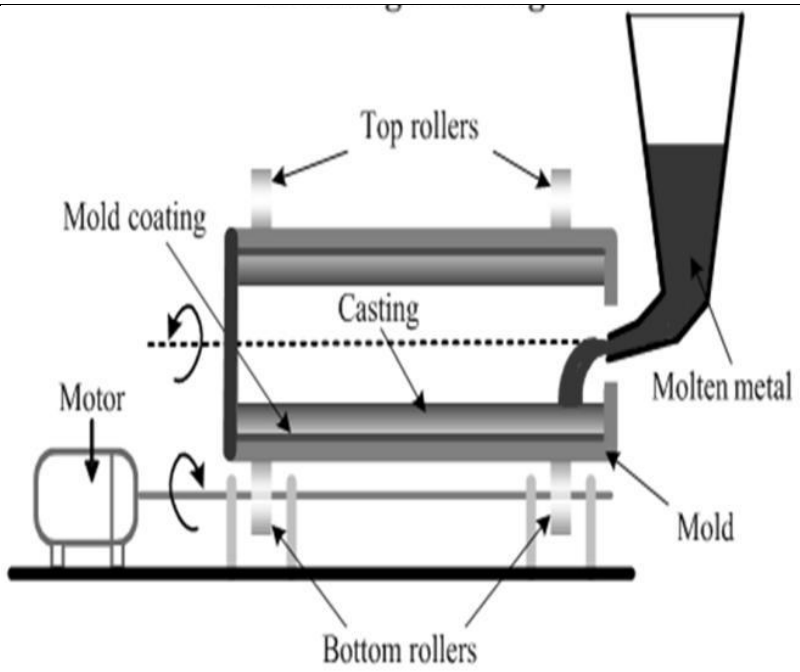


Figure: True centrifugal casting. — 02

c) Draw a neat sketch of hot chamber die casting and write two advantages and disadvantages. — 04

Answer: Hot chamber die casting:

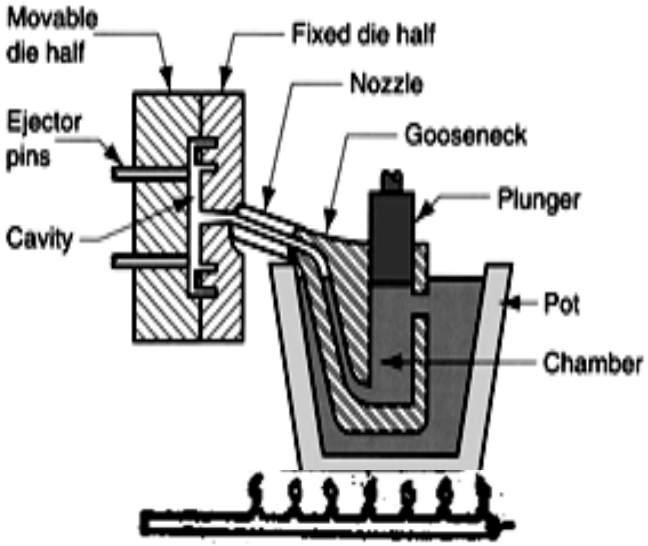
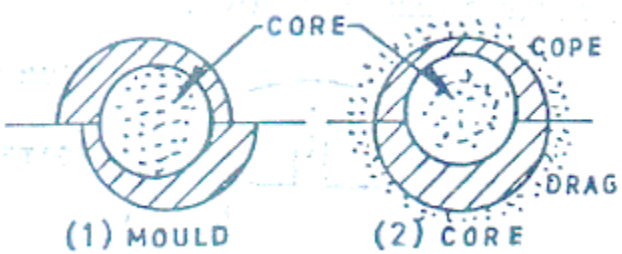
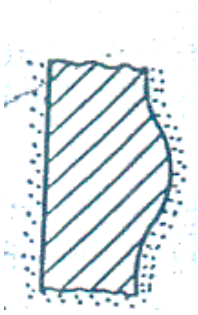


Figure: Hot chamber Pressures die casting. — 02

Advantages of hot chamber die casting: (Any 02- ½ mark each) — 01

1. Hot chamber die casting has the advantage of a very high rate of productivity.
2. Close dimensional tolerance is possible.
3. Surface finish of 0.8 microns can be obtained.
4. Very thin sections can be casted.
5. Longer die life.
6. Less floor space.

Disadvantages of hot chamber die casting:(Any 02- ½ mark each) 1. Not economical for small runs. 2. Only economical for non ferrous alloys. 3. Heavy casting cannot be cast. 4. Cost of die and die equipment is high. 5. Die casting usually contains some porosity.	01
d) Sketch and explain two casting defects with causes and remedies.	04
Answer: **Defects in casting with its cause and remedies**: *(Any 02- 02 marks each)* **1. Shifts:** This is an external defect in a casting.  **Cause:** Due to 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. **Remedy:**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. Swell:** A swell is an enlargement of the mould cavity by metal pressure, resulting in localised or overall enlargement of the casting.  Figure: Swell. **Cause:** This is caused by improper or defective ramming of the mould. **Remedy:** To avoid swells, the sand should be rammed properly and evenly. **3. Blowholes:** Blow holes are smooth, round holes appearing in the form of a cluster of a large number of small holes below the surface of a casting. These are entrapped bubbles of gases with smooth walls.	04

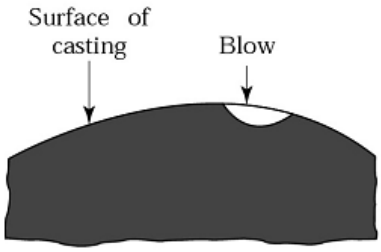


Figure: Blow hole.

