

**OBJECTIVE**

- To impart the knowledge about various production processes.
- To impart knowledge about different processes in rapid manufacturing and also rapid tooling technology.

**UNIT I THEORY OF METAL CUTTING****9**

Orthogonal and oblique cutting– Classification of cutting tools: Single, Multipoint – Tool signature for single point cutting tool – Mechanics of orthogonal cutting – Shear angle and its significance – Chip formation– Cutting tool materials– Tool wear and tool life – Machinability – Cutting Fluids– Simple problems.

**UNIT II MACHINING****9**

General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal Milling machine, Universal Drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining and Laser beam machining.

**UNIT III CASTING AND WELDING****9**

**CASTING**-Pattern and Core making – Moulding sand – Melting furnaces Cupola and Induction furnaces. Special casting processes – Shell, Investment, Die casting – Defects in casting.

**WELDING**-Gas welding, Basic Arc Welding Processes, Thermit Welding, Electron – Beam Welding, Laser – Beam Welding- Plasma Arc. Solid State Welding: Ultrasonic Welding, Friction Welding.

**UNIT IV METAL FORMING AND POWDER METALLURGY****9**

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning. Powder metallurgy – Principal steps involved advantages, disadvantages and limitations of powder metallurgy.

**UNIT V FORMING AND SHAPING OF PLASTICS****9**

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods.

**TOTAL= 45 PERIODS****TEXT BOOK**

1. Kalpakjian, S., “Manufacturing Engineering and Technology”, Pearson education India, 4th edition, 2001(ISBN 81 78081 571) (UNIT-I, II, III, IV)
2. Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005 (UNIT-I, II, IV)

## REFERENCES

1. P. N. Rao, Manufacturing Technology vol I, Tata-McGraw-Hill Publishing Limited, 2010(UNIT-III)
2. Chua, C K, Leong, K F and Lim, C S., "Rapid Prototyping: Principles and Applications", John Wiley, New York, 2003(UNIT-V)
3. Rao P.N., "Manufacturing Technology, Metal cutting and Machine Tools", Tata McGraw Hill, 2000. (UNIT-I)
4. Sharma, P.C., A textbook of Production Technology – Vol I and II, S. Chand & Company Ltd., New Delhi, 1996. (UNIT-I, II, III, IV)
5. Jain. R. K., Production Technology, Khanna Publishers, New Delhi, 2001. (UNIT- II, IV)

## COURSE OUTCOME:

**At the end of the course student should be able to:**

- Understand the basics of cutting, cutting tools, and tool wear
- Gather knowledge about the conventional and unconventional machining processes.
- Characterize the major machining operations of Turning, Milling, and Drilling
- Gather knowledge about the casting and welding
- Have an exposure to powder metallurgy and plastics



**SNS COLLEGE OF TECHNOLOGY  
COIMBATORE-35  
Department of Mechatronics Engineering**



**MANUFACTURING TECHNOLOGY**

## *UNIT I – THEORY OF METAL CUTTING*

### **1. Define Metal Cutting .**

Metal cutting or machining is the process of by removing unwanted material from a block of metal in the form of chips.

### **2. What are the important characteristics of materials used for cutting tools?**

High red hardness	High wear resistance
High toughness	Low frictional co-efficient
High thermal conductivity	

### **3. How do you define tool life?**

The time period between two consecutive sharpening, with which the cuts the material effectively is called as tool life.

### **4. What is tool signature?**

The various angles of tools are mentioned in a numerical number in particular order. That is known as tool signature.

### **5. What is the effect of back rack angle and mention the types?**

Back rake angle of tool is increases the strength of cutting tool and cutting action. It can be classified in to two types.

1. Positive rake angle.
2. Negative Rake angle.

**6. Explain the nose radius?**

Joining of side and end cutting edges by means of small radius in order to increase the tool life and better surface finish on the work piece

**7. What are all conditions for using positive rake angle?**

1. To machine the work hardened materials
2. to machine low strength ferrous and non-ferrous metals.
3. to machine long shaft of small diameters.
4. To machine the metal below recommended cutting speeds.
5. Using small machine tools with low horsepower.

**8. Define the orthogonal and oblique cutting.**

*Orthogonal cutting:* The cutting edge of tool is perpendicular to the work piece axis.

*Oblique cutting:* The cutting edge is inclined at an acute angle with normal to the cutting

velocity vector is called oblique cutting process.

**9. What are the favorable factors for discontinuous chip formation?**

- |  |                    |
|--|--------------------|
| Machining of brittle materials.  | Small rake angle   |
| Higher depth of cut  | Low cutting speeds |
| Excess cutting fluid.  |                    |
| Cutting ductile materials with low speed and small rake angle of the tool. |                    |

**10. What are the favorable factors for continuous chip formation?**

- |   |                        |
|---|------------------------|
| Small rake angle                            | Low cutting speed      |
| Strong adhesion between chip and tool face. | Coarse feed            |
| Insufficient cutting fluid.                 | Large uncut thickness. |

**11. Define machineability of metal.**

Machine ability is defined as the ease with which a material can be satisfactorily machined.

Life of the tool before tool failure or resharpening.

**12. What is shear plane?**

The material of work piece is stressed beyond its yield point under the compressive force. This causes the material to deform plastically and shear off. The plastic flow takes place in a localized region is called shear plane.

**13. What is chip and mention its different types?**

The sheared material begins to along the cutting tool face in the form of small pieces is called chip.

The chips are mainly classified into three types.

- a. Continuous chip.
- b. Discontinuous chip.
- c. Continuous chip with built up edge.

**14. Write the factors affecting the tool life or Write the Taylor's tool life equation.**

Taylor's equation  $VT^n = C$

- i. Cutting speed
- ii. Feed and Depth of cut.
- iii. Tool Geometry
- iv. Tool material
- v. Type of Cutting Fluid

- vi. Work material
- vii. Rigidity of the Machine tool.

**15. Define “Side relief” and “End relief” angle.**

**Side relief angle:** It is the angle between the portion of the side flank immediately below the side cutting edge and a line perpendicular to the base of the tool, and measured at right angle to the side flank.

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

**16. What are the importances of Nose Radius?**

Nose radius is favorable to long tool life and good surface finish. A sharp point on the end of a tool is highly stressed, Short lived and leaves a groove in the path of cut. There is an improvement in surface finish and permissible cutting speed as nose radius is increased from zero value.

**17. What are the differences between orthogonal cutting and oblique cutting?**

<b>orthogonal cutting</b>	<b>oblique cutting</b>
Cutting edge of the tool is perpendicular to the direction of tool travel	Cutting edge of the tool is inclined to the direction of tool travel
The direction of chip flow is perpendicular to the cutting edge	The direction of chip flow is angled to the cutting edge
The chip coils in a tight flat spiral	The chip flows sideways in a long.
Produces sharp corners.	Produces chamfer at the end of cut.

**18. Name the types of chip formed during machining.**

- Continuous chip
- Discontinuous chip
- Continuous chip with built-up edge.

**19. What is chip breaker?**

The chip coils in a helix and curl around the work and the tool and may injure the operator in case of continuous chip. A chip breaker is a metal piece attached to the tool, breaks the chip and reduces the difficulties.

**20. Define “cutting power” and “specific metal removal rate”**

**Cutting power:** The cutting power or the specific energy consumption , is the product of the cutting speed and the cutting force.

**Specific metal removal rate :** The amount of metal removal per unit power consumption is called “specific metal removal rate” .

**21. What are the major types of tool wear?**

- Crater wear,
- Flank wear
- Chip breakage.

**22. What are the variables that affect the tool life?**

- Cutting conditions,
- Tool Geometry,
- Work material
- Tool material
- Cutting fluid.

**23. What are the functions of cutting fluid?**

1. Cool the tool and the work piece
2. Reduce the friction
3. Protect the work against rusting
4. Improves the surface finish
5. Prevent the formation of built up edge.

**24. What are the required properties for a tool material?**

1. High hot hardness
2. High Temperature strength
3. Low co-efficient of friction
4. High thermal conductivity
5. Low ductility.

**25. What is meant by Shear plane in metal cutting?**

A wedge shaped tool is made to move relative to the workpiece. As the tool makes contact with the metal, it exerts a pressure on it resulting in the compression of the metal near the tool tip. This induces shear type deformation within the metal and it starts moving upwards along the top face of the tool. As the tool advances, the material ahead of it is sheared continuously along plane called the shear plane.

**26. Define – Rake surface and Flank surface.**

The surface along which the chip moves upwards is called Rake angle and the other surface which is relieved to avoid rubbing with the machined surface is called Flank surface.

**27. Define - Rake angle and clearance angle.**

The angle between the rake surface and the normal is known as Rake angle, and the angle between the flank and the horizontal machined surface is known as the relief or clearance angle.

**28. Name the two systems used in metal cutting to designate the tool shape:**

American standards Assosiation.                      Orthogonal rake system.

**29. Define ASA system:**

In the ASA system, the angles of tool face, that is, its slope, are defined in two orthogonal planes, one parallel to and the other perpendicular to, the axis of the cutting tool, both planes being perpendicular to the base of the tool.

**30. What is the importance of Nose Radius?**

Nose radius is favourable to long tool life and good surface finish. A sharp point on the end of a tool is highly stressed, short lived and leaves a groove in the path of cut. There is an improvement in surface finish and permissible cutting speed as nose radius is increased from zero value. Too large nose radius will induce chatter.

**31. Name the types of chip formed during machining.**

1. Discontinuous chips
2. Continuous chips
3. Continuous chips with built up edge.

**32. Define tool life.**

The total cutting time accumulated before tool failure occurs is termed as tool life.

**33. Write the criteria commonly used for measuring tool life.**

The two most commonly used criteria for measuring the tool life are

1. Total destruction of the tool when it ceases to cut.
2. A fixed size of wear land on tool flank.

**34. What are the variables that affects the tool life?**

The process variables that play role in tool life are:

Process variables

Tool material

Work piece material, its hardness and micro structure.

