SUMMER – 13 EXAMINATION

Subject Code: **12051** **Model Answer** Page No: 1/24

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 any equivalent 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.

Q1. Attempt any ten of the following

a) Name the various mechanical properties of metal. **2**

Ans: Any 4 of the following (½ Mark Each)

i. Strength
ii. Elasticity
iii. Plasticity
iv. Ductility
v. Malleability
vi. Toughness
vii. Hardness
viii. Brittleness
ix. Resilience
x. Creep
xi. Fatigue
xii. Stiffness

b) Differentiate between thermoplastic and thermosetting. 2

Ans: Any 2 (1 Mark Each)

Thermoplastics	Thermosetting
They can be repeated softened by heat and hardened on cooling	once hardened and set they do not softened with application of heat
They are formed by addition polymerization only	They are formed by condensation polymerization
They consist of long chain linear polymers	They have three dimensional network structure
They are usually soft, weak and less brittle	They are usually hard, strong and more brittle
They are usually soluble in some organic solvents	They are insoluble in almost all organic solvents

These can be repeatedly used and have resale value	They cannot reused and do not have resale value.	
They cannot be used at higher temperature as they will tends to soft under heat	They can be used at comparatively higher temperature without damage.	

c) Write the purpose of heat treatment process. **2**

Ans: Any 4 (½ Mark Each)

i. Improve machinability.
ii. Relieve internal stresses
iii. Improve mechanical properties like ductility, strength, hardness, toughness etc
iv. Change grain size
v. Increase resistance to heat and corrosion
vi. Change the chemical composition
vii. To homogenize the structure
viii. Modify electrical and magnetic properties.

d) Explain the term "Surface hardening." **2**

Ans:

The heat treatment process of producing a hard wear-resistant carbon rich case (surface layers) on a tough and soft core of steel part is known as case hardening or surface hardening. Low carbon steel is used for the case hardening processes except in induction, hardening, where medium carbon steel or high carbon steel is used.

e) Write the advantages and limitations of wood as pattern material. **2**

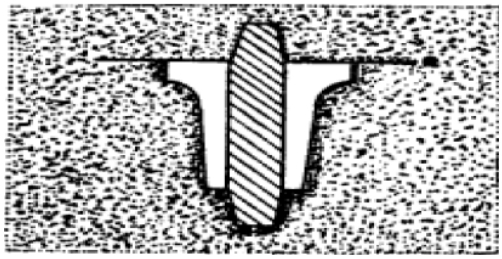
Ans: Any 2 advantages & any 2 disadvantage (½ Mark Each)

- **Advantages:**
  i) It is readily available.
  ii) It can be easily cut and formed in a desired shape by gluing.
  iii) By applying preservatives like shellac, varnish etc., it can be preserved for a long time.
  iv) It is light in weight.
- **Disadvantages:**
  i) It is affected by moisture when it comes in contact with damp moulding sand.
  ii) Because of sand abrasion, it wears out quickly.
  iii) Its life is short. Therefore the wood used for forming patterns should be well seasoned, straight grained, free from knots, strong and of reasonable cost.

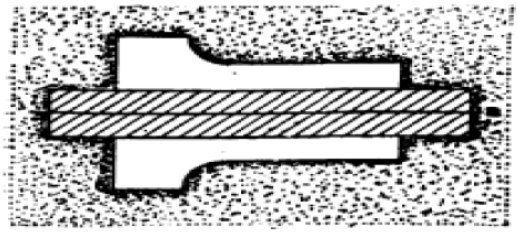
f) Draw neat sketch of vertical and horizontal types of core only. **2**

Ans: (1 Mark Each)

Vertical core



Horizontal core



g) Differentiate between continuous and discontinuous chips. **2**

Ans: Any Two (1 Mark Each)

Continuous chips	Discontinuous chips
Continuous chips consist of elements bonded firmly together without being fractured which gives continuous ribbon of metal	Consist of elements fractured into fairly small pieces ahead of the cutting tool.
Continuous fragments are produced because of high ductility of material.	Small fragments are produced because of lack in ductility of material
Condition for formation of these chips is high cutting speed and large rake angle and proper lubrication.	condition for formation of these chips is low cutting speed and small rake angle
Machining of ductile materials produce these chips	Machining of brittle materials produce these chips

h) State the required properties of good cutting fluids. **2**

Ans: Any 4 (½ Mark Each)

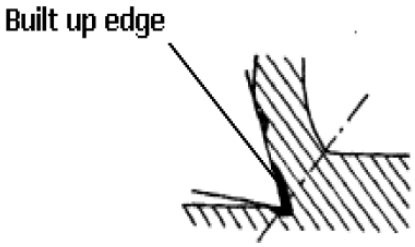
Properties:

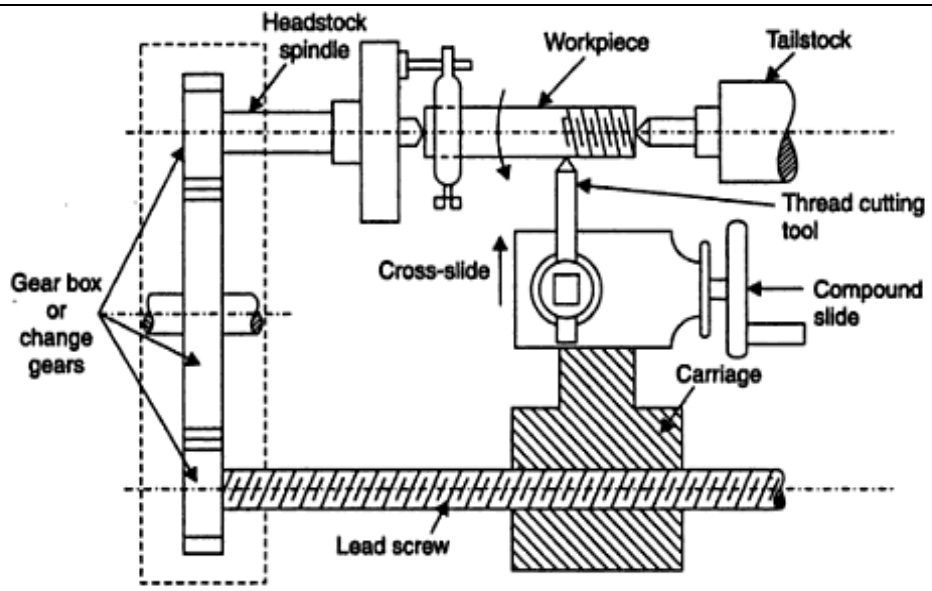
i. High heat absorption for readily absorbing heat developed.
ii. Good lubricating qualities to produce low-coefficient of friction.
iii. High flash point so as to eliminate the hazard of fire.
iv. Stability so as not to oxide in the air.
v. Neutral so as not to react chemically.
vi. Low viscosity.
vii. Non corrosive to the work or the machine.
viii. Odorless, so as not to produce any bad smell.
ix. Harmless to the skin of operator.