Cause: 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.

Remedy: 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 adequate.

4. **Drop:** A drop occurs when the upper surface of the mould cracks, and pieces of sand fail into the molten metal.

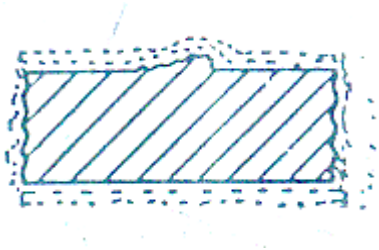


Figure: Drop

Cause: This is caused by low strength and soft ramming of the sand, insufficient fluxing of molten metal and insufficient reinforcement of sand projections in the cope.

Remedy: The above factors are eliminated to avoid drop.

e) Explain oblique cutting with neat sketch. 04

Answer: Oblique cutting:

The cutting edge is inclined at an angle less than 90^0 to the path of the tool. The forces which cuts the metal acts on larger area. The oblique tool has longer life as the heat developed per unit area due to friction along tool–work piece interface is small. Chips flows sideways in a long curl. The maximum chip thickness may not occur at the middle. More than one cutting edges are in action. 02

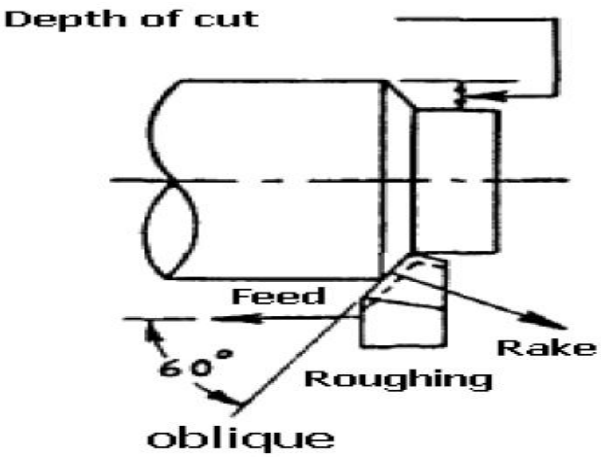
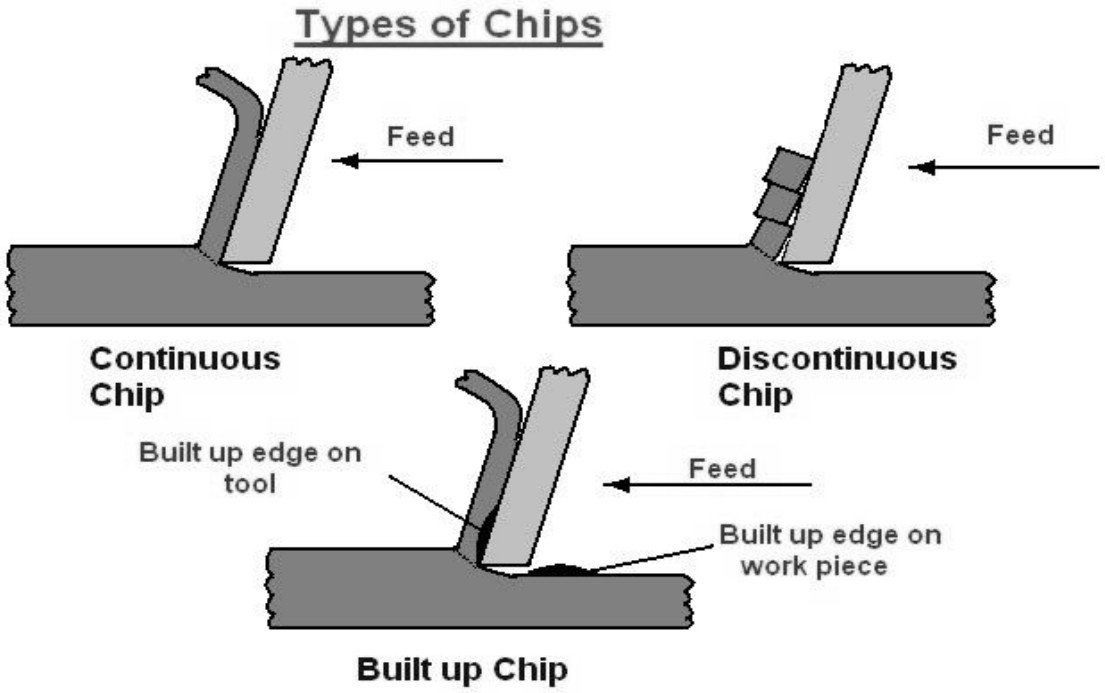
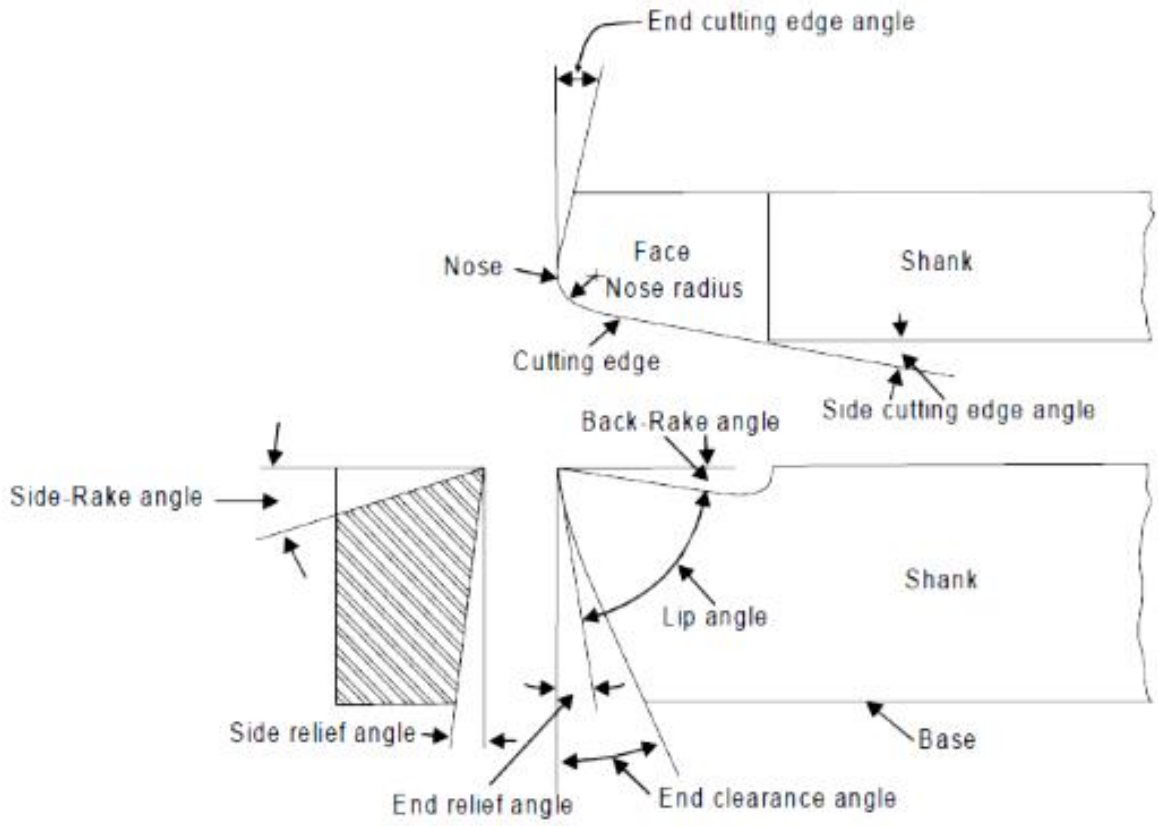


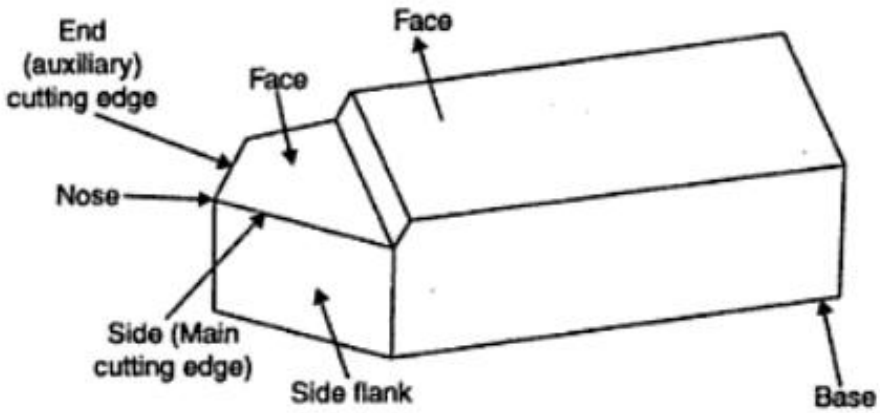
Figure: Oblique cutting. 02

f) State types of chips. Explain any one type of chip with neat sketch.	04
Answer: Different types of chips: ***(Types – 01 mark, Explanation of any one type - 02 mark, sketch -01 mark)*** 1. **Discontinuous or segmental chips**: Machining of brittle materials 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. 2. **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. 3. **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.  ***(Note: Any one figure from above.)***	04
5. Attempt any four of following :	**16**
a) Show Nomenclature of single point cutting tool with neat sketch	04

