



**School of Manufacturing Skills**  
**Session: 2018-19 (Summer Semester)**  
**B. Voc. Program, 3<sup>rd</sup> Semester,**  
**End-Sem. Examination**

**Set-1**

**Course Code: SMS1301**

**Time: 1.5 Hours**

**Course Name: CNC Milling & Programming**

**Max. Marks: 50**

**Instructions:**

1. Attempt all questions.
2. Use of Calculators is Prohibited.
3. Section A contains 10 Questions. Each question carries 1 Mark.
4. Section B contains 05 Questions (Attempt any 04 questions out of 05 questions).  
Each question carries 05 Marks.
5. Section C contains 02 Questions. Each question carries 10 Marks.

**Section – A**

**10X01 = 10 Marks**

1. Which operations can be performed on Vertical Milling Machine?  
d) All of the above
2. A Coordinate system in which the point is specified in a plane by a pair of coordinates which are signed distance to the point from two perpendicular lines, measured in same unit length is known as  
b) Cartesian coordinate system
3. M01 is named as:  
d) Optional Stop
4. G03 is named as:  
c) Circular Interpolation Anti clockwise
5. Touch probe is used:  
d) To take zero reference in Z direction
6. Edge finder is used to:  
b) Take the reference point X and Y direction



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7. G90 is named as:  
a) Absolute Coordinate
8. M03 is named as:  
a) Tool rotation Clockwise
9. G code used for X-Y plane selection is:  
a) G17
10. ATC stand for:  
b) Automatic tool changer

## Section – B

04X05 = 20 Marks

11. What is the difference and similarity between Face Mill and Shoulder Mill?

Ans. **Similarity:** Both are used for milling process, both can be of same dimension,

**Difference:** Shoulder Mill make 90 degrees at the wall whereas, Face Mill do not make 90 degrees at the wall.

12. Describe G83 cycle in Milling with all its parameters.

Ans. **G83 is peck drilling cycle.**

Syntax:

- G83 X Z P Q R F;
  - X = hole position in X (always zero).
  - Z = absolute drilling depth.
  - P (m sec) = dwell at the hole bottom (P1000 = 1 sec)
  - Q (mm) = depth of cut in Z.
  - R (mm) = incremental retract.
  - F = feed (mm/rev)

13. Calculate the Spindle RPM and Feed in mm/min for the given data:

Tool- Facemill  $\phi$ 50 with 5 insert

$V_c = 200$  m/min

Feed per tooth = 0.2 mm/rev.

Ans.  $N = \frac{V_c \times 1000}{\pi \times D} = \frac{200 \times 1000}{3.14 \times 50} = 1275$  RPM



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Feed= Feed per tooth X N X Number of cutting insert

$$= 0.2 \times 1275 \times 5$$

$$= 1275 \text{ mm/min}$$

14. What do you mean by point to point tool path system? Give four examples.

Ans. Point-to-point control systems cause the tool to move to a point on the part and execute an operation at that point only.

The tool is not in continuous contact with the part while it is moving.

Examples: drilling, reaming, punching, boring and tapping.

15. Explain open loop and closed loop system.

Ans. Open loop system:

The open-loop control means that there is no feedback and uses stepping motors for driving the lead screw. A stepping motor is a device whose output shaft rotates through a fixed angle in response to an input pulse. The accuracy of the system depends on the motor's ability to step through the exact number. The frequency of the stepping motor depends on the load torque. The higher the load torque, lower would be the frequency. Excessive load torque may occur in motors due to the cutting forces in machine tools. Hence this system is more suitable for cases where the tool force does not exist (Example: laser cutting).

Closed loop system:

Closed -loop NC systems are appropriate when there is a force resisting the movement of tool/work piece. Milling and turning are typical examples. In these systems the DC servomotors and feedback devices are used to ensure that the desired position is achieved. The feedback sensor used is an optical encoder.



16. Write down any ten differences between NC and CNC machines.

Ans.

