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## Government of Maharashtra

### Directorate of Vocational Education and Training, Maharashtra State

#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

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|                                   |   |     |
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|                                   | xi. Motor With Control Unit (24V DC,1A)   |     |
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|    |  |     |
|----|--|-----|
| 29 | Personal Computers CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher.<br>RAM:-4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 17 Inch.)<br>Licensed Operating System and Antivirus compatible with trade related software | 207 |
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|    |   |     |
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| 58 | Pillar/column type Drilling machine 25 mm capacity-motorized with drill chuck and Key with Standard and optional accessories  | 264 |
| 59 | Power hacksaw machine 21” or more length blade with Standard and optional accessories   | 267 |
| 60 | Double ended Pedestal Grinder 178 mm wheels(one fine and one rough wheel)   | 269 |
| 61 | SS and SC centre lathe (all geared) with minimum specification as: Centre height 150 mm and centre distance 1000 mm along with 3 and 4 jaw chucks, Auto feed system, safety guard, taper turning attachment, motorized coolant system, lighting arrangement with standard accessories and optional accessories with set of cutting tools  | 271 |
| 62 | Shearing machine (lever type) hand operated complete 300 mm blade length.   | 280 |
| 63 | Universal Milling Machine, Standard and optional accessories and set of cutters.  | 282 |
| 64 | Horizontal and Vertical milling machine Standard and optional accessories and set of cutters each.  | 289 |
| 65 | Hydraulic Surface Grinding Machine standard and optional accessories and set of wheels  | 296 |
| 66 | Universal cylindrical grinding machine, Standard and optional accessories and set of wheels.  | 302 |
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| 69 | Drafting /AutoCAD software  | 330 |
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| 71 | Simulation software<br>Multimedia based simulator for CNC technology and interactive CNC part programming software for turning & milling with virtual machine operation and simulation using popular operation control system such as Fanuc, Siemens, etc. (Web based or licensed based) With help of this software the trainees should be able to Write, Edit, Verify & Simulate | 344 |



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#### SPECIFICATION FOR TRAINEES TOOL KIT

### 1. Steel Rule- 150mm,English and Metric Combined

#### 1.1 Basic Indicative Diagram:



|     |                        |  |
|-----|------------------------|--|
| 1.7 | Range:                 | 150mm  |
| 1.8 | Measuring least count: | Metric Graduation+0.5mm and English graduation 1/64 inch |
| 1.9 | Accuracy:              | Metrology Standard EEC Class- I                          |





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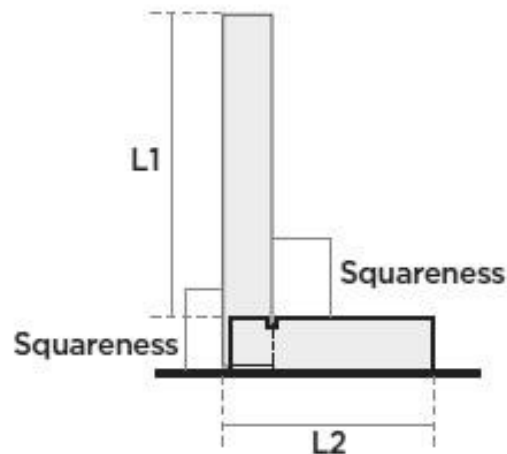
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## 2. Engineer's Square 150 mm with knife edge :-

### 2.1 Basic Indicative Diagram: -



- 2.2 Blade length (L1): 150mm
- 2.3 Stock length (L2): 100mm
- 2.4 Square ness: 16microns
- 2.5 Material for Blade: Spring Steel
- 2.6 Stock: MS
- 2.7 Hardness of Blade: 40- 50HRC
- 2.8 Groove on the inner corner of the stock



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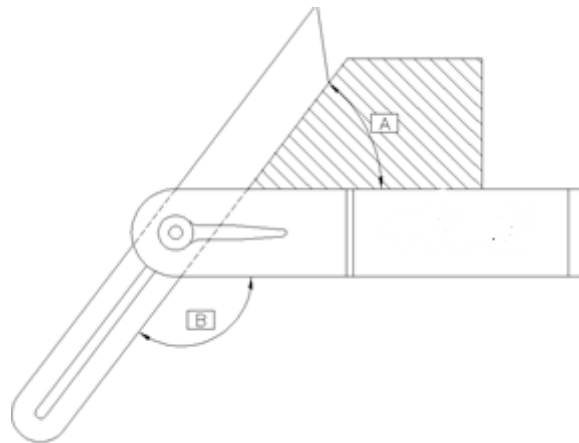
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### 3. Bevel Straight Edge 80 X 100 mm :-

#### 3.1 Basic Indicative Diagram:-

A & B – SET ANGLE



- 3.2 Material: Blade 1.0 thickness S.S.420 & Base in
- 3.3 Range: 6 inch blade length & 4 inch base length
- 3.4 Accuracy: +0.04 mm
- 3.5 Finish: Polished
- 3.6 Should be supplied in Wooden/Plastic Box with proper cushioning



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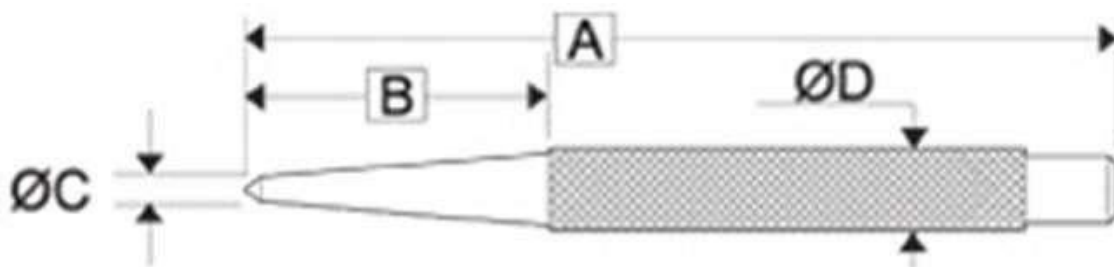
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#### 4. Centre punch 100 mm:-

##### 4.1 Basic Indicative Diagram:-



4.2 Generally conform to I.S. 7177-1974

4.3 Dimensions (in mm): A - 100, B - 33,  $\text{ØC}$  - 4,  $\text{ØD}$  - 10

4.4 Made from high grade chrome Steel

4.5 Hardness

4.5.1 Working surface: 55- 57 HRC

4.5.2 Body: 35- 45 HRC

4.6 Overall Length: 100mm

4.7 Black phosphate finish, Hardened & tempered

4.8 Deep knurling on body for firm grip



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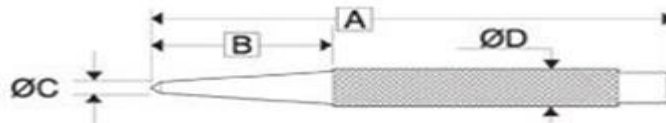
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#### 5. Dot punch 100mm