Answer:*(Sketch 2 marks, labeling of parts and angles-2 marks)*
Nomenclature of single point cutting tool

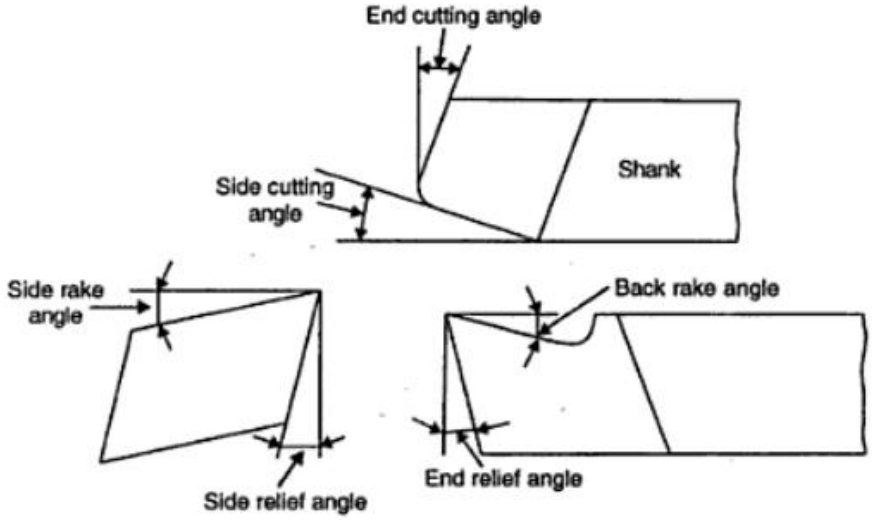


Or



(*a*) Elements of a Single Point Tool

04



(*b*) Tool Angles

Figure: Single point cutting tool nomenclature.

b) State four properties and purposes of cutting fluid	04
Answer: Properties of cutting fluid: *(Any 04- ½ mark each)* 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	02
Purposes of cutting fluid: *(Any 04 - ½ mark each)* 1. To cool the tool 2. To cool the work piece. 3. To lubricate & reduce friction. 4. To improve surface finish. 5. To protect the finished surface from corrosion. 6. To cause chips break up into small parts. **7.** To wash the chips away from the tool	02
c) Draw block diagram of lathe machine. Write function of tail stock and carriage.	04
Answer: **Function of tailstock:** 1) To support the other end of the work when it is being machined between the center 2) It holds a tool for performing operation such as drilling, reaming etc.	01
Function of carriage: The carriage of a lathe has several parts that serves to support, move and control the cutting tool.	01

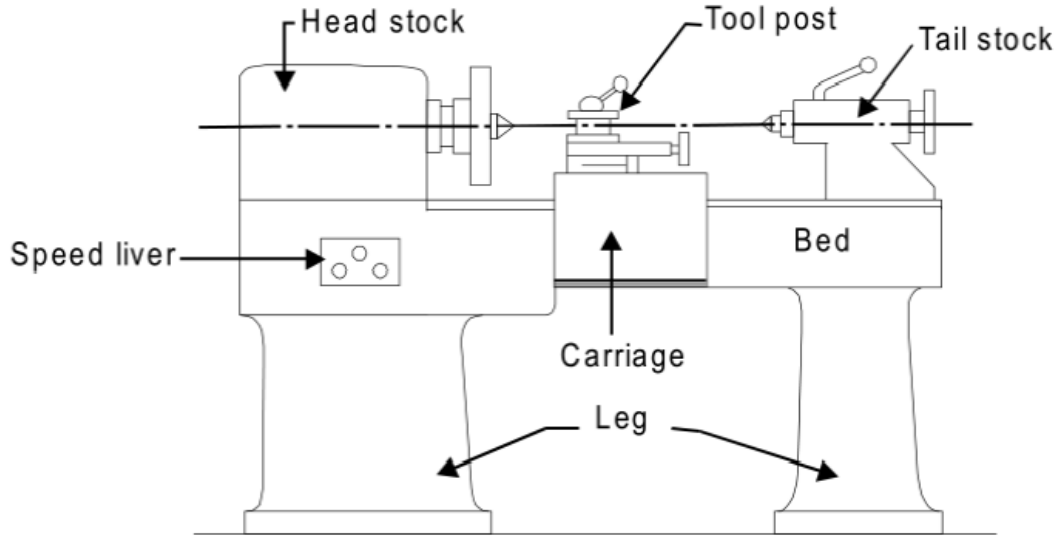
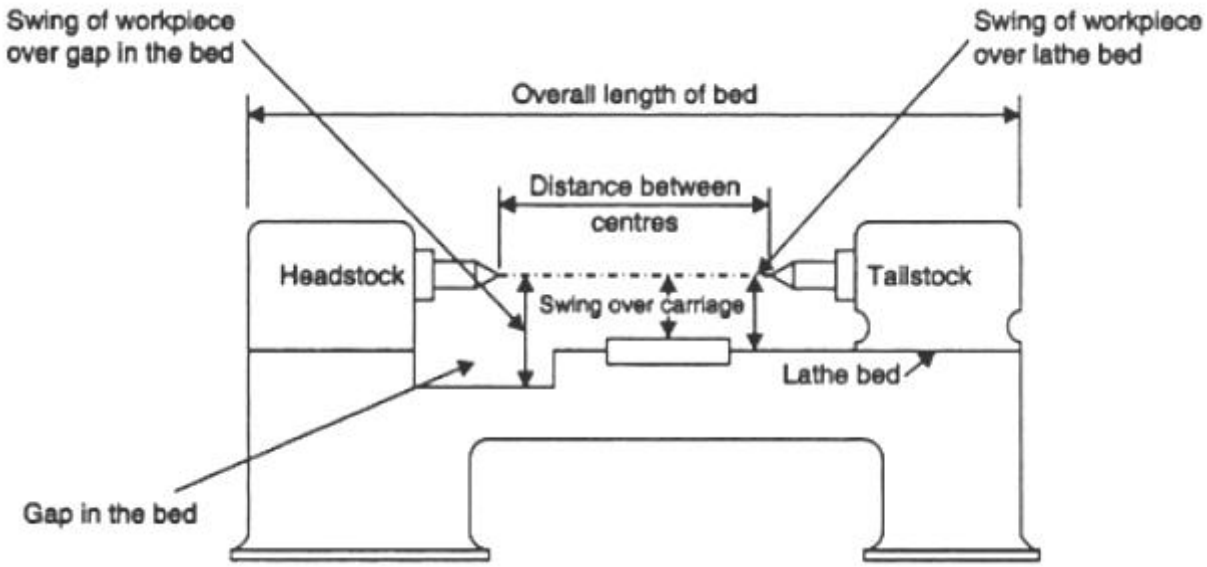


