BME PART-B

ASSIGNMENT-01

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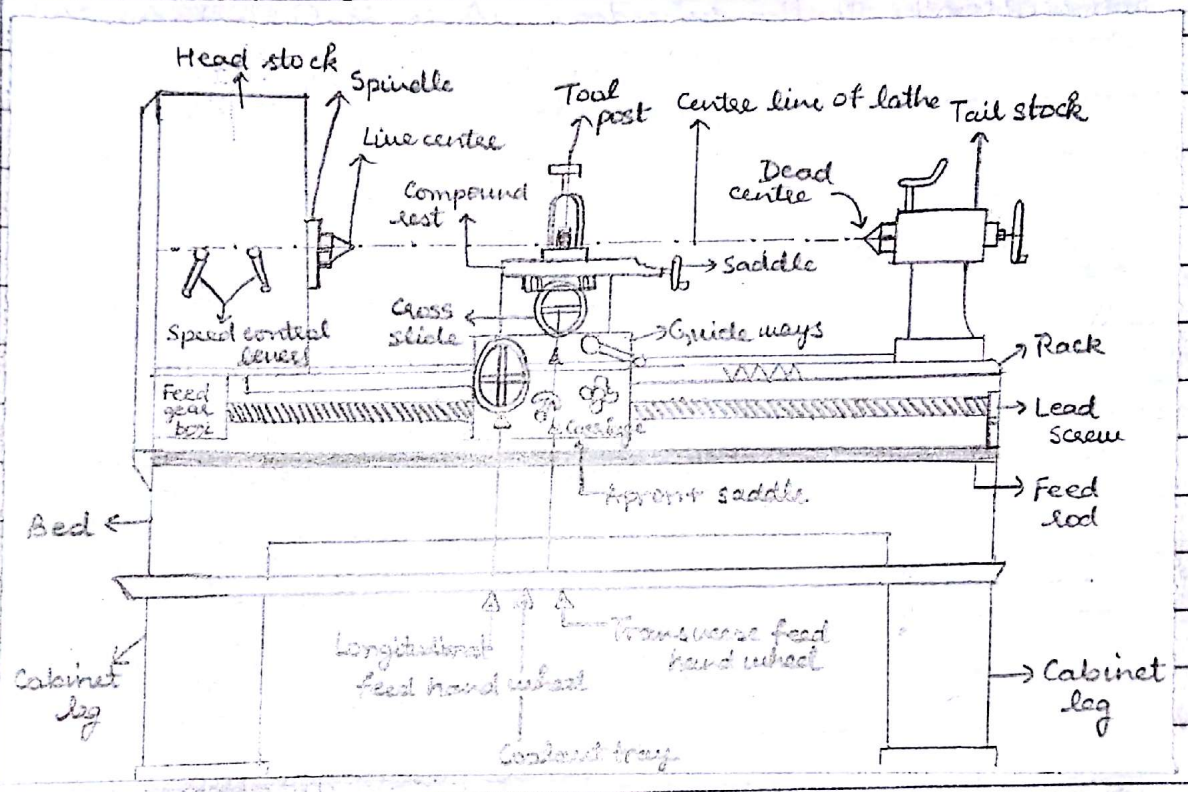
BME Part-B Assignment - 01

Answers

Q1. Draw lathe diagram and explain types of operation on lathe machine.



Operations on lathe machine are:

(1) **TURNING**: In this operation, the nose piece is rotated suitable r.p.m, so that metal cutting may take place at recommended cutting speed. This process have to be repeated several times until the desired diameter is reached. In this cylindrical shape is generated.

(2) **FACING**: In this operation, the nose piece is rotated as but the tool is moved across by cross slide. The tool remains fixed in one position. Result is a flat circle section at one end of the cylinder.

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(3) TAPER TURNING : It means production of a conical surface by gradual reduction in diameter as we proceed along the length of the cylinder. A conical surface will be produced of the cutting tool means along a line which is inclined in the longitudinal axis instead of moving parallel to it.

(4) PROFILE OR FORM TURNING : In this operation, tapee turning happens with the help of a form tool. Form tools should have a short profile, otherwise the work piece and the tool tend to vibrate with each other.

(5) PARTING OFF : This operation is performed with a parting tool. Diameter of the work piece reduces parting it into 2 parts and ultimately the left hand piece will very tightly clamp in the chuck, while the right hand piece will separate and cut.

(6) BORING : Boring means enlarging an existing hole. The boring operation really an ~~interr~~ internal turning operation but not being able to see actual cutting makes the operation tricky and delicate.

(7) THREADING : Threading is an operation of cutting thread or helical groove the external cylindrical surface of the job.