Surface condition of the work piece.

Cutting.

**UNIT II**

**1. What is a Lathe?**

Lathe is a machine tool which removes the metal from a piece of work to the required shape and size.

**2. What are the uses of headstock?**

Headstock carries a hollow spindle with nose to hold the work piece.

To Mount the driving and speed changing mechanisms.

**3. What is an apron?**

The integral part of several gears, levers and clutches mounted with the saddle for moving the carriage along with lead screw while thread cutting.

**4. What are the advantages semi-automatic lathes?**

Production time is minimized

Accuracy will be high.

Production rate is increased.

**5. List any four work holding devices.**

1. Chucks.

2. Centres.

3. Faceplates.

4. Angle Plate.

**6. How can the number of teeth on various change gears be calculated?**

$$\frac{\text{Driver teeth}}{\text{Driven teeth}}$$

$$\frac{\text{Teeth on the spindle gear}}{\text{teeth on head screw gear}}$$

$$\frac{\text{Pitch to be cut on the work.}}{\text{Pitch of lead screw.}}$$

**7. Compare the advantages of turret lathe over capstan lathe**

Heavier and Larger workpiece chucking can be done.

More rigid, hence it withstands heavy cuts.

**8. Name any four tool holding devices used in capstan and turret lathe.**

Multiple cutter holders.

Offset cutter holder.

Sliding cutter holder.

Knee tool holder.

**9. What are the four types of tool post?**

1. Single screw

2. Open side

3. Four bolt

4. Four way

**10. List any four types of lathe?**

1. Engine lathe
2. Bench lathe
3. Tool room lathe
4. Semi automatic lathe
5. Automatic lathe

**11. What is a semi-automatic lathe?**

The lathe in which all the machining operations are performed automatically and loading and unloading of work piece, coolant on or off is performed manually

**12. State the various feed mechanisms used for obtaining automatic feed?**

1. Tumbler gear mechanism
2. Quick change gearbox
3. Tumbler gear- Quick change gearbox
4. Apron mechanism

**13. What are the different operations performed on the lathe?**

Centering, straight turning, rough turning, finish turning, shoulder turning, facing, chamfering, knurling, etc.

**14. Define the term 'Conicity'?**

The ratio of the difference in diameters of tapers its length  $k = \frac{D-d}{l}$   
d-smaller dia  
D-larger dia  
l-length of the work piece

**15. State the purpose of providing lead cam in single spindle automatic screw cutting machine?**

The turret slide travel is controlled by a lead cam. The lead cam gives a slow forward and fast return movement to the turret slide.

**16. What are the advantages of sliding head automatic lathes?**

The advantages of a sliding head automatic lathe is that long slender work pieces can be machined with very good surface finish, accuracy and concentricity in sliding head automatic lathes.

**17. State the advantages of swiss type screw cutting machine.**

1. It has five tool Slides
2. Wide range of speeds
3. Rigid construction.
4. Micrometer tool setting
5. Inter Changeability of cams.
6. Simple design of cams.
7. Tolerance of 0.005 to 0.0125 mm are obtained.
8. Numerous working stations.

**18. Mention any four types of components manufactured in automatic lathes.**

It is used for producing small jobs, screws, stepped pins, pins, bolts etc.

**19. Define automatic lathes.**

Automatic lathes or simply automats are machines tools in which all the operations required to finish off the work piece are done automatically without the attention of an operator.

**20. State any four advantages of automatic lathes.**

1. Mass production of identical parts.
2. High accuracy is maintained.
3. Time of production is minimized.
4. The bar stock is fed automatically

**21. What are the types single spindle automatic lathe?**

1. Automatic cutting off machine.
2. Automatic screw cutting machine.
3. Swiss type automatic screw machine.

**22. State the purpose of providing lead cam in single automatic screw cutting machine?**

The turret slide travel is controlled by a lead cam. Cam gives a slow forward and fast return movement to slide.

**23. Mention the applications of single spindle automatic screw cutting machine.**

It is used for producing small jobs, screws, stepped pins, pins, bolts etc.

**24. What are the advantages of sliding head automatic lathes?**

The advantage *of* a sliding head automatic lathe *is* that *long*, slender work pieces can be machined with very good surface finish, accuracy and concentricity in sliding head automatic lathes.

**25. What are the four major parts of swiss type automatic lathes?**

- |                      |                          |
|----------------------|--------------------------|
| 1. Sliding headstock | 2. Cam shaft             |
| 3. Tool bracket      | 4. Auxiliary attachments |

**26. State the advantages of Swiss type screw cutting machine**

- |                               |                                 |
|-------------------------------|---------------------------------|
| 1. Wide range <i>of speed</i> | 2. Rigid construction           |
| 3. Micrometer tool setting    | 4. Simple design <i>of cams</i> |

**27. State the principle of multi spindle automats.**

The principle of the multi spindle automate is that it has a tool slide working on the *jobs* on all spindles simultaneously.

**28. Define cam controlled automats.**

The operating mechanism for sliding, feeding are actuated by cams through levers and gears.

**29. How the centre lathe is specified?**

Length of the bed	Length between the centers.
Maximum swing Diameter over bed	Maximum swing diameter over carriage.
Diameter of the Spindle.	

**30. How to specify turret and capstan lathe?**

Maximum size of the work diameter swing over cross slide and over bed.  
Number of feeds for the carriage  
Number of spindle speeds  
Number of feed s for turret.

**31. How automats are classified?**

Classification According to the type of work used  
a) Bar stock machine.      b) Chucking machine.



Classification According to the number of spindles

- a) Single spindle machine. b) Multi spindle machine.

Classification According to the position of the spindle

- a) Horizontal Spindle machine. b) Vertical Spindle machine.

Classification According to the use.

- a) General Purpose machine. b) Single purpose machine.

**32. How multi spindle automats are classified?**

According to the type of work used

- a) Bar stock machine. b) Chucking machine.

According to the Arrangement of spindle

- a) Horizontal Spindle machine. b) Vertical Spindle machine.

According to the principle of operation

- a) Parallel Action type, b) progressive action type.

**33. What is Swiss type Automates.**

These are designed for machining long accurate parts of small diameter, such as 4 to 25 mm. An exclusive feature of these machines is the longitudinal travel of the headstock, or of a quill carrying the rotating work spindle.

**34. Mention the typical operations carried on automatic lathes.**

Centering, Boring, Knurling, Cutting off, Reaming, Thread cutting, Drilling and spot facing.

**1. Define cutting ratio of the shaper.**

The ratio between the cutting stroke time and the return stroke time is called as cutting ratio.

$$\text{Cutting ratio } m = \frac{\text{Cutting stroke time}}{\text{Return stroke time}}$$

**2. Mention any four shaper specifications.**

1. Maximum stroke length. 2. Type of driving mechanism.  
3. Power of the motor. 4. Speed and feed available.

**3. How the planer differs from a shaper?**

Planer- The work piece reciprocates while the tool is Stationary.

Shaper – The tool reciprocates while the work Stationary.

**4. What is the main difference made in divided table planer?**

The working principle is similar to that of a planer. But it has two reciprocating table. In that one table is working with work the other is loaded and unloaded

**5. What is gang drilling machine?**

More number of single spindle with essential speed and feed are mounted side by side on one base and have common work table, is known as the gang- drilling machine.

**6. What is the use of a tapping tool?**

A tap is a tool which is used for making internal threads in a machined component.

**7. What are the applications of boring?**

The boring machine is designed for machining large and heavy work piece in mass production work of engine frame, Cylinder, machine housing etc.

**8. What is the main difference between boring bar and boring tool?**

Boring bar:

The tool which is having single point cutting edge known as boring bar.

Boring tool:

The tool which is having multi point cutting edge known as boring tool.

**9. How omniversal milling machine differs from universal milling machines?**

This is a modified form of a milling machine It is provided with two spindles, one of which is in the horizontal plane while the other is carried by a universal swiveling head.

**10. What are the advantages of up milling processes?**

1. It does not require a backlash eliminator.
2. Safer operation due to separating forces between cutter and work.
3. Less wear on feed screw and nut due to the absence of pre loaded.
4. Milled surface does not have built up edge.

**11. What is meant by plain or slab milling?**

Plain or Lab milling is the operation of producing flat horizontal surface parallel to the axis of the cutter using a plain or slab milling cutter.

**12. What is meant by the term indexing?**

Indexing is the process of dividing the periphery of a job in to equal number of divisions.

**13. What are the three types dividing heads?**

1. Plain or simple dividing head.
2. Universal dividing head.
3. Optical dividing head.

**14. What is cam milling?**

Cam milling is the operation of producing cams in a milling machine by the use of a universal dividing head and a vertical milling attachment.

**15. List the advantages and limitations of thread milling.**

Advantages;

1. the threads will be smoother and more accurate than those cut in a lathe.
2. Threads can be cut closer to shoulders of work piece.
3. It is a faster method.
4. It is more efficient than cutting threads in a lathe.

Limitations:

1. It is Difficult to produce internal threads.
2. Threads milling cannot be used for making thread with more than 30 helix angle.

**16. List the various types of planners?**

1. Double housing
2. Open side planer
3. Pit planer
4. Edge planer
5. Divided table planer

**17. Name the various parts of a double housing planer?**

1. Bed
2. Table
3. Columns
4. Cross rail
5. Tool head

**18. Mention any four specification of planer?**

1. Maximum length of the table
2. Total weight of the planer
3. Power of the motor
4. Range of speeds & feed available
5. Type of drive required

**19. What is meant by drilling?**

Drilling is the process of producing hole on the work piece by using a rotating cutter called drill.

**20. Mention any four drilling machine specifications**

1. Maximum size of the drill in mm that the machine can operate
2. Table size of maximum dimensions of a job can mount on a table in square meter
3. Maximum spindle travel in mm
4. Number of spindle speed & range of spindle speeds in rpm.

