

Scoring Indicators

Code : (15)-6021-ADVANCED PRODUCTION PROCESS

| Qn. No. | Scoring Indicators | Split score | Total score |
|---------|--|------------------------|-----------------------|
| I.1 | The term Automation represents a higher degree of mechanization, through which most or all of the operations or activities involved in die manufacturing of a product or products are performed through automatic means, i.e., without direct participation of a human being. | 2 | 2 |
| I.2 | Casting. Plastic Rolling. Extrusion. Stamping. Powder metallurgy. Machining. | any four | 2 |
| I.3 | An unconventional machining process is a type of machining process in which there is no direct contact between the tool and the workpiece. In unconventional machining, a form of energy is used to remove unwanted material from a given workpiece | 2 | 2 |
| I.4 | Robotics is the branch of technology that deals with the design, construction, operation, and application of robots | 2 | 2 |
| I.5 | A <i>flexible manufacturing system</i> (FMS) is a <i>manufacturing system</i> in which there is some amount of <i>flexibility</i> that allows the <i>system</i> to react in case of changes, whether predicted or unpredicted. | 2 | 2 |
| Part B | | | |
| II.1 | A Machining center is a simply a CNC milling machine with an automatic tool changer and an enclosure are capable of carrying out milling, drilling, reaming, tapping, boring, counter boring and allied operations without operator intervention for change of tools. 1.Three Axis Machining Center. 2.Horizontal Three Axis Machining Center. 3.Four Axis Machining Center. 4.Five Axis Machining Center. 5.Machining Center with pallet changer. | 1 5 | 6 |
| II.2 | The hexapod is a closed chain kinematic structure. The component has to be composed of six struts. The hexapod consists of six struts-hydraulic ones. These struts are free to expand and contract between the base at the bottom, and the top platform. The platform is the output element that gets the 6 DOF of the system. The platform receives all six coordinates freedom in motion. Both ends of the hydraulic struts are connected to either the platform or the base using universal joints. Such a system was first introduced in the flight simulators positioning systems. | 3 | |



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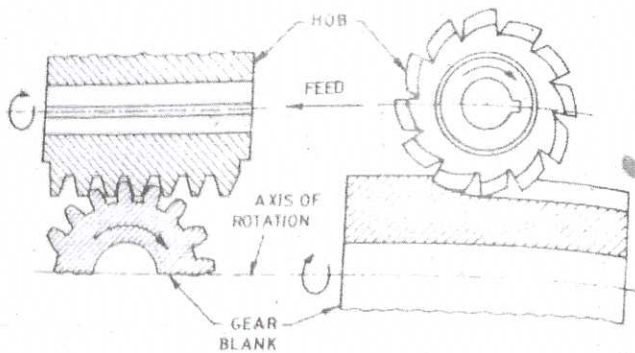
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II.3

THE GEAR HOBGING PROCESS

In this process, the gear blank is rolled with a rotating cutter called hob. In operation, the hob is rotated at a suitable speed and fed into the gear blank. The blank also rotates simultaneously. The speeds of the two are so synchronised that the blank rotates through one pitch distance for each complete revolution of the hob.

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II.4

jigs and fixtures advantages:

1. They enable easy means for manufacture of interchangeable parts and, thus, facilitate easy and quick assembly.
2. Pre-machining operations, like marking, measuring, laying out, etc., required in case of individual parts, are totally eliminated with the use of jigs and fixtures.
3. Once a properly designed jig or fixture is set up in position, any number of identical parts can be produced without any additional setup.
4. Production capacity is increased with their use because any number of parts can be produced in a single setup.
5. They enable quick setting and proper location of work. Hence, the work handling time is considerably reduced.
6. They offer a high clamping rigidity. Therefore, higher speeds, feeds and depth of cut can be used for machining.
7. Because of the automatic location of the work and guidance of the

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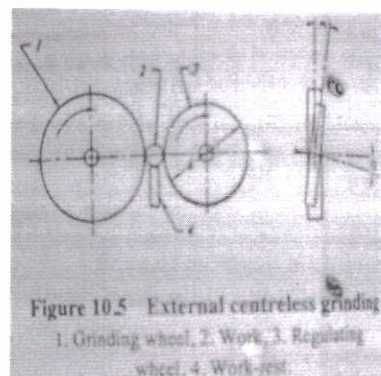
took the machining accuracy is increased.

