**COURSE TITLE : ADVANCED PRODUCTION PROCESSSES**
**COURSE CODE : 6021**
**COURSE CATEGORY : A**
**PERIODS/ WEEK : 5**
**PERIODS/ SEMESTER : 75**
**CREDIT : 5**

## TIME SCHEDULE

| MODULE | TOPIC | PERIODS |
|---|---|---|
| 1 | Turret and Capstan lathes, Automatic and copying lathes. Machining and turning centers. | 19 |
| 2 | Broaching, Gear manufacturing, Press tools, Jigs and fixtures, Jig boring machines. | 19 |
| 3 | Grinding & surface finishing methods, Non conventional machining. | 18 |
| 4 | NC & CNC machines and robotics. Flexible Manufacturing System. | 19 |
| TOTAL | | 75 |

**COURSE OUTCOME :**

| sl.no. | sub | student will be able to |
|---|---|---|
| 1 | 1 | Comprehend the working of Turret and Capstan lathes. |
| | 2 | Understand the automatic and copying lathes. |
| | 3 | Appreciate the machining and turning centres. |
| 2 | 4 | Understand the working of broaching, gear manufacturing and press tools. |
| | 5 | Comprehend the Jigs, fixtures and Jig boring machines. |
| | 6 | Comprehend the grinding machines, surface finishing methods. |
| 3 | 7 | Understand the principle of non conventional machining. |
| | 8 | Appreciate the NC, CNC and robotics. |
| | 9 | Comprehend the Flexible Manufacturing System. |

**SPECIFIC OUTCOME**

**MODULE I**

1.1.0 **Understand the working of turret and capstan lathes**
1.1.1 Identify the parts of turret and capstan lathes by drawing sketches
1.1.2 Describe the working of head stock of turret and capstan lathes
1.1.3 Explain capstan and turret lathe mechanism with the help of line sketch
– indexing & bar feeding

1.1.4 List the work holding & tool holding devices
1.1.5 Sketch the tool layout in sequence for a given set of operations of a work- hexagonal bolt
1.1.6 State the mode of specifying a machine for the purpose of procurement
1.2.0 **Comprehend the working of automatic and copying lathes**
1.2.1 Define the term automation
1.2.2 State the principle of automatic control
1.2.3 List the applications of automatic machines
1.2.4 Illustrate the working of a single spindle automatic lathe.
1.2.5 Classify the multi spindle automatic lathes
1.2.6 Distinguish between single spindle and multi spindle automatic lathes.
1.2.7 List the various purposes of the automatic machines
1.2.8 Define the tool layout of an automatic lathe.
1.2.9 State the copying principles.
1.2.10 Classify the copying machines.
1.2.11 Describe with sketch the pantograph, electric and hydraulic copying system.
**1.3.0 Understand the working of machining and tuning centres**
1.3.1 Describe the requirements of machine centers
1.3.2 List the types of machining centers
1.3.3 Identify the characteristics and capabilities of machining centers.
1.3.4 Explain the reconfigurable machines and systems.
1.3.5 Describe the hexapod machines

## MODULE II

**2.1.0 Understand the working of broachers**
2.1.1 Define the principle of broaching
2.1.2 Identify the purpose of broaching
2.1.3 Illustrate the broaching tool details
2.1.4 Select the types of broaching tools
2.1.5 Explain the broaching tool materials and its specifications
**2.2.0 Understand the various methods of gear manufacturing**
2.2.1 List the methods of gear manufacture
2.2.2 Describe the forming process in milling (review only)
2.2.3 Explain the various gear generating processes with sketches.
2.2.4 State gear hobbing
2.2.5 Explain with the sketches, the principle of gear hobbing
2.2.6 Mention the advantages and disadvantages of gear hobbing
2.2.7 Explain the various gear finishing operations
2.2.8 Specify the gear materials.
**2.3.0 Understand about the press tools and their operations**
2.3.1 Identify the press operations.
2.3.2 Describe the various press working operations.
2.3.3 Classify the dies.
**2.4.0 Appreciate the importance of jigs and fixtures**
2.4.1 Identify the jigs and fixtures
2.4.2 Classify the jigs and fixtures
2.4.3 State the advantages of jigs and fixtures
2.4.4 List the types of jigs and fixtures

2.4.5 Illustrate drill jigs, universal jigs and indexing jigs
2.4.6 Explain the principle of location.
**2.4.7** Describe the principle of minimum locating points.
**2.5.0 Appreciate the working of jig boring machine.**
2.5.0 Explain the jig boring machines
2.5.1 Classify the jig boring machines
2.5.2 Illustrate the different types of jig boring machines.