Figure: Block diagram of Lathe machine. — 02

d) How lathe machine is specified? — 04

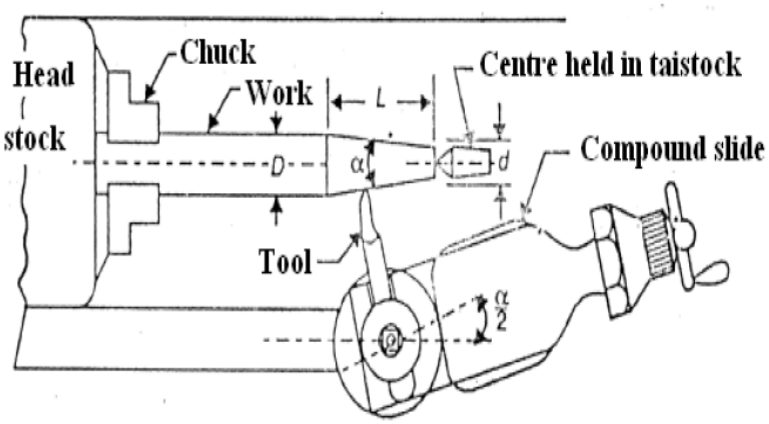
Answer: Specification of lathe machine: *(Any 04)*

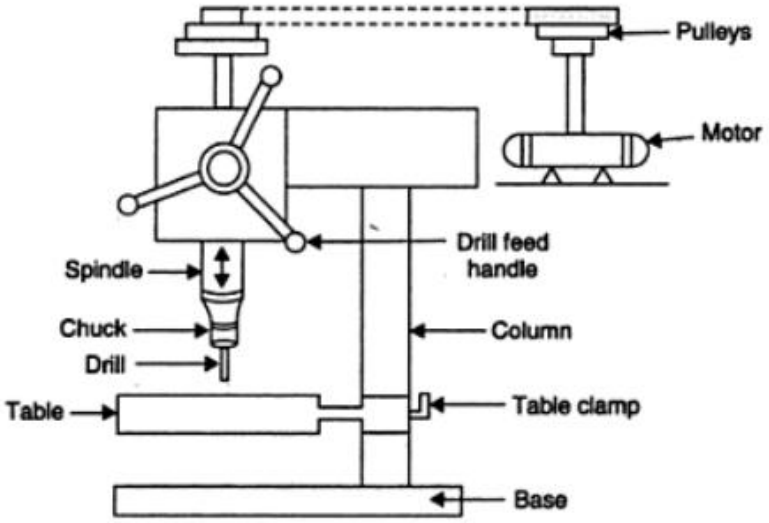
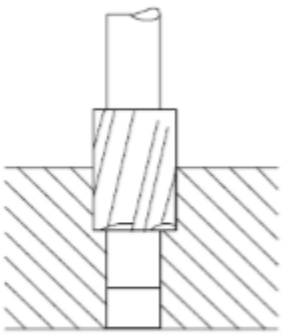