S.no	NC Machine	CNC Machine
1.	Here NC stands for Numerical Control	CNC stands for Computer Numerical Control.
2.	It is defined as the machine which is controlled by the set of instructions in the form of numbers, letters and symbols. The set of instructions is called as program.	It is defined as the machine which is used to control the motions of the workpiece and tool with the help of prepared program in computer. The program is written in alphanumeric data.
3.	In NC machine the programs are fed into the punch cards.	In CNC machine the programs are fed directly into the computer by a small key board similar to our traditional keyboard.
4.	Modification in the program is difficult.	Modification in the program is very easy.
5.	High skilled operator is required.	Less skilled operator is required.
6.	Cost of the machine is less.	Cost of the CNC machine is high.
7.	Maintenance cost is less	Maintenance cost is high.
8.	The programs in the NC machine cannot be stored.	In CNC machines, the programs can be stored in the computer and can be used again and again.
9.	It offers less flexibility and computational capability.	It offers additional flexibility and computational capability.
10.	The accuracy is less as compared with the CNC.	It has high accuracy.
11.	It requires more time for the execution of the job.	It takes very less time in the execution of the job.
12.	It is not possible to run it continuously.	It can be run continuously for 24 hours of a day.

17. Draw the schematic diagram of the working principles of CNC machines.

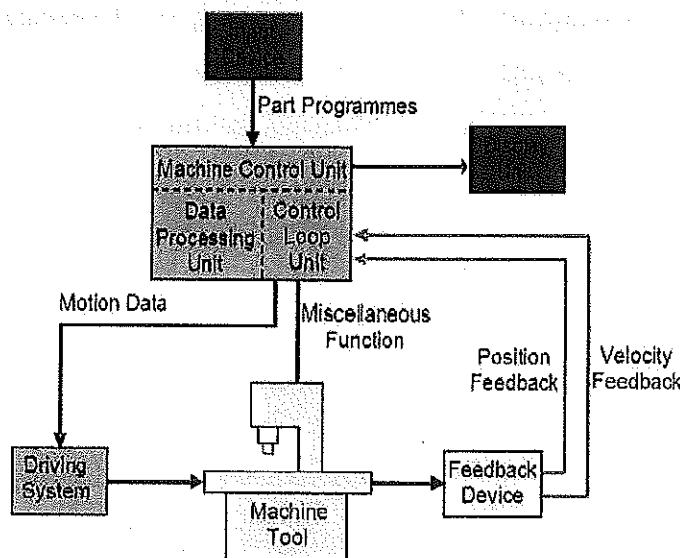


Fig.1-3 Working Principles of CNC Machines



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## Set- 2

Course Code: SMS1302

Time: 1.5 Hours

Course Name: CNC Turning & Programming

Max. Marks: 50

### Instructions:

Attempt all questions.

Use of Calculators is Prohibited.

Section A contains 10 Questions. Each question carries 1 Mark.

Section B contains 05 Questions (Attempt any 04 questions out of 05 questions).

Each question carries 05 Marks.

Section C contains 02 Questions. Each question carries 10 Marks.

### Section – A

10X01 = 10 Marks

1. Process of removing metal from the end of a work piece to produce the flat surface in which tool moves perpendicular to the axis of the work piece.
  - a) Facing
2. Which is a block code?
  - c) G28
3. M01 is named as:
  - d) Optional Stop
4. What is the code for Dwell time?
  - c) G04
5. What is the unit of Cutting Velocity?
  - c) m/min
6. NC Stand for:
  - b) Numerical Control
7. G92 is named as:
  - a) Spindle Speed Limit



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8. M03 is named as:  
c) Spindle Rotation Clockwise
9. G code used for X-Z plane selection is:  
b) G18
10. What character do we use to skip any block in program?  
c) /

## Section – B

04X05 = 20 Marks

11. What is the use of Dry Run mode and MDI mode?

Ans. Dry run mode: This mode is used to check the tool movement quickly as per the program but without the spindle rotation. We give safety distance in work shift to test run the program in dry run mode.

MDI mode: This mode is used to run the program only for one time. Once the program or command is executed, it will vanish from the screen.

12. Describe G74 cycle with all its parameters.

Ans. G74 cycle is Facing cycle.