i) Explain the term "Built up chips" in metal cutting. **2**

Ans: Explanation- 1 mark and figure 1 mark

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.



j) Draw only setup of threading operation on lathe.	**2**
	
k) List eight accessories used in lathe machine.	**2**
Ans : Any Eight (1/4 Mark Each) i. Centre ii. Chuck iii. face plate iv. angle plate v. mandrel vi. rests vii. carriers viii. catch plates ix. collets	
l) What is machining allowance on pattern?	**2**
Ans: **Machining Allowance *:*** Rough surfaces of castings that have to be machined are made to dimensions somewhat over those indicated on the finished working drawings. The extra amount of metal provided on the surfaces to be machined is called machine finish allowance and the edges of these surfaces are indicated by a finish mark V, or F.	

Q2 Attempt any four of the following.	
a) What is an alloy steel? Write the effect of any two alloying elements on steel.	**4**

Ans: explanation of alloy steel - 2 marks & effects - 2 marks.

Alloy steel:

It contains iron & carbon as a main element. It also contains silicon, manganese, sulphur, phosphorus in different %. Some alloy steels contain Manganese varies up to 1 % & silicon up to 0.3 %. Some alloy steels contain manganese more than 1 % & silicon more than 0.3 %. It also contains nickel, chromium, molybdenum, vanadium in different %. These steels are called as "Alloy Steels".

Effects Of Alloying Element:

1) **Nickel** : -
   - i) It improves Toughness
   - ii) It improves Tensile Strength
   - iii) It improves Ductility
   - iv) It improves Corrosion Resistance

2) **Chromium** : -
   - i) It improves Ductility
   - ii) It is added in different proportions upto 18 %
   - iii) Below 1.5 % addition increases Tensile Strength
   - iv) 12 % addition gives high Corrosion Resistance
   - v) It improves Hardenability & Toughness simultaneously

3) **Cobalt** : -
   - i) It improves Corrosion Resistance
   - ii) It improves Thermal Resistance
   - iii) It improves Magnetic Properties
   - iv) It is act as a Grain Refiner

4) **Manganese** : -
   - i) Lower proportions from 1.0 to 1.5 % improves Strength & Toughness
   - ii) Higher proportions upto 5 % improves Hardness
   - iii) Very Higher proportions from 11 to 14 % improves very degree of Hardness

5) **Silicon** : -
   - i) It is act as a Ferritic Strengthener
   - ii) It improves Elastic Limits
   - iii) It improves Magnetic Property
   - iv) It decreases Hysteresis Losses

6) **Molybdenum** : -
   - i) It improves Hardness
   - ii) It improves Wear Resistance
   - iii) It improves Thermal Resistance
   - iv) It gives ability to maintain Mechanical Properties at Elevated Temperatures

7) **Tungsten** : -
   - i) It improves Hardness
   - ii) It improves Wear Resistance
   - iii) It improves thermal Resistance
   - iv) It improves shock Resistance
   - v) It improves Magnetic Properties
   - vi) It gives ability to maintain Mechanical Properties at Elevated Temperatures

8) **Vanadium** : -
   i) It improves Elastic Limit
   ii) It improves Shock Resistance
   iii) It act as a Degasser when added to Molten Metal

9) **Boron** : -
   i) It improves Toughness
   ii) It improves Tensile Strength
   iii) It improves Ductility
   iv) It improves Corrosion Resistance
   v) It improves Hardenability
   vi) It is very useful when alloyed with Low Carbon Steels

10) **Aluminium** : -
   i) It improves Tensile Strength
   ii) It improves Corrosion Resistance
   iii) It is used as a Deoxidizer
   iv) It improves growth of Fine Grains
   v) It improves Hardness by Nitriding to form Aluminum Nitrides

11) **Titanium** : -
   i) It improves Corrosion Resistance
   ii) It is good Deoxidizer
   iii) It forms titanium carbides means improves hardness

12) **Copper** : -
   i) It improves Toughness
   ii) It improves corrosion Resistance
   iii) It improves Strength
   iv) Its proportions varies from 0.2 % to 0.5 %

13) **Niobium** : -
   i) It deceases Hardenability
   ii) It improves Impact Strength
   iii) It improves Fine Grain Growth
   iv) It is also called as *' Columbium '*

b) List any two aluminium alloy and explain composition and engineering applications of any one. **4**

Ans: listing of Al Alloy- 1mark, composition & Application – 1.5 marks each.