04

OR

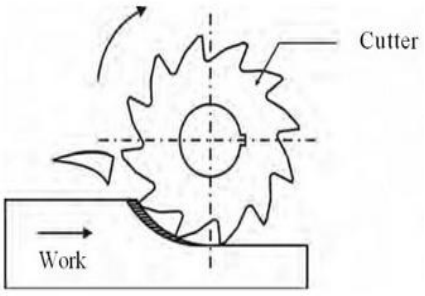
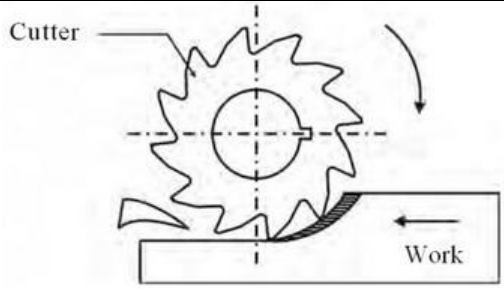
1. The height of the centers measured from the lathe bed.
2. The swing diameter over bed. This is the largest diameter of work that will revolve without touching the bed and is twice the height of the centre measured from the bed of the lathe.
3. The length between centers. This is the maximum length 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.

e) Explain taper turning method by swiveling the compound rest.	04
Answer: Taper turning method by swiveling the compound rest**:** This method employs the principle of turning taper by rotating the work piece on the lathe axis and feeding the tool at an angle to the axis of rotation of the work piece. The tool mounted on the compound rest is attached on a circular base (Swivel plate), graduated in degree, which may be swiveled and clamped at any desired angle. Once the compound rest is set at the desired angle half the taper angle, rotation of the compound slide screw will cause the tool to be fed at the angle and generate a corresponding taper. The movement of tool is controlled by hand.  Figure: Taper turning method by swiveling the compound rest ***(Note: Equivalent credit should be given to any other suitable sketch.)***	02 02
f) Write any four types of drilling machine. Draw a block diagram bench of drilling machine.	04
Answer: **Types of drilling machine:** *(Any 04 – ½ mark each)* 1. Portable drilling machine 2. Bench drilling machine 3. Sensitive drilling machine 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 machine	02

Bench type drilling machine:  Figure:Bench type drilling machine.	02
6. Attempt any four of following:	**16**
a) State different operations performed on drilling machine. Explain counter boring with neat sketch.	04
Answer: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	02
Counter boring: It isthe operation of enlarging the end of a hole cylindrically,for the recess for a counter-sunk rivet. The tool used isknown as counter-bore. The enlarged hole forms a square shoulder with the original hole to accommodate the heads of bolts,studs and pins.	01
 Figure: Counter boring.	01

b) Compare between up milling and down milling. 04

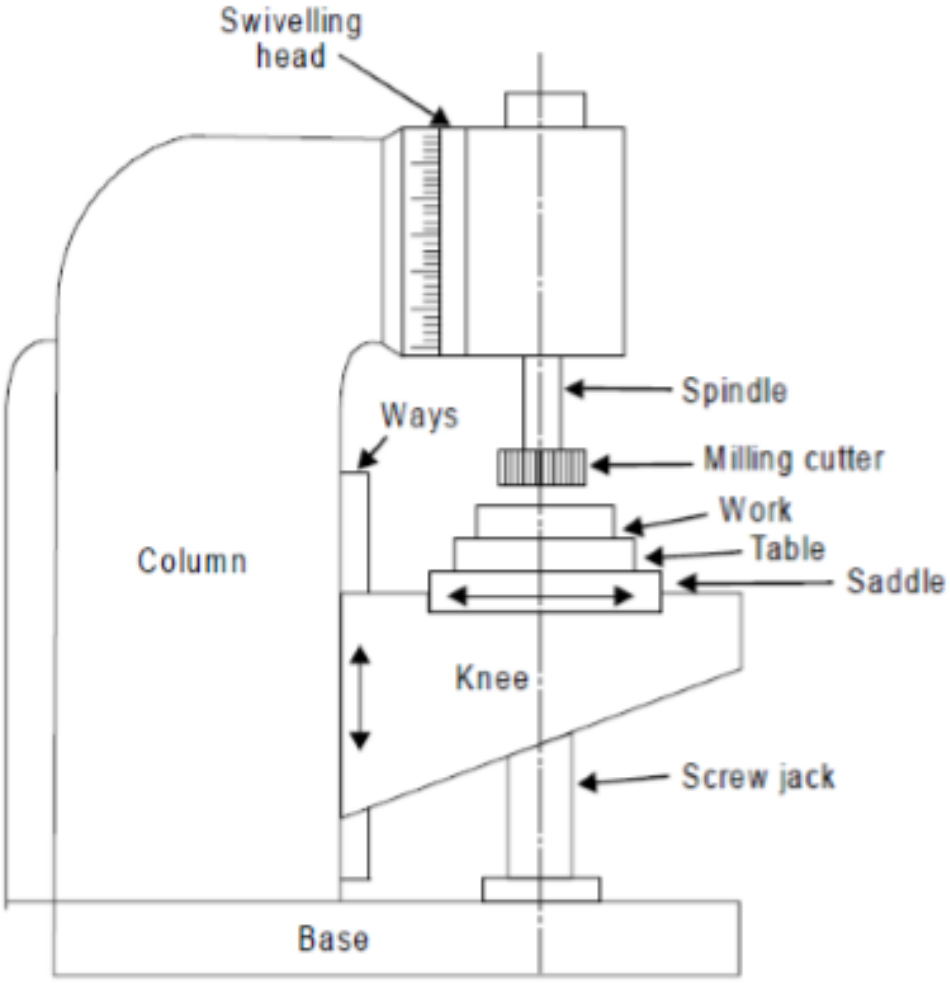
Answer:Comparison between up milling and down milling:*(Any 04 – 01 mark each)* 04