Syntax:

- G74 W R;  
G74 P Q U W F;
- BLOCK 1:
  - W (mm) = depth of cut in Z direction (incremental) without sign.
  - R (mm) = retract in X direction (diametrically) and Z direction
- BLOCK 2:
  - P = block number of the first block for the profile.
  - Q = block number of the last block for the profile.
  - U (mm) = finishing allowance in X direction.
  - W (mm) = finishing allowance in Z direction.
  - F = feed (mm/rev).

13. Write down the difference between Machine coordinates and Absolute coordinates with the help of a diagram.

Ans. Machine coordinates – Machine coordinates shows the distance between the machine zero point and turret zero point.

Absolute coordinates – Absolute coordinates shows the distance between the work piece zero point and turret zero point.



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14. Explain grooving cycle with all its parameters.

Ans. Grooving cycle is G77.

Syntax:

- G77 R;  
G77 X Z P Q R F;
- BLOCK 1:
  - R (mm) = Retraction height in X direction for chip breaking.
- BLOCK 2:
  - X = Final point coordinates of grooving diameter in X.
  - Z = Final point coordinates of grooving diameter in Z.
  - P ( $\mu\text{m}$ ) = Depth of cut in X direction without sign.
  - Q ( $\mu\text{m}$ ) = Incremental infeed in Z direction.
  - R (mm) = Retract in Z direction (always positive) to finish the surface.
  - F = feed (mm/rev).

15. Explain the difference between G83 and G84 cycle.

Ans. **G83 is peck drilling cycle.**

Syntax:

- G83 X Z P Q R F;
  - X = hole position in X (always zero).
  - Z = absolute drilling depth.
  - P (m sec) = dwell at the hole bottom (P1000 = 1 sec)
  - Q ( $\mu\text{m}$ ) = depth of cut in Z.
  - R (mm) = incremental retract.
  - F = feed (mm/rev)

**G84 is tapping cycle.**

Syntax:

- G84 X Z P R F;
  - X = hole position in X (always zero).
  - Z = absolute tapping depth.
  - P (m sec) = dwell at the hole bottom (P1000 = 1 sec)
  - R (mm) = incremental retract.
  - F = feed rate (mm/rev)

## Section – C

02X10 = 20 Marks

16. Describe Threading Cycle (G78) with all the parameters. Also calculate all the parameters for M10 threads.

Ans. Threading cycle (G78)



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Syntax:

- G78 Pxxxxxx Q R;  
G78 X Z P Q R F;
- BLOCK 1:
  - PXXxxxx = number of finishing cuts.
  - PxxXXxx = chamfer value ( $C_F$ ) =  $C_F \times 10 / \text{Pitch}$
  - PxxxxXX = thread angle
  - Q ( $\mu\text{m}$ ) = first depth of cut
  - R (mm) = finishing allowance
- BLOCK 2:
  - X (mm) = minor diameter
  - Z = absolute thread length.
  - P ( $\mu\text{m}$ ) = thread depth (always positive)
  - Q ( $\mu\text{m}$ ) = remaining depth of cut
  - R (mm) = incremental taper value (R0 for cylindrical threads)
  - F = thread pitch = feed (mm/rev)

17. Write down any five advantages and five disadvantages of CNC machines.

Ans. Advantages:

- Easier to program.
- Easy storage of existing programs.
- Easy to change a program.
- Avoids human errors.
- Safer to operate
- Complex geometry is produced as cheaply as simple ones
- Usually generates closer tolerances than manual machines

Disadvantages:

- Costs quite a lot more than conventional machinery
- Does not eliminate the need for expensive tools
- Expensive to repair
- Skilled part programmer required
- Computer & programming knowledge required



**School of Manufacturing Skills**  
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**Set- 1**

**Course Code: SMS1303**

**Time: 1.5 Hours**

**Course Name: CMM & GRINDING**

**Max. Marks: 50**

**Instruction:**

1. Attempt all questions.
2. Use of Calculator is Prohibited.
3. Section A contains 10 Questions. Each question carries 1 Mark.
4. Section B contains 04 Questions. Each question carries 5 Marks.
5. Section C contains 02 Questions. Each question carries 10 Marks.