Aluminium alloys :

- Duralumin
- Y – alloys

Duralumin :

Composition:

- 3.5 to 4.5 % copper
- 0.4 – 0.7 % manganese
- 0.4 – 0.7 % magnesium
- remaining is aluminum (94.1 – 95.7) %

Applications:

- Used in aircraft industries
- Available in bars, tubes, sheets

- Also age hardened (3 – 4 days)

Y – alloys :

Composition:

- 3.5 to 4.5 % copper
- 1.8 – 2.3 % nickel
- 1.2 – 1.7 % magnesium
- remaining is aluminium (nearly 90) (91.5 – 93.5) %

Applications:

- Mainly used as a casting alloys
- Piston of I.C. engines
- Used in strips & sheets form

c) What is the different between brass and bronze with respect to composition, properties, durability and application? **4**

Ans: (1 Marks Each)

Factors	Brass	Bronze
Composition	It is an alloy of copper and zinc	It is an alloy of copper and tin
Properties	• It has lower strength than bronze • It has low corrosion resistance than bronze • It has less antifriction and bearing properties • It is less costlier than bronze • It is not ductile when it contains about 5 % of tin	• It has higher strength than brass • It has better corrosion resistance than brass • It has antifriction and bearing properties • It is costlier than brass • It is most ductile when it contains about 5 % of tin
Durability	It has less durability	It has more durability
Application	• Caps of detonators in ammunition factories • Bullet envelopes, drawn containers, condenser tubes, coins, needles and dress jewellery • Cartridge cases, radiator fins, lamp fixtures, rivets and springs • Utensils, shafts, nuts and bolts, pump parts, condenser tubes and similar applications where corrosion is not too severe • Marine hardware, propeller shafts, piston rods, nuts and bolts, and welding rods	• Jewellery, heat exchangers, heavy duty parts, marine equipments, gear bearings and bushes • Coins, pumps, gears, heavy load bearings and marine fittings • Used for gun barrels, ordnance parts, Marine castings, gears, bearings and steam pipe fittings • Bearings, gear wheels, slide valves and gudgeon pins • Spring

d) Write down any four application of thermoplastic and thermosetting plastic material in automobiles.	**4**
Ans: Any 4 – (½ Marks Each) **1. Applications of thermoplastic materials:** i. Copper wire insulation ii. Water tubes iii. Polystyrene, iv. PVC v. Polyethylene **2. Applications of thermosetting plastic materials.** i. It is used in foundry and in transformer as an insulating material ii. Radio cabinets iii. Knife handles iv. Vacuum cleaner parts	
e) List the properties of brass that make it a useful engineering metal.	**4**
Ans: Any Four (1 Marks Each) i. Very ductile, Easily worked in a cold condition - Cold rolled in sheets - Drawn into wires, tubes ii. Reduces strength at high temperature. But very plastic - Converted in sheets, tubes, foils, plats with the help of hot rolling, hot extrusion, hot stampings, casting iii. Highly Strong, Very Ductile -Used in Head lamp reflectors, radiator shells, tubes iv. Good resistance to corrosion - Easy for casting, rolling, extrusion, stamping, Casting pump parts, valves, taps v. Corrosion resistance in sea water is improved - Used for cast & forged fittings for ships vi. Good resistance to sea water corrosion - It used for manufacturing sheets, tubes, bars, ship fittings, bolts, nuts, washers, other parts subjected to sea water corrosion, condenser plant vii. Colour varies red to bright yellow - For jewellery, decorative ornamental works viii. High corrosion resistance, Good tensile strength – used for hot worked, rolled, casted ix. Higher % of zinc gives headiness & brittleness, But it softens quickly when heated & melt at 870 ° C - Mainly used as a brazing solder (spelter)	
f) Write the meaning of following IS designation codes: i) 40 C8 ii) 11 Mn 2 iii) FeE 330 iv) Fe240	
Ans: (1 Marks Each) **i. 40 C 8** Carbon steel having 0.4 % carbon, and 0.8 % manganese. **ii. 11 Mn 2** Alloy steel having 0.11 % carbon, 0.5 % manganese. **iii. Fe E 330** Semi–killed steel having minimum yield stress of 330 N / mm^2 **iv. Fe 240** Semi– killed steel having minimum tensile strength of 240 N / mm^2	

Q3. Attempt any four of the following.

a) State the composition and properties of white/chilled cast iron. **4**

Ans: composition - 2 marks & property – ½ marks each

Composition:

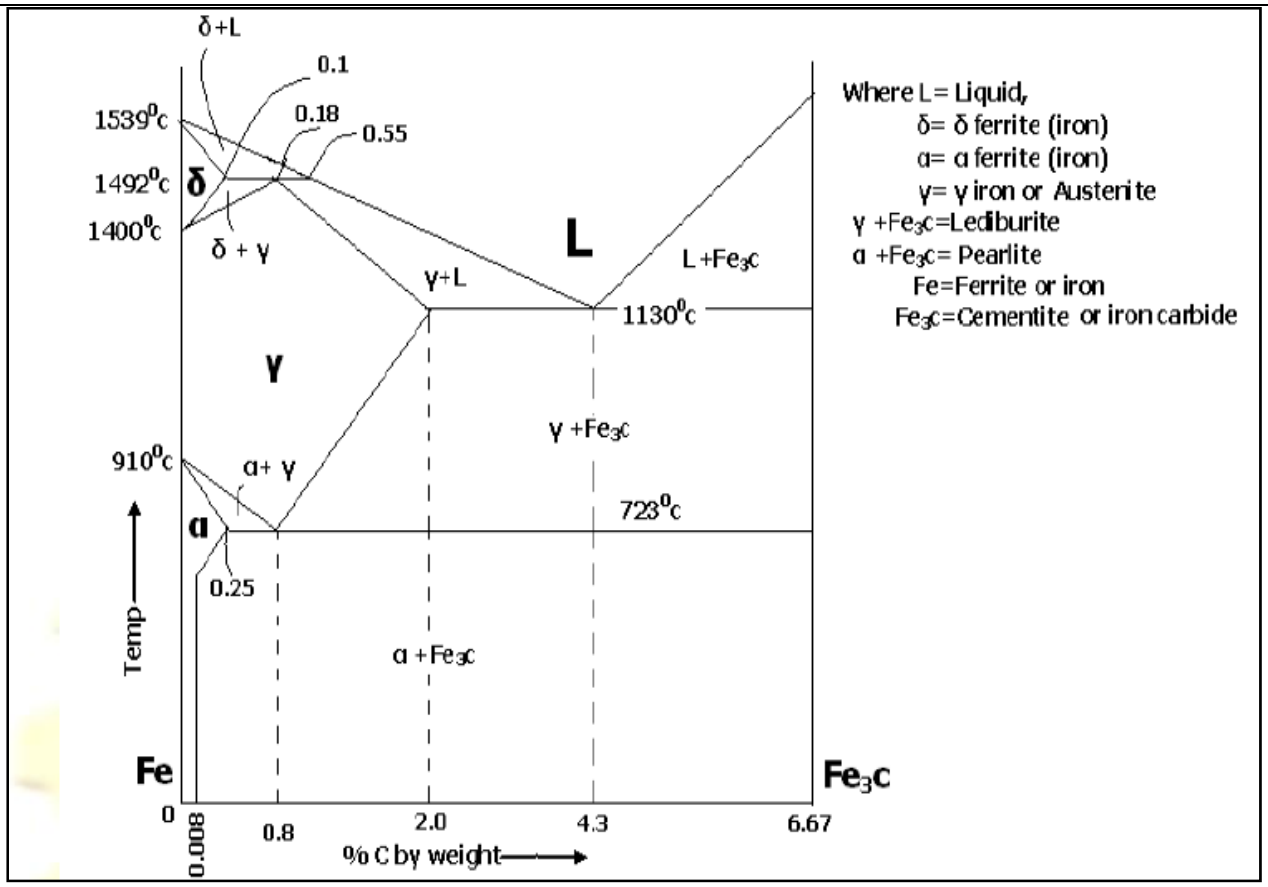
Material	Carbon	Silicon	Manganese	Sulphur	Phosphorous
White cast iron	1.75-2.30	0.85-1.20	0.10-0.40	0.12-0.35	0.05-0.20