**21. List any four machining operations that can be performed on a drilling machine?**

1. Drilling
2. Counter sinking
3. Tapping
4. Trepanning

**22. What are the different ways to mount the drilling tool?**

1. Fitting directly in the spindle
2. By using a sleeve
3. By using a socket
4. By means of chucks

**23. What are the specifications of the milling machine?**

1. The table length & width.
2. Number of spindle speeds & feeds.
3. Power of driving motor.

**24. Mention the various movements of universal milling machine table?**

1. Vertical movement-through the knee.
2. Cross wise movement-through the saddle.

**25. State any two comparisons between plain & universal milling machine?**

1. In plain milling machine the table is provided with three movements, longitudinal, cross & vertical. In universal milling machine in addition to these three movements, there is a fourth movement to the table. The table can be swiveled horizontally & can be fed at angles to the milling machine spindle.
2. The universal milling machine is provided with auxiliaries such as dividing head, vertical milling attachment, rotary table etc. Hence it is possible to make spiral, bevel gears, twist drills, reamers etc on universal milling machine.

**26. What are the cutter holding devices?**

- 1. Arbors
- 2. Adaptors
- 3. Collets

**27. List the various type of milling attachment?**

- 1. Vertical milling
- 2. Universal milling
- 3. High speed milling
- 4. Rotary
- 5. Slotting
- 6. Rack milling

**28. Write any ten nomenclature of plain milling cutter?**

Body of cutter, cutting edge, face, fillet, gash, lead, land, outside dia, root dia, cutter angles

**29. What are the advantages of milling process?**

- 1. It does not require a backlash eliminator.
- 2. Mild surface does not have built up edge.

**30. What are the down milling processes?**

- 1. Cutter with higher rake angle can be used. This reduces power requirements.
- 2. Cutter wear is less because chip thickness is maximum at the start of cut.

**31. List out the various milling operations?**

- 1. Plain or slab milling.
- 2. Face milling.
- 3. Angular milling.
- 4. Gang milling.
- 5. End milling.
- 6. Gear cutting.

**32. What does term indexing mean?**

Indexing is the process of dividing the periphery of a job into equal number of divisions.

**33. How the milling machines classified?**

Column and knee type

- a) Plain milling machine, b) vertical milling machine, c) universal milling machine

Plano miller

- a) Manufacturing , b) Fixed bed type

Special types

- a) Rotary Table milling machine, b) Drum type milling machine,
- c) planetary milling machine d) Pantograph milling machine.

**34. Distinguish between up milling and down milling.**

<b>Up milling</b>	<b>Down milling</b>
Work is feed against the rotating cutter	Work moves parallel to the cutter rotation
Thickness of the chip is minimum in the initial stages and increases maximum at the end of the cut	Thickness of the chip is maximum in the initial stages and minimum at the end of the cut
Cutter lifts the work, so requires more claming force	Cutter holds the work. Requires less claming force
Surface finish is nod good,	Good surface finish

**35. What are the types of drilling machine?**

- Portable drilling machine
- Sensitive drilling machine
  - Bench Type, Floor Type
- Upright drilling machine
  - Box Column, Round Column
- Radial drilling machine
  - Plain, Semi universal, Universal
- Gang drilling machine
- Multispindle drilling machine
- Automatic drilling machine
- Deep hole drilling machine
  - Vertical, Horizontal

**36. What is multiple spindle drilling machine?**

Several drill spindles are mounted in a drill head and driven by a common motor using set of gear with different speeds and drills. This machine is used to drill more number of holes in the work at a time. The feed is given either rising the table and lowering the spindle head.

**37. Write the differences between drilling and boring?**

Drilling: A process of initiating a hole or enlarging a hole with a tool called Drill.

Boring: The process of enlarging a hole that has already drilled using a boring tool is called as boring.

**38. What are the types of boring?**

Horizontal boring machine.

Table type, Floor Type, Planer Type, Multi head type

Vertical boring machine

Vertical Turret lathe, Standard vertical boring machine

Precision boring machine

Jig boring machine

Vertical milling machine type, planer type.

**39. Give the specifications of boring machine.**

Column height

Table size,

Size of the boring bar

Distance between the column

**40. What is jig boring machine?**

Jig boring machine is a specially designed machined machine tool used for precision location and manufacturing of holes in the precision equipments like, jigs, fixtures, dies, gauges.

**41. What is meant by counter boring?**

Counter boring is a operation of enlarging the end of the hole through a certain distance to form a seat for the bolts and nuts have been seated.

**42. What is slotting machine?**

A slotting machine is a reciprocating machine tool in which a ram reciprocates in the vertical direction. The work is held stationary in a rotary table.

#### **43. How slotters are specified?**

Stroke length,  
Diameter of the rotary table  
The maximum travel of the longitudinal and cross wise movement.

#### **44. What is shaping machine?**

Shaping machine is a machine tool in which a ram reciprocates in the horizontal direction, indented mainly for the machining of flat surfaces.

#### **45. What are the classification of the shaping machine?**

- According to the type of mechanism.
  - Crank and slotted link
  - Whitworth driving mechanism
  - Hydraulic mechanism
- According to the position of the ram travel
  - Horizontal type an vertical type
- According to the Type of the table
  - Plain, Standard, Universal
- According to the type of cutting
  - Draw Type, Push type machine.

#### **46. What is the need of quick return mechanism?**

In shaping machine metal is cut during the forward stroke and the return stroke no metal is removed.. It is known as idle stroke. To reduce the total machining time the idle stroke time should be reduced. So the return stroke is made faster than the cutting stroke. This is done by a mechanism called quick return mechanism.

#### **47. What are the types of planer?**

Double housing planer  
Open side planer  
Pit planer  
Edge or plate planer  
Divided table planer.

#### **1. What is broaching?**

Broaching is a processes of machining a surface with a special multipoint cutting tool called ' broach' which has successively higher cutting edges in a fixed path.

#### **2. Indicate any two specification of a broaching machine?**

1. Maximum length of stroke in mm
2. Maximum force developed by the slide in tones

#### **3. What are the advantages and limitation of broaching?**

Advantages:

1. Roughing, semi finishing & finishing cuts are completed in one pass of the broach
2. Broaching can be used for either external or internal surface finish

Limitation:

1. High initial cost of the broach tool compare to other tools
2. Job work or batch work is not advisable due to the high tool cost.

**4. What are the different operations that can be performed on a broaching machine?**

1. Broaching splines
2. Broaching a key way

**5. What are the advantages of gear planning process?**

Any given module can be cut using a single cutter.

The rate of production is higher when compared to forced cutter method.

It is a simple flexible and accurate method of generating gears.

**6. What are the limitations of gear hobbing?**

1. Internal gears cannot be generated.
2. Hobbing process cannot be applied very near to shoulders

**7. State the purpose of grinding?**

1. To remove small amount of metal from work pieces & finish then to close tolerances.
2. To obtain the better surface finish.

The machining accuracy of holes produce by this machine tool lies with in a range of 0.0025 mm.

**8. Define the term “grade” used in grinding wheel?**

Grade or hardness indicates the strength with which the bonding material holds the abrasive grain in the grinding wheel.

**9. What is meant by dressing & truing?**

The process of loading & breaking away the glazed surface so that new sharp abrasive particles are again present to work for efficient cutting is called dressing.

Truing is a process of trimming the cutting surface of the wheel to run true with the axis.

**10. What is process of lapping?**

Lapping is a surface finishing process used for producing geometrically accurate flat, cylindrical & spherical surfaces.

**11. What are the three types dividing heads?**

1. Plain or simple.
2. Universal.
3. Optical

**12. What are the other forming methods for manufacturing gears?**

1. Gear cutting by single point form tool.
2. Gear cutting by shear speed shaping process.
3. Gear broaching.
4. Template method.
5. Gear milling using a formed end mill.

**13. List the gear generating process?**

1. Gear shaping process.
2. Gear planning process.
3. Gear hobbing process.

**14. Mention the applications of gear shaping process?**

- 1. Gear shaping used for generating both internal & external spur gears.
- 2. Helical gears can also be generated using special attachments.

**15. What are the limitations of gear hobbing?**

- 1. Internal gears cannot be generated.
- 2. Hobbing process cannot be applied very near to shoulders.

**16. What are the advantages of gear planning process?**

- 1. Any given model can be cut using a single cutter.
- 2. It is a simple flexible & accurate method of generating gears.

**17. List the various gear finishing processes?**

- 1. Gear shaving.
- 2. Gear grinding.
- 3. Gear burnishing.
- 4. Gear lapping.

**18. How the centre less grinder operates?**

The centre less grinder operates with two wheels as the cutting wheel, to remove the excess stock and a regulating wheel which is used to control the speed of rotation of the work and the rate of feed.

**19. What are the advantages of centre les grinding?**

The work pieces are suppressed through the wheels  
 No tendency for chatter and deflection of the work piece.  
 Easy size control of the work.  
 No need of chucking or mounting of the work piece.

**20. What is honing?**

Honing ids also a surface finishing process like grinding, which uses a “hon” tool that consists of stones to abrade the metals.

**21. What is meant by polishing?**

Polishing is the surface finishing operation performed by a polishing wheel, for the purpose of removing appreciable metal to take out scratches, hole marks, Pits and other defects from rough surfaces.

**22. What is meant by buffing?**

Buffing is used give much high lustrous, reflective finish that can not be obtained by polishing. The buffing process consists of applying a very fine abrasive with rotating wheel.

**23. Distinguish between Gear forming and generating process.**

Gear forming	generating
The tool used is a form cutter with standard involutes.	One cutter is used for all number of gears
Gear blank is rotated every tooth is over-indexed	Gear blank is not indexed.
Each module this process requires a set of standard cutter.	One cutter is enough for more number of modules
Time consuming and inaccurate method	Accurate and quick process.



**24. Write the advantage of gear shaping/ gear generating.**

- With a particular module of DP cutter, Gears having same module of DP but different number of teeth can be cut accurately.
- Quicker and economical
- Only one cutter is used for cutting all spur gears of same pitch
- Both internal and external gears can be cut.

