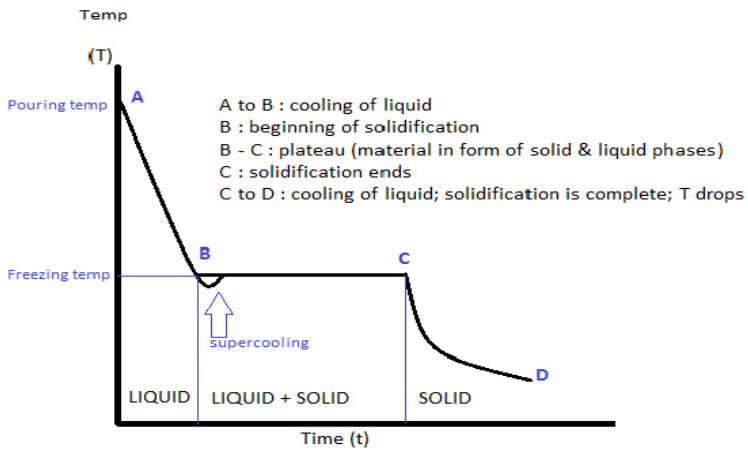
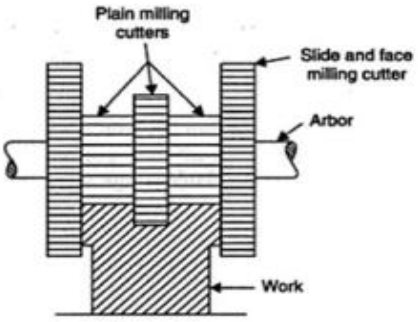
WINTER – 19 EXAMINATION

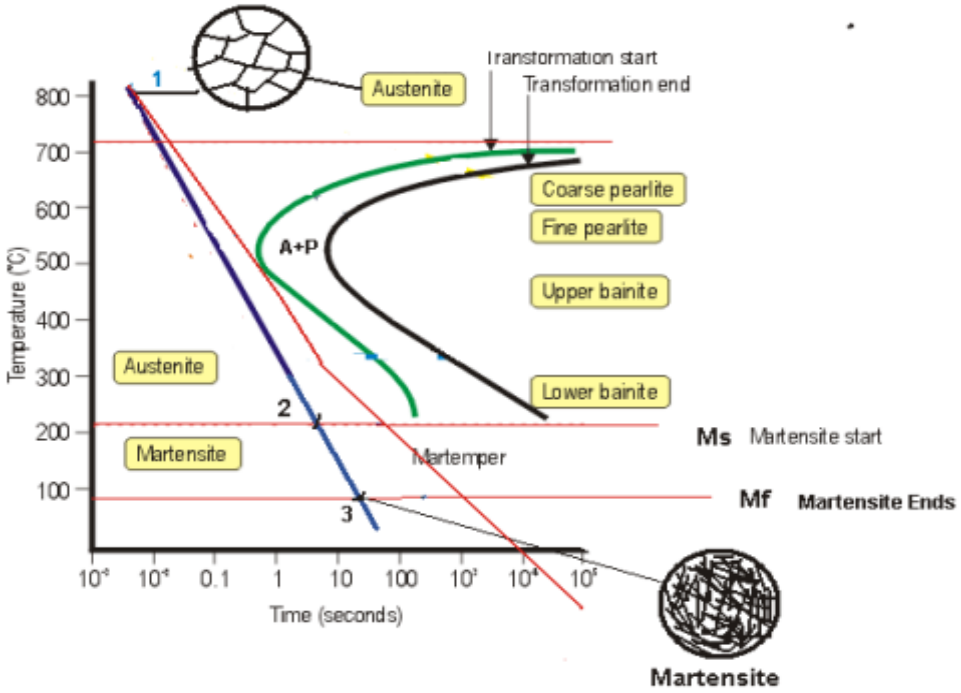
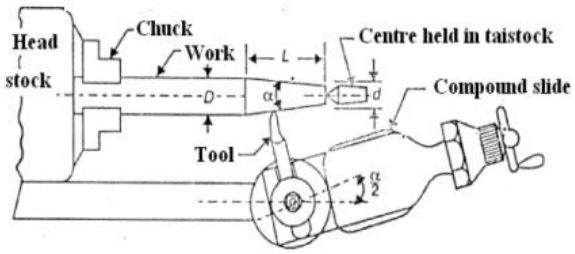
Subject Name: Matl & Mfg. Processes **Model Answer** Subject Code: 22307