Properties: (Any Four)

i. Because carbon is in combined form (cementite) that is why it is hard and brittle, so it cannot be machined easily.
ii. Hardness range from 400 to 600 BHN.
iii. Tensile strength is good.
iv. Freshly broken surface shows a bright white fracture
v. Highly resistant to wear.
vi. Due to poor fluidity, it does not fill mould freely.
vii. It can be made in sand moulds.
viii. The solidification range of white cast iron is 2550 – 2065°F
ix. It can be cooled rapidly.

b) Draw the iron-carbon equilibrium diagram and show critical temperature on it. **4**

Ans:



c) Compare "induction and flame hardening" as surface hardening processes. **4**

Ans: (1 Marks Each)

Flame Hardening	Induction Hardening
Material is heated with oxyacetylene flame at a required temperature, and then it is followed by water spraying.	Material is heated by using high frequency induced current and then it is followed by water spraying.
Holding time is required.	Due to very fast heating, no holding time is required.
Oxidation & decarburization are minimum.	No scaling & decarburization.
Irregular shape parts can be flame hardened.	Irregular shape parts are not suitable for induction hardening.
Flame hardening requires more care in control of temperature.	Easy control of temperature by control of frequency of supply voltage.

d) Write down properties of thermosetting material. **4**

Ans: (1 Marks Each)

Properties of thermosetting materials:

i. Hard, rigid, scratch resistant, resistant to heat & water
ii. Non oxidizing acids
iii. Excellent electrical insulating property
iv. Very cheap in cost
v. Durable, available in wide range of colours.
vi. High dielectric strength
vii. Resistant to shock
viii. Good resistance to moisture.
ix. Resists high temperatures.
x. Good chemical & electrical resistance
xi. Low shrinkage
xii. Good adhesion to metal & glass

e) Write the procedure of heat treatment used for gears. **4**

Ans: Any one

Heat treatment is a critical and complex element in the manufacturing of gears that greatly impacts how each will perform in transmitting power or carrying motion to other components in an assembly. Heat treatments optimize the performance and extend the life of gears in service by altering their chemical, metallurgical, and physical properties.

Hardening

There are two general classifications of heat treatments used for hardening steels: neutral hardening, and case hardening. Neutral hardening refers to maintaining the carbon potential of the atmosphere at the same percentage as the carbon in the steel during the hardening cycle. This means that carbon is entering and leaving the surface of the steel at the same rate, and no net gain or net loss of carbon atoms inside the surface of the steel occurs.

Carburizing

Carburizing, the most widely used form of surface hardening, is the process of diffusing carbon into the surface

of low carbon steel at elevated temperatures. This results in a high carbon case forming just inside the surface of a low carbon component. The goal of this process is to produce a hard, strong, wear resistant outer surface while retaining a softer, ductile tough core.

LCP/High Pressure Gas Quench

Low Pressure Carburizing (LPC) with high pressure gas quench is a relatively new carburizing technology. The equipment consists of vacuum chambers capable of heating parts to carburizing temperatures and capable of injecting small amounts of hydrocarbon gases at low pressure that act as a carbon source. The gas quench cells are equipped with powerful fans and are capable of injecting gases typically up to 20 bar positive pressure in conjunction with heat-exchangers using chilled water to quickly remove heat from the quenching gases. The most common quenching media is high pressure nitrogen gas, and the more common carburizing gases are propane and acetylene.

Gas Nitriding

This process is performed at low subcritical temperatures and completely avoids the problems of structural transformations associated with high temperature austenitizing and quenching of steel during carburizing. The nitriding process basically consists of placing steel surfaces at nitriding temperatures in contact with ammonia gas (NH3). The ammonia dissociates at the steel surface providing atomic nitrogen which can then diffuse into the gear, react with specific alloying elements in the steel, and form alloy nitrides which creates a hardened wear resistant case below the gear's surface.