##### 5.1 Basic Indicative Diagram:-



##### 5.2 Generally conform to I.S.7177–1974

##### 5.3 Dimensions (in mm): A - 125, B - 40, ØC - 5, ØD - 12

##### 5.4 Made from high grade chrome Steel

##### 5.5 Hardness

5.5.1 Working surface: 55- 57HRC

5.5.2 Body: 35- 45 HRC

##### 5.6 Overall Length: 100mm

##### 5.7 Black phosphate finish, Hardened & tempered

##### 5.8 Deep knurling on body for firm grip



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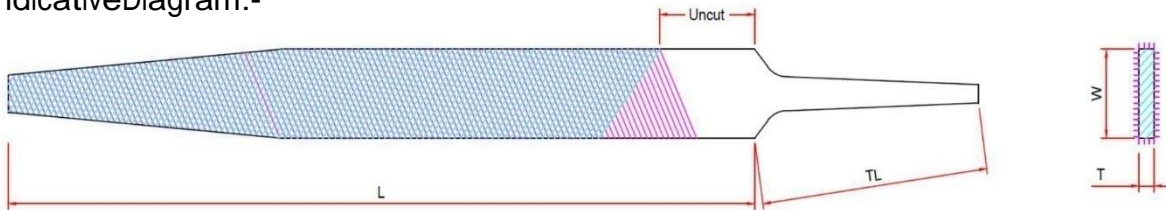
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#### 6. File flat bastard 300 mm with Handle:-

Basic Indicative Diagram:-



|      |                             | Range(InMM) |        |
|------|-----------------------------|-------------|--------|
|      |                             | From        | To     |
| 6.2  | Generally conforming to IS  | 1931        | 2000   |
| 6.3  | Body Length(L)              | 298         | 302    |
| 6.4  | Tang Length(TL)             | 54          | 56     |
| 6.5  | Width(W)                    | 19.6        | 20.6   |
| 6.6  | Thickness(T)                | 3.7         | 4.4    |
| 6.7  | No. of Upcut/Inch           | 24          | 26     |
| 6.8  | Upcut inclination           | 64°         | 66°    |
| 6.9  | No. of Overcut/Inch         | 18          | 20     |
| 6.10 | Overcut inclination         | 44°         | 46°    |
| 6.11 | No. of Edgecut/Inch         | 25          | 27     |
| 6.12 | Edgecut inclination         | 80°         | 91°    |
| 6.13 | Hardness                    | 60 HRC      | 64 HRC |
| 6.14 | Performance in 7500 strokes | 15          | 15.5   |
| 6.15 | Rake Angle                  | -7°         | -12°   |



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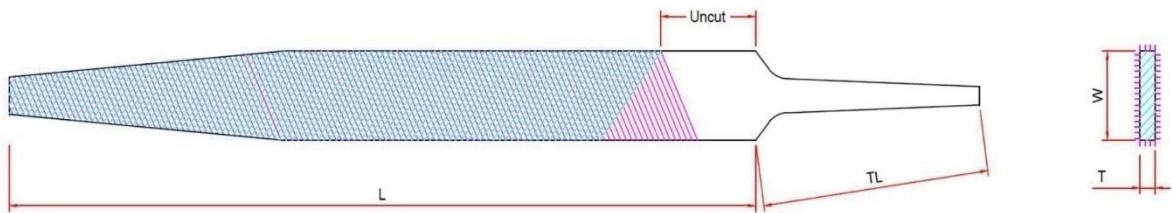
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#### 7. File flat 2nd cut 250 mm with handle:-

##### 7.1 Basic Indicative Diagram:-



|      |                                      | Range(InMM)     |                  |
|------|--------------------------------------|-----------------|------------------|
|      |                                      | From            | To               |
| 7.2  | Generally conforming to IS 1931-2000 |                 |                  |
| 7.3  | Body Length(L)                       | 248             | 252              |
| 7.4  | Tang Length(TL)                      | 59              | 61               |
| 7.5  | Width(W)                             | 23.9            | 24.9             |
| 7.6  | Thickness(T)                         | 5.05            | 5.75             |
| 7.7  | No.ofUp cut/Inch                     | 29              | 30               |
| 7.8  | Up cut inclination                   | 64 <sup>U</sup> | 66 <sup>U</sup>  |
| 7.9  | No.ofOvercut/Inch                    | 23              | 24               |
| 7.10 | Overcut Inclination                  | 44 <sup>U</sup> | 46 <sup>U</sup>  |
| 7.11 | No.ofEdgecut/Inch                    | 31              | 32               |
| 7.12 | Edgecut Inclination                  | 89 <sup>U</sup> | 91 <sup>U</sup>  |
| 7.13 | Hardness                             | 60 HRC          | 64 HRC           |
| 7.14 | Rake Angle                           | -7 <sup>U</sup> | -12 <sup>U</sup> |



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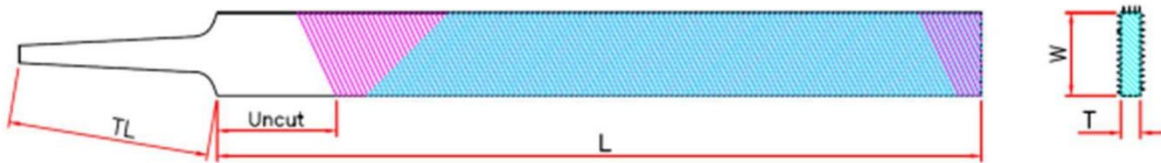
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#### 8. File flat safe edge 200 mm with Handle:-

##### 8.1 Basic Indicative Diagram:--



|      |                            | Range(InMM)     |                  |
|------|----------------------------|-----------------|------------------|
|      |                            | From            | To               |
| 8.2  | Generally conforming to IS | 1931            | 2000             |
| 8.3  | Body Length(L)             | 198             | 202              |
| 8.4  | Tang Length(TL)            | 54              | 56               |
| 8.5  | Width(W)                   | 19.6            | 20.6             |
| 8.6  | Thickness(T)               | 3.7             | 4.4              |
| 8.7  | No. of Up cut/Inch         | 34              | 35               |
| 8.8  | Up cut inclination         | 64 <sup>0</sup> | 66 <sup>0</sup>  |
| 8.9  | No. of Overcut/Inch        | 29              | 30               |
| 8.10 | Overcut Inclination        | 44 <sup>0</sup> | 46 <sup>0</sup>  |
| 8.11 | No. of Edgecut/Inch        | 36              | 37               |
| 8.12 | Edgecut Inclination        | 89 <sup>0</sup> | 91 <sup>0</sup>  |
| 8.13 | Hardness                   | 60 HRC          | 64 HRC           |
| 8.14 | Rake Angle                 | -7 <sup>0</sup> | -12 <sup>0</sup> |



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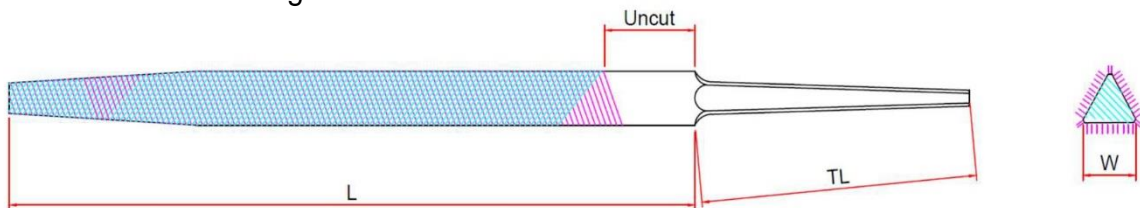
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