Important Instructions to examiners:

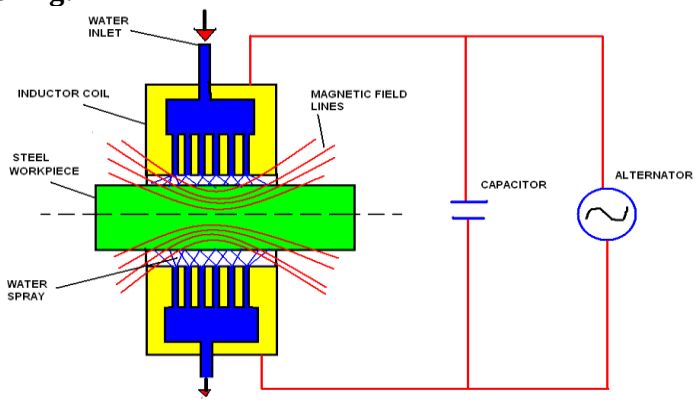
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling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

Q. No.	Sub Q. N.	Answer	Marking Scheme
1		**Attempt any FIVE of the following:**	*10*
	a	**Write two need of advanced material in Automobile Sector.**	*02*
	Ans	**The Advanced Materials in Automobile Sector include:** [1] Advanced High Strength Steels, [2] Non-Ferrous Alloys, such as aluminum, magnesium and titanium alloys, [3] Composites, including carbon fiber composites, metal matrix composites and nano-composites.	*Any Two = 02 Marks*
	b	**Draw Cooling Curve for Pure Iron and explain.**	*02*
	Ans	**Cooling Curve for Pure Iron:**  **Figure: Cooling Curve for Pure Iron**	*Sketch = 01Mark & Explain = 01 Mark*
	c	**Classify various Manufacturing Processes.**	*02*
	Ans	**The Four main types of Manufacturing Processes are** (1) Casting & Molding, (2) Machining, (3) Joining & Shearing and (4) Forming.	*Any 4 =02 Marks*
	d	**Explain importance of Tool Life.**	*02*
	Ans	Tool life is a volume of material removed by a machining tool during its total usage span.	*Any*

		The volume may be in cubic mm or cubic cm at a standard cutting speed. **Importance of Tool Life:** 1. More will be profit in manufacturing processes. 2. Time saved in frequent tool changing. 3. Low inventory.	***Two = 01 Mark Each***
	e	**List two important properties of Cutting Fluids.**	***02***
	Ans	**Properties of Cutting Fluid:** 1. High heat absorption 2. Good lubricating qualities to produce low coefficient of friction 3. Low viscosity to permit free flow of liquid 4. Non-corrosive to the work or the machine 5. High flash point so as the eliminate the hazards of fire 6. Odorless, so as not to produce any bad smell 7. Harmless to the skin of operator 8. Transparency so that the cutting action of the tool may be observed	***Any Two = 01 Mark Each***
	f	**Write four operations performed on Lathe /machine.**	***02***
	Ans	**Operations Performed on Lathe Machine are:** 1. Facing, 2. Plain turning, 3. Step turning, 4. Taper turning, 5. Drilling, 6. Reaming, 7. Boring, 8. Undercutting, 9. Threading, 10. Knurling.	***Any 4= ½ Each***
	g	**Explain Gang Milling Process.**	***02***
	Ans	**Gang Milling Operation:**  **Figure: Gang Milling Operation** It involves the use of a combination of more than two cutters, mounted on a common arbor, for milling a number of flat horizontal and vertical surfaces of a work piece simultaneously. This method saves much of machining time and is widely used in repetitive work. The cutting speed of a gang of cutters is calculated from the cutter of the largest diameter.	***Sketch = 01 Mark*** ***& Explain = 01 Mark***
2		**Attempt any THREE of the following:**	***12***
	a	**State various types of Cast Iron and give application of each.**	***04***
	Ans	**There are four basic types of Cast Iron –** **(1) White Cast Iron:** **Applications:** Lifter Bars, Shell Liners in Grinding Mills, Pumps, Balls and Rings of Coal Pulverisers, etc. **(2) Gray Cast Iron.** **Applications:** Frames for Electric Motors, Machine Tool Structures, Engine Frames, Drainage Pipes, Cylinders & Piston & Piston Rings, Fly Wheels etc.. **(3) Ductile Cast Iron.** **Applications:** Automotive Parts, Anchor of Ships, etc. **(4) Malleable Cast Iron.** **Applications:** Pots Pans and utensils, etc.	***Types 02 Marks Any one Relevant Application 1/2 Mark each***