**Section – A**

**10X01 = 10 Marks**

1. What precise movement does CMM has?
  - a) Precise movement in x coordinate
  - b) Precise movement in x and y coordinates
  - c) Precise movement in y and z coordinates
  - d) Precise movement in x, y and z coordinates
2. Which type of CMM is most suited for large heavy workpieces?
  - a) Cantilever type
  - b) Bridge type
  - c) Gantry type
  - d) Floating bridge type
3. Which of the following is not related to the geometrical accuracy of CMM?
  - a) Straightness of axes
  - b) Squareness of axes
  - c) Position accuracy
  - d) Axial length measuring accuracy
4. A circle element is measured with minimum points:
  - a) One
  - b) Two
  - c) Three
  - d) Cannot say
5. If a vertical solid cone is cut by horizontal plane the top view of the frustum looks as:
  - a) Cone
  - b) Cylinder
  - c) Point
  - d) Circle



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6. Six degree of freedom means:
  - a) Freedom of rigid body in space in rotation.
  - b) Freedom of rigid body in space in linear.
  - c) Rigid body cannot move until an external force as per newton's law of inertia.
  - d) Freedom of rigid body in space in rotation and linear.
7. Maximum length range for TP20SF with steel extension and stylus is.....
  - a) 20mm
  - b) 40mm
  - c) 60mm
  - d) 50mm
8. Write types of angle of MH20i
  - a) Twist & rotate angle
  - b) Twist & tilt angle
  - c) Tilt & rotate angle
  - d) Turn & rotate angle
9. What kind of bond do Aluminium Oxide or Silicon Carbide wheel have?
  - a) Vitrified bond
  - b) Rubber bond
  - c) Resinoid bond
  - d) Metal bond
10. What is the unit of Vc used for Grinding wheel?
  - a) mm/s
  - b) m/s
  - c) m/min
  - d) mm/min

## Section – B

04X05 = 20 Marks

11. Draw Symbols of given tolerances:

a) Cylindricity	b) Flatness
c) Concentricity	d) Circularity
e) Perpendicularity	f) Parallelism
g) Position	h) Symmetry
i) Angularity	j) Straightness

12. Name parts of CMM.

13. Name different kinds of grinding wheel abrasive materials and bonds.

14. Why granite material is used in CMM?

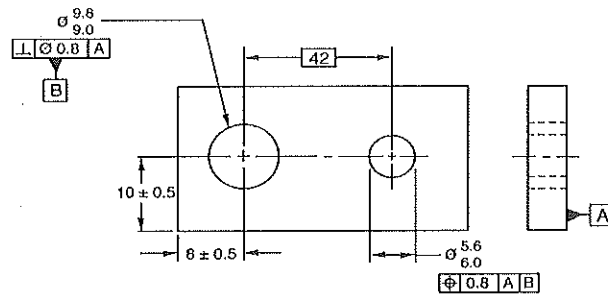
## Section – C

02X10 = 20 Marks

15. Draw PROBE HEAD assembly.



16. Read the drawing and fill in the blanks.



- a) The basic dimension given in the drawing is.....
- b) ..... is the secondary datum.
- c) The position of dia. 5.6 hole is given from.....
- d) In position tolerance  $\varnothing$  symbol before 0.8 value is missing:
  - TRUE
  - FALSE

**Set- 2**

Course Code: SMS1305

Time: 1.5 Hours

Course Name: Pneumatic Technology

Max. Marks: 50

**Instruction:**

- 1. Attempt all questions.
- 2. Use of Calculator is Prohibited.
- 3. Section A contains 10 Questions. Each question carries 1 Mark.
- 4. Section B contains 04 Questions. Each question carries 5 Marks.
- 5. Section C contains 02 Questions. Each question carries 10 Marks.