(8) KNURLING : For a better grip, some ~~most~~ work pieces are provided with a ~~shape~~ sharp diamond shaped pattern on its circumference. Knurling rollers have a similar

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pattern cut on their surface are hardened. As the roller and work piece surface rotate together, the ~~pearl is~~ pattern is itched into the surface of the work piece.

Q2. Discuss the steps of mould making with neat diagram.

(1) Select a suitable flask, which can accomodate pattern, runner, risers and gate.
(2) Place the drag part on moulding board having parting surface down on board.
(3) Place the drag pattern inside the flask.
(4) Fill facing sand to appropriate depth around the pattern and rest of the part of the drag is filled with ordinary sand.
(5) Ram the sand uniformly and remove the excess sand
(6) Apply parting sand on the top surface and turn the drag upside down.
(7) Cope pattern is placed on drag pattern in proper alignment with it.
(8) Place the cope ~~and~~ over the drag.
(9) Sprinkle the parting sand around the cope pattern and over the drag.
(10) Put runner and riser in appropriate position.
(11) Fill facing sand to appropriate depth around the pattern and then fill the cope with ordinary sand.
(12) Ram the sand uniformly and remove excess sand.
(13) Remove the runner and riser pins, vent the cope and sprinkle parting sand over the surface.
(14) Place the bottom board, over the cope and roll over the cope on bottom board.

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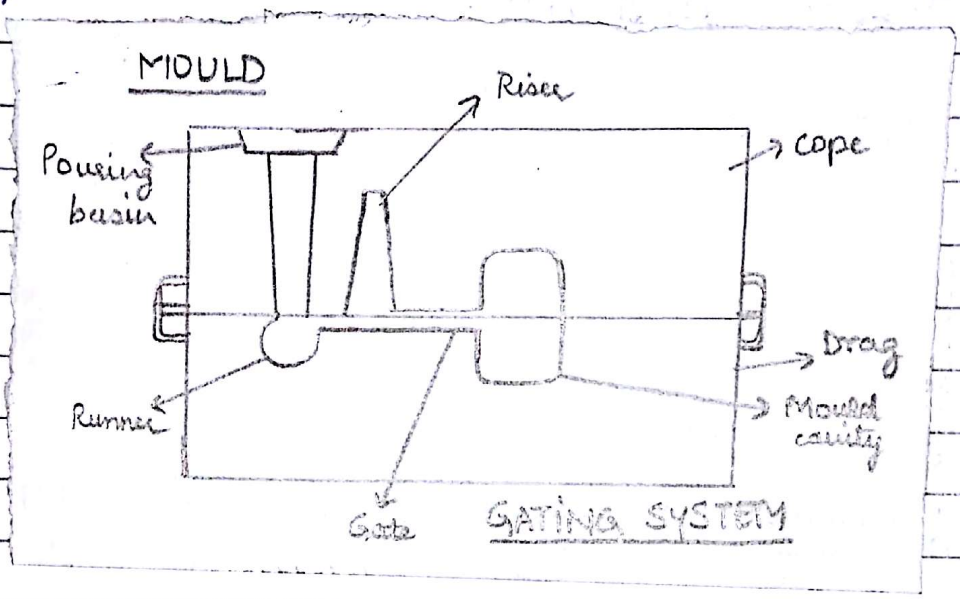
(15) Remove the patterns, repair the mould if required.
(16) In case of dry sand mould, bake it.
(17) Position the core if required.
(18) Close the mould and clamp it. Mould is now ready to pour.



Q3. Explain the properties of moulding material and explain types of sand used in moulding process.

Ans.

PROPERTIES OF MOULDING SAND

(1) Porosity: The sand must be sufficiently porous to allow the gases or moisture present or generated within the mould to be removed freely when the moulds are prepared.
(2) Flowability: It refers to its ability to behave like a fluid so when rammed it will flow to all portions of the mould and pack all round the pattern and take the required shape.
(3) Collapsibility: After the molten metal gets solidified, the sand must be collapsible so that to avoid the terrain cracking of the contracting material.

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④ Adhesiveness : The sand particles must be capable of adhering to another body in they should cling to the side of moulding boxes.

⑤ Cohesiveness or Strength : This is the ability of sand particles to stick together . Insufficient strength may lead to a collapse in mould or its particle destruction

⑥ Refractoriness : The sand must be capable of withstandin the high temperature of molten metal without fusing should not burn on casting.

I TYPES OF MOULDING SAND

① Green Sand : It is a mixture of silica sand, 18-30% clay and 6-8% water . When applied pressure, it retains its shape . It once prepared within this sand is called green mould sand .

② Dry Sand : Green sand that has been dried or baked after the mould is made is called dry sand. They are suitable for larger cast moulds prepared in this sand are known as dry sand moulds.

③ Loam Sand : Loam sand is high in clay , as much as 50% or so and hard . This is particularly employed for loam moulding usually for large castings.