	b	**Describe various phase transformations of iron after cooling at various rates using TTT diagram.**	***04***
	Ans	**TTT is Time-Temperature-Transformation diagram**. It shows the microstructures resulting from non-equilibrium cooling which is not possible on Fe-c diagram. It shows various microstructures of steels depending upon cooling rate & also the temperature and time taken for each transformation.  **Figure: TTT Diagram**	***Sketch 04 Marks***
	c	**Explain the importance of pattern allowances and state various pattern allowances.**	***04***
	Ans	**Pattern Allowances are Important Because:** 1. Solid contraction can be reduced by providing more allowance on patterns. 2. When a pattern is drawn from a mould, there is always some possibility of injuring the edges of the mould. 3. Rough surfaces of castings that have to be machined are made to dimensions somewhat over those indicated on the finished working drawings. 4. Some castings, because of their size, shape and type of metal, tend to warp or distort during the cooling period. **Various Pattern Allowances are:** i. Shrinkage allowance ii. Draft allowance iii. Machining allowance iv. Distortion or camber allowance v. Shake allowance / rapping allowance	***Any Two = 02 Marks*** ***Any Four = 02 Marks***
	d	**Explain taper turning by using swiveling compound rest.**	***04***
	Ans	**Taper Turning Method by Swiveling the Compound Rest:**  **Figure: Taper Turning Method by Swiveling the Compound Rest**	***Sketch = 02 Marks*** ***&***

		This method employs the principle of turning taper by rotating the work piece on the lathe axis and feeding the tool at an angle to the axis of rotation of the work piece. The tool mounted on the compound rest is attached on a circular base (Swivel plate), graduated in degree, which may be swiveled and clamped at any desired angle. Once the compound rest is set at the desired angle half the taper angle, rotation of the compound slide screw will cause the tool to be fed at the angle and generate a corresponding taper. The movement of tool is controlled by hand.	***Explain = 02 Marks***
3		**Attempt any THREE of the following:**	***12***
	a	**Enlist four properties of Magnesium AlloyAZ31 and also give it's applictions.**	***04***
	Ans	**Properties of Magnesium AlloyAZ31:** 1) An extremely light metal, 2) This alloys are of Excellent Specific Strength, 3) Excellent Sound Damping Capabilities, 4) Good Castability, 5) Hot Formability, And 6) Excellent Machinability **Applications:** Electronics, Aerospace, Transportation Industries &Sports Industries, etc.	***Any Four= 02 Marks & Any Two = 02 Marks***
	b	**Explain the effect of nickel, chromium, silicon, molybdenum addition on the properties of steel.**	***04***
	Ans	**1) Effect of Nickel as alloying Element:** i) Provides toughness, corrosion resistance, and deep hardening. ii) Increases resistance to impact iii) Improves tensile strength **2. Effect of Chromium as alloying Element::-** i) Improves corrosion resistance, toughness and harden ability ii) Improves resistance to abrasion and wear **3) Effect of Silicon as alloying Element:** i) Increases Hardenability. ii) Increases Electrical Resistivity. **4) Effect of Molybdenum as alloying Element:** i) It increases red hardness of steel. ii) Increases hardness, hardenability. iii) Increases wear resistance, iv) Reduces temper brittleness. iv) increases strength. V0 Mo-carbides help increase creepresistance at elevated temps	***Any one effect 01 mark each***
	c	**Describe Carburizing Process with its applications.**	***04***
	Ans	**Principle of Carburizing:** Carburizing is the case hardening process to obtain hard wear resistant and shock resistant case /surface and tough core inside, by introducing carbon on the steel surface by heating it in contact with solid, liquid, gaseous carbon containing substances to a temperature of 870-925ºC for several hours by absorption and diffusion. The high carbon steel surface is hardened by quenching from above the lower critical temperature. **Applications of Carburizing:** 1) Gears 2) Camshafts 3) Bearings 4) Shafts	***Principle = 02 Marks & Appl.= 02 Mark***
	d	**Classify various types of molding sands and give it's uses.**	***04***
	Ans	**1. Special Sand:** **Uses:** Used for cores of brass and bronze casting, for non- ferrous castings of an intricate shape and for heavy steel casting. **2. Green sand:** **Uses:** It is used only for simple and rough casting. It is used for both ferrous and non-ferrous metal.	