## MODULE III

**3.1.0 Understand the grinding machines and its operations**
3.1.1 List the various grinding operations
3.1.2 Explain the various types of natural and artificial abrasives.
3.1.3 Categorize the bonding materials
3.1.4 Mention the factors affecting the selection of grinding wheel
3.1.5 Classify the various grinding machines
3.1.6 Explain the principle of cylindrical grinding with a line sketch
3.1.7 Illustrate the working principles of a centre less grinder
3.1.8 Explain the principle of tool and cutter grinder with a line sketch
3.1.9 Distinguish the basic features of finishing, honing , lapping and super finishing
3.1.10 **Explain the method of mounting, truing and dressing a grinding wheel**
**3.2.0 Understand about the special surface finishing methods.**
3.2.1.1 Describe other surface finishing methods such as hot dipping, anodizing, electroplating, organic coating, metal spraying.
**3.3.0 Understand the working of non-conventional machines**
3.3.1.1 List the nonconventional methods of machining
3.3.1.2 Describe the working of USM , EDM, AJM, LBM and ECM
3.3.1.3 State the advantages, disadvantages and applications of the above mentioned operations

## MODULE IV

**4.1.0 Understand the working of numerically controlled machine tools**
4.1.1 State the numerical control machine tool
4.1.2 Explain the various components of N.C machines with block diagram.
4.1.3 List the essential steps required for operation.
4.1.4 Classify the N.C machines- feedback system and control system ,
4.1.5 Illustrate the block diagram- computer numerical control ( CNC)
4.1.6 State the advantages of CNC machines.
4.1.7 Identify the Part programming – code
4.1.8 Write a part program for drilling, and turning
4.1.9 State the principle of CAD and CAM
4.1.10 Mention the advantages of CAD and CAM
4.1.11 List the applications of CAD and CAM
4.1.12 Explain the functions of CAD and CAM
4.1.13 List the different hardwares and software for CAD/CAM
4.1.14 Describe the computer aided process planning (CAPP)

**4.2.0 Appreciate robotics**

4.2.1 Define robotics
4.2.2 State the reason for using robots
4.2.3 List the basic elements of robots
4.2.4 Define degrees of freedom and explain its importance.
4.2.5 Draw the various types of joints
4.2.6 Identify the notations of robot manipulator
4.2.7 Explain the configurations of Robots with diagram
4.2.8 Classify the Robots
**4.2.9** Explain the robotic arm, robotic hands and grippers

**4.3.0 Appreciate the advantages of flexible manufacturing system**

4.3.1 Define Flexible Manufacturing systems
4.3.2 Define flexible automation
4.3.3 List the components of FMS
4.3.4 Illustrate the flexible manufacturing cell ( FMC)
4.3.5 Explain how to achieve the flexibility in manufacturing systems
4.3.6 Describe briefly the components of FMS
4.3.7 Identify the problems in implementing FMS
4.3.8 Explain the transport mechanism in FMS in relation with the material handling system ( MHS)
4.3.9 Identify the Artificial intelligence ( AI) tools for MHS planning
4.3.10 Describe the AGVS,
4.3.11 List the requirements to fulfill the main purpose of FMS communication systems.
4.3.12 Explain the principle of CIM

## CONTENT DETAILS

### MODULE I

**Turret and Capstan Lathe.**

Construction and parts - Head stock- work holding devices - tool holding devices – straight and circular holder- flanged tool holders- Tool layout - sequence of operation - Turret indexing mechanism and work feeding mechanism - Machine specifications.