Sr.	Up milling	Down milling
01	The cutter rotates against the direction in which the work is being fed	The cutter rotates in the same direction as that in which the work is being fed
02	It is known as conventional milling	It is known as climb milling
03	Job-tool motion is in the opposite direction	Job-tool motion is in the same direction
04	Cutting force vary from zero to maximum	Cutting force varies from maximum to zero
05	Chip thickness vary from minimum to maximum	Chip thickness vary from maximum to minimum
06	Surface finish is better. i.e no effect of backlash in screw nut system	Surface finish is better ,if it is free from backlash error as backlash affect process and product
07	Use of cutting fluid is difficult	Use of cutting fluid is easy
08	There is tendency to lift the job so more clamping forces are needed to fix the job on the table	Forces are sufficient on the job to press downward, so clamping problem is not so much
09	It is practicable	It is impracticable
10	 **Upmilling**	 **Downmilling**

c) State any eight types of milling machine. 04

Answer:Types of milling machine:*(Any 08 – ½ mark each)* 04

1. Column and knee type milling machine
2. Plain or horizontal milling machine
3. Hand milling machine
4. Vertical milling machine
5. Universal milling machine
6. Omniversal milling machine
7. Manufacturing or fixed bed type milling machine
8. Simplex milling machine
9. Duplex milling machine
10. Triplex milling machine
11. Planer type milling machine
12. Special purpose milling machine
13. Cam milling machine
14. Planetary milling machine

15. Profile milling machine 16. Drum milling machine **17.** Duplicating milling machine	
d) Explain any one principal part of milling machine with neat sketch of column and knee type milling machine.	04
Answer:  Figure: Column and Knee type milling machine. OR	03

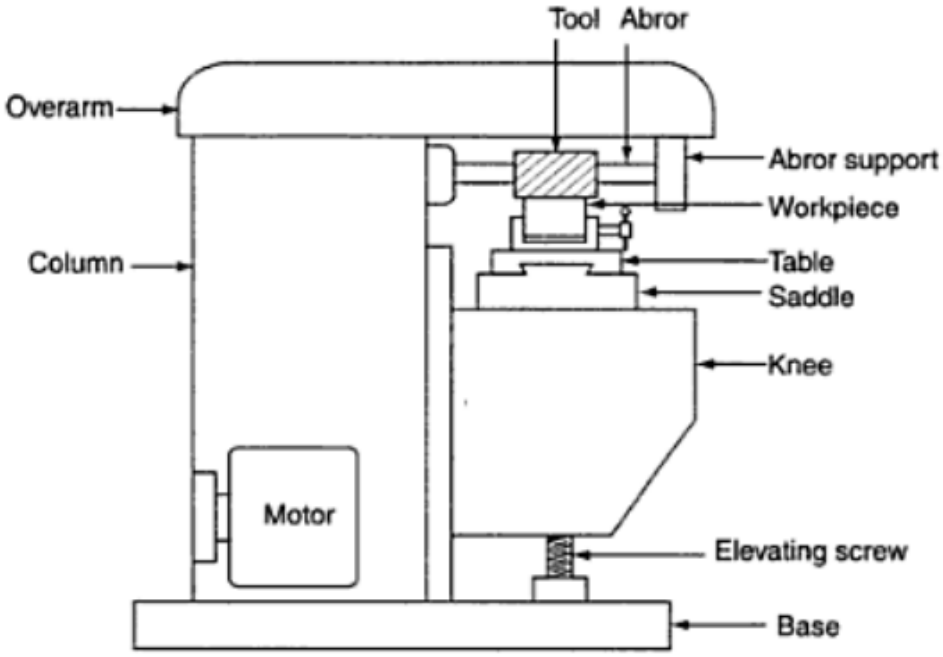


Figure: Column and knee type milling machine.

Function of parts:*(Any 01- 01 mark)*

1. Base: It is a heavy casting on which column and other parts are mounted. It may be bolted to floor strongly.
2. Column: there are guide ways on the front face of the column, on which the knee slides. It houses power transmission units such as gears, belt drives and pulleys to give rotary motion to the arbor. The drive mechanisms are also used to give automatic feed to the handle and table.
3. Knee: It supports the saddle, table, work piece and other clamping devices. It moves on the guide ways of column. It resists the deflection caused by the cutting forces on the work piece.
4. Saddle: It is mounted on the knee and can be moved by hand wheel or by power. The direction of travel of the saddle is restricted towards or away from the column face.
5. Table: It is mounted on the saddle and can be moved by a hand wheel or by power. Its top surface is machined accurately to hold the work piece and other holding devices. It moves perpendicular to the direction of saddle movement.
6. Arbor: Its one end is attached to the column and the other end is supported by an over arm. It holds and drives different types of milling cutters.
7. Spindle: It gets power from the gears, belt drives, to drive the motor. It has provision to add or remove milling cutters on to the arbor.