**25. Give three differences between gear hobbing and milling.**

<b>gear hobbing</b>	<b>milling</b>
Hobb operates several teeth at a time	Milling cutter cuts one tooth at a time
It is not necessary to disengage the cutter and work before indexing	It is necessary to disengage the cutter and work before indexing
Gear hobbing is faster process than milling	Is a slower process.

**26. What is sawing?**

Sawing is one of the basic metal cutting processes, in which the cutting off the metal is done by using saws.

**27. How broaches are classified?**

According to the type of surface broched

Internal broaches

External broaches

According to the method o operation

Push broaches

Pull broaches

According to the operations performed on the work

Surface broaches

Keyway broaches

Round hole broaches

Spline broaches

**28. Name some broaching operations.**

Surface broaching

Keyway broaching

Round hole broaching

Spline broaching.

Gear broaching.

**29. How the centre less grinder operates?**

The centre less grinder operates with two wheels as the cutting wheel, to remove the excess stock and a regulating wheel which is used to control the speed of rotation of the work and the rate of feed.

**30. What are the limitations of gear hobbing?**

1. Internal gears cannot be generated.
2. Hobbing process cannot be applied very near to shoulders.

**31. What does term indexing mean?**

Indexing is the process of dividing the periphery of a job into equal number of divisions.

**32. What is meant by polishing?**

Polishing is the surface finishing operation performed by a polishing wheel, for the purpose of removing appreciable metal to take out scratches, hole marks, Pits and other defects from rough surfaces.

**33. What is meant by buffing?**

Buffing is used give much high lustrous, reflective finish that can not be obtained by polishing. The buffing process consists of applying a very fine abrasive with rotating wheel.

**34. Write the advantage of gear shaping/ gear generating.**

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- Only one cutter is used for cutting all spur gears of same pitch
- Both internal and external gears can be cut.

**35. Give a summary of the abrasive of their application for different operation?**

	<i>ABRASSIVE</i>	<i>APPLICATION</i>
(1)	Aluminium	Cleaning, Cutting and Deburrig
(2)	Silicon Carbide.	Faster cleaning, Cutting.
(3)	Glass Heads	Matt polishing, cleaning
(4)	rushed glass	Peening and cleaning.

**36. What are the disadvantages of using abrasives again and again?**

Cutting ability of the abrasives decreases after the large  
Contamination of wears materials clogging the nozzle and the cutting unit orifices.

**UNIT III**  
**METAL CASTING PROCESSES**

**1. What are the different types of pattern?**

- i) Solid pattern    ii) Split pattern    iii) Loose-piece pattern
- iv) Gated pattern    v) Sweep pattern    vi) Match plate pattern.

**2. What is a pattern? Mention the various pattern materials.**

A pattern is a replica or reproduction of the casting to be made. It is similar to the casting in shape and size. The materials used for making the pattern are wood, metals, plastics, rubber and wax.

**3. What are the ingredients of moulding sand?**

The main ingredients of moulding sand are:

- i) Silica sand    ii) Clay
- iii) Moisture    iv) Additives.

**4. Mention the types of moulding.**

- a) Based on the location:
  - i) bench moulding    ii) floor moulding    iii) pit moulding
- b) Based on the moulder:
  - i) Manual moulding    ii) Machine moulding.

**5. What are the properties of moulding sand?**

- i) Strength
- ii) Permeability
- iii) Flow-ability
- iv) Collapsibility
- v) Cohesiveness
- vi) Adhesiveness

**6. What is the use of a core?**

A core is used to make cavities and recess in a casting. It is made of core sand. It is supported in its place by core-print. A core-print is a projection provided on the pattern.

**7. Mention the advantages of CO<sub>2</sub> process.**

- i) It gives strength and hardness
- ii) It does not require baking of the mould.
- iii) The process is quick and consumes less time.

**8. List the various pattern allowances.**

- i. Shrinkage allowance
- ii. Machining allowance
- iii. Taper allowance
- iv. Rap allowance
- v. Distortion allowance or Camber.

**9. What is a Core print?**

A core print is the projection provided on the pattern to make a recess to support the core. Core-print provides support to the core and keeps it in proper position.

**10. Mention the types of moulding sand.**

- i. Green sand
- ii. Dry sand
- iii. Loam sand
- iv. Core sand
- v. Facing sand.

**11. Define the process of casting.**

The process of pouring molten metal into the mould cavity and allowing the hot metal to solidify is called casting. The product is called 'casting'.

**12. Mention some advantages of casting.**

- i) Casting is a versatile process. Intricate shaped parts can be made by casting.
- ii) Large size objects and complicated parts can be made.
- iii) The process is suited for batch and mass production.

**13. Mention the Casting defects.**

- i. Blow holes
- ii. Pin hole porosity
- iii. Run out
- iv. Swell
- v. Cold-shut
- vi. Slag inclusions.

**14. What are the types of casting?**

- 1. centrifugal casting
- 2. die casting
- 3. continuous casting

**15. Write the demerits of casting?**

- 1. The number of workers required for casting is more
- 2. Accuracy and finishing is not good

**16. Write the merits of casting?**

- 1. Any material ferrous can be casted
- 2. It is possible to produce the large component

**17. Mention the different types of Furnaces.**

- |                        |                         |
|------------------------|-------------------------|
| i. Cupola furnace      | ii. Reverberate furnace |
| iii. Induction furnace | iv. Crucible furnace.   |

**18. Mention factors affecting selection of pattern materials.**

1. Service requirements e. g quantity, quality and increasing of casting ie, minimum thickness desired degree of accuracy and finish required.
2. Type of production of castings and the type of moulding forces.
3. Possibility of design changes.
4. Number of castings to be produces, ie possibility of repeating orders.

**19. Write few pattern materials.**

- Wood and wood products,
- Metals and alloys,
- Plasters, plastics and rubbers,
- Waxes

**20. What is meant by “Gated Pattern”?**

To produce good casting, it is necessary to ensure that full supply of molten metal flows into every part of the mould. Provision for easy passage of the flowing metal into the mould is called gating which cannot be made by hand operations for volume production particularly because of the time involved.

**21. Brief about Machining allowance?**

Rough surfaces of castings that have to be machined are made to dimensions somewhere 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 of machining allowance.

**22. What are the advantages of green sand?**

1. Green sand moulding is the least expensive method of producing a mould.
2. There is less distortion than in dry sand moulds, because no baking is required.
3. Flasks are ready for reuse in minimum time.
4. Dimensional accuracy is good across the parting line.
5. There is less danger of hot tearing of castings than in other types of mould.

**23. What is draft allowance? How is it provided for patterns?**

It the vertical faces of pattern are perpendicular to parting line, the edges of mould may damaged when the pattern is removed from the sand. Hence the vertical faces are mode taper for easy removal of pattern. This slight taper given on the vertical sides of pattern in caused draft allowance.

**24. What are the common allowances provided on pattern?**

The various types of pattern allowances normally given are

- Shrinkage allowance
- Machining or finish allowance
- Draft or taper allowance
- Distortion or camber allowance
- Rapping or shake allowance

**25. What are the functions or riser?**

The main function of the riser is to supply excess molten metal to the solidifying casting It allows the escape of air.

**26. How pattern differ from casting?**

Pattern is slightly larger in size as compared to the casting. Pattern may be in two or three pieces whereas a casting is in one piece.

**27. What are the tests carried out to determine the quality of casting?**

Destructive test:

Tensile, Impact, Hardness etc.

Non Destructive:

Visual, sound, magnetic particles, dye penetration, ultrasonic etc.

**28. Define foundry.**

- A plant where the castings are made is called a foundry.

**29. Define casting.**

The Process of producing metal parts by pouring molten metal into the mould cavity of the required shape and allowing the metal to solidify. The solidified metal piece is called as casting.

**30. Define the following.**

a.Mould, b.Pattern:

- Mould is the cavity of the required casting made in wood, metal or plastics.
- The Model of the required casting made in wood, metal or plastics.

**31. Name the various pattern materials.**

Wood, Metal, Plaster, Plastic, Wax.

**32. What are the different types of patterns used in foundries?**

Solid or single piece pattern, match plate pattern, split pattern, sweep pattern, skeleton pattern, segmental pattern, loose piece pattern, shell pattern.

**33. When do you make core (or) what is function of core in moulding sand?**

To provide a hollow surface or recess on the casting, the core is made.

**34. What is core print and what is its purpose?**

A core print is an extra projection on the pattern. It supports the core.

**35. What do you understand by core setting?**

Curing or heating the cores to obtain enough hardness is called as core setting.

**36. What are requirements of core sand?**

Permeability, refractoriness, strength collapsibility, stability.

**37. Mention the specific advantages of CO<sub>2</sub> process.**

Give strength and hardness to core

Process cost is less

It saves time on heating

It can be stored for long use

**38. What are the properties good moulding sand?**

Porosity or permeability, plasticity or flowability, strength or cohesiveness, adhesiveness, refractoriness, collapsibility.

**39. What are types of moulding sand?**

Green sand, Dry sand, Synthetic sand, Loam sand, Special sand, parting sand.

**40. Write the composition of good moulding sand.**

Green sand:

It contains 5 to 8% water and 15 to 20% clay.

Loam Sand:

Loam sand is a mixture of fine sands, fine refractoriness, clay, graphite fiber and water. It contains more clay (50 %)

**41. What are the uses of runner and riser?**

Riser:

It supplies excess molten metal to the solidifying casting.

Runner:

It is used to make a sprue a hole in the cope. It allows the escape of air.

It receives the molten metal from the pouring basin and passes to the cavity.

**42. What are chaplets?**

Some times it is not possible to provide sufficient support for a core in the mould being poured, if the cores are bigger in size. In such cases the core is supported with rigid metal pieces called chaplets.

**43. What are the different types of furnaces used for casting?**

Cupola furnace, open hearth furnace, crucible furnace, pot furnace, Electric furnace.

**44. What is need for providing chills in casting?**

The chills are used to provide directional solidification or to increase the rate of solidification where the higher hardness required.