### 9. File triangular rough 200 mm with Handle:-

#### 9.1 Basic Indicative Diagram



|      |                                      | Range(InMM)     |                  |
|------|--------------------------------------|-----------------|------------------|
|      |                                      | From            | To               |
| 9.2  | Generally conforming to IS 1931-2000 |                 |                  |
| 9.3  | Body Length(L)                       | 198             | 202              |
| 9.4  | Tang Length(TL)                      | 55              | 56               |
| 9.5  | Equilateral Triangle Side(W)         | 14.25           | 14.95            |
| 9.6  | No.of Up-cut/Inch                    | 25              | 27               |
| 9.7  | Up-cut Inclination                   | 63 <sup>U</sup> | 67 <sup>U</sup>  |
| 9.8  | No.of Overcut/Inch                   | 21              | 22               |
| 9.9  | No.of Edgecut/Inch                   | 31              | 32               |
| 9.10 | Edgecut Inclination                  | 89 <sup>U</sup> | 91 <sup>U</sup>  |
| 9.11 | Hardness                             | 60 HRC          | 64 HRC           |
| 9.12 | Rake Angle                           | -7 <sup>U</sup> | -12 <sup>U</sup> |





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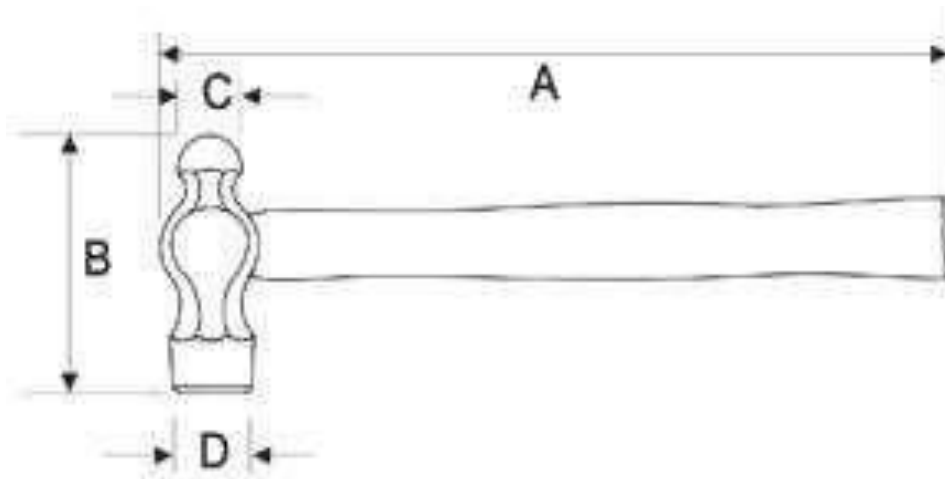
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 10. Hammer ½ lb. ball peen:-

10.1 Basic Indicative Diagram:-



10.2 Generally conform to I.S. 841– 1983

10.3 Ball Peen Hammer

10.4 Length: 300mm+10%

10.5 Weight: 200 grams

10.6 Drop forged from high grade carbon Steel

10.7 Material: EN – 9

10.8 Partially hardened upto 46- 56 HR Con striking surface

10.9 Depth of Hardness: 6mm

10.10 Phosphated and painted

10.11 Handle

10.11.1 Material: Hickory Wood/Red Wood/Babul Wood / Indestructible Handle

10.11.2 Handle fixed firmly to hammer head so that it does not come out after long use



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SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 11. Scriber 6 inch:-

##### 11.1 Basic Indicative Diagram:-



- 11.2 Scriber with Min. Length 150
- 11.3 90° Bend and Straight
- 11.4 Both Point end Hardness 55-60 HRC
- 11.5 Should be of material EN -9



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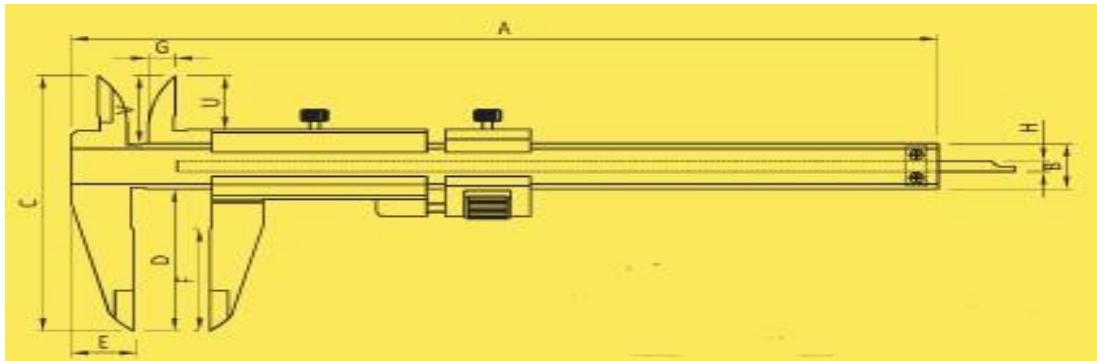
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

## 12. Vernier Calliper 150mm with 0.02 mm least count:-

### 12.1 Basic Indicative Diagram:-



|         |   |                                |
|---------|---|--------------------------------|
| 12.2    | Compliance:                               | Generally Compliant to DIN 862 |
| 12.3    | Range:                                    | 0mm - 180 mm                   |
| 12.4    | Overall Length:                           | 280mm                          |
| 12.5    | Lower jaw length:                         | Min. 50mm                      |
| 12.6    | Upper jaw length:                         | Min. 24mm                      |
| 12.7    | Graduation:                               | 0.02mm                         |
| 12.8    | Accuracy:                                 | $\pm 0.05$ mm                  |
| 12.9    | Material:                                 | Stainless Steel/Alloy Steel    |
| 12.10   | Standard Accessories:                     |                                |
| 12.10.1 | Operating Manual                          |                                |
| 12.10.2 | Wooden/Plastic Box with proper cushioning |                                |



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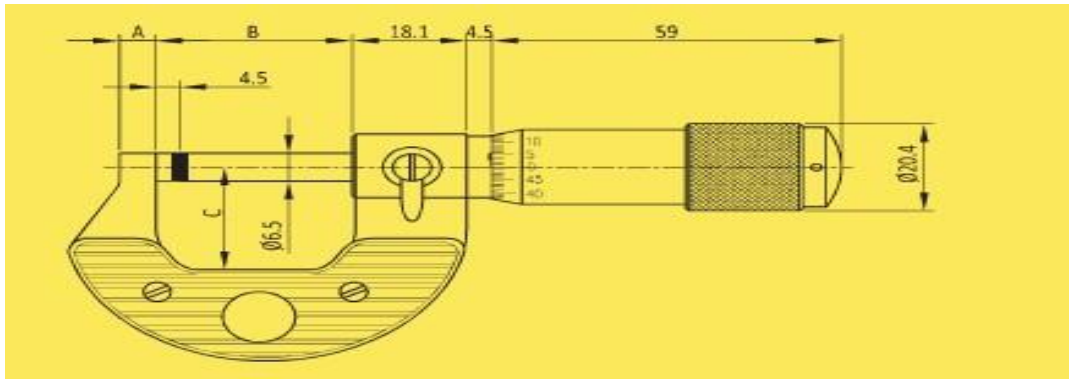
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