8. The parts produced with their use are very accurate. As such, the expenditure due to inspection and quality control of finished components is considerably

II.5

CENTRELESS GRINDERS

Centre less grinding is a method of grinding exterior, cylindrical, tapered and formed surfaces on workpieces that are not held and rotated on centres. The principal elements of an external centre less grinder are the grinding wheel, regulating or back up wheel, and the work rest. Both wheels are rotated in the same direction. The work rest is located between the wheels. The work is placed upon the work rest, and the latter, together with the regulating wheel, is fed forward, forcing the work against the grinding wheel



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II.6

EDM

1. The process can be applied to all conducting metal and alloys irrespective of their melting point hardness toughness
2. Any complicated shape can be made on the tool
3. Highly complicated shapes can be made by fabricating the tool
4. Time of machining is less
5. It can applied to extremely hardened work piece
6. No mechanical stress is present

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II.7

Automatic guided vehicle (AGV) is a portable robot that follows along marked lines or wires on the floor, or uses radio waves, vision cameras, magnets, or lasers for navigation. They are most often used in industrial applications to transport heavy materials around a large industrial building, such as a factory or warehouse. AGVs use tape for the guide path. The AGV is fitted with the appropriate guide sensor to follow the path of the tape. The navigation is done by mounting reflective tape on walls, poles or fixed machines. The AGV carries a laser transmitter and receiver on a rotating turret. The laser is transmitted and received by the same sensor. The navigation is done by mounting reflective tape on walls, poles or fixed machines. The AGV carries a laser transmitter and receiver on a rotating turret.

4 points

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The laser is transmitted and received by the same sensor. Flexible manufacturing systems containing more than one AGV may require it to have traffic control so the AGV's will not run into one another. Traffic control can be carried out locally or by software running on a fixed computer elsewhere in the facility.

III.a

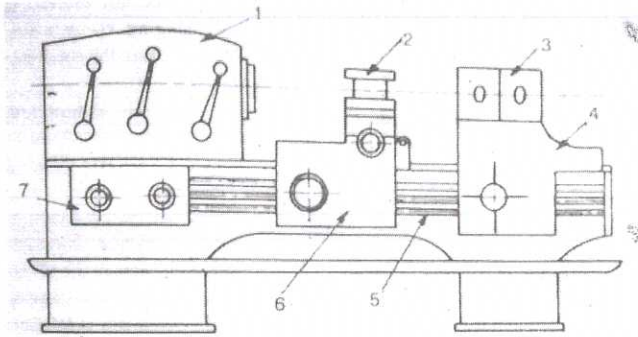


Figure 4.4 Turret lathe parts

1. Headstock, 2. Cross slide toolpost, 3. Hexagonal turret, 4. Turret saddle, 5. Feed rod, 6. Saddle for cross slide

Bed: The bed is a long box like casting provided with accurate guide ways upon which are mounted the carriage and turret saddle.

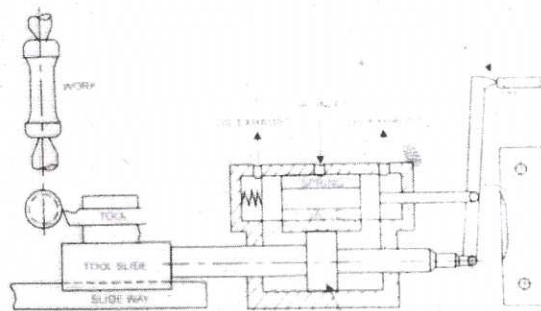
Headstock: The head stock is a large casting located at the left hand end of the bed

Cross-slide and saddle: In small capstan lathes, hand operated cross-slide and saddle are used which are clamped on the lathe bed at the required position. The larger capstan lathes and heavy duty turret lathes are equipped with usually two designs of carriage.