**45. Name four different casting defects.**

Shifts - Two halves mismatching or casting

Hot tear - Internal or external cracks

Fins - Thin projection of parting line

Inclusions - Foreign material present in casting

**JOINING PROCESSES**

**1. Define welding process.**

Welding is the process of joining two metals by applying heat, with or without applying pressure ,with or without the addition of filler material.

**2. Name the various metal joining processes.**

i) welding ii) soldering iii) brazing iv) adhesive bonding.

**3. What is the function of a flux?**

i) It prevents the oxidation of the weld pool, by forming a protective gaseous shield.

ii) It helps in the formation of slag , thereby collecting impurities in the weld pool to the surface.

**4. Mention the principle of resistance welding.**

It is a fusion welding process in which heat and pressure are applied at the weld surface. No filler metal or flux is added. The heat is obtained by the electrical resistance.

**5. Define soldering.**

It is a method of joining similar or dissimilar metals , with the melting temperature of below 450°C. This method is used for mass production of electronic components.

**6. Define brazing.**

Brazing is the process of joining metals with a non-ferrous filler metal whose melting point is above 427°C. Typical filler metals are brasses with zinc content up to 40%.

**7. What are the different types of brazing?**

- i. Torch brazing
- ii. Induction brazing
- iii. Furnace brazing
- iv. Dip brazing.

**8. List the different weld defects.**

- i. Undercut
- ii. Incomplete fusion
- iii. Porosity
- iv. Hot cracking
- v. Cold cracking
- vi. Slag inclusion.

**9. What are the types of flame in Oxy-acetylene gas welding?**

- i. Neutral flame (Oxygen : Acetylene = 1.1 : 1)
- ii. Oxidising flame (Oxygen : Acetylene = 1.5 : 1)
- iii. Reducing flame (Oxygen : Acetylene = 1.0 : 1.5)

**10. Mention the principle of Thermit welding.**

It is a thermo-chemical welding process .The heat required is obtained due to the reaction of the ‘thermit mixture’( Aluminium + Iron oxide). Due to the exothermic reaction intense heat is produced(2200 - 2400°C) in less than a minute.

**11. List the metals that can be welded by TIG welding.**

TIG welding or Gas Tungsten Arc Welding is used for fusion welding of Aluminum, Magnesium, low carbon Steel, mild steel, brass ,bronze etc.,

**12. What is Solid state welding. Mention its types?**

It is the process of joining two clean metal surfaces by applying pressure.

Inter-atomic bonding takes place between the surfaces, under the pressure. Its types are: Friction welding, Diffusion bonding, Ultrasonic welding and Explosive welding.

**13. Mention the principle of friction welding. What are its important variables?**

The two parts to be friction welded are axially aligned. One part is rotated while the other part is given an axial pressure. The three important variables are:

- (i) rotational speed
- (ii) axial pressure
- and (iii) time of contact.

**14. Mention the advantages of Electron beam welding.**

- (i) Depth to width ratio is 25: 1.
- (ii) No filler or flux is required.
- (iii) The heat liberated is low and Heat Affected Zone (HAZ) is narrow.

**15. What is meant by fusion welding?**

Fusion welding is defined as melting together and coalescing materials by means of heat. The thermal energy required for these welding operations as usually supplied by chemical or electrical means.

**16. Mention the type of arc- welding processes:**

- Submerged metal arc welding (SMAW)
- Submerged Arc welding (SAW)
- Gas metal arc welding (GMAW)
- Flux cored arc welding.
- Electro gas welding (EGW)
- Electro slag welding

**17. State the process capability of Gas metal arc welding.**

It is suitable for welding a variety of ferrous and nonferrous metals and is used extensively in the metal fabrication industry. The process is versatile, rapid and economical and welding productivity is double that of the SMAW process. The cost of equipment is from 1000 to 3000 dollars.

**18. Mention factor that affects selection of welding.**

The selection of a welding process for particular operations depends on the workpiece material, on its thickness and size, on its shape complexity, on the type of joint, on the strength required and on the change in product appearance caused by welding.

**19. What is diffusion welding?**

It is a process in which the strength of the joint results primarily from diffusion (Movement of atoms across the interface) and secondarily from plastic deformation of the flaying surfaces.

**20. List the advantages of Laser Beam Welding over Electron Beam Welding.**

- A vacuum is not required, and so the beam can be transmitted through air.
- Laser beams can be shaped, manipulated and focused optically, so the process can easily be automated.
- The beams do not generate X-axis (as opposed to EBW)
- The quality of the weld is better, which less tendency for incomplete fusion, spatter and porosity and with less distortion.

**21. Mention few weld joints.**

- Butt joint,
- Edge joint
- T joint
- Corner joint
- Lap joint

**22. Mention mechanical fastening methods.**

Fastening	Seaming
Crimping	Stitching

**23. List the types of adhesives.**

- Natural adhesives
- Inorganic adhesives
- Synthetic organic adhesives

**24. List the limitations of Adhesive bonding.**

- Limited range of service temperature
- Possibly a long bonding time(curing)
- The need for great care in surface preparation.
- The difficulty of resting bonded joints non destructively, particularly for large structures
- The limited reliability of adhesive bonded structures during their service life.



**25. What are the advantages of welding?**

1. It produces permanent joints.
2. The overall cost of the welding equipment is very low.
3. A Large number of metals can be welded.
4. A good weld is as strong as base metal.

**26. Give some example for pressure welding.**

Spot welding, seam welding, lap and butt welding, projection welding.

**27. Give some example for non - pressure welding.**

1. Gas welding
2. Electric arc welding.

**28. Give some example for resistance welding**

Spot welding, seam welding, butt welding, projection welding

**29. Give some example for gas welding.**

1. Oxy acetylene welding
2. Oxy hydrogen welding
3. Oxy butane welding.

**30. What are the types of flame used in gas welding?**

1. Neutral flame
2. Oxidizing flame
3. Reduction flame.

**31. List the methods used for welding.**

1. Left ward welding.
2. Rightward welding.
3. Vertical welding.
4. Overhead welding.

**32. What is electrode?**

Electrode made of metallic wire called core wire, coated uniformly protective coating called flux.

**33. What are the types of electrode?**

1. Bare electrode
2. Dust coated electrode

**34. What are the types of welding rods?**

Low carbon steel rod, mild steel rod, vanadium steel rod.

**35. List the spot welding methods.**

Direct, indirect, push pull method.

**36. What is seam welding?**

It is the resistance welding process. The heat is produced due to resistance against current. It is also called stitch welding.

**37. Define - Electro slag welding**

It is the welding process in which metal fused together by molten slag which melts the filler material and surface of the work to be welded.

**38. List the power sources used in arc welding.**

1. AC machine
2. DC machine
3. Transformer
4. Transformer with DC rectifier

**39. What are the advantages of AC arc welding?**

- i The transformer maintenance cost is less

- ii Efficiency is very high.
- iii The power available is very less

**40. What is submerged arc welding?**

The arc is produced between the electrode and the work piece. The arc, end of electrode, the molten pool is submerged in the molten pool.

**41. What is the use of inert gases in TIG welding?**

It is used to avoid atmospheric contamination of the weld pool. The gases used in the welding process are argon helium hydrogen.

**42. What is the difference between TIG and MIG welding?**

There is no filler material used in the MIG welding instead of filler material some inert gases are used.

**43. What are the equipments used in the TIG welding?**

- |                                     |                         |
|-------------------------------------|-------------------------|
| 1. Electrode, filler material, FLUX | 2. Welding power source |
| 3. Inert gas cylinder               | 4. Pressure regulator.  |

**44. What is the use of wire feed mechanism in MIG welding?**

It is used to deliver electrode to the constant or varying speed

**UNIT IV**

**BULK DEFORMATION PROCESS**

**1. Mention the various mechanical working processes.**

- i ) Forging                      ii) Rolling                      iii) Drawing                      iv) Extrusion.

**2. Mention the advantages of Cold working.**

- i. It produces an improved surface finish and close dimensional tolerances.
- ii. Cold working results in increased strength and hardness of the metal.

**3. What is Recrystallisation temperature?**

When a metal is heated, the temperature at which old grains start disintegrating and new grains are formed in the metal is called its Recrystallisation temperature ( $T_{cr}$ ).

$$T_{cr} = ( 0.3 - 0.5 ) X T_m$$

**4. Mention the process of Rolling. List its typical parts.**

Rolling is the process where the metal is compressed between two rotating rolls for reducing its cross sectional area. Normally it is a Cold working process. Typical rolled parts are: I-sections , Angle sections, Round and Square rods.

**5. Mention the process of Extrusion.**

Extrusion is the process of confining the metal in a closed container and then allowing it to flow through a die opening (orifice). Thus the metal takes the shape of the die opening. It is identical to squeezing of the tooth paste from tooth paste tube.

**6. List the different types of Rolling Mills.**

- |                          |                     |                     |
|--------------------------|---------------------|---------------------|
| i. Two-high mill         | ii. Three-high mill | iii. Four-high mill |
| iv. Cluster Rolling mill | v. Planetary mill.  |                     |

**7. Mention the typical products of Rolling .**

- i. Thick and thin sheets.
- ii. Pipes and special rolled stock(e.g.: spherical ball, rings)
- iii. I- section beams and other sections.

**8. Distinguish between Hot working and Cold working.**

If the metal working is carried out **above** Recrystallisation temperature ( $T_{cr}$ ), the process is called Hot working. If the metal working is carried out **below** Recrystallisation temperature ( $T_{cr}$ ), the process is called Cold working.

**9. What are the types of Forging?**

- i. Drop forging
- ii. Smith forging
- iii. Press forging
- iv. Machine forging.

**10. Mention the defects in Forged parts.**

The various forging defects are : Unfilled section, Cold shut, Die shift, Flakes and scale pits.

**11. Mention the various Forging operations.**

- i. Upsetting
- ii. Drawing down
- v. Bending
- iii. Fullering
- iv. Swaging
- vi. Welding.

**12. Mention the advantages of Forging process.**

Best mechanical properties are obtained due to un-interrupted flow of fibre and grain structure. The forged parts have high strength to weight ratio and good strength.