### 13. Micrometre (outside) 0-25 mm:-

#### 13.1 Basic Indicative Diagram:-



13.2 Compliance: Generally Compliant to IS 2967/1938

13.3 Range: 0mm -25mm

13.4 Reading: 0.01mm

13.5 Accuracy:  $4\mu\text{m}$

13.6 Spindle Material: Stainless Steel/Alloy steel

13.7 Standard Accessories:

13.7.1 Suitable spanner

13.7.2 Wooden/Plastic Box with proper cushioning

13.7.3 Operating Manual



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 14. Safety goggles (Personal Protective Equipment) :-

##### 14.1 Basic Indicative Diagram:-



- 14.2 Help provide limited impact protection from flying particles
- 14.3 Hard-coated poly carbonate lens offers 99%UV protection
- 14.4 Meets ANS IZ87.1 standards
- 14.5 Light weight, contemporary style
- 14.6 Adjustable temple
- 14.7 Eye protection against dust & impact
- 14.8 Universal size



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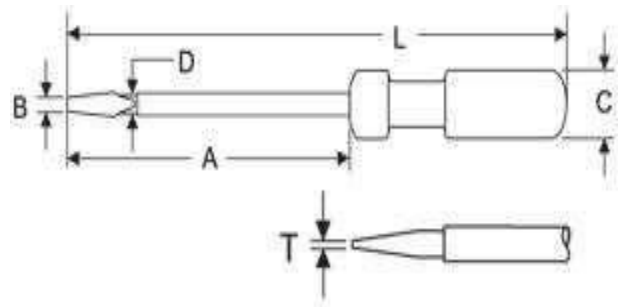
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 15. Screw driver electrician 150 mm:-

##### 15.1 Basic Indicative Diagram:-



15.2 Generally conform to IS 844-1979

15.3 Insulated Blade

15.4 Dimensions:

15.4.1 Size: 4mm X 150 mm (A- 150 mm, D-4mm)

15.4.2 Tip Bit Size: B XT: 4 mm X 0.6mm

15.5 Blade:

15.5.1 Blade made of high grade Silicon-Manganese Steel (EN45A)

15.5.2 Blade should be differentially hardened & tempered to resist wear, bending & meet high torque requirement

15.5.3 Hardness on Tip: 55- 58HRC

15.5.4 Minimum Torque Value: 0.15Kg.m

15.5.5 Bright and Smooth Nickel Chrome plating finish to effectively protect Blade against corrosion

15.6 Handle:

15.6.1 Material of Handle: Cellulose Acetate

15.6.2 Handle should be made of high-grade CA Plastic, which is non-flammable & Unaffected by oil, petrol, grease, water- practically anything

15.6.3 Handle should stand rough use including hammering \

15.6.4 Handle design should be such that it gives comfortable grip even at higher Torques

15.6.5 Handle & blade assembly should be insert moulded

15.7 Tip:

15.7.1 Tip should be formed by Forging & Trimming

15.7.2 Tip should be precision-ground to 10-degree angle to ensure a firm grip in The screw slot.

15.7.3 The Blade tips should be magnetized to lift small screws from confined places or to hold the screw in position

15.7.4 Tip sides & faces should be well ground with good finish



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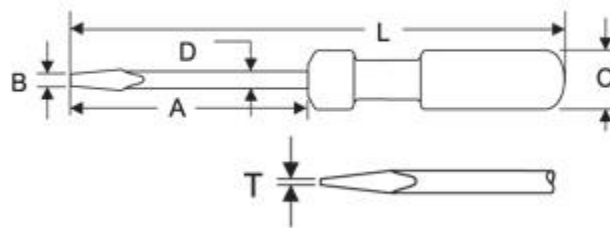
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

### 16. Screw driver Nos. 860,862

#### 16.1 Basic Indicative Diagram:-



- 16.2 It should be made out of High Grade Steel and Transparent green cellulose acetate handle
- 16.3 The handle should be made from high grade C. A. Plastic which is non-flammable and Unaffected by oil petrol, grease, water etc.
- 16.4 Generally Conforming to IS 844-1979
- 16.5 Size:-
- |        |                 |     |  |
|--------|-----------------|-----|--|
| 16.5.1 | Tip Size        | : - | 1.6 X 0.4mm (B X T) for 860 screw driver<br>3.0 X 0.4mm (B X T) for 862 screw driver |
| 16.5.2 | Blade size      | : - | 75mm (A) X 3 mm (D) for 860 screw driver<br>50mm (A) X 3 mm (D) for 862 screw driver |
| 16.5.3 | Handle Diameter | : - | 13 mm (C) for 860 screw driver<br>13 mm (C) for 862 screw driver                     |
| 16.5.4 | Overall Length  | : - | 135 mm (L) for 860 screw driver<br>110 mm (L) for 862 screw driver                   |



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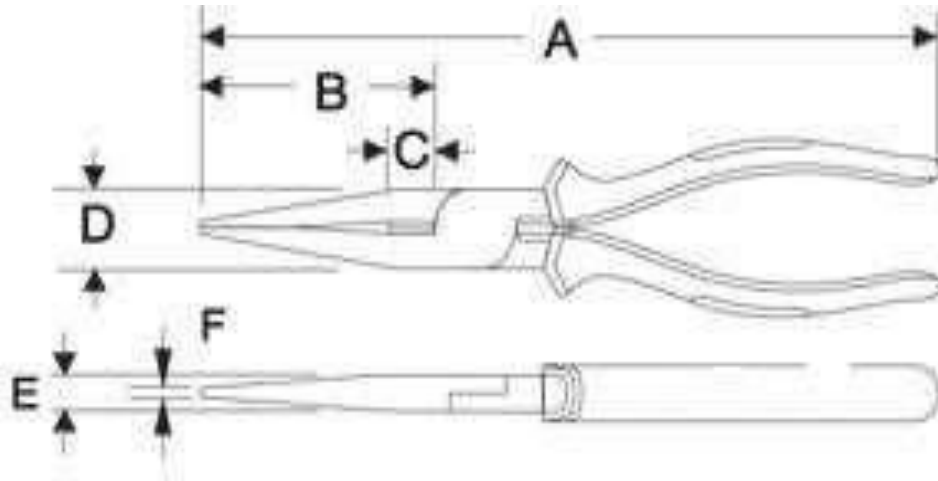
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 17. Long nose plier 150mm:-

##### 17.1 Basic Indicative Diagram:-



17.2 Generally conform to IS 3552- 1989

17.3 Length: 200mm

17.4 Drop Forged from High Carbon Steel & scientifically treated to give a tough body (45- 48HRC)

17.5 Cutting edges should be induction hardened. Cutting edge Hardness 55- 60HRC.

17.6 Rivet should be hardened and made of carbon steel

17.7 High Voltage Insulation: Should be able to withstand 4000VDC or 2800VAC

17.8 Minimum load value: 13.80Kg

17.9 Insulation Sleeves made from High-Quality CA Plastic which are long-lasting and Will not break or crack even if falls from Height and ensure safe electrical Working.