1. Conventional type carriage.
2. Side hung type carriage.

. In a turret lathe, **the turret** is directly mounted on the top of the saddle and any movement of the turret is effected by the movement of the saddle. After one operation is completed, as the turret is brought back away from the spindle nose, the turret indexes automatically by a mechanism incorporated on the bed and in turret saddle, so that the tool mounted on the next face is aligned with the work

III.b



The hydraulic units are basically servomechanism which magnifies a relatively small input force or signal in order to provide a larger output force or signal for operating the mechanism. This output signal from the servo mechanism must be

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continually and automatically modified to suit variations in the input signals. the lathe saddle traverses along the bed, the stylus will follow the template edge always being kept in contact by spring pressure on the left-hand end of the valve spool. If the stylus moves to the right then the spool will move to the right. This will allow the oil to the left of the piston to exhaust, and will allow oil to the right of the piston hence moving it to the left. Therefore, the tool slide and tool will move to the left reproducing the template shape upon the work piece.

IV.a

- *Multispindle Bar Automatics.* these multi-spindle automats use bar stock as the stock material. The bar stock may have square, hexagonal, round, or any other shape of its cross-section, but the round shape is most widely used.

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- *Multispindle Chucking Automatics.* These machines are made in both horizontal as well as vertical types. In either case, they machine individual blanks, usually castings or forgings, held in chucks. But, the capacity of horizontal chucking machines is only limited. The vertical designs are, therefore, preferred in mass production of relatively larger and heavier jobs

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- **According to the principle of operation**

- *Parallel-action multi-spindle automatics.* These machines are normally employed for producing relatively shorter components of simple shapes. A significant feature of these machines is that the same operation is performed on the bar stock on each spindle simultaneously and the entire component is finished in a single operation cycle. Therefore, in a single cycle of operation, on these machines as many finished components will be produced as the number of spindles they carry.

2

- *Progressive-action multi-spindle automatics.* These machines differ from the parallel-action type machines in that, unlike the latter, the complete job is not finished at any single spindle. Instead of that, the total number of operations are divided into a number of sets or combinations and one such set of operations is performed on each separate spindle. Thus, the operation of completely machining a component is performed in several stages, progressing from one spindle to the next.

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IV.b

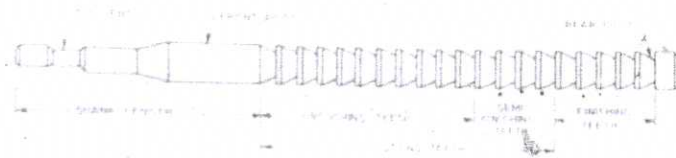
PRINCIPLE OF AUTOMATION

- *Processing.* In this the actual cutting or removal of metal takes place by means of different cutting tools.
- *Handling.* This includes all the operations other than processing,
 - loading of work,
 - unloading of finished components,
 - mounting and removal of cutting tools,
 - feeding of tools and inspection of work during the operation, etc.

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V.a



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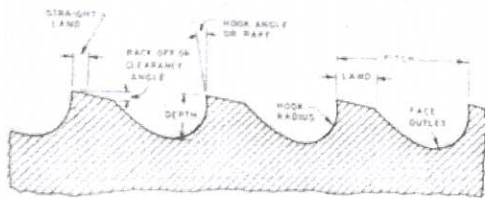


Fig. 15.3. Broach teeth details.

brief description of the following terms

Pull end.

Front pilot.

Rear pilot

Land.

Tooth gullet.

Pitch.

Cut per tooth.

Back off angle.

Hook or rake angle.

Hook radius.

listing and exp in one or two sentence

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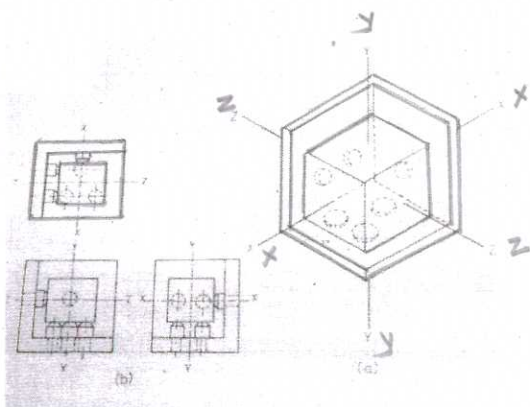
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V.b

THE PRINCIPLE OF SIX-POINT LOCATION

According to this principle, a work piece can be completely restrained by providing three location points in one plane, two location points in the second plane and one location point in the third plane.