**13. What is Swaging?**

Swaging is the mechanical deformation technique of reducing the cross-section of rods and tubes , by repeated blows or impacts.

**14. Write down the typical forged parts.**

Some typical forged parts are: Crank shaft, Cam shaft, Spanner, Wrench, Crane hook and Gear blank. Due to fibre flow in the desired direction, the forged parts have good strength.

**15. Mention some of the Cold working processes.**

- i. Shearing - Press work
- ii. Drawing - Blank drawing, Wire drawing
- iii. Squeezing - Swaging, Stamping, Coining
- iv. Bending - Angle bending , Seaming.

**16. Name some forgeable metals.**

- Carbon steels,
- Alloy steels,
- Stainless steels,
- Aluminium alloys
- Wrought iron,
- Copper base alloys,
- Nickel and nickel-copper alloys,
- Magnesium alloys,
- Low carbon steels and low alloy steels.

**17. Name some forging tools.**

Hand hammer

- Tongs
- Chisels
- Swages
- Fullers
- The set- hammer
- Flatter
- The punch & the drift

**18. Write about Fullering.**

Fullering or spreading the metal along the length of the job is done by working separate sections. In this case the axis of the job is positioned perpendicular to the width of the flat die.

**19. Why we go for power forging?**

Large machine parts cannot be forged by hand, since the comparatively light blow of a hand or sledge hammer is unable to produce a great degree of deformation in the metal being forged. Hand forging is a lengthy process and requires repeated heating of metal. This has led to the use of power hammers and presses in forging.

**20. Mention the type of power hammers.**

- Helve hammers
- Trip hammers
- Lever spring hammers
- Pneumatic hammers.

**21. Write about Hot extrusion.**

Extrusion is carried out at elevated temperature, for metals and alloys that do not have sufficient ductility at room temperature or in order to reduce the forces required. Hot extrusion has special requirements because of high operation temperatures. To avoid oxide formation, the dummy bar is used in the process.

**22. Mention –merits of cold extrusion over hot extrusion.**

- Improved mechanical property, resulting from work hardening, provided that the heat generated by plastic deformation and friction does not recrystallize the extruded metal.
- Good control of dimensional tolerances, reducing the need for subsequent machining or finishing operations.
- Improved surface finish.
- Elimination of the need for billet heating

**23. Name the extrusion cracks.**

- Surface cracking
- Pipe
- Internal cracking
- Center cracking, Center burst, Arrowhead fracture

**24. Factors considered for extrusion process.**

- Die design
- Extrusion ratio
- Billet temperature

- Lubrication
- Extrusion speed

**25. What is canning or jacketing?**

For metals that have a tendency to stick to the container and the die, the billet can be enclosed in a thin walled container made of a softer, lower strength metal such as copper or mild steel. This procedure is called jacketing or canning.

**26. What are the general advantages of forging as a manufacturing process?**

- Porosity in the materials largely eliminated
- Better mechanical properties
- Ability of forging to withstand unpredictable loads
- Rapid duplication of the components
- Wide range of forgeable metals is available

**27. Define cold working of metals.**

Those processes, which are working below the recrystallisation temperature are called cold working of metals.

**28. Define hot working of metals.**

Those processes which are working above the recrystallisation temperature is called hot working of metals

**29. What are the advantages of hot working over cold working?**

Hot working requires less to get necessary deformation  
Brittle materials can also be hot worked.

**30. Define extrusion ratio.**

It is defined as the ratio of the cross sectional area of the billet to the cross section area of the product.

**31. Define degree of drawing.**

The ratios of the difference in cross sectional area before and after drawing to the initial cross sectional area.

**32. What are the methods used for producing seam less tube?**

Extrusion, piercing

**33. What is the difference between a bloom and a billet?**

Bloom – fast break down of ingot into the size of 150mm x 150 mm to 250 mm x 300mm  
Billet – a reduction of bloom of 50mm x 50mm to 125mm x 125mm by hot rolling

**34. Define slab, plate, sheet, and strip.**

Slab - obtained from bloom by rolling  
Plate - the thickness, which is having minimum 6.35 mm  
Sheet - thin partner of plate  
Strip - a narrow sheet having maximum width of 6.00mm

**35. Define foil.**

Foil – strip with maximum width of 300mm and maximum thickness of 1.5m.

**36. Define hobbing.**

It is the process of forming a very smooth, accurate polished shape on punch.

**37. What is the difference between coining and embossing process?**

Coining - pressing operation  
Embossing - forging operations

**38. What is meant by spring back?**

During the bending operations, when the pressure on the metal release the bend angle may slightly change this is called spring back.

**39. What do you understand by “recrystallisation” and recrystallisation temperature?**

The approximate minimum temperature at which complete recrystallisation of a cold worked metals take place within a specified time.

Recrystallisation: Formation of new grain when the metal undergoes working.

**40. List the different types of forging machines.**

1. Forging hammers
2. Forging presses
3. Forging machine or up setter

**41. What is tube piercing?**

It is used to produce the seamless tube by using mandrel. It is used to produce the pierce at the center of the ballet.

**42. List the different types of rolling mills.**

Two high rolling mills, Three high rolling mills, Cluster rolling mills.

**43. What are the defects in rolled parts?**

Pitting, Cold shut and laps, Dents, Cracks.

**44. What are the types of extrusion?**

1. Direct or forward extrusions
2. Indirect or backward extrusion.

**45. What is wire drawing?**

Wire drawing is carried out by pulling a rod through the die which causes the reduction in cross section area of the rod.

**46. Define bar wire.**

Bar – a round or square has long straight, symmetrical pieces of uniform cross section.

**47. Describe the methods used for cleaning the forging.**

Tumbling, Blast cleaning, Cleaning by picking.

**48. Define forgeability.**

It is defined as utility of a material to deform before cracks appear in the metal.

**49. What is meant by break down passes in rolling?**

It is used for reducing the cross sectional area to the required size.

**FORMING**

**1. What are all the characteristics in sheet metal processes?**

Elongation ,Yield point elongation ,Anisotropy (planer), Anisotropy(normal),Grain size, Residual stresses, Spring back, Wrinkling, Quality of sheared edges and surface condition of sheet.

## **2. How grain size will affect the sheet metal?**

Grain size will give the surface roughness on stretched sheet metal. The coarser the grain, the rougher the appearance and also affects material strength.

## **3. What is wrinkling?**

It is caused by compressive stresses in the plane of the sheet. It can be objectionable or can be useful in imparting stiffness to parts, can be controlled by proper tool and die design.

## **4. What is meant by “burr”, how it will affect the forming operations?**

A burr is a thin edge or ridge, burr height increases in the clearance and in the ductility of the sheet metal. The height, shape and size of the burr can significantly affect subsequent forming operations.

## **5. Differentiate punching & blanking?**

In punching the sheared slug is discarded. In blanking the slug is the part and the rest is scrap.

## **6. Mention all the operations, involved in die cutting processes.**

- Perforating – punching a number of holes in a sheet.
- Parting – shearing the sheet into two or more pieces.
- Notching - removing pieces (or various shapes) from the edges.
- Lancing – learning a tab without removing any material.

## **7. State the test methods for formability of sheet metal?**

Cupping test

Forming – Limit diagrams.

## **8. Mention sheet metal forming processes?**

Bending, Roll forming, Stretch forming, Stamping, Rubber forming, Spinning, Super elastic forming, Peen forming, Embossing and Explosive forming.

## **9. Explain: Hemming, Seaming**

In the hemming process the edge of the sheet is folded over itself. It increases the stiffness of the part, improves its appearance, and eliminates sharp edges. Seaming involves joining two edges of sheet metal by hemming. Double seams are made by a similar process, using specially shaped rollers, for watertight and airtight joints, such as are needed in food and beverage containers.

## **10. What is metal spinning and stage its types?**

Spinning is an old process which involves the forming of axisymmetric parts over a mandrel, by the use of various tools and rollers. It is like forming clay on a potter's wheel.

Types: Conventional or Manual spinning

Shear spinning,

Tube spinning

## **11. Brief about peen forming?**

In peen forming, the surface of the sheet is subjected to compressive stresses, which tend to expand the surface layer, because the material below the peened surface remains rigid, the surface expansion causes the sheet to develop a curvature. The process also induces compressive surface residual stresses, which improve the fatigue strength of the sheet.

**12. State the applications of magnetic pulse forming.**

Magnetic pulse forming is used for collapsing thin-walled tubes over rods, cables and plugs, for compression –crimp sealing of automotive oil filter canisters, for bulging and flaring operations, and for swaging end fittings on to torque tubes for the Boeing 777 aircraft.

**13. State merits of super plastic forming.**

- Lower strength is required of the tooling, because of the low strength of the material at forming temperature, hence tooling costs are lower.
- Complex shapes can be formed out of one piece, with time detail and close tolerances and with elimination of secondary operations.
- Weight material savings can be realized, because of the formability of the metals.
- Little or no residual stress occurs in the formed parts.

**14. State demerits of super plastic forming.**

The material must not be super plastic at service temperature. Because of the extreme strain – rate sensitivity of the super plastic material, it must be formed at sufficiently low rates. Forming times range anywhere from a few seconds to several hours. Thus, cycle times are much longer than those of conventional forming processes. So it is batch-forming process.

**15. What is rubber forming?**

In rubber forming, one of the dies in a set can be made of a flexible material, such as polyurethane membrane. Polyurethanes are used widely because of their resistance to abrasion, their resistance to cutting by burrs or by sharp edges on the sheet metal and their long fatigue life.

**16. What is hydro forming?**

In the hydro form or fluid – forming process the pressure over the rubber membrane is controlled throughout the forming cycle with maximum pressure of up to 100Mpa. This procedure allows close control of the part during forming, to prevent wrinkling or tearing.