17.10 Thicker Sleeves for Comfortable Grip

17.11 Special thumb protector for sleeves to minimize the risk of electric hock in case Plier slips while in use.

17.12 Should be able to cut soft (74 to 84Kg/ mm<sup>2</sup>) & hard (140mm<sup>2</sup>) wires

17.13 Should be able to cut hard wire of Diameter: 1.60mm & Soft wire of Diameter: 1.0 mm

17.14 Cutting edges should be sharp and precision machined to the appropriate angle to cut thick and thin wires with ease.





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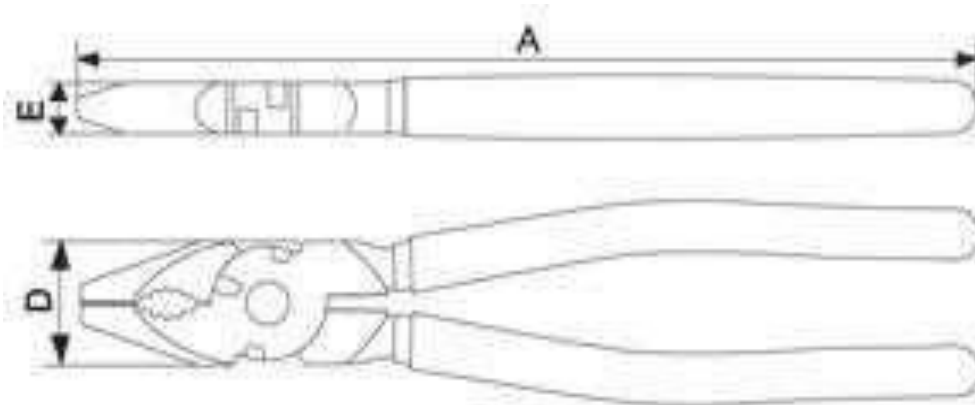
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 18. Combination plier 150mm: -

##### 18.1 Basic Indicative Diagram:-



18.2 Generally, conform to IS 3650– 1981

18.3 Material: C– 70

18.4 Finish: Polished /Chrome plated/satin finish

18.5 Length (A): 200 mm

18.6 Drop forged, hardened tempered

18.7 Differential hardening

18.8 Radius Gap from the front side: Upton 0.2 mm

18.9 Play between shanks: Upton 0.3 mm

18.10 Shank Material: C70 / EN9

18.11 Rivet material: SAE 1541 / 40Cr4

18.12 Cutting Edge Hardness: 60 - 62 HRC

18.13 Shank Hardness: 40 - 48 HRC

18.14 Rivet Hardness: 38 - 42 HRC

18.15 High Voltage Insulation: Should be able to withstand 4000 V DC or 2800 V

AC

18.16 Insulation Sleeves made from High-Quality CA Plastic

18.17 Thicker Sleeves for Comfortable Grip

18.18 Special thumb protector for sleeves to minimize the risk of electric shock in case plier slips While in use.

18.19 Should be able to cut soft (74 to 84 Kg/mm<sup>2</sup>) &hard (140 Kg/mm<sup>2</sup>) wires

18.20 Should be able to cut 2 mm of hardwire Diameter & 1 mm of soft wire  
Diameter



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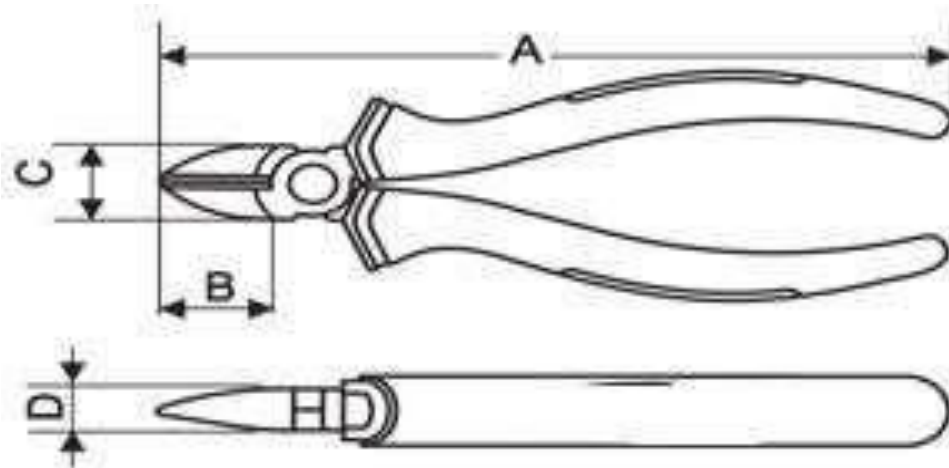
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 19. Diagonal cutter 150mm:-

##### 19.1 Basic Indicative Diagram:-



19.2 Generally, conform to IS 4378 - 1990

19.3 Drop Forged from High Carbon Steel & scientifically treated to give tough Body (45 -48 HRC)

19.4 Cutting edges should be induction hardened. Cutting edge Hardness 55 - 60 HRC.

19.5 Rivet should be hardened and made of carbon steel

19.6 Length: 200 mm

19.7 High Voltage Insulation: Should be able to withstand 4000 V DC or 2800 V

AC

19.8 Insulation Sleeves made from High-Quality CA Plastic

19.9 Thicker Sleeves for Comfortable Grip

19.10 Special thumb protector for sleeves to minimize the risk of electric shock in case of plier Slips while in use.

19.11 Should be able to cut soft (74 to 84 Kg/ mm<sup>2</sup>) & hard (140 Kg/ mm<sup>2</sup>) wires

19.12 Should be able to cut 2.0 mm of hard wire Diameter & 1.5 mm of soft wire Diameter

19.13 Cutting edges should be sharp and precision machined to appropriate angle to cut Thick and thin wires with ease.



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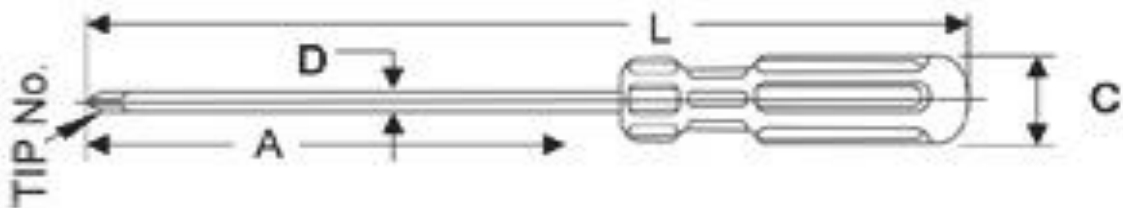
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

## 20. Screwdriver Philips Nos. 860,862: -

20.1 Basic Indicative Diagram:-



20.2 It should be made out of High Grade Steel and Transparent green cellulose acetate handle

20.3 The handle should be made from high grade C. A. Plastic which is non-flammable and

Unaffected by oil petrol, grease, water etc.