Induction Hardening Gear Teeth

Induction heat treating is localized heat treatment used to increase the fatigue life, strength, and wear resistance of a component. Induction hardening is accomplished by placing the part inside an alternating magnetic field causing an electrical current to form at the surface. Heat is generated as a result of the I2R losses in the material and allows heat treaters to selectively austenitize only the surface material of a component while leaving the core material untransformed.

f) Compare parting and backing sand. **4**

Ans: Any Four (1 Marks Each)

Parting sand	Backing sand
Parting sand is used to keep the green sand from sticking to the pattern	Backing sand or floor sand is used to back up the facing sand
Not fill the whole volume of the flask.	Fill the whole volume of the flask.
The parting sand is sometimes called separating sand	The backing sand is sometimes called black sand
This sand is clay free.	This sand is not clay free.
It contains dried silica sand, sea sand / burnt sand	It contains coal dust & silica sand
It is used for parting the surface	It is not used for parting the surface
It is used between cope & drag boxes	It is used between cope & drag boxes

Q4) Attempt any four of the following.

a) Differentiate between hardening and tempering. **4**

Ans: Any Four (1 Marks Each)

Hardening	Tempering
To make steel hard to resist tough shock & fatigue	To make steel tough to resist tough shock & fatigue
To remove external stresses	To remove internal stresses
To regenerate the structure	To stabilize the structure
To increase the hardness	To decrease the hardness
It is not carried out in liquid baths as oil, salt or lead	It is carried out in liquid baths as oil, salt or lead
Types of hardening process – low temperature, medium temperature, high temperature	Types of tempering process – low temperature, medium temperature, high temperature

b) What is casting? Explain any two defects in casting with its causes and remedies. **4**

Ans: Casting-1 mark & causes, remedies- 3 Marks.

Casting:

When the mould filled with molten metal & metal is allowed to solidify, It forms reproduction of pattern is called as casting.

Defects in casting: (Any Two)

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.Warpage.

Warpage is unintentional and undesirable deformation in a casting that occurs during or after solidification.

Cause:

Due to 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.

Remedy:

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.

A swell is an enlargement of the mould cavity by metal pressure, resulting in localised or overall enlargement of the casting.

Cause:

This is caused by improper or defective ramming of the mould.

Remedy:

To avoid swells, the sand should be rammed properly and evenly.

4.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.

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.

5.Drop.

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

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.

c) State advantages and limitations of die casting process. **4**

Ans: Any two Advantage & Limitations each – (1 marks each)

Advantages of die casting Process: (Any two)

i. Very high rate of production is achieved.
ii. Close dimensional tolerances of the order of ± 0.025 mm is possible.
iii. Surface finish of 0.8 microns can be obtained.
iv. Very thin sections of the order of 0.50 mm can be cast.

Limitations of die casting Process: (Any two)

i. Not economical for small runs.
ii. Only economical for nonferrous alloys.
iii. Heavy castings cannot be cast. In fact, the maximum size is limited by the size of the dies and the capacity of the die casting machines available.
iv. Cost of die and die casting equipment is high.

d) What are core prints? Also state various types of core prints. **4**

Ans: Core prints – 2 marks & types – 2 marks

Core prints

Castings are often required to have holes, recesses, etc. of various sizes and shapes. These print impressions are obtained by using sand cores which are separately made in boxes known as core boxes. For supporting the cores in the mould cavity, an impression in the form of a recess is made in the mould with the help of a projection suitably placed on the pattern. This projection on the pattern is known as the core print. A core print is, therefore, an added projection on a pattern, and it forms a seat which is used to support and locate the core in the mould. There are several types of core prints, viz., horizontal or parting line core print, vertical or cope and drag core print, balancing core print, cover or hanging core-print, wing or drop core-print.

Types of Core Prints:

1. Horizontal core print:

This is laid horizontally in the mould and is located at the parting line of the mould. The core print is often found on the split or two-piece pattern.

2. Vertical core print:

This stands vertically in the mould. This is why this type of core is referred to as a vertical core print. The core print is located on the cope and drag sides of a pattern and is constructed with considerable taper especially on the cope side (about 10-15°) so that they are easily moulded. The taper on drag print is only 1.5-3°.

3. Balancing core print:

This is used when a horizontal core does not extend entirely through the casting, and the core is supported at one end only. An important feature of this core print is that the print of the core in the mould cavity should balance the part which rests in the core seat.

e) List the factors on which the types of pattern depend. **4**

Ans: Any Four (1 Marks Each)

The selection of pattern materials depends on factors such as:

i. service requirements, e.g. quantity, quality and intricacy of castings, minimum thickness desired, degree of accuracy and finish required;

ii. possibility of design changes;

iii. type of production of castings, and type of moulding method and equipment to be used;

iv. Possibility of repeat orders.

v. easily worked, shaped and joined;

vi. light in weight for facility in handling and working;

vii. strong, hard and durable (i.e. of high strength to weight ratio);

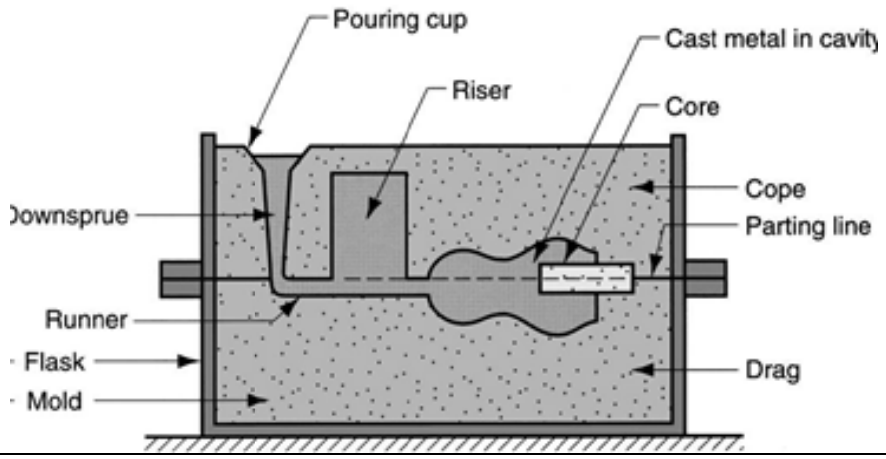
viii. resistant to wear and abrasion, to corrosion, and to chemical action;

ix. dimensionally stable and unaffected by variations in temperatures and humidity;

x. available at low cost

f) Draw neat sketch of gating system and show following elements on it. i) Drag ii) Riser iii) Cope iv) Sprue **4**