④ Parting Sand : It is used to keep the green sand from sticking to the box and also allow the sand on the parting surface to the cope and and drag to separate without changing . This is clean clay - free silica and which serves the same purpose as parting dust .

⑤ Core Sand : Sand used for making cores is called core sand . Some called oil sand . This is silica mixed with core oil which is composed of linseed oil , resin , light mineral.

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Q4. Explain different types of pattern allowances.

Ans. Patterns are not made the exact same size of metal casting desired. For several reasons such as pattern which are undersize must be allowed for shrinkage, draft, finish, distortion and rapping

(1) Shrinkage Allowance: As a metal solidifies and cools, it shrinks and contracts size. To compensate for this a pattern, the pattern maker for this by using shrink or contraction rule of the metal is slightly longer than the ordinary rule of the same length.
Different metals have different shrinkages, therefore there is a shrinkage rule for each type of metal used in casting. A master pattern from which metal patterns are cast may have double shrinkage allowance

(2) DRAFT ALLOWANCE: When a pattern is withdrawn from the mould there is a possibility of injuring the edges of the mould. This possibility can be easily decreased by tapering the vertical surfaces slightly inward. This slightly taper inward on the vertical surfaces of the pattern is known as draft. The amount of draft needed in each cast depends upon:
(1) Length of vertical side.
(2) Intricacy of pattern.
(3) The method of moulding.

(3) MACHINING ALLOWANCE: Rough surfaces of casting that leave to be machined are made with some extra amount of metal than needed for the finish drawing

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The extra amount of metal provided on the surfaces to be machined is called machine finish allowance.

Amount of metal to be added depends upon:

(1) Kind of metal used.

(2) Shape & size of casting

(3) Method of casting mould.

(4) DISTORTION OR CAMBER ALLOWANCE: It is only applicable to those patterns having irregular shape like U-shape / V-shape which undergo distortion when molten metal is poured due to irregular cooling of molten metal. The shape of the pattern is thus in opposite dir'n to overcome this distortion. This feature called distortion / chamber allowance.

Q5. Write briefly about various cutting tool materials.

Ans. Different cutting tool materials used for cutting operations in practice are high carbon steel, high speed steel, non-ferrous cast alloys, cemented carbides, ceramics and sintered oxides, cermets, diamond, cubic boron nitride, UCON and Sialon.

(1) High Carbon Steel Tools: Its composition is C = 0.8 to 1.3%, Si = 0.1 to 0.4% and Mn = 0.1 to 0.4%. It is used for machining soft metals like free cutting steels and brass and used as chisels etc. These tools loose hardness above 250°C.

(2) High Speed Steel: Used for drills, milling cutters, single point cutting tools, dies, reamers etc. It looses hardness above 600°C. Molybdenum based (H.S.S) is cheaper than Tungsten based H.S.S and has greater toughness but less

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water resistance.

(3) Non-ferrous cast alloys : It cannot be heat treated and are used as cast form. It looses its hardness above 800 °C. It will give better tool life than H.S.S and can be used at slightly higher cutting speeds.

(4) Cemented Carbides : Produced by powder metallurgy technique with sintering at 1000 °C. Speed can be used 6 to 8 times that H.S.S. It can withstand upto 1000°C. High compressive strength is more than tensile strength.

(5) Ceramics and sintered oxides : Basically made of Al_2O_3. They are made by powder metallurgy technique, used for very high speed continuous cutting (500 m/min), can withstand upto 1200 °C. They have high ~~Carbo~~ abrasion resistance.

(6) Cermets : Cermets is the combination of ceramics (90%) and metals (10%) produced by Powder Metallurgy process. When they combine, ceramics will give high refractoriness and metals give high toughness and thermal shock resistance.

(7) Diamond : It can withstand speeds ranging from 1500 to 2000 m/min. Can withstand above 1500 °C. It has extreme hardness, low thermal expansion, high thermal conductivity, very low coefficient of friction.

(8) Cubic Boron Nitride (CBN) : Called Borazone as it consists of atoms of Nitrogen and Boron and produced by power metallurgy process. Used as a grinding wheel on H.S.S tools, excellent surface finish is obtained.

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Q6: What are the various types of milling and drilling operations?

Ans: DRILLING : Creates a round hole in a workpart. It constrasts with boring which can only enlarge an existing hole. Various types of drilling operations are:

① Reaming: Used to slightly enlarge a hole, provide a better tolerance on diameter and improve surface finish.

② Drilling: It is an operation of producing a circular hole in a workpiece by forcing a drill in the workpiece.

③ Boring: It is an operation of enlarging a hole that has already been drilled. Single point cutting tool is used in boring.

④ Tapping: It is an operation of producing internal threads in a hole by means of a tap.