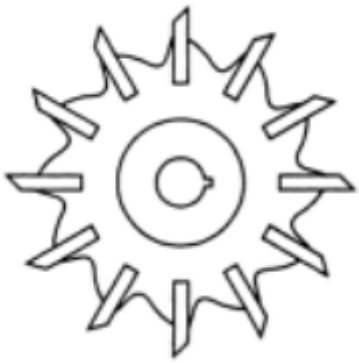
01

e) List four types of milling cutter. Explain face milling cutter with neat sketch. 04

Answer:Types of milling cutter:*(Any 04 – ½ mark each)*

1. Plain milling cutter
   a) Light duty b) Heavy duty c) Helical
2. Side milling cutter
   a)Plain b) Staggered teeth c) Half d) Interlocking
3. Metal slitting saw
   a) Plain b)Staggered teeth
4. Angle milling cutter
   a) Single b) Double

02

5. End milling cutter a) Taper shank b)Straight shank c)Shell 6. T-slot milling cutter 7. Woodruff key slot milling cutter 8. Fly cutter 9. Formed cutter a) Convex b)concave c)corner rounding d) gear cutter e) thread milling cutter 10. Tap & reamer cutter 11. Face milling cutter **Face milling cutter:**  Figure: Face milling cutter. ***(Note: Any other equivalent figure shall be considered)*** **Face milling:** It is used for milling flat surface using teeth on its face. The cutter may be mounted on arbor or rigidly clamped on the nose of the machine spindle Face milling cutter of shell –end –mill type is as shown in fig. It has teeth on both face and periphery .It is a general purpose facing tool. For facing bigger surfaces ,inserted tooth facing cutter is employed which has cutting edge made of superior cutting tool material and inserted in the steel shank .These teeth project a little outside the body so that cutter end has cutting edges .These cutter has tapered shank and it is mounted directly on to the spindle.	01 01
f) State four operations performed on milling machine. Explain T-slot milling operation with neat sketch	04
Answer:Operations performed on milling machine:*(Any 04 – ½ mark each)* **1.** Plain milling: For producing a plain,flat, horizontal surface parallel to axis of rotation of plain milling cutter. **2.** Face milling: To produce flat surface face milling cutter rotated about an axis perpendicular to work surface. **3.** Side milling: Producing flat vertical surface on the side of the work piece. **4.** Straddle milling: Producing flat vertical surfaces on both sides of a work piece by using two side milling cutters mounted on the same arbor. **5.** Angular milling: Producing angular surface on the work piece other than at right angles to the axis of the milling machine spindle. **6.** Gang milling: Operation of machining several surfaces of a work piece simultaneously by feeding the table against a number of cutters having same or different diameters mounted on	02

same arbor.

7. Form milling: Operation of producing irregular contours by using form cutters.
8. Profile milling: Operation of reproduction of an outline of a template or complex shape of a master die on a work piece.
9. End milling: Producing flat surface which may be vertical, horizontal or at an angle in reference to table surface.
10. Saw milling: Producing narrow slots or grooves on the work piece.
11. Milling keyways, Grooves, slots: Producing keyways ,Grooves ,slots in work piece
12. Gear cutting: To produce gears
13. Helical milling: Producing helical flutes or groves around the periphery of cylindrical or conical work piece.
14. Thread milling: Producing threads by using a single or multiple thread milling cutter.

T-Slot milling operation: 01

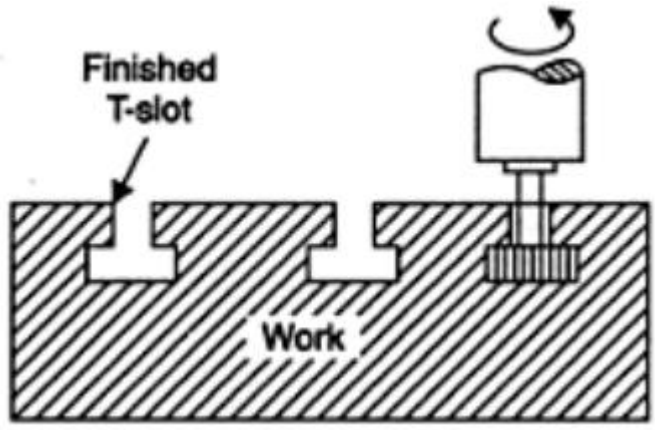


Figure:T-Slot milling operation. 01

T-slot milling cutters are special form of end mills for producing T-slot. In this milling operation, first a plain slot is cut on the work piece,by a side and face milling cutter or end mill cutter. Then T-slot cutter is fed from the end of the work piece.