Ans: Sketch - 2 Marks & naming of elements 2 Marks



Q5 Attempt any four of the following	
a) List the various type of pattern used in foundry work.	**4**
Ans: Any Eight (½ Marks Each) i. Single piece pattern ii. Split pattern iii. Match plate pattern iv. Cope and drag pattern v. Gated pattern vi. Sweep pattern vii. Loose piece viii. Follow board pattern ix. Skeleton pattern x. Segmental pattern xi. Shell pattern xii. Built-up pattern xiii. Box-up pattern xiv. Lagged-up pattern xv. Left & right hand	
b) Describe standard colour coding used in pattern.	**4**
Ans: Any Four (1 Marks Each) The colour codes are given for identification of the parts of patterns and core boxes. i. Surface to be left unfinished are to be painted black ii. Surface to finished are painted by red colour. iii. Seats for loose pieces are marked by red strips on yellow background iv. Core prints are painted by yellow colour. v. Stop-offs is marked by diagonal black strips on yellow background.	

c) Compare single and multi-points cutting tool. **4**

Ans:(1 Marks Each)

Single Point cutting tool	Multipoint cutting tool
Single point cutting tool have only one cutting edge	These tools have more than one cutting edge.
It is simplest form of cutting tool & it has only one cutting edge.	These tools are merely two or more single point tools arranged together as a unit.
Rate of machining is less.	The rate of machining is more.
Surface finish is not better as compare to multipoint cutting tool.	Surface finish is also better in this case.
E.g. Lathe, shaper, planer, boring tool etc	E.g. Milling, cutters, drills, etc

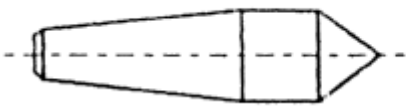
d) Explain any two accessories used in lathe machine with neat sketch. **4**

Ans: Any Two (2 Marks Each)

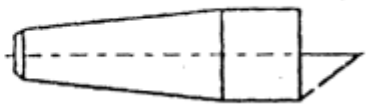
The lathe accessories are used for holding and supporting the work or for holding the cutting the various lathe accessories are discussed as follows

1. Centres.

- There are two types of centres i.e., live centre and dead centre.
  - A centre which fits into the headstock spindle and revolves with the work is called live centre.
  - The centre which is used in a tailstock spindle and does not revolve is called dead centre.



(a) Standard centre



(b) Half centre

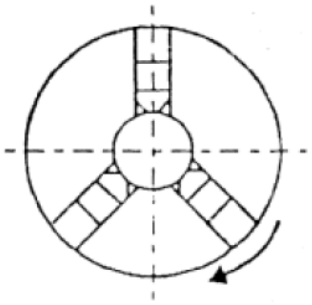
2. Chucks.

- It is an important device used for holding and rotating the workpiece in laths.
- The work pieces which are too short to be held between centres are clamped in a chuck.
- It is attached to the lathe spindle by means of two bolts with the back plate screwed on to the spindle nose.

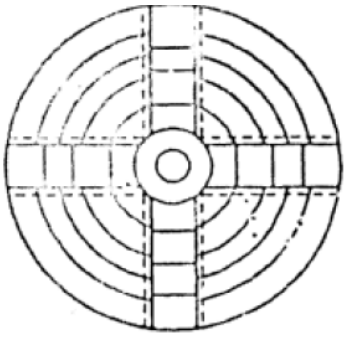
There are many types of the chuck, but the following two are commonly used.

- **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.



(a) Three jaw chuck



(b) Four jaw chuck

- **Four jaw independent chuck.**

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. 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:

- combination chucks,
- magnetic chuck,
- collect chuck,
- drill chuck, and
- air or hydraulic chuck
- Lathe dog or carrier

3. Lathe dog or carrier

- 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.
- This is engaged with a pin attached to the drive plate or face plate. The lathe dog or carrier may be of straight type or bent type as shown in Fig. (a) and (b) respectively

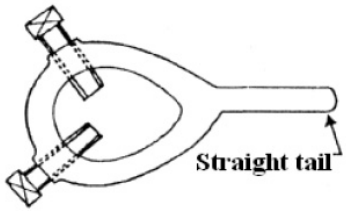


Fig. (a)

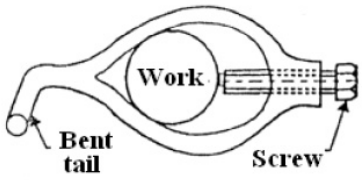
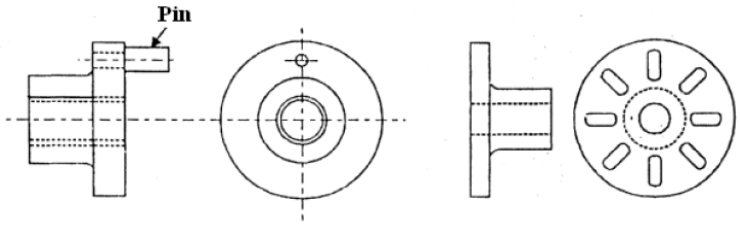


Fig. (b)

4. Drive plate

- 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.
- 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



5. Faceplate.

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

6. Angle plate.

- An angle plate is simply a cast iron plate with two faces planed at right angles to each other and having slots in various positions for the clamping bolts.
- It. is always used with the face plate for holding such parts which cannot be clamped against the vertical surface of the face plate.

7. Mandrels.

- 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.
- 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.