⑤ Counter Boring: It is an operation of enlarging the entry of a drilled hole to accomodate the bolt head etc. Counter boring tool does it.

⑥ Spot Facing: It is an operation done on the drilled hole to provide smooth seat for bolt head.

⑦ Counter Sinking: It is an operation to bevel the top of a drilled hole for making a conical seat. A counter sunk drill as shown in figure is used in this operation.

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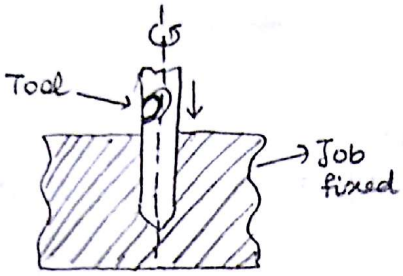
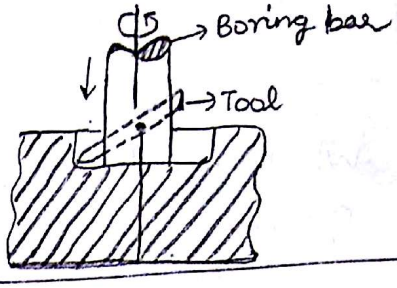
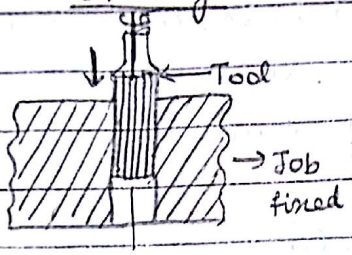
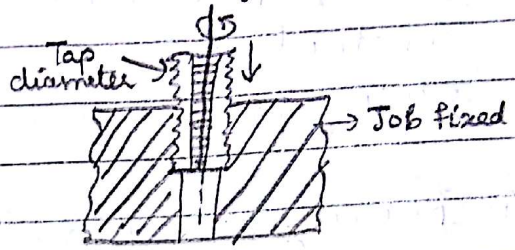




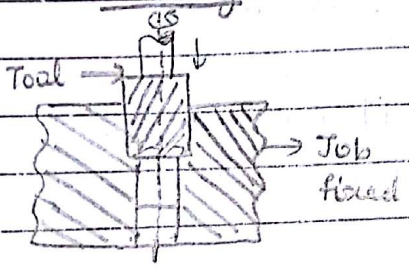
Drilling



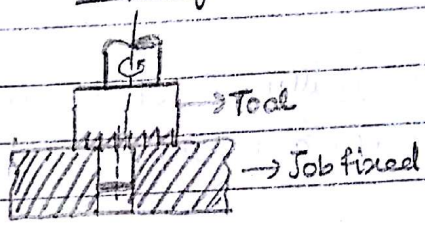
Boring



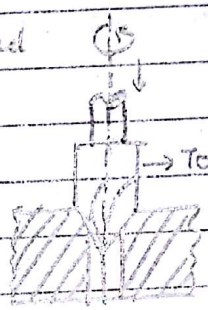
Reaming



Tapping



Counter Boring



Spot Facing

Counter Sinking

MILLING OPERATIONS

① Plain or Slab Milling : It is the production of flat or horizontal surface parallel to the axis of the cutter.

② Face Milling : It is also the production of flat surface which is at right angle to the axis of rotation of face milling cutter.

③ Angular or Bevel Milling : It is the production of a flat surface, which is at an angle to the axis of the cutter

④ Side Milling : The operation is used for the production of a vertical flat surface on the side face of a job by using a side milling cutter.

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(5) Form Milling: Form milling operation is the production of irregular contours by using the cutters having the same profile corresponding to the surface to be generated.

(6) Gang Milling: It is the production of irregular contours by using the cutters having the same profile corresponding to the surface to be generated.

(7) End Milling: It is the production of both peripheral and face milling operations simultaneously, generates vertical, horizontal or angular surfaces by using an end milling cutter.

(8) Milling T-Slots: This operation is performed in two steps. In first operation, the end milling operation is made by using end milling cutter. In the second operation T-slot is made by using the T-Slot cutter.

(9) Milling Key Ways, Grooves, Slots etc.: Recesses in shafts of various shapes and sizes are produced by using either a plain milling cutter, saw milling cutter or a side milling cutter.

(10) Gear Milling Operation: First, gear blank is held in between universal dividing head and tail stock of a machine table. Then form relieved cutter (having same profile as of desired teeth) is used to produce the desired tooth profile of the gear.