20.4 Generally conforming to IS 844-1979

20.5 Size: -

20.5.1 Tip Size: - 0 mm for 860 screwdrivers  
2 mm for 862 screwdrivers

20.5.2 Blade size: - 150mm (A) X 3 mm (D) for 860 screwdriver  
150mm (A) X 6 mm (D) for 862 screwdriver

20.5.3 Handle Diameter: - 17 mm (C) for 860 screwdrivers  
26 mm (C) for 862 screwdrivers

20.5.4 Overall Length: - 225 mm (L) for 860 screwdrivers  
298 mm (L) for 862 screwdrivers



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

#### 21. Tweezers: -

##### 21.1 Basic Indicative Diagram



- 21.2 Total Length: 120mm  $\pm$ 1 mm
- 21.3 Total Width: 9.3 mm $\pm$ 0.1mm
- 21.4 Total thickness: 1.2 mm $\pm$ 0.05 mm
- 21.5 Material: Stainless Steel
- 21.6 Hardness: 40- 42HRC

21.7 Should be useful for bending and many aspects of watch &clock repair.



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SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 22. Knife 100mm: -

##### 22.1 Basic Indicative Diagram



- 22.2 Blade should be made of high-grade Steel for sharp and long cutting
- 22.3 Hardness:62- 64HRC
- 22.4 ABS Plastic Body for higher strength & soft material for comfort in use
- 22.5 Slider locking system for enhanced safety
- 22.6 BladeWidth:18mm



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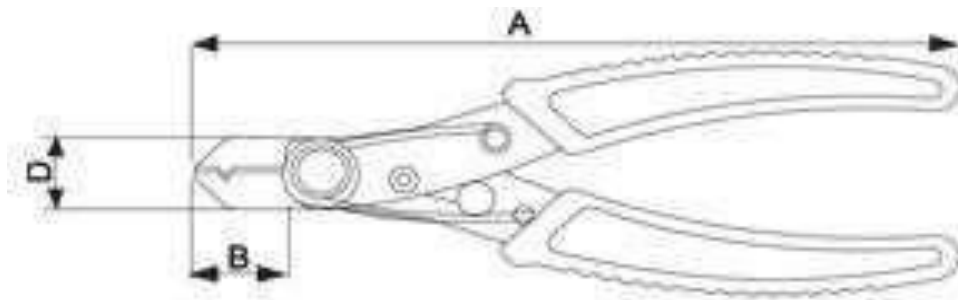
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

### 23. Wire Stripper:-

#### 23.1 Basic Indicative Diagram



- 23.2 Generally conform to I.S. 5995-1971
- 23.3 Dimensions (in mm):A - 150, B- 18, D-15
- 23.4 Sleeve should be made of Cellulose Acetate
- 23.5 Should withstand 400VAC
- 23.6 Drop forged from high grade carbon Steel (EN9)
- 23.7 Accurate machined and Heat-treated



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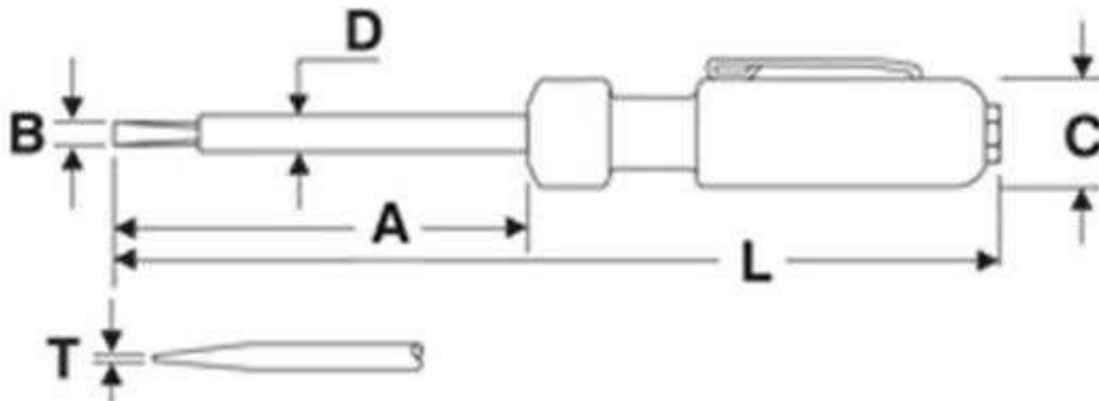
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 24. Neon Tester:-

##### 24.1 Basic Indicative Diagram



24.2 Generally conforming to IS 5579- 1985

24.3 Dimension

24.3.1 A: 60mm

24.3.2 D: 6mm

24.3.3 Tip Size: BXT=3.5 mmX0.5 mm

24.4 Minimum Torque Value: 0.09 Kg.m

24.5 Generally conform to IS 5579-1985

24.6 Blade made of high grade Silicon-Manganese Steel (EN - 45A)

24.7 Blade should be differentially hardened & tempered to resist wear, and bending & Meet high torque requirement

24.8 Hardness on Tip: 55 - 57 HRC

24.9 Bright and Smooth Nickel Chrome plating finish to effectively protect the blade against Corrosion

24.10 Handle should be made of high-grade CA Plastic, which is non-flammable & Unaffected by oil, petrol, grease, water- practically anything

24.11 Suitable for checking at minimum 90V DC and 60 AC voltage and maximum up to 500V AC

24.12 Blade is provided with PVC insulation sleeve & resistance having 1 mega ohm For preventing the electric shock

24.13 NEON-filled glow lamps would give a visible glowing normal daylight

24.14 Maximum leakage current of 0.12 micro ampere ensures safe & shock-free in use.

24.15 Tips should be precision-ground to 5-degree angle to ensure a firm grip in the screw slot.



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

#### 25. Scissors 150mm:-

25.1 Basic Indicative Diagram:-



25.2 Material:Tampered Scissor

25.3 Should have Brass Handle

25.4 Size:300 mm (+/- 10%)





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#### 26. Soldering iron 25watts:-

26.1 Basic Indicative Diagram:-



- 26.2 Should have specially coated Copper bits (High Quality) for Longer Life.
- 26.3 Should have a Special double-layered cartridge-type element to transfer heat very efficiently directly to the bits.
- 26.4 Should have Iron reach soldering temperature within a few seconds
- 26.5 Should have Prolonged Life of heating Elements and Soldering Bits.
- 26.6 Should have extremely low leakage current.
- 26.7 Should have Very light and heat-resistant handles for comfortable use.
- 26.8 Tip replacement should be Easy and speedy
- 26.9 25 Watts/ 240 Volts Soldering Iron
- 26.10 Should have Maximum Temperature: 3800C



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SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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27. BRAIDBOARD:-