**17. Name some basic tools used in sheet metal work?**

- Measuring tools
- Straight edge
- Steel square
- Scriber
- Divider
- Punches
- Chisels
- Hammers

**18. What is chisel and state its types?**

Chisels are generally used in sheet metal work for cutting sheets, rivets, bolts and chipping operations. They are classified into flat chisel and round nose chisel.

**19. What is the use of hammer, state its types?**

Hammers are used for forming shapes by hollowing, raising or throwing off. There are many types of hammers,

- Riveting hammer used for riveting.
- Setting hammer for setting down the edge.
- Raising hammer used for forming of a flat sheet.



**20. What is Mallet?**

These are the soft hammers, and made of hard rubber, copper, brass, Lead or mostly of wood, used to strike a soft and light blow on the metal.

**21. What is NIBBING & SLITTING?**

Nibbing is an operation of cutting any shape from sheet metal without special tools. It is done on a nibbing machine. When shearing is conducted between rotary blades, the process is referred to as slitting. It cuts the sheet metal lengthwise.

**22. Mention the type of “Seam”.**

- Lap seam
- Grooved seam
- Single seam
- Double seam
- Dovetail seam.

**23. What is “Burring”?**

The flange on cylindrical jobs is often referred to as a burr, and the process of making a narrow flange is known as burring.

**24. What is “Punch force”, write the mathematical expression?**

The maximum punch force  $F$ , can be estimated from the below equation,

$$F = 0.7TL \text{ (UTS)}$$

Where,

$T$  – Sheet thickness,

$L$  – Total length sheared

UTS – Ultimate Tensile Strength of the material.

**25. What is a residual stress?**

It is caused by non uniform deformation during forming, causes part distortion when sectioned and can lead to stress corrosion cracking, reduced or eliminated by stress relieving.

**26. Enumerate the various typical applications of electro magnetic forming process.**

Compression and expansion of circular bar was carried out

It is used for instrument gear assembly, embossing and sizing of cups etc.

**27. Name any 4 four high power explosive used in explosive forming.**

Dynamite

Amatol

TNT

RDX (Cyclotrimethylene trinitramine)

**28. List out major functions which affect the performance in electromagnetic forming.**

High intensity between the coils

Eddy current

Coil compression

Flux concentration

**29. List out and 2 advantages of explosive forming.**

Forming process occurs in

Small interval of time

Very high compact densities can be obtained  
Mixtures of metal can be easily compacted

**30. Give the applications of electro hydraulic forming.**

Bulging, bending, drawing, blanking and piercing

**31. What is high energy rate forming process?**

It includes a number of process in which part are formed at a rapid rate by extremely high pressure. The energy needed for processing the material is released in a very short time. It is called high-energy rate forming process.

**32. Mention the few applications of HERF.**

It is used for compacting metal powder  
It is used for forging and cold welding  
It is also used for bending and extruding  
Metal cutting process is also possible

**33. Classify the high – energy rate forming process.**

Explosive forming, Electro hydraulic forming, Electromagnetic forming, Dynapak high speed forming process.

**34. What are materials used for making dies in explosive forming?**

The commonly used die materials are concrete, wood, epoxy, plastics, and plaster of paris and CI, steel etc.

**35. What is the principle of magnetic pulse forming?**

The basic principle is that discharging of a capacitor through coil over a period of micro seconds, the magnetic flux densities of the order of hundreds of kilogauss can be produced.

**36. What is the basic principle of dynapak machine?**

They are simple in construction  
Better surface finish is achieved  
Better control of grain and size forging capability

**37. Define – blanking.**

It is used to produce the outer contour of the work piece by using presses.

**38. What are the types of sheet metal joining tools?**

1. Seaming tools                      2. Grooving punch                      3. Rivet set

**39. Describe spinnability.**

The spinnability of a metal is defined as the maximum reduction in thickness to which a part can be subjected by spinning, without fracture. It is related to the tensile reduction of area of the material, just as bendability.

**40. Give the various forms of explosives.**

Rod, sheet, granules, liquid, stick etc.

**41. State merits of peen forming process.**

Complex contours can be produced easily.  
Peening is also used as salvage operations for correcting bent or distorted parts.  
This process does not require any die and punch.

**42. State demerits of Peen forming.**

It requires longer time for forming the required shape.

It requires additional devices for forcing out metal shots.

**43. How the finished product is released in super plastic forming process?**

At the end of the forming cycle, the part perfectly conforms to the die, even in its smallest details.

**44. Name any two applications of super plastic forming process.**

In automotive body components

In forming of aircraft frames and skins.

**45. Name the various processes can be performed by explosive process.**

Blanking, cutting, expanding, coining, embossing, flanging, powder compacting, drawing and sizing operations etc.

**46. State the methods of stretch forming process.**

Form – block method.

Mating –die method.

**47. How deep drawing operations differ from shallow drawing operations?**

The length of the part to be drawn is deeper than its width.

**48. Define the term “Spring back”.**

Spring back is defined as the movement of the metal to resume its original position causing a decrease in bend angle after the applied force is withdrawn.

**49. Mention the effect of insufficient clearance.**

It does not allow a clean break but partial break occurs. It is also called as secondary shear.

**50. What is meant by seaming?**

The process of providing lock between the two edges of the different work metal is called as seaming.

## UNIT V

**1. What are thermoplastics? Give examples.**

Thermosetting plastics become soft when heated to 65 – 315° C. They can be remoulded without any change in strength. Thus they can be reshaped while in soft state. Examples are : Nylon, polyethylene, P.V.C. and Teflon.

**2. What are thermo-setting plastics? Give examples.**

Thermosetting plastics are cross-linked polymers. They become hard and brittle after working once. They cannot be softened and reshaped. Examples are: Polyesters, Urethane, Silicones and Epoxides.

**3. What are Elastomers? Give examples.**

Elastomers are polymers that have high elasticity. They stretch 5-10 times, when tensile load is applied. They regain their original size when the load is removed. Examples: Natural rubber, Poly butadiene.

**4. What are i) Plasticizers ii) Stabilizers?**

Plasticizers are added to make the product more flexible and less brittle.

Stabilizers are added to initiate the polymerization reaction and stabilize the reaction.

Hydrogen peroxide is a good stabilizer.

**5. What is compression moulding?**

In this process, the plastic material is heated to 125- 260° C and placed in the die-cavity. It is squeezed by a punch which applies a pressure of 3.5 – 42 MPa. It is usually employed for processing thermosetting plastics.

**6. What is Transfer moulding?**

In this process, the plastic charge is heated to fluid condition and placed in a chamber. It is then forced to flow through a runner into the mould cavity. This process is costly, but can produce parts of closer tolerances, high strength and uniform density.

**7. What is the principle of Injection moulding?**

This process involves the filling of heating cylinder with the charge from the hopper. After the charge becomes soft, the plunger forces it into the mould cavity and the desired shape is obtained.

**8. What is Calendaring?**

It is the process of manufacturing plastic sheets. The plastic material which consists of resin, filler, plasticizers and colour pigments is allowed to pass between a series of Hot rolls. The required product is obtained in the form of sheets.

**9. Mention the principle of Blow moulding.**

In this process, the thermoplastic material used is called ‘parison’. The Hot parison is placed between the jaws of a split mould. The extruder inflates the material with compressed air. This process is used for making PET jars (plastic bottles) and containers.

**10. What is thermoforming?**

Thermoforming is the process of shaping hot sheets of thermoplastic materials into desired shape by applying mechanical or pneumatic force. Thus a flat sheet (blank) is converted into a contoured product of variable thickness.

**11. Mention the use of catalyst.**

Catalyst is usually added to promote faster and more complete polymerization. It is also called accelerators and hardeners.

**12. State extrusion and its applications.**

Extrusion means the continuous flow of material through a die.

Its applications are,

- Production of sheets,
- Production of Tubes,
- Production of bar & thermoplastic materials.

**13. What is slush moulding?**

Slush moulding employs a thermoplastic resin slurry or “Slush” which is poured into a preheated mould. The heat causes the slurry to set in a viscous layer of the desired wall thickness.

**14. Define the following acronyms: PMMA, PVC, and ABS.**

- PMMA – Polymethylmethacrylate
- PVC – Polyvinyl chloride
- ABS – Acrylonitrille butadiene styrene

**15. Mention the major types of plastics.**

Thermoplastics  
Thermosetting

**16. How extruders are rated?**

Extruders are generally rated by the diameter D of the barrel and by the length to dia (L/D) ratio of the barrel. Typical commercial units are from 25 to 200 mm in diameter, with L/D ratios ranging from 5 to 30.

**17. What is “over molding”?**

This is a term used for producing hinge joints and ball and socket joints in one operation and without any post – molding assembly. Two different plastics have thus far been used, to ensure that no bond will form between the molded halves of the joint, because otherwise motion would be impeded.

**18. What are the types of blow molding?**

- Extrusion blow molding
- Injection blow molding
- Multilayer blow molding.

**19. Mention types of compression molding.**

- Flash type
- Positive
- Semi positive

**20. What are the applications of compression molding?**

Flash type – for shallow or flat parts.  
Positive type – for high density parts  
Semi positive type – for quality production

**21. What are the applications of transfer molding?**

Typical parts made by transfer molding are electrical and electronic components and rubber and silicone parts. The process is particularly suitable for intricate shapes with varying wall thicknesses.

**22. Describe solid-phase forming.**

It is carried out at a temperature from 10°C to 20°C (20°C - 40°) below the melting temperature of the plastic, while it is still in a solid state. The advantages over cold forming are that forming forces and spring back are lower. These processes are not as widely used as hot – processing methods.

**23. Brief “Jet Moulding”.**

In this process the plastic is preheated to about 93°C in the cylinder surrounding the nozzle, then it is further heated as the plunger forces the resin through the nozzle. After the mould has been filled, the nozzle is cooled by running water to prevent polymerization of the remaining material.

**24. What is “Bulging”?**

The process involves placing a tubular, conical, or curvilinear part into a split – female die and then expanding it is called bulging.

**25. Write about “segmented dies”.**

Dies which consist of individual segment, which are placed inside the part, then mechanically expanded in a generally radial direction, and finally retraced. Segmented dies are relatively inexpensive and they can be used for large production runs.