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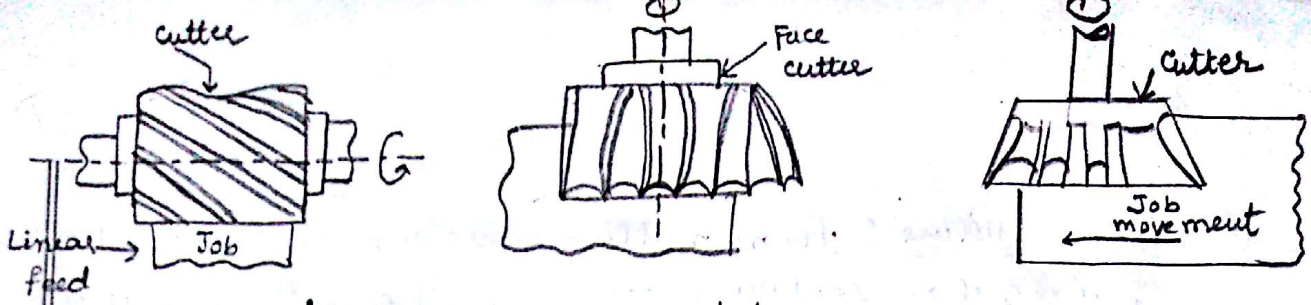
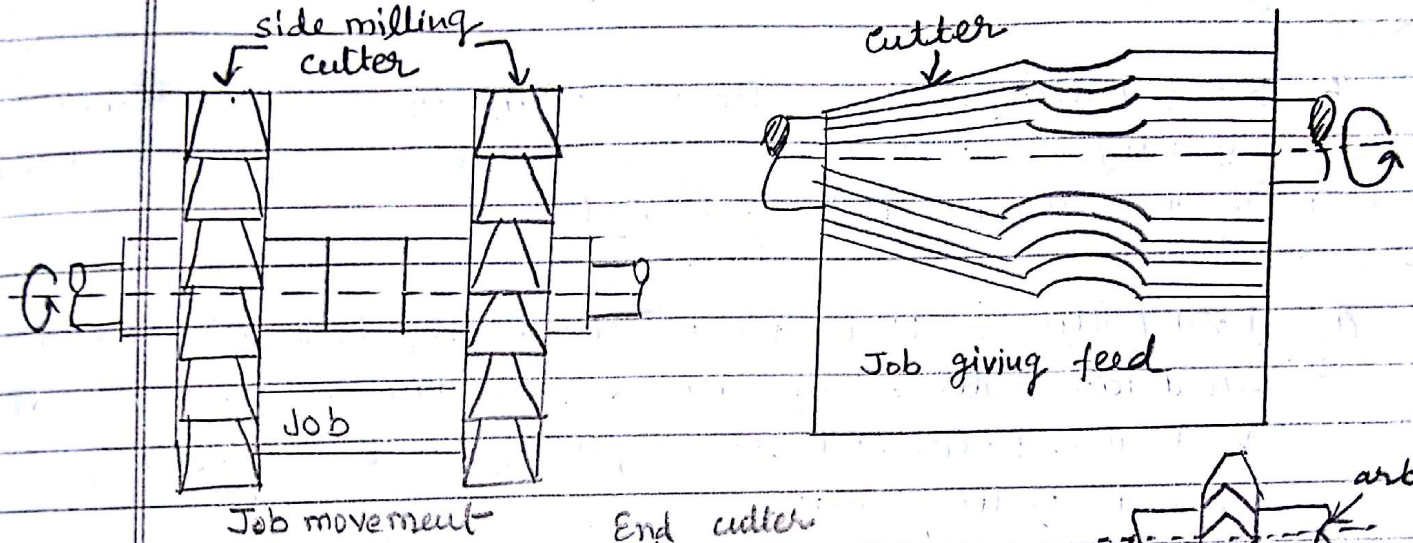
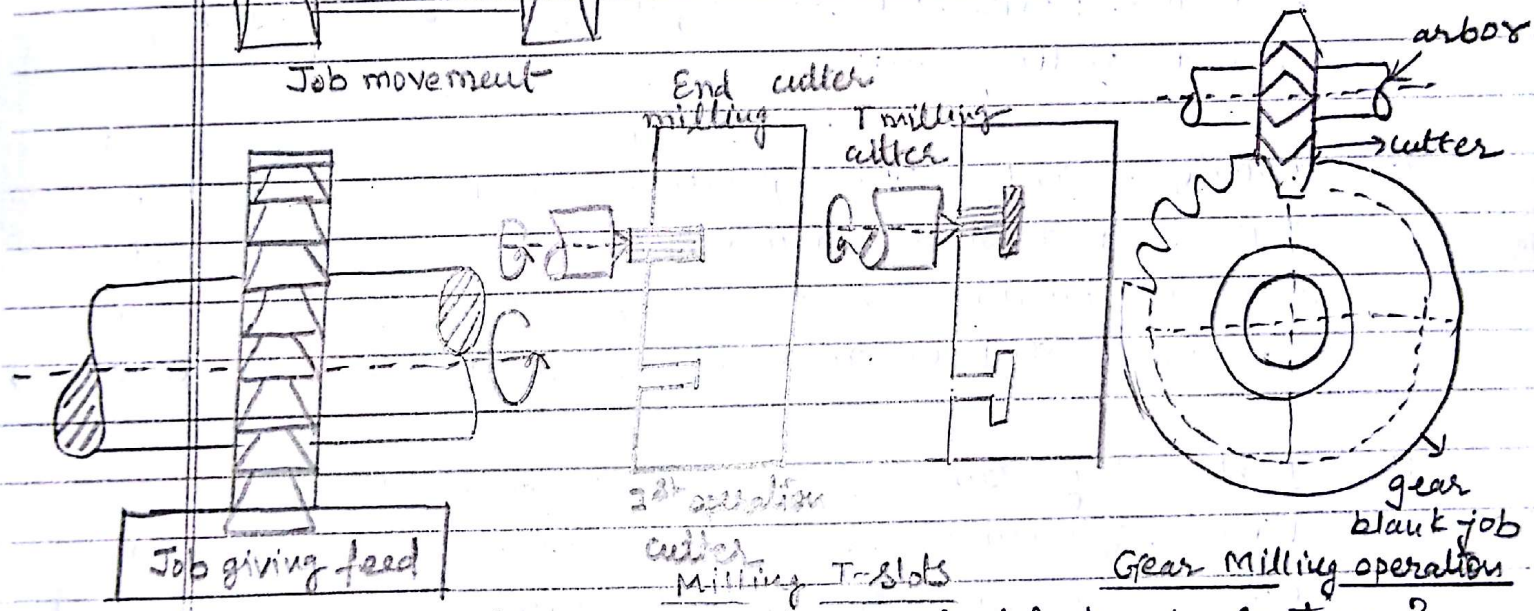