RAW MATERIAL

This item is repeated in sr.no.123



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

### 1. Calliper– Outside150mm

#### 1.1 Basic Indicative Diagram



#### 1.2 Outside Callipers with Size:150mm

#### 1.3 Material for

1.3.1 Legs: Carbon & Alloy Steel

1.3.2 Spring: Spring Steel

1.3.3 Others: Free Cutting Steel

#### 1.4 Finish for

1.4.1 Legs: Polished

1.4.2 Rest parts: Auto Black

#### 1.5 Hardness for

1.5.1 Tip: 50- 55HRC

1.5.2 spring: 45- 50HRC

#### 1.6 Proper rust preventive packing



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

#### 2. V-block 50 mm X 100mm and 75 mm X 100 mm each:-

##### 2.1 Basic Indicative Diagram



- 2.2 Total Length: 150 mm  $\pm$  1 mm
- 2.3 Total Width: 100 mm  $\pm$  0.2 mm
- 2.4 Total Height: 75 mm  $\pm$  0.2 mm
- 2.5 Angle: 90 Degree
- 2.6 V-run out: 10  $\mu$
- 2.7 Clamping capacity: 25 mm



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

### 3. DIVIDER 150 MM

#### 3.1 Basic Indicative Diagram



|       |                                |                      |
|-------|--------------------------------|----------------------|
| 3.2   | Spring DividerSize(L):         | 150mm                |
| 3.3   | Material for                   |                      |
| 3.3.1 | Legs:                          | Carbon & Alloy Steel |
| 3.3.2 | Spring:                        | Springsteel          |
| 3.3.3 | Others:                        | Free Cutting Steel   |
| 3.4   | Finish for                     |                      |
| 3.4.1 | Legs:                          | Polished             |
| 3.4.2 | Restparts:                     | AutoBlack            |
| 3.5   | Hardnessfor                    |                      |
| 3.5.1 | Tip:                           | 50- 55HRC            |
| 3.5.2 | Spring:                        | 45- 50HRC            |
| 3.6   | Proper rust preventive packing |                      |



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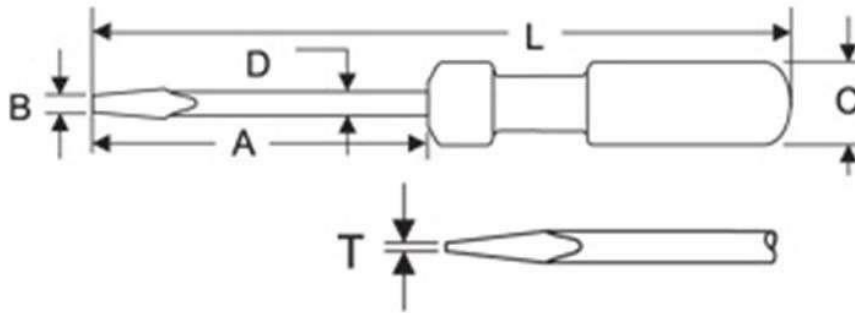
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 4. Screw Driver 200 mm and 150mm each

##### 4.1 Basic Indicative Diagram



4.2 Generally conform to IS 844-1979

4.3 Dimensions:

4.3.1 Size: 10 mm X200mm(A-200 mm,D-10 mm)

4.3.2 Tip Bit Size: BXT:10 mm X1.2 mm

4.4 Blade:

4.4.1 Blade made of high-grade Silicon-Manganese Steel (EN45A)

4.4.2 Blade should be differentially hardened & tempered to resist wear, bending & meet High torque requirement.

4.4.3 Hardness on tip: 55- 58HRC

4.4.4 Minimum Torque Value: 1.46Kg.m

4.4.5 Bright and Smooth Nickel Chrome plating finish to effectively protect blade against Corrosion

4.5 Handle:

4.5.1 Material of Handle: Cellulose Acetate

4.5.2 The handle should be made of high-grade CA Plastic, which is non-flammable & Unaffected by oil, petrol, grease, water- practically anything

4.5.3 Handle should stand rough use including hammering

4.5.4 Handle designs should be such that it gives comfortable gripe venat higher torques

4.5.5 Handle & blade assembly should be insert moulded

4.6 Tip:

4.6.1 Tip should be formed by Forging & Trimming

4.6.2 Tip should be precision-ground to 10 degree angle to ensure firm grip in the Screwslot.

4.6.3 The Blade tip should be magnetized to lift small screw from confined places Or to hold the screw in position

4.6.4 Tip sides & faces should be well ground with good finish

4.6.5 Double ear coinings should be provided for the blade.



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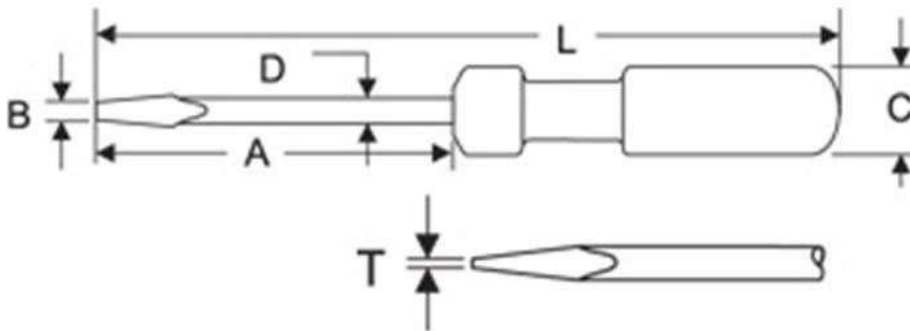
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 4(B). ScrewDriver-8X 150mm

##### 4.1 (B). Basic Indicative Diagram



4.2 Generally conform to IS 844–1979

##### 4.3 Dimensions:

4.3.1 Size: 8 mm X 150mm (A-200 mm, D-10 mm)

4.3.2 Tip Bit Size: BXT:10 mm X1.2 mm

##### 4.4 Blade:

4.4.1 Blade made of high grade Silicon-Manganese Steel (EN45A)

4.4.2 Blade should be differentially hardened & tempered to resist wear, bending & meet High torque requirement

4.4.3 Hardness on Tip: 55- 58HRC

4.4.4 Minimum Torque Value: 1.17Kg.m

4.4.5 Bright and Smooth Nickel Chrome plating finish to effectively protect blade against Corrosion

##### 4.5 Handle:

4.5.1 Material of Handle: Cellulose Acetate

4.5.2 Handle should be made of high grade CA Plastic, which is non-flammable & Unaffected by oil, petrol, grease, water- practically anything

4.5.3 Handle should withstand rough use including hammering

4.5.4 Handle design should be such that it gives comfortable gripeven at higher torques

4.5.5 Handle & blade assembly should be insert moulded

##### 4.6 Tip:

4.6.1 Tip should be formed by Forging & Trimming

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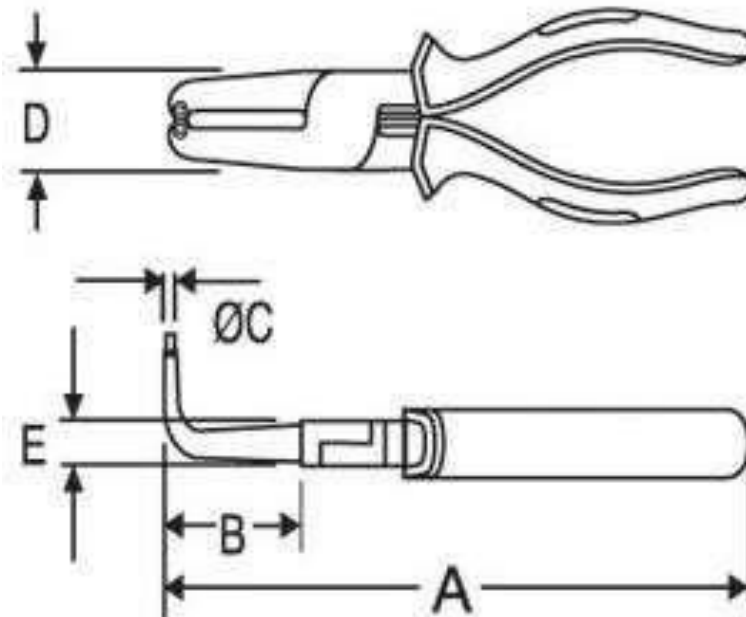
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 5. Circlip plier (inside and outside) each :- Circlip plier (inside)