		3. Dry sand: **Uses:** They are suitable for larger castings. **4. Loam sand:** **Uses:** This is particularly employed for loam moulding usually for large castings. **5. Facing sand:** **Uses:** Facing sand forms the face of the mould. **6. Backing sand:** **Uses:** To back up the facing sand and to fill the volume of the box. It is also known as floor sand. **7. System sand:** **Uses:** This molding sand is applicable to mechanical heavy castings.. **8. Parting sand:** **Uses:** Parting sand is used to keep the green sand from sticking to the pattern and also to allow the sand on the parting surface of the cope and drag to separate without clinging. **9. Core sand:** **Uses:** Sand used for making cores is called core sand, sometimes called, oil sand.	***Name of Any Four Sand 02 Marks & Any One Use Of Each ½ Mark.***
4		**Attempt any THREE of the following:**	***12***
	a	**Write four properties of Ceramic Materials and give it's applications in automobile industry.**	***04***
	Ans	**Properties of Ceramic Material:** *(Any Two- ½ mark each)* i. Inorganic & non -metallic material. ii. Brittle material. iii. Insulation to flow of electric current iv. Withstand high temperature. v. Rock like appearance vi. Hardness vii. Corrosion resistance **Applications in Automobile Industry:** 1. Low and high voltage insulators. 2. High frequency applications. 3. Heat resistant applications as pyrometers, burner, burner tips. 4. Chemical industry such as crucible, jars and components of chemical reactors. 5. In refractories for industrial furnaces. 6. In electrical and electronics industries as insulators, semiconductors, dielectric, porcelain alumina, quartz, mica etc. 7. In I.C. engines and turbines as armor plates. 8. In cutting tools	***01 Marks Each = 02 Marks*** ***01 Marks Each 02 Marks***
	b	**Explain induction hardening process and give it's applications.**	***04***
	Ans	**Induction Hardening:**  **Figure: Induction Hardening**	***Explain = 03 & Appl. =01 Mark***

.It involves heating thin surface layer of hardenable steel and cast iron components by means of a high frequency induced current to a temperature within or above the transformation range followed immediately by quenching.

OR

Steel is heated by high freq. electric induction current and cooled rapidly to convert austenite into martensite.

Success is related to selection and design of proper work coil. Suitable for round shaped components

Applications:

[1] Piston rods, [2] Crankshaft,[3] Spur gear,[4] Camshaft, [5] Cams, [6] Automobile parts

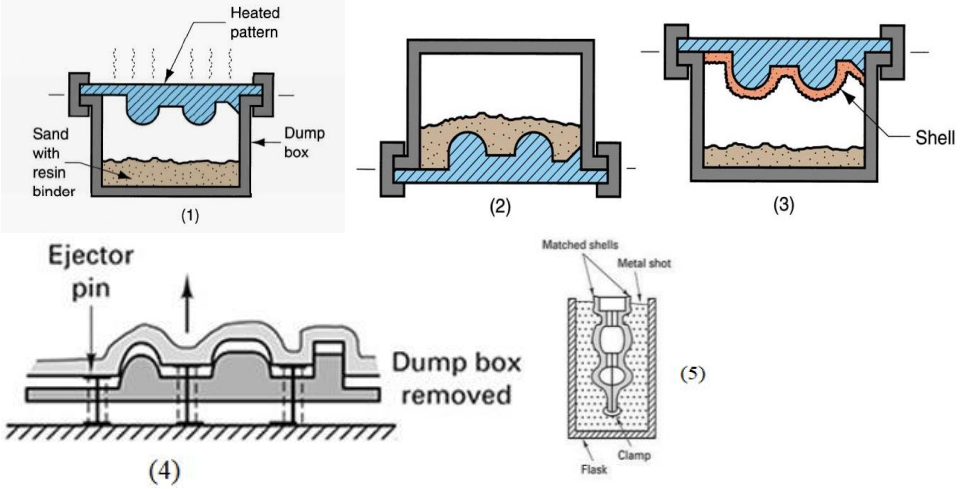
c **Differentiate Hardening and Tempering of Automobile Parts.** ***04***