Plain / Slab Milling

Face Milling





Milling T-slots

Gear Milling operation

Q7. What are the various types of defects in casting?.

Ans ① Blow Holes: Rounded, flattened or elongated cavities present on the surface are called as open blows and cavities below the surface are called as blow holes. When the molten metal is poured into cavity, moisture of the mould is converted into steam. Part of this steam is trapped in casting resulting in open blows

② Misrun: When molten metal is not able to fill the entire mould cavity thus leaving unfilled cavities

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(3) Cold Shut : It occurs when two streams of metal coming from opposite direction do not fuse together due to cooling of molten metal due to very low fluidity of molten metal.

(4) Run Out : It occurs due to leakage of molten metal from the mould cavity. Main causes of this defect are faulty moulding and defective moulding boxes.

(5) Scab : They are sort of projections which occur when a portion of mould face lifts and molten metal flows underneath in a thin layer.

(6) Rat Tail : It is a long, shallow, angular depression resulting due to slight compression failure of the thin layer of moulding sand.

(7) Scar : It is a shallow blow which usually occurs on a flat surface of casting.

(8) Blister : It is a scar covered with thin layers of metal.

(9) Fin : A thin unintended projection of metal usually occuring at the parting line is known as fin. It occurs due to improper clamping, over flexible bottom boards and inadequately weighted sand.

(10) Shift : Misalignment between two halves of a mould or of a core results in mould shift or core shift.

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Q8: What is sheet metal and explain its various types of operations.

Ans: Many products which fulfill the household needs, decoration work and various engineering articles are produced from sheet metals. Examples of sheet metal work are hoppers, canisters, guards, covers, pipes, hoods, funnels, bends, boxes etc. Such articles are found less expensive, lighter in weight and in some cases sheet metal products replace use of casting & forging.

Various sheet metal operations are:

① Measuring and marking: It is done with the help of steel rule, steel tape, folding rule, steel circumference rule etc. After measuring, marking is done with the help of scribers, punches etc.

② Cleaning: Pickling process is used for cleaning where sheets are immersed in a hot bath of 1 part dilute sulphuric acid and 20 parts water. The blanks are then thoroughly washed in a stream of water and then allowed to dry.

③ Laying out: While doing the marking of development of the surface of the component on the sheet, certain material for various allowances (such as overlapping, cutting, bending etc.) are added. Such a layout when made on the sheet is called laying out process.

④ Cutting and Shearing: Sheet metal is cut by means of a chisel and a hammer manually. Shearing means cutting of sheet metal by two parallel cutting edges moving in opposite directions manually.

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(5) **Bending**: It is the plastic deformation of metals about a linear axis with little or no change in the surface area. The bars, rods, wires, tubes and sheet metal may be bent to many shapes in the cold condition with the help of dies.

(6) **Stretch Forming**: It is the process of producing contoured parts by stretching metal sheets over a shaped form block. Stretch forming strains the metal beyond the elastic limit, to give the work piece a permanent set. Form block and movable jaws method is used in stretch forming.