**Section -A**

10X01 = 10 Marks

- 1. In a solenoid the core material is:
  - a) Plastic
  - b) Magnet
  - c) Copper
  - d) Ferro magnet
- 2. In pneumatic the volume flow of air is expressed in terms of \_\_\_\_\_
  - a) M<sup>3</sup>/s
  - b) Liter/min.
  - c) Both a and b
  - d) None of above



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3. The difference in charge between the two points is called \_\_\_\_\_
  - a) Current
  - b) Voltage
  - c) EMF
  - d) Power
4. Fluid power system is based on-
  - a) Bernoulli's principle
  - b) Gas laws
  - c) Avogadro's law
  - d) Pascal law
5. 1 mpa =.....
  - a) 0.1 bar
  - b) 100 bar
  - c) 10 bar
  - d) None of these
6. When PV=Constant, if we decrease the volume then pressure will-
  - a) Remains constant
  - b) Decrease
  - c) Increase
  - d) none of these
7. In Isochoric process,
  - a) Constant pressure
  - b) Constant volume
  - c) constant entropy
  - d) both b & c
8. Which device used to pressurize to liquid;
  - a. Pumps
  - b. Air compressor
  - c. Both a & b
  - d. None of these
9. Which sensor/switch cannot be used in environments subjected to magnetic fields
  - a) Reed switch
  - b) Inductive sensor
  - c) Capacitive sensor
  - d) Optical sensor
10. The total resistance in parallel connection is:
  - a)  $R_{total} = R_1 + R_2 + \dots + R_n$
  - b)  $R_{total} = R_1 \cdot R_2 \cdot R_3 \dots R_n$
  - c)  $R_{total} = R_1 - R_2 - \dots - R_n$

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$$



**Section – B**

04X05 = 20 Marks

11. Explain an elementary electrical circuit consisting of three essential elements with the help of a diagram
12. Differentiate between pneumatics and electro pneumatics. (any four)
13. What is Air Production system? Explain all the components of Air production system.
14. Draw the symbol of Timer and Pressure Switch. A 5 mm diameter piston is lifting 10 kg block of material. If the piston lifts 2 block of material at once. Then calculate the required pressure in bar.

**Section – C**

02X10 = 20 Marks

15. Describe relays and their principle. Also write down their five functions
16. Explain all types of direction control valve and auxiliary valve with their symbols and their functions.





**School of Manufacturing Skills**

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**Set-1**

**Course Code: SMS1303**

**Time: 1.5 hrs**

**Course Name: CMM & GRINDING**

**Max. Marks: 50**

**Section – A**

10X01 = 10 Marks

1. What precise movement does CMM have? 1mark  
Ans. d) Precise movement in x, y and z coordinates
2. Which type of CMM is most suited for large heavy workpieces? 1mark  
Ans. c) Gantry type
3. Which of the following is not related to the geometrical accuracy of CMM? 1mark  
Ans. d) Axial length measuring accuracy
4. A circle element is measured with minimum points: 1mark  
Ans. c) Three
5. If a vertical solid cone is cut by horizontal plane the top view of the frustum looks as:  
Ans. d) circle 1mark
6. Six degree of freedom means: 1 mark  
Ans. d) Freedom of rigid body in space and linear.
7. Maximum length range for TP20SF with steel extension and stylus is..... 1mark  
Ans. b) 40mm
8. Write types of angle of MH20i 1mark  
Ans. a) Twist and rotate angle
9. What kind of bond do aluminium oxide or silicon carbide wheel have? 1mark  
Ans. a) Vitrified bond
10. What is the unit of Vc used for Grinding wheel? 1mark  
Ans. b) m/s

**Section – B**

04X05 = 20 Marks

0.5X10 = 5marks

11. Draw Symbols of given tolerances.

Ans.

a) Cylindricity



b) Flatness



c) Concentricity



d) Circularity



e) Perpendicularity



f) Parallelism



g) Position



h) Symmetry



i) Angularity



j) Straightness



12. Name parts of CMM.

0.5X10 = 5marks

Ans - Granite Structure

- Servo motor

- Air Bearings

- Probe Heads

- Probes

- Styli

- Controller

- Software

- Measuring scales (Each axis)

- Dehumidifier

13. Name different kind of grinding wheel abrasive materials and bonds.

2.5X2 = 5marks

Ans.



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Abrasive material –

- aluminium oxide (electrical furnace molten)
- aluminium oxide (sintered)
- silicon carbide
- boron nitride
- diamond

Bonds –

- vitrified
- resinoid
- resinoid fiber reinforced
- rubber
- rubber fiber reinforced
- metal

14. Why granite material is used in CMM?

1X5 = 5 marks

Ans.