Ans **Differentiate Hardening and Tempering:** ***Any Four Points = 01 Mark Each.***

Parameter	Hardening	Tempering
Definition	Hardening or quenching is the process of increasing the hardness of a material.	Tempering is the process of heating a substance to a temperature below its critical range, holding and then cooling.
Process	In hardening process, the metal is heated into austenitic crystal phase and then quickly cooled.	Tempering is done by re-heating the metal alloy to a temperature lower than the critical temperature, holding for some time and cooling.
Purpose	Hardening increases the hardness and strength of materials such as metal alloys.	Tempering reduces hardness & strength of steel
Application	hardening is done to increase the hardness of a metal	tempering is done to reduce the brittleness of quenched metal or alloy.

d **Describe Shell Molding Process with applications.** ***04***

Ans



Desc. or Sketch 02 Marks & Any 2 Appl. = 01 Mark Each

Shell Molding:

[1] Fine Silica sand with liquid catalyst is dumped onto a hot pattern.

[2] Box is inverted so that the sand and resin fall on to a hot pattern, due to which a layer of mixture cures on the surface to form a hard shell.

[3] Box is repositioned so that loose uncured particles drop away.

[4] Dump box removed and then Mold is removed

[5] Clean the mold using sand blasting.

Shell Molding Applications:

Body panes, truck hoods, small size boats, bath tubs, shells of drums, connecting rods, gear housings, lever arms, etc. are cast using Shell Molding process.

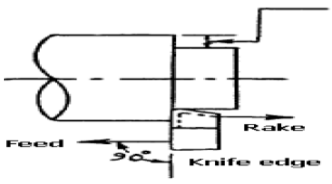
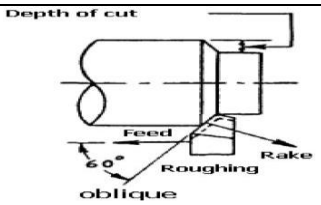
	e	**Explain any four defects in casting and give remedies of it.**	***04***
	Ans		***Any Four Defect ½ Mark Each And their Remedies ½ Each***

S. N.	Casting Defects	Remedies
1	**Shifts**	By ensuring proper alignment of the pattern or die part, moulding boxes, correct mounting of patterns on pattern plates, and checking of flasks, locating pins, etc. before use.
2	**Warpage**	Is to produce large areas with wavy, corrugated construction, or add sufficient ribs or rib-like shapes, to provide equal cooling rates in all areas; a proper casting design can go a long way in reducing the warpage of the casting.
3	**Swell**	To avoid swells, the sand should be rammed properly and evenly.
4	**Blowholes**	To prevent blowholes, the moisture content in sand must be well adjusted, sand of proper grain size should be used, ramming should not be too hard and venting should be adequate.
5	**Drop**	The given factors are eliminated to avoid drop.
6	**Porosity**	Increase flux proportion, Ensure effective degassing, Reduce moisture and increase permeability
7	**Shrinkage**	Ensure proper directional solidification by modifying risering and chilling.
8	**Misruns and cold shuts**	Adjust proper pouring temperature, Modify design, Modify gating system.
9	**Inclusions**	Improve or modify gating and pouring, Use a superior sand, Provide harder ramming, Use proper flux
10	**Hot Tears**	Improve collapsibility, Modify design, Provide soft ramming
11	**Cuts and Washes**	Improve collapsibility, Modify design, Provided soft ramming
12	**Metal Penetration**	Use sand having finer grain size, Provide harder ramming, Increase the strength of sand, Adjust the proper pouring temperature,
13	**Fusion**	Improve refractoriness, Modify refractoriness, Use lower pouring temperature, Improve quality of facing sand
14	**Shot metal**	Use higher pouring temperature, Reduce sulphur content, Modify gating system.
15	**Rat Tails or Buckles**	Reduce mould hardness, Break continuity of large surface by grooving or depressions.
16	**Hard Spots**	Suitable change in the metal composition, Modify the casting design
17	**Run outs**	Improve moulding technique,Change the defective moulding boxes.
18	**Crushes**	Repairs or replace core boxes, Repairs or replace core prints, Proper setting of cores.