(7) **Deep Drawing**: It is a process by which hollow shapes are formed from the sheet metal. Die and punch is used in drawing operation. In deep drawing, a parallel walled cup is created from a flat blank. The blank maybe circular, rectangular or of a more complex outline.

(8) **Riveting**: It is a process of joining the two pieces of sheet metal permanently by means of rivets. These rivets are made of soft iron and are usually coated with tin.

(9) **Soldering**: It is the process of joining two or more pieces of metal sheets by means of an alloy of tin and lead. Soft solder consists of 50% tin and 50% lead and other solder consists of 60% tin and 40% lead.

(10) **Hollowing or Blocking**: It implies beating the sheet metal into a particular shape such as sauce pan, lid or bowl. It is performed on a hollowing block.

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It is a wooden block having hollow cuts into it. The metal is placed over a suitable hole and metal is beaten with a hammer. The hollowing process may also be done on a sandbag. The main advantage of sandbag is that there is no indentation on the top.

(11) Sinking: Sinking is a method of thinning metal to form a shallow tray. A piece of wood with a sharp corner is placed vertically in the vice and over the edge of this, the metal is beaten down with a tray hammer to shape the tray as shown.

(12) Raising: It is the process of denting the metal down to shape over a tool with a raising hammer or mallet so in this process sheet metal is beaten and induced to flow into the required shape.

(13) Planishing: It is the careful hammering operation by which exact shape and good surface is obtained. This process also imparts some degree of hardness to the metal. It is done to remove any small marks or indentations left by previous sheet metal operations such as raising etc.

Qq. What is a comparator? Explain the types of comparator?

Ans. It is a device which includes two i/p terminals namely inverting and non-inverting terminals. One input terminal is fed with reference i/p signal and remaining i/p is fed with actual values of the signal. The o/p

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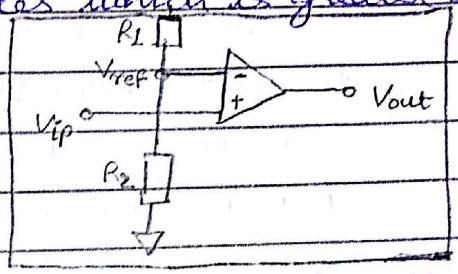
signal can be generated based on the difference b/w two i/p signals either high or low. The main purpose is to compare two currents or voltages which are fed to the two i/p signals and generates binary digital o/p signal that specifies which is greater is called as a comparator.



Types Of Comparators

① Mechanical Comparator: It is called microcator. Here, magnification is achieved by various mechanical devices and mechanical linkages. Mechanism of this instrument is in the form of tape spring twisted, and that is positioned in the middle part. This comparator is used for linear measurements by using relative contact method.

② Mechanical Optical Comparator: A small dislocation of measuring plunger is first amplified by a mechanical system comprising pivoted levers. Optical magnification offers a high degree of precision measuring.

③ Pneumatic comparator: Works on the principle that when the air under constant pressure discharges by passing through two openings, if one of the hole is kept uniform the pressure will change according to the size of the other.

④ Electric Comparators: It consists of a base, a stand, power unit, measuring unit, indication unit and

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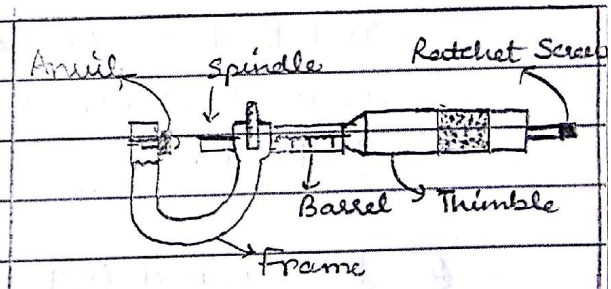
amplification unit. In this comparator, measuring contact movement is changed into an electrical signal and then this signal is recorded by a device that can be adjusted in terms of plunger movement.

⑤ Reed Type Comparator: It is frictionless device for expanding small motions of the spindle. It compeises of a static block A which is strictly attached to the gauge head case. The floating block B carries the gauging spindle & is connected horizontally to the static block by reeds C. A perpendicular reed is attached to every block with higher ends combined together.

Q10. Explain the working and principle with neat sketch of the following terms:

ⓐ Micrometer (Screw Gauge)

Uses the principle of a screw to amplify small distances into large rotations of screw that are big enough to read from a scale.



MICROMETER.

i) The amount of rotation is directly related to a certain amount of axial movement called screw's lead (pitch).

ii) With an appropriate lead and major diameter of screw, a given amount of axial movement will be amplified in resulting circumferential movement.