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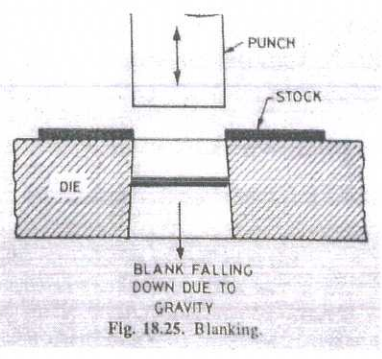
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VI.a

brief description of the following any four processes

listing 4

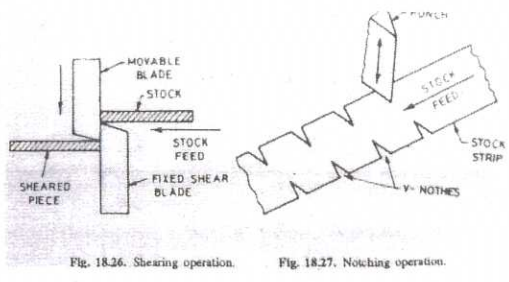
Blanking.



Punching

Perforating and piercing

Shearing, parting and notching.



Trimming, shaving and burnishing.

Slitting and lancing.

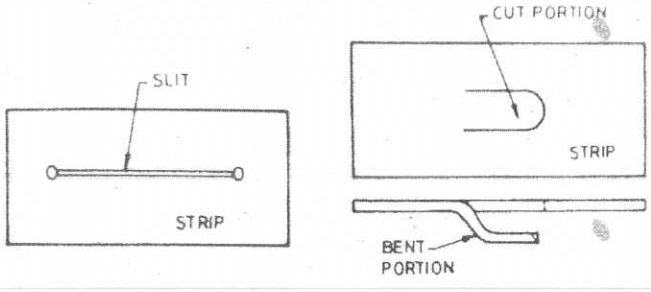


figure. definiton 8
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VI.b

INDEX JIGS

This type of jig incorporates, a suitable indexing mechanism, by means of which the work piece can be indexed to required positions. Such a requirement recurs when, say, a number of equidistant holes are to be drilled, on the circular flange of a work piece. By means of the indexing device, each time a hole is drilled the work piece is indexed to the next position of the hole to come under the drill bush automatically. Thus, a series of equidistant holes can be drilled along a circle.

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UNIVERSAL JIGS

These jigs are manufactured as basic units, to which a number of other elements and parts can be fitted to make them suitable for specific uses. Since the same basic unit can be adopted for many different purposes, by simply changing a few elements, a single jig can be used for several different work pieces and operations.

VII.a

MOUNTING THE GRINDING WHEELS

1. All wheels should be closely inspected just before mounting to make sure that they have not been damaged in transit, storage, or otherwise. The wheel must first be subjected to the ringing test.

2. The abrasive wheels should have an easy fit on their spindles or locating spigots. They should not be forced

3. The hole of grinding wheels mostly is lined with lead. The lead liner bushes should not project beyond the side of wheels.

4. There must be a flange on each side of the wheel, at least the flange diameter must be equal to the half of the grinding wheel diameter.

5. The sides of the wheel and the flanges which clamp them should be flat and bear evenly all round

6. All flanges must be relieved in the centre so that the flanges contact the wheel only with the annular clamping area.

7. Washers of compressible materials such as card board, leather, rubber, etc. not over 1.5 mm thick should be fitted between the wheel and its flanges.

8. The inner fixed flange should be keyed or otherwise fastened to the spindle, whereas the outer flange should have an easy sliding fit

9. The nut should be tightened to hold the wheel firmly. Undue tightness is unnecessary and undesirable as excessive clamping strain is liable to damage the wheel.