5 — **Attempt any TWO of the following:** — ***12***

a — **Differential clearly between Orthogonal and Oblique Cutting(Minimum SIX points Each)** — ***06***

Ans — **Difference between Orthogonal and Oblique Cutting:**

S. N.	Orthogonal Cutting	Oblique Cutting
1	The cutting edge of the tool is perpendicular to the cutting velocity factor	The cutting edge is inclined at an angle 'I' with the normal to the cutting velocity factor
2	The cutting edge clears the width of the workpiece on either ends	The cutting edge may not clear the width of the workpiece on either ends.
3	The chip flows over the tool face.	The chip flows on the tool face.
4	Only two components of the cutting forces are acting on the tool.	Only three components of the cutting forces are acting on the tool.
5	Tool is perfectly sharp.	Tool is not perfectly sharp.
6	Tool contacts the chip on rake face only.	The toll may not generate a surface parallel to workface.
7	The maximum chip thickness occurs at the middle.	The maximum chip thickness may not occur at the middle.
8	Only one cutting edge in action.	More than one cutting edges are in action
9		

Any Six Points 01 Mark Each

b — **Explain single point cutting tool nomenclature with sketch.** — ***06***

Ans — **Single Point Cutting Tool Nomenclature:**

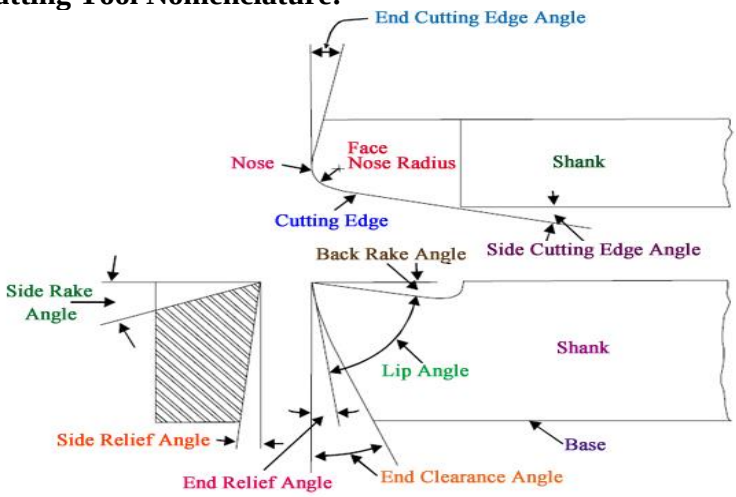


Figure: Nomenclature of Single Point Cutting Tool.

1. Shank: The main body of the tool is known as shank. It is the backward part of tool which is hold by tool post.

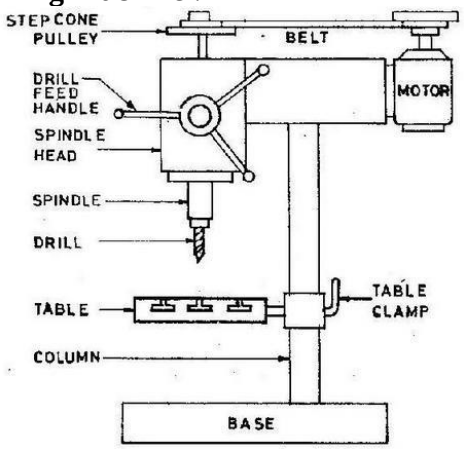
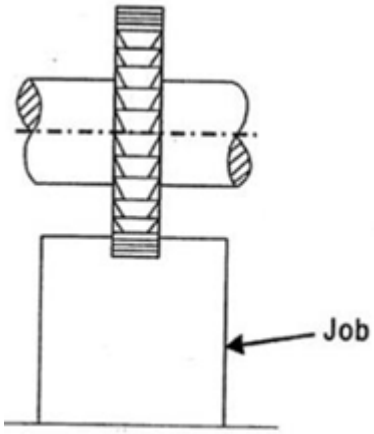
2. Face: The top surface tool on which chips passes after cutting is known as face. It is the horizontal surface adjacent of cutting edges.

3. Flank: Sometime flank is also known as cutting face. It is the vertical surface adjacent to cutting edge. According to cutting edge, there are two flank side flank and end flank.

3. Nose or Cutting Point: The point where both cutting edge meets known as cutting point or nose. It is front of the tool.