**Automatic and Copying Machines**

Automation – definition- automatic control principles- types - single spindle lathe- multi spindle lathe- tool layouts- Copying machines- Copying principles – types- Mechanical ( pantograph copying systems)

**Machining and Tuning Centers**

Requirements- types- characteristics and capabilities of machine centers - Reconfigurable machines- systems- Hexapod machines.

### MODULE II

**Broaching Machines**

Introduction – definition - purpose - Broaching tools – parts of the tool- tool details - Types - internal - external

Broaching machines (brief description with line sketches)- pull up- pull down- push down

**Gear manufacture**- Review of terminology of tooth shapes- Method of making gears - review of gear cutting on milling machine- casting of gears- gear hobbling- description of gear hob- operation of gear hobbling machines - Gear materials - specifications.

**Press Tools**

Introduction – components of presses- Press working operation – piercing- blanking- bending- notching- trimming- shaving- slitting- lancing- nibbling- beading- classification of dies- Principles of metal cutting- Different types of dies.

**Jigs and Fixtures**

Definition of jigs and fixtures- classification of jigs –fixtures- advantages of jigs – fixtures- Constructional details of -drill jigs- Universal jigs- index jigs- milling fixture- Boring fixture- grinding fixture- welding fixture.

**Jig Boring Machines**

Introduction – definition- need for greater accuracy on objects like jigs- types of jig boring machines.

## MODULE III

**Grinding**

Abrasives- natural- artificial - Bonding materials –vitrified- silicate- shellac- rubber - Factors affecting the selection of grinding wheels- size and shape of the wheel - kind of abrasives- grain size- grade and structure- kind of bond material- functions of the grinding wheels- grinding machines- classifications- cylindrical grinders- Special purpose grinders - Tool and cutter grinder - Cylindrical grinders - centre type and centre less type grinders - Methods of truing and dressing- Various speed- feed - depth of cut for materials such as - cast iron- high carbon steel- alloy steel- Honing- lapping- super finishing

**Other surface finishing methods**

Introduction – purpose – types – - hot dipping- metal spraying- organic coating

**Non- conventional machining**

USM- EDM- AJM- LBM – ECM- advantages- disadvantages- application

## MODULE IV

**Numerically Controlled Machine Tools**

Introduction- Block diagram of N.C machines- Steps in operation- preparation of program manuscript - Types of Numerical control system- according to the control system – ( Explain point to point - straight line - contour system of positioning)- according to feed back system ( Explain open loop system and closed loop system)

**Computer Numerical Control (CNC**)

Machine tools (brief description only)- Computer aided design (CAD)-Computer Aided Manufacturing (CAM)- Introduction- advantages of CAD – CAM- Part programming- CAPP

**Robotics**

Robotics - Reason for using robots- Basic elements of robots- Mechanical design of a robot- Types of joints- Notations of Robot manipulator- Configuration of robots- Robot arms- Robot hands- Grippers

**Flexible Manufacturing System (FMS**)

Introduction- Flexible Automation-Flexible Manufacturing Cell (FMC)-Achieving Flexibility in Manufacturing Systems- Components of FMS- Problems in Implementing FMS- FMS Communication – Information-Transport Mechanism - Materials Handling System (MHS)- Tools for MHS- Planning- Automated Guided Vehicle Systems (AGVS)- Artificial Intelligence (AI)- Introduction to CIM

**TEXT BOOKS**

1. Production Technology - R.K. Jain
2. Production Technology Vol. I & II - O.P Khanna

**REFERENCE**


1. Manufacturing process – Serope Kalpakjian, Steven R.Schmid
2. A Text Book of Production Engineering - P.C. Sharma
3. Modern Machining Methods - M. Adithian
4. Machine Tools Vol. I - R.N. Datta
5. Computer Integrated Design and Manufacturing - Bed worth
6. CAD, CAM, CIM -Radhakrishnan
7. CNC Machines - B.S.Pabla &M.Adithan (Pub: New Age)
8. Numerical control and computer aided manufacturing -T.K.Kundra, P.N.Rao (Pub: TMH)
9. Industrial robotics - Gordon.N.Mair Pub: PHI
10. CAD/CAM -Ibrahim Zeid, R Sivasubramanian