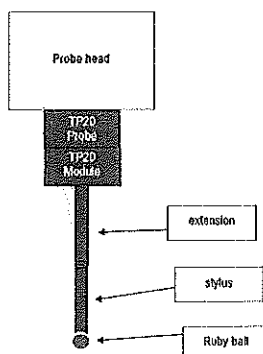
- Granite is used because of its wear resistance, slow thermal response and relatively low cost.
- Today all the major manufacturers build frames from aluminium alloy for some derivative and also use ceramic and silicon carbide to increase the stiffness of the z-axis for scanning application.
- Only low volume CMM builders and domestic manufacturers in China and India are still manufacturing granite CMM due to low technology approach.
- The thermal expansion of Al is 3.5 times that of granite yet over 80% of CMM's supplied annually have an Al frame because the thermal diffusion of Al is 60 times faster than granite.
- Granite takes eight hours to fully dissipate thermal change.

### SECTION – C

15. Draw PROBE HEAD assembly.

2X10 = 20 marks  
10 marks

Ans.





16. Read the drawing and fill in the blanks.

2.5X4 = 10 marks

Ans.

- a) 42
- b) Hole dia. 9.8/9.0
- c) Front plane & hole dia. 9.8/9.0
- d) False

**Set- 2**

**Course Code: SMS1305**

**Time: 1.5 Hours**

**Course Name: Pneumatic Technology**

**Max. Marks: 50**

**Instruction:**

- 1. Attempt all questions.
- 2. Use of Calculators is Prohibited.
- 3. Section A contains 10 Questions. Each question carries 1 Marks.
- 4. Section B contains 04 Questions. Each question carries 5 Marks.
- 5. Section C contains 02 Questions. Each question carries 10 Marks.

**Section –A**

- 1. In a solenoid the core material is:
  - Ferro magnet (d)
- 2. In pneumatic the volume flow of air is expressed in term of \_\_\_\_\_
  - Liter/min (b)
- 3. The difference in charge between the two points is called \_\_\_\_\_
  - Voltage (b)
- 4. Fluid power system is based on-
  - Pascal law (d)
- 5. 1 mpa =.....
  - 10 bar (c)
- 6. When  $PV=Constant$ , if we decrease the volume then pressure will-
  - Increase (c)
- 7. In Isochoric process, The Pressure is proportional to Temperature at.....
  - Constant volume (b)
- 8. Which devise used to pressurize to liquid;
  - Pumps (a)
- 9. Which sensor/switch cannot be used in environments subjected to magnetic fields
  - Reed switch (a)
- 10. The total resistance in parallel connection is:



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(d) 
$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$$

## Section – B

04X05 = 20 Marks

11. Explain an elementary electrical circuit consisting of three essential elements with the help of a diagram

**Ans.** An electrical circuit consists always of a closed loop, with three essential elements:

Power supply

- The Power supply can be a battery, an accumulator or a generator which is the origin of the power supply to a wall plug. Without this component there is no electromotive force to move electrons.

Load

- The load can be a lamp, coil, or heating element etc.
- Fuses in the circuit prevent this; a very thin wire melts to disconnect the supply, avoiding the danger of fire or destruction of expensive equipment.

Switching element

A switching element or contact is required to interrupt the working of the load. It can be anywhere in the circuit. It opens or closes the circuit. A contact is called "open" when it makes no connection between its terminals and "closed" when this connection

12. Differentiate between pneumatics and electro pneumatics. (any four)

**Ans.**

SR.NO	PNEUMATIC	ELECTROPNEUMATICS
1	It used only mechanical devise that operated by compressed air	It used mechanical and electronic devise that operated by current and compressed air
2	It has all mechanical parts so it is difficult to operate.	It is controlled by electrical devise so it is easy to operate.
3	it has less efficiency due to all moving parts.	It has high efficiency
4	More reliability	less reliability

13. What is Air Production system? Explain all the components of Air production system.



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**Ans.** Air production system mainly involves the process of Producing compressed dry air. For Producing compressed dry air, different components are used. They are given as below:

- ✓ **COMPRESSOR:** Air Taken in at Atmospheric pressure is compressed and delivered at higher pressure to pneumatic systems. Thus, transforms mechanical energy into Pneumatic energy.
- ✓ **ELECTRIC MOTOR:** Supplies mechanical power to compressor. Thus, transforms electrical energy into mechanical energy.
  