10. The wheel guard should be placed and tightened before the machine is started for work.

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any 6
points
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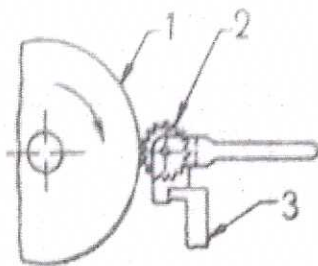


Figure 10.20 Dressing a grinding wheel

1. Wheel, 2. Dresser, 3. Work rest.

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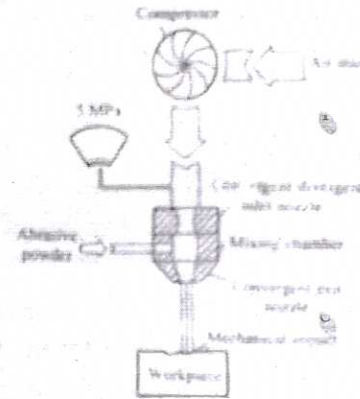
Dressing removes loading and breaks away the glazed surface so that sharp abrasive particles are again presented to the work. This is done with various type of dressers. A common type of wheel dresser, known as the **star-dresser**. It consists of a number of a hardened steel wheels with points on their periphery. The dresser is held against the face of the revolving wheel and moved across the face to dress the hole surface.

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VII.b working of AJM :it involves the high speed streams of abrasive particle carried by a high pressure gas or air on the work surface through a nozzle. The removal of metal occurs due to erosion caused by abrasive particle impacting the work surface at high speed.

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VIII.a Natural: The natural abrasives include sandstone or solid quartz, emery corundum, and diamond.

listing 4

Artificial or manufactured abrasives include chiefly (a) silicon carbide, and (b) aluminium oxide.

(brief description of the above items)

4

8

VIII.b **Honing** is an abrasive machining process that produces a precision surface on a metal work piece by scrubbing an abrasive stone against it along a controlled path. Honing is primarily used to improve the geometric form of a surface, but may also improve the surface texture. Typical applications are the finishing of cylinders for internal combustion engines, air bearing spindles and gears.

3

LAPPING is a machining process in which two surfaces are rubbed together with an abrasive between them, by hand movement or using a machine

2

Super finishing, is a metalworking process that improves surface finish and work piece geometry. This is achieved by removing just the thin amorphous surface layer left by the last process with an abrasive stone or tape; this layer is usually about 1 μm in magnitude. Super finishing, unlike polishing which produces a mirror finish, creates a cross-hatch pattern on the work piece.

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IX.a

Robotic arm

A robotic arm is a type of mechanical arm, usually programmable, with similar functions to a human arm; the arm may be the sum total of the mechanism or may be part of a more complex robot. The links of such a manipulator are connected by joints allowing either rotational motion or translational displacement. The links of the manipulator can be considered to form a kinematic chain. The terminus of the kinematic chain of the manipulator is called the end effector and it is analogous to the human hand.

3

Robotic hand

The end effector, or robotic hand, can be designed to perform any desired task such as welding, gripping, spinning etc., depending on the application. For example, robot arms in automotive assembly lines perform a variety of tasks such as welding and parts rotation and placement during assembly. In some circumstances, close emulation of the human hand is desired, as in robots designed to conduct bomb disarmament and disposal.

2

Grippers

Grippers are devices which can be used for holding or gripping an object.

They include what you might call mechanical hands and also anything like hooks, magnets and suction devices which can be used for holding or gripping. Grippers take advantage of point-to-point control (exact path that the robot takes between what it is picking up and where it is placing it).

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IX.b

Productivity improvement in design

Shorter lead times

Design analysis

Fewer design errors

Greater accuracy in design calculations

Standardization of design

Drawings are more understandable

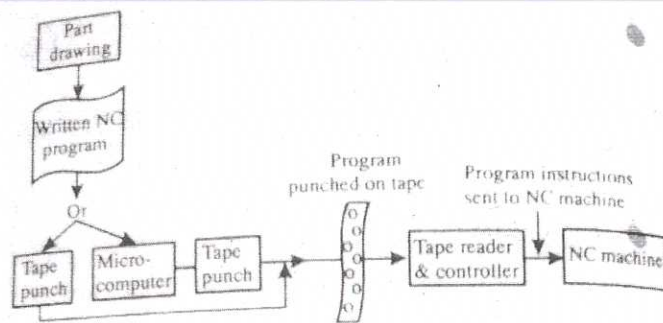
Benefit in manufacturing

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X.a

Components of a traditional NC system



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Figure 19.1 Components of a traditional NC system

1. Program of instructions : The program of instructions, is the detailed set of directions for producing a component by the NC machine. Each line of instruction



is a mixture of alphabetic codes and numeric data and is punched in an input media (usually paper tape) in a specified format. The input is read by a tape reader which transfers the instructions to a machine controller to operate the machine slides and to generate specific surfaces on the job.