Sketch 04 Marks & Explanation Of any Two Element Of It 01 Mark Each.

		4. Base: The bottom surface of tool is known as base. It is just opposite surface of face. **5. Heel:** It is a intersecting line of face and base. **6. End Cutting Edge Angle:** The angle between end cutting edge or flank to the plane perpendicular to the side of shank is known as end cutting angle. **7. Side Cutting Edge Angle:** The angle between the side cutting edge or flank to the plane parallel to the side of the shank known as side cutting edge angle. **8. Back Rake Angle:** The angle form to smooth flowing of chips from face, known as rack angle. It allows to smooth flow of chips. Back rack angle is the angle between face and the plane perpendicular to the end cutting edge. **9. Side Rack Angle:** The angle between the face and plane perpendicular to the side cutting edge is known as side rack angle. It allows chips to flow smoothly when material cut by side cutting edge. **10. End Relief Angle:** It is also known as clearance angle. It is the angle which avoids tool wear. It avoid the rubbing of flank with work piece. End cutting angle made by end flank to the plane perpendicular to base. **11. Side Relief Angle:** It is the angle made by the side flank to the plane perpendicular to the base. It avoid rubbing of side flank with work piece. **12. Nose Radius:** The intersecting area of both cutting edges is known as nose of the tool.	
	c	**Classify various types of Milling Machines. List major parts of Universal Milling Machine.**	***06***
	Ans	**Classification of Milling Machine:-** ***1) Column and Knee Type Milling Machine*** a. Plain or Horizontal Milling Machine b. Hand Milling Machine c. Vertical Milling Machine d. Universal Milling Machine e. Omniversal Milling Machine ***2) Manufacturing or Fixed Bed Type Milling Machine*** a. Simplex Milling Machine b. Duplex Milling Machine c. Triplex Milling Machine ***3) Planer Type Milling Machine*** ***4) Special Purpose Milling Machine*** a. Cam Milling Machine b. Planetary Milling Machine c. Profile Milling Machine d. Drum Milling Machine e. Duplicating Milling Machine **Major Parts of Universal Milling Machine:** [1]Base [2]Column [3]Knee [4]Saddle [5]Table [6]Overhanging arm [7]Spindle [8]Arbor	***Classification 04 Marks*** ***&*** ***Any Four Parts ½ mark each***
6		**Attempt any TWO of the following:**	***12***
	a	**Explain the importance of various machining parameters in improving tool life.**	***06***
	Ans	**Various Machining Parameters in Improving Tool Life are:** 1. Hardness and machinability of the metal to be machined. 2. Quality of heat treatment if it is steel tool. 3. Whether machining is to be done with or without the use of coolant 4. Rigidity of the tool and the work. 5. Shape of the tool. 6. Depth of cut. 7. Feed to be given to the tool. 8. Cutting Speed.	***Any Six Parameters 01 Mark Each***

	b	**Describe the construction and working of bench drilling machine with block diagram.**	***06***
	Ans	**Major Parts of Bench Drilling Machine** *:*  **Figure: Bench Drilling Machine** **Functions of Parts**: (Any 02) **i. Base:** It supports the column, which in turn, support the table and head etc. **ii. Spindle:** It is made up of alloy steel. It rotate as well as moves up and down in a sleeve **Iii. Drill Chuck:** It is held at the end of the drill spindle and in turns it holds the drill bit or tool. **iv. Head :**it contains the electric motor ,V pulley & v-belt which transmit rotary motion to drill spindle at number of speeds **v. Adjustable Table:** It is supported on the column of the drilling machine and can be moved vertically and horizontally. It also carries slot for bolt clamping **vi. Column:** It is vertical round or box section, which rests on the base and supports the head and the table.	***Sketch 02 Marks*** ***Construction 02 Marks*** ***Working 02 Marks***
	c	**Explain keyway milling process with standard milling cutters.**	**06**
	Ans	**Keyway Milling Operation:**  **Figure: Keyway Milling** This milling process produce keyway slot. The cutter use if thin size. This operation suited for long keyways. The position of the cutter is shown in figure. Standard keyways are cut on shafts by using side milling cutters or end mills. The cutter is exactly at the center line of the work piece and then the cut is taken. Woodruff key is produced by using a woodruff key slot cutter.	***Sketch 03 Marks*** ***&*** ***Process 03 Marks***