- ✓ **PRESSURE SWITCH:** Controls the electric motor by sensing the pressure in the tank. It is set to a maximum pressure at which it stops the motor, and a minimum pressure at which it restarts it.
- ✓ **CHECK VALVE:** Lets the compressed air from the compressor into the tank and prevents it leaking back when the compressor is stopped.
- ✓ **TANK:** Stores the compressed air from the compressor and prevents the Pressure fluctuations.
- ✓ **PRESSURE GAUGE:** Indicates the tank pressure.
- ✓ **AUTO DRAIN:** Drains all the water condensing in the tank without supervision.
- ✓ **SAFETY VALVE:** Blows compressed air off if the pressure in the tank should rise above the allowed pressure.
- ✓ **AIR DRYER:** Cools the compressed air to a few degrees above freezing point and condenses most of the air.
- ✓ **LINE FILTER:** Being in the main type, this filter must have a minimal pressure drop and the capability of oil mist removal. It helps to keep the line free from dust, water and oil.

14. Draw the symbol of Timer and Pressure Switch. A 5 mm diameter piston is lifting 10 kg block of material. If the piston lifts 2 block of material at once. Then calculate the required pressure in bar.

**Ans.** we know that  $P = \frac{F}{A}$  and  $F = mg$  (  $m = 10 \text{ kg}$ ,  $g = 9.81 \text{ m/s}^2$  )

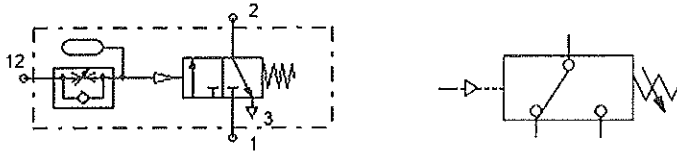
$$\begin{aligned} &= (10 \times 2) \times 9.81 \\ &= 20 \times 9.81 \\ &= 196.2 \text{ N} \end{aligned}$$

$$A = \frac{\pi d^2}{4} = \frac{3.14 \times 5^2}{4} = 19.26 \text{ mm}^2 = 0.0785 \text{ m}^2$$



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$$P = \frac{F}{A} = \frac{196.2}{0.0785} = 2499.36 \text{ bar}$$



## Section – C

02X10 = 20 Marks

15. Describe relays and its principle. Also write down its five functions.

**Ans.**

- Relay is an electrically operated switch. It consists of a coil with an iron core and one or more contacts, switched by the magnetic field of the coil assembly. An electrical device, typically incorporating an electromagnet, which is activated by a current or signal in one circuit to open or close another circuit.

**Principle:**

- When the voltage is applied to the coil, an electric current flows through the coil; a magnetic field builds up and causes the armature to be pulled into the core of winding. The switching position is maintained as long as the voltage is applied. When the voltage is removed, the armature is restored to its original position by the return spring.

Relay Functions:

- Changing from a N.C. to a N.O. contact (inversion)
- Multiplying contacts from one to any reasonable number of contacts
- Power Amplification
- Voltage Change
- Memory function

16. Explain all types of direction control valve and auxiliary valve with its symbol and functions.

**Ans.**

S.NO	NAME	SYMBOL	FUNCTION
1	3/2 NC pilot operated spring return valve		When it has normal condition then input air is not pass to output but when we push to push button then air will be pass from input to output



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2	5/2 both side pilot operated dcv		When it has normal condition then input air is not pass to output but when we give pilot then position will be switch from 2 to 4
3	5/2 pilot operated spring return dcv		When it has normal condition then input air is not pass to output but when we give pilot then position will be switch from 2 to 4
4	Flow control valve		Allow air flow only in one direction
5	Or element/shuttle valve		It provide output when we gives any input
6	And element/dual pressure valve		It only provide output when we gives both side input
7	Quick Exhaust valve		It is used to Quick remove air from actuator