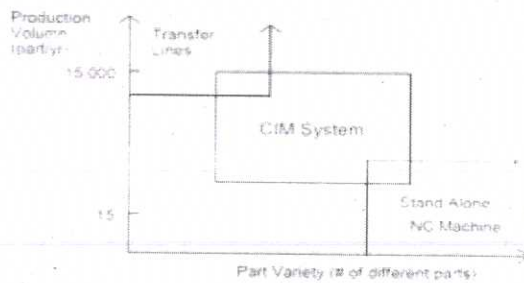
2. Tape punch : Usually it is a paper tape of 1" width. Paper-mylar, aluminium mylar or plastics are also used as tape materials. Paper tapes are cheap and popular but cannot last long. It is treated to resist oil and water. Mylar tapes are expensive but durable. Mylar tapes are still used by machine manufacturers to store informations as executive tapes. Punching machines (flexo writers) of various types are used to key in program instructions to tapes.

3. Tape reader : A tape reader reads the hole pattern on the tape and converts the pattern to a corresponding electrical signal.

4. Machine controller : Controller receives the electrical signals from the tape reader and causes NC machine to respond.

X.b

CIM are designed to fill the gap between high production transfer lines and low production NC machines. The gap includes parts produced in midrange volumes. These parts are of fairly complex geometry and the production equipment must be flexible enough to handle a variety of part design.



11

QUESTION WISE ANALYSIS

Course: ADVANCED PRODUCTION PROCESSES

Code: (15)-6021

| Qn. No. | Specific out come | Module | Content in details | Score | Time in Minutes |
|---------|-------------------|--------|---|-------|-----------------|
| I.1 | 1.2.1 | I | automation | 2 | 2 |
| I.2 | 2.2.0 | II | Gear manufacture | 2 | 2 |
| I.3 | 3.3.0 | III | non-conventional machining. | 2 | 2 |
| I.4 | 4.2.1 | IV | robotics | 2 | 2 |
| I.5 | 4.3.1 | II | Flexible Manufacturing systems | 2 | 2 |
| II.1 | 1.3.2,1.3.1 | I | machining centers | 6 | 10 |
| II.2 | 1.2.5 | I | multi spindle automatic lathes | 6 | 10 |
| II.3 | 2.2.5 | II | Gear hobbing | 6 | 10 |
| II.4 | 2.4.3 | II | Jigs and fixtures | 6 | 10 |
| II.5 | 3.1.7 | III | Centreless Grinder | 6 | 10 |
| II.6 | 3.3.1.3 | III | EDM Advantages | 6 | 10 |
| II.7 | 4.3.10 | IV | AVGS | 6 | 10 |
| III.a | 1.1.1 | I | turret lathes | 8 | 15 |
| III.b | 1.2.11 | I | Hydraulic copying system. | 7 | 15 |
| IV.a | 1.2.5 | I | multi spindle automatic lathes | 8 | 15 |
| IV.b | 1.2.2 | I | automatic control | 7 | 15 |
| V.a | 2.1.3 | II | broaching tool | 8 | 15 |
| V.b | 2.4.6 | II | principle of location. | 7 | 15 |
| VI.a | 2.3.2 | II | press working operations | 8 | 15 |
| VI.b | 2.4.5 | II | universal jigs indexing jigs | 7 | 15 |
| VII.a | 3.1.10 | III | mounting, Dressing | 8 | 15 |
| VII.b | 3.3.1.2 | III | AJM | 7 | 15 |
| VIII.a | 3.1.2 | III | natural and artificial abrasives. | 8 | 15 |
| VIII.b | 3.1.9 | III | honing , lapping | 7 | 15 |
| IX.a | 4.2.9 | IV | robotic arm, robotic hands and grippers | 8 | 15 |
| IX.b | 4.3.3 | IV | components of FMS | 7 | 15 |
| X.a | 4.1.2 | IV | components of N.C machines | 8 | 15 |
| X.b | 4.3.12 | IV | principles of CIM | 7 | 15 |
| | TOTAL | | | | 180 |

12