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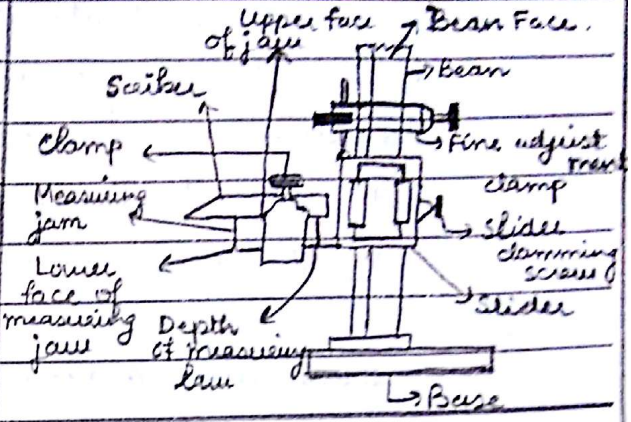
② Height Gauge

→ It is used to either set or measure vertical distances; the pointer is sharpened to allow it to act as a scriber and assist in marking out work pieces.

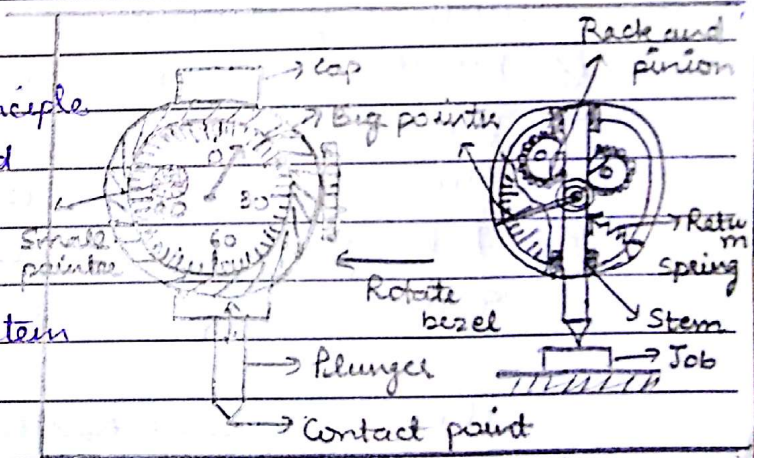


HEIGHT GAUGE.

→ It measures height of an object by using underside of the scriber as the datum. The datum may be permanently fixed or height gauge may have provision to adjust the scale and the scriber is set to the same level as the base, the scale can be matched to it which minimises errors.

③ Dial Indicators

→ It operates on the principle that a very slight upward pressure on the spindle at the contact point is multiplied through a system of gears and levers.



a) Dial Indicator b) Mechanism of Dial Indicator

→ The hand on dial face indicates the amount of movement of the contact point.

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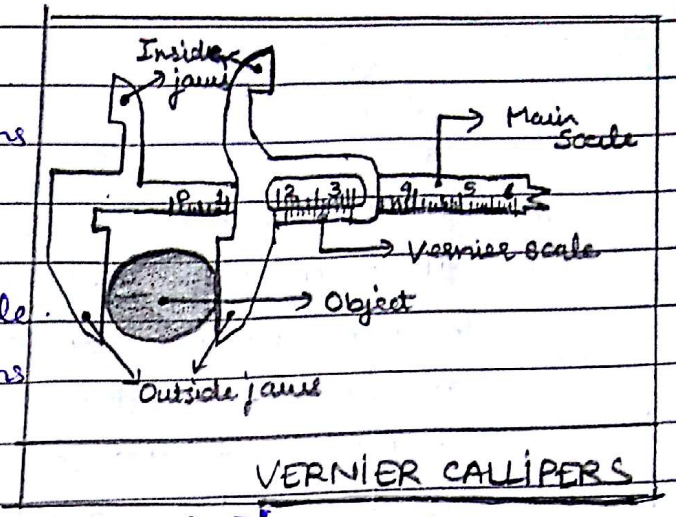
④ Vernier Callipers

Principle: Graduations on vernier scale are such that the length of 'n' divisions on the vernier scale is equal to (n-1) divisions of the main scale.



VERNIER CALLIPERS

Generally, a vernier scale has 10 divisions and the length of these 10 divisions = length of 10-1 = 9 divisions of the main scale.

Working: ① The jaws are first gently closed on the object to be measured.

② Note the main scale reading (M.S.R)

③ Note the division on vernier scale which coincides with any division of the main scale. Multiply this number of vernier division with the least count. This is the vernier scale reading (V.S.R)

Hence V.S.R = Vernier scale coincidence × Least count

④ Add the main scale reading to the vernier scale reading. This gives the observed length.

Hence, Observed Reading = Main scale reading + Vernier scale reading

Observed reading = M.S.R + V.S.R.

OR

Observed reading = M.S.R + (Vernier scale coincidence × L.C)

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