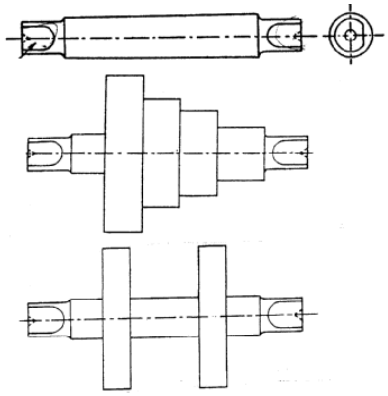
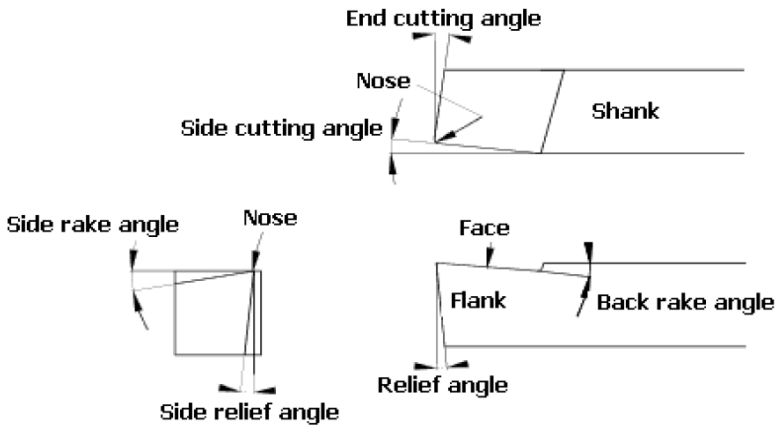
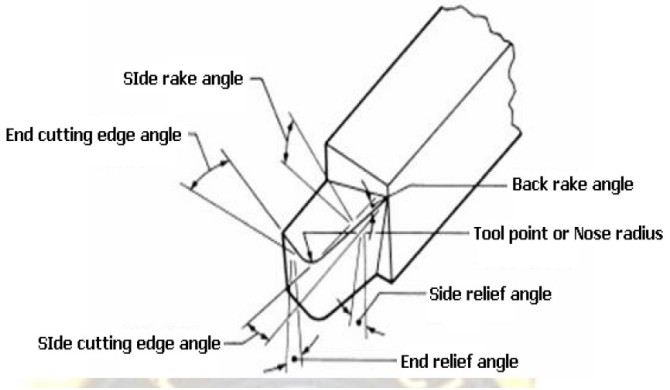


Figure. – a) Plain mandrel, b) Step mandrel and c) Collar mandrel

e) Explain purpose of shank, end relief angle, back rake angle and nose radius in single point cutting tool.	**4**

Ans: (1 Marks Each)





- **Shank –**

  It is main body of tool. It is a part of tool which is gripped in tool holder The Shank is that portion of the tool bit which is not ground to form cutting edges and is rectangular in cross-section

- **End relief angle-**

  It is the angle between portion of the end flank immediately below the end cutting edge and a line perpendicular to base of tool and measured at right angle to the end flank.

  End relief indicates that the nose or end of tool has been ground back at an angle sloping down from the end cutting edge.

- **Back rake angle -**

  It indicates that plane which forms the face or top of the tool has been ground back at an angle sloping from the nose.

  Rake angle is provided for ease of chip flow and overall machining. It helps to reduce cutting force and thus cutting power requirement. Also to increase edge-strength and life of the tool.

- **Nose Radius –**

  The nose of a tool is the conjunction of the side- and end-cutting edges. A nose radius increases the tool life and improves surface finish.

f) Describe various type of cutting fluids with respect to its applications.	**4**

Ans: Any Two (2 Marks Each)

Type of Cutting Fluids:

1. **Water:**

   Water, either plain or containing an alkali, salt or water-soluble additive but little or no oil or soap are sometimes used only as a coolant. But water alone is, in most cases, objectionable for its corrosiveness.

2. **Soluble oils:**

   Soluble oils are emulsions composed of around 80 per cent or more water, soap and mineral oil. The soap acts as an emulsifying agent which breaks the oil into minute particles to dispose them throughout water. The water increases the cooling effect and the oil proxies the best lubricating properties and ensures freedom from rust. By mixing various proportions of water with soluble oils and soaps, cutting fluids with a wide range of cooling and lubricating properties can be obtained.

3. **Straight oils:**

   The straight oils may be (a) straight mineral (petroleum) oils, kerosene, low-viscosity petroleum fractions, such as mineral seal, or higher-viscosity mineral oils, (b) straight fixed or fatty oils consisting animal, vegetable, or synthetic equivalent, lard oil, etc. They have both cooling and lubricating properties and are used in light machining operations.

4. **Chemical compounds:**

   These compounds consist mainly of a rust inhibitor, such as sodium nitrate, mixed with a high percentage of water.

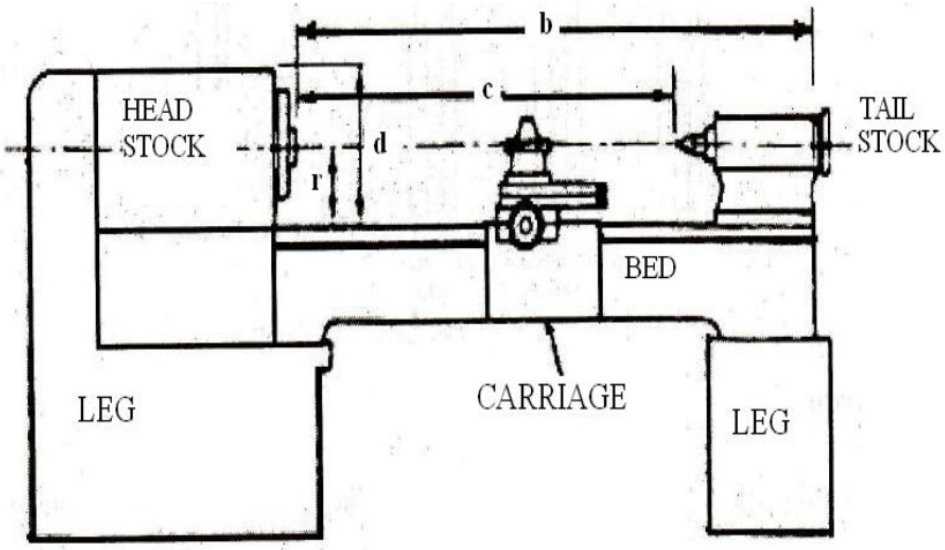
5. **Solid lubricants:**

   Stick waxes and bar soaps are sometimes used as a convenient means of applying lubrication to the cutting tool.