**26. Classify thermoplastics.**

1. Amorphous – Methacrylate, polyvinyl chloride, cellulose, fluorinated polymer
2. Crystalline – polyethylene, polyamide, polypropylene

**27. What are the characteristics of thermosetting plastics?**

1. It cannot soften once it moulded even at high temperature.
2. These plastics have cross linked molecules
3. These links are broken at high temperature but important properties are destroyed.

**28. Give some example for thermosetting plastics.**

Phenol formaldehyde, urea formaldehyde, phenolic, polyester, epoxide.

**29. Distinguish between thermo and thermosetting plastics.**

- |  |  |
|--|--|
| 1. They can be rapidly softened by heat and hardened by cooling. | 1. Once hardened and set, they do not soften with the application of heat. |
| 2. They are comparatively softer                                 | 2. They are more stronger and and less Strong harder than thermoplastics   |
| 3. They are produced by the condensation Polymerization          | 3. They are produced by the Polymerization                                 |

**30. What are the types of injection mouldings?**

1. Straight plunger type
2. Single stage reciprocating screw type
3. Two stage plunger or screw plasticizer type.

**31. What is extrusion?**

It is the term applied to the Process OF shaping plastics through die orifice.It is a continuous process.

**32. List the parts used in the transfer moulding.**

- |                    |                      |                  |
|--------------------|----------------------|------------------|
| 1. Plunger         | 2. Sprue.            | 3. Knockout pins |
| 4. Cooling systems | 5. Transfer chamber. |                  |

**33. What is the use of torpedo and hopper?**

Hopper – It is used to feed the granular form of material in to the heated cylinder.

Torpedo – It helps in spreading the moulding material uniform around the wall of the heated cylinder.

**34. What is the use of rotational moulding?**

It is used to produce the hollow component like toys. Normally it is used for polyvinyl chloride, polyethylene.

**35. What is calendaring?**

It is used to produce sheets and films from plastics materials such as polyvinyl chloride, polyethylene.

**36. What is Parison?**

The blow moulding process starts with the production of a tube made of thermoplastics material. This is called parison.

**37. List the types of joining of plastics.**

- |                         |                       |
|-------------------------|-----------------------|
| 1. Mechanical fastening | 2. Solvent bonding    |
| 3. Hot plate welding    | 4. Induction welding. |

**38. Define - solvent welding.**

It is used to join the plastics by the help of solvent. The solvent is used to soften the plastics and joining by pressing together.

**39. How the organic materials are classified?**

Natural organic	Synthetic organic.
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**40. Give some synthetic organic materials.**

Plastics, synthetic rubber, and glass.

**41. How the plastic is defined?**

It is defined as an organic polymer which can be moulded into any required shape with the help of heat and pressure.

**42. What are the materials used for processing plastics?**

Additives	Fillers.
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**43. Give some of filler materials?**

Mica	Asbestos	Cloth fiber.
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**44. What is reinforced plastics?**

The low pressure laminates are called reinforced plastics.

**45. Give some examples of foamed plastics?**

Phenolic, Silicone, Epoxy and Propylene.

**46. What are the fusion and solvent methods?**

Hot gas welding	Hot tool welding
-----------------	------------------

**47. What is co polymerization?**

Cross linking of two or more polymers is known as copolymerization.

**48. Give some additives added to the manufacturing of rubber.**

Accelerators	Softener	Reinforcing agents
Fillers	Colouring agents	

## PART – B QUESTIONS

### UNIT – I

1. What are the conditions that favor the formation of continuous and discontinuous chips?[8][NOV' 03]  
What are the functions of rake angle and end relief angle in single point cutting tool? [8]
2. What is crater wear? [4]  
During machining C<sub>20</sub> steel with a carbide cutting tool having a tool geometry given by 0-5-6-6-8-75-1 mm ORS, the following forces have been recorded by a two dimensional dynamometer.  
Cutting force = 1300 N, Feed force = 800 N Determine the following: Radial component of force, Frictional force and Nominal force and Kinetic coefficient of friction  $\mu$  [12] [NOV' 03], [NOV'04]
3. Explain the continuous chip formation process. Discuss the conditions that favor continuous chip formation [6] [NOV'04]
4. Discuss the types of wear occurs in the cutting tool due to machining. [6] [NOV'04]  
Discuss the functions of cutting fluids. List down the essential properties of cutting fluids.[10]
5. The following equation for tool life is given for a turning operation:  
$$VT^{0.15} f^{0.8} d^{0.4} = C$$
  
A 60 minute tool life was obtained while cutting at  $V = 30$  m/min,  $f = 0.4$  mm/ rev and  $d = 2.4$ mm  
Determine the change in tool life if the cutting speed, feed and depth of cut are increased by 15% individually and also taken together [12] [APR'05]  
Define the term machinability. Explain, how it is influenced by work material micro- structure [4]
6. Explain 'Merchant Force Circle' with suitable diagram [5] [APR'05]  
Discuss various types of tool wears [5]  
Discuss the various types of chips produced during metal cutting [6]
7. Explain the different types of tool wear.
8. Explain the different types of Tool Material and their composition.
9. How the tool life is measured.

### UNIT – II

1. Explain the following methods of taper turning in a lathe [8+8] [NOV' 03]  
By swiveling the compounding rest.  
By a taper turning attachment.
2. Explain the taper turning operation in a lathe by taper turning attachment. Write the advantages of taper turning attachment. [16] [NOV'04]
3. How do you specify a lathe? Explain with suitable diagram. [6] [APR'05]  
Explain the working principle of apron mechanism with neat diagram [10]
4. Differentiate between a Capstan and Turret lathe. [6] [APR'05]  
Explain the turret indexing mechanism with neat sketch [10]
5. Explain the thread cutting operation in a lathe.
6. How the automats work? Explain with an example.
7. Explain the single spindle automatic lathe.
8. Explain the Cutting off machine with diagram.
9. Explain the different types of multi spindle automats.
10. Explain the automatic Screw machine.



**UNIT III**  
**METAL CASTING PROCESS**

1. What are all the types of moulding sand? Explain any five properties.
2. Explain Cupola Furnace with neat sketch.
3. Explain the Cleaning process of Casting.
4. a) Differentiate between Open die and closed die forging.  
b) Explain True Centrifugal Casting with neat sketch.
7. Explain the types of moulding sand and classification of moulding sand?
8. Explain the properties of moulding sand?
9. Define core. Explain the types of core?
10. What are the methods of sand testing available, explain it?
11. What are the types of moulding machines?
13. With a neat sketch explain investment casting process?. state its advantages.
14. Enumerate the defects in castings. Explain the causes of these defects.
15. Define melting furnace, explain the types.
16. Explain the testing and inspection of casting.

**JOINING PROCESSES**

1. Explain the Ultrasonic welding process with a neat sketch
2. Write briefly about the various welding defects?
3. Explain the Carbon Arc welding process with a neat sketch.
4. Write briefly on Testing and Inspection of welded joint?
5. Explain the Laser beam welding process with a neat sketch.
6. Write the various welding defects?. Give their reasons and suggest the remedies.
7. Explain the Ultrasonic welding process with a neat sketch
8. How are the neutral, oxidizing and reducing flames obtained in a welding torch?
9. Describe in brief the equipments required for oxy acetylene welding.
10. Describe and explain the following welding methods giving their advantages limitation and specific applications.
  - (1) Laser beam welding
  - (2) Projection welding
11. Explain the welding process?
12. Explain the gas welding process, with a neat sketch.
13. Explain (1) TIG  
(2) MIG

**UNIT IV**

1. With the help of a diagram explain electro hydraulic forming. State its advantage and application.
2. Compare hot working and cold working. Describe the various roll arrangement used in rolling mills.
3. Explain the forging equipment process. Explain it?
4. Define extrusion method, and write the advantages.
5. Explain
  1. Blanking
  2. Nibbling
  3. Trimming
  4. Punching
6. Explain the power forging process.
7. Explain the Pneumatic Type forging hammer with neat sketch
8. Explain the Injection moulding process with a neat sketch.
9. Explain the Blow moulding process with a neat sketch.
10. Define drawing and discuss the classifications with neat sketch.

11. What do you understand about thread rolling? Explain.
12. Explain flat strip rolling process.
13. Explain the shape rolling process.

#### **UNIT IV**

1. Describe sheering operations in a sheet metal work with a neat sketch.
2. How press capacity for shearing operations can be determined?
3. Describe various types of bending operations with its neat sketches.
4. Write down the step by step procedure for determining pass capacity for drawing operations.
5. What is stretch forming? How it is carried out in sheet metal?
6. Explain any one method of stretch forming operation with a neat sketch.
7. Write short notes on formability tests.
8. Explain hydroforming process with its neat sketches. State their advantages and applications.
9. Describe the rubber pad forming process with a neat sketch. How it differs from rubber hydroforming process?
10. Explain the power spinning process with a neat sketch. Give their applications.
11. Describe explosive forming process with a neat sketch.
12. How magnetic pulse forming process is carried out on sheet metal?
13. Explain peen forming process with a neat sketch.
14. What is super plastic of metal? How this process is carried out on sheet metals?
15. Write short notes on super plastic forming materials.

#### **UNIT V – PLASTIC MATERIAL TECHNOLOGY**

1. Describe the following plastic processing methods with sketches
  - (1) injection moulding
  - (2) thermoforming
2. Describe the following plastic processing methods with sketches
  - (1) compression moulding
  - (2) transfer moulding
3. What are the types of moulding and explain it?
4. Explain the reinforced plastic and laminating plastics?
5. What are the characteristics of the forming and shaping processes?
6. What are the types of moulding of thermoplastics?
7. Explain the working principles and application of
  - a. Blow moulding
  - b. Rotational moulding
8. Explain the extrusion process.
9. Explain the thermoforming process.
10. What is bonding of thermoplastics?
11. What are the fusion and solvent methods?
12. Explain induction and ultrasonic methods.