Q 6. Attempt any four of the following.	
a) State different properties required in moulding sand.	**4**
Ans: Any Four (1 Marks Each) **1. Porosity/Permeability:** Molten metal always contains a certain amount of dissolved gases, which are evolved when the metal freezes. Also, the molten metal, coming in contact with the moist sand, generates steam or water vapor. If these gases and water vapor evolved by the moulding sand do not find opportunity to escape completely through the mould they will form gas holes and pores in the casting. **2. Flow ability:** Flow ability of moulding sand refers to its ability to behave like a fluid, so that, when rammed, it will flow to all portions of a mould and pack all-around the pattern and take up the required shape. The sand should respond to different moulding processes. High flow ability is required of a moulding sand to get compacted to a uniform density and to obtain good impression of the pattern in the mould. **3. Collapsibility:** After the molten metal in the mould gets solidified, the sand mould must be collapsible so that free contraction of the metal occurs, and this would naturally avoid the tearing or cracking of the contracting metal. **4. Adhesiveness:** The sand particles must be capable of adhering to another body, i.e., they should cling to the sides of the moulding boxes. It is due to this property that the sand mass can be successfully held in a moulding box and it does not fall out of the box when it is removed. **5. Cohesiveness or strength:** This is the ability of sand particles to stick together. Insufficient strength may lead to a collapse in the mould or its partial destruction during conveying, turning over or closing. The mould may also be damaged during pouring by washing of the walls and core by the molten metal. The strength of moulding sand must, therefore, be sufficient to permit the mould to be formed to the desired shape and to retain this shape even after the hot metal is poured in the mould. **6. Refractoriness:** The sand must be capable of withstanding the high temperature of the molten metal without fusing. Moulding sands with a poor refractoriness may bum on to the casting. Refractoriness is measured by the sinter point of the sand rather than its melting point.	
b) State the points required to specify lathe machine and draw a suitable block diagram of the lathe.	**4**
Ans: Listing of points - 1 marks & figure -3 marks 1. The height of the centres 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 centres. This is the maximum length of work that can be mounted between the lathe centres. 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.



r- Centre height c- Length between centres
d- Swing diameter over bed b- Length of bed

c) Calculate gear train for cutting 1.25 mm pitch of the thread to be cut, pitch of lead screw is 6 mm. Available gears are with 20 teeth to 120 teeth in steps of 05 teeth. **4**

Ans:

$$\frac{Driver\ Teeth}{Driven\ Teeth} = \frac{Pitch\ of\ Work}{Pitch\ of\ the\ Lead\ screw}$$

$$= \frac{1.25}{6}$$

$$= \frac{1.25x4}{6x4}$$

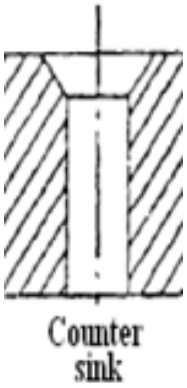
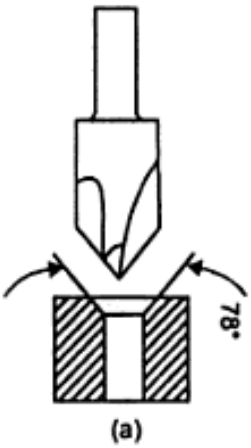
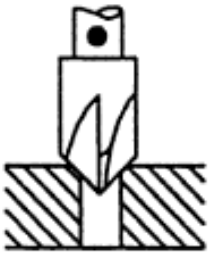
$$= \frac{5}{24}$$

$$= \frac{5x1}{4x6}$$

$$= \frac{5x10}{4x10} X \frac{1x20}{6x20}$$

$$= \frac{50}{40} X \frac{20}{120}$$

= The driving gears will have 50 and 20 T and driven gears 40 and 120 T

d) Explain counter sinking operation with neat sketch.	**4**
Ans: Sketch- 2 marks & explanation 2 marks **Counter-sinking.** It is an operation to bevel the top of a drilled hole for making a conical seat for a flat head screw. Ordinary flat drill ground to correct angle is used for countersinking holes. The operation of leveling the mouth of a hole with a rotary tool is known as countersinking. Countersinks are made in various sizes and angles. The standard included angles of countersink are 60deg. 82deg. and 90 deg.   (a)  (b)	
e) Give classification of drilling machines.	**4**
Ans: (1/2 Marks Each) 1. Portable drilling machine 2. Sensitive drilling machine 3. Upright or column drilling machine 4. Radial drilling machine 5. Gang drilling machine 6. Multi-spindle drilling machine 7. Vertical drilling machine 8. Automatic drilling machine 9. Deep hole drilling machine	

f)	**With the help of neat sketch, describe the taper turning method by broad nose form tool, also state its limitations.**	**4**

Ans: Sketch- 2 marks & explanation- 2 marks

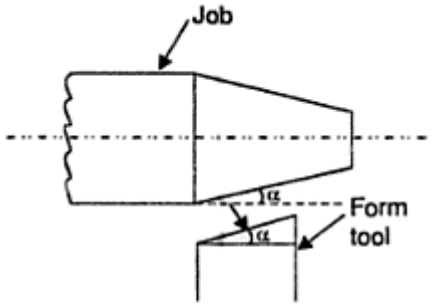


Fig. Taper turning by a form tool.

- It is a method of taper turning shown in fig. a broad nose tool having straight cutting edge is set on to the work at half taper angle and is fed straight into the work to generate a tapered surface.
- With this method, tapers of short length only can be turned.
- This form tool taper turning method not adversely used.
- It is limited to short external tapers.
- The edge tool must be exactly straight for accurate work.