##### 5.1 Basic Indicative Diagram:-



5.2 Generally conform to IS 7990- 1976

5.3 External Bend

5.4 Capacity: 40 - 100 mm

5.5 Length: 180 mm

5.6 Tips should be precision machined with dimensions to available standards. Tips are bent and provided with serrations to prevent Circlip from "Flying away" during use.

5.7 Drop Forged from suitable High Grade Steel

5.8 Hardness: 43 - 48 HRC

5.9 Rivet should be hardened to prevent play after long use

5.10 Pliers should be fitted with return spring between the shanks to facilitate smooth operation

5.11 PVC Dip coated sleeve





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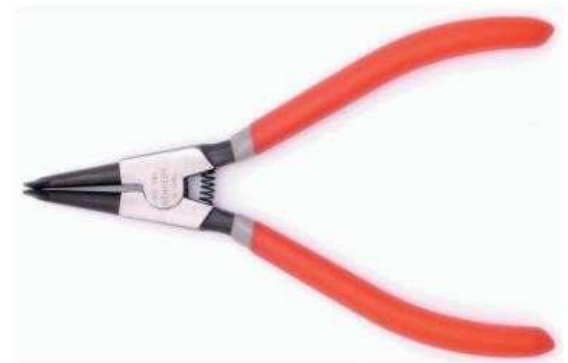
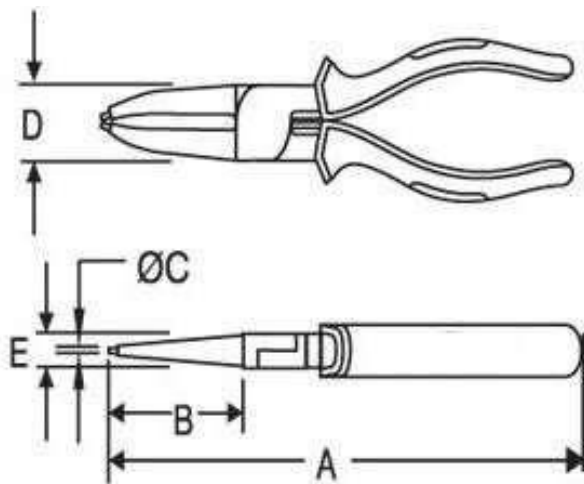
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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### 5 (B) Circlip plier (outside)

#### 5.1 (B) Basic Indicative Diagram:-



5.2 Generally conform to IS 7990 – 1976

5.3 External Straight

5.4 Capacity: 40 - 100 mm

5.5 Length: 200 mm

5.6 Tips should precision machined with dimensions to available standards. Tips are bent and Provided with serrations to prevent Circlip from “Flying away” during use.

5.7 Drop Forged from suitable High Grade Steel

5.8 Hardness: 43 - 48 HRC

5.9 Rivet should be hardened to prevent play after long use

5.10 Pliers should be fitted with return springs between the shanks to facilitate smooth operation

5.11 PVC Dip coated sleeve



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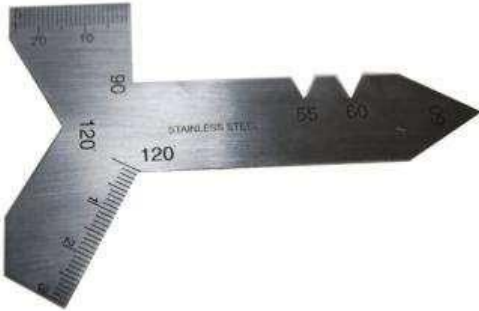
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 6. Centre gauge 55° and 60° :-

##### 6.1 Basic Indicative diagram :-



- 6.2 Total length: 95 mm  $\pm$  1 mm
- 6.3 Width: 45 mm  $\pm$  0.2 mm
- 6.4 Blade thickness: 1.5 mm  $\pm$  0.05 mm
- 6.5 Blade material: Stainless Steel
- 6.6 Should be handy and useful for grinding & setting thread cutting tools.
- 6.7 Satin chrome finish.
- 6.8 Should have permanently deep etched graduations also edge profile ground.
- 6.9 Should be useful to find numbers of thread per inch by mean of given value.
- 6.10 Different angles are as per profile (rectangular, conical or edge cutting) .



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#### 7. Oil can

##### 7.1 Basic Indicative Diagram:-



- 7.2 Metal Oil can with 500ml Capacity
- 7.3 150mm rigid Steel spout
- 7.4 Tin coated Steel body with premium powder coated finish
- 7.5 Steel pump with double ball check
- 7.6 Discharge of 16 - 18ml per 10 strokes with general Mobil oil



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#### 8. Oil Gun and Grease Gun each:-

##### 8.1 Basic Indicative Diagram:-



- 8.2 150 mm rigid Steel extension & 4 jaw coupler
- 8.3 Aluminium die Cast grease gun head with built-in release wall
- 8.4 Soft Rubber grip on lever handle
- 8.5 Powder Coated Body
- 8.6 Delivers: Upton 1 gm/stroke
- 8.7 Develops: up to 6,000 PSI
- 8.8 500gms Bulk Capacity/400gms with Cartridge



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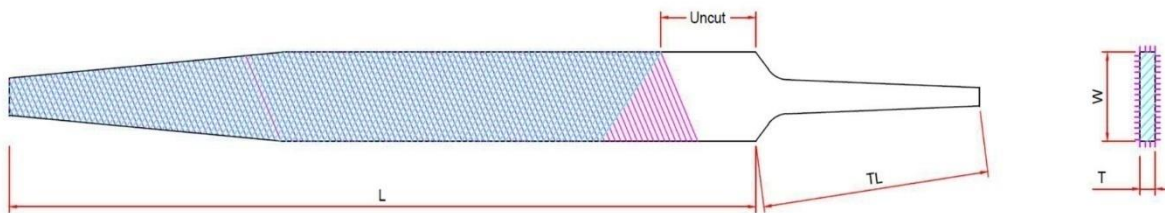
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

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#### 9. File flat smooth 200 mm with handle:-

##### 9.1 Basic Indicative Diagram:-



|      |                            | Range(InMM) |        |
|------|----------------------------|-------------|--------|
|      |                            | From        | To     |
| 9.2  | Generally conforming to IS | 1931        | 2000   |
| 9.3  | Body Length(L)             | 198         | 202    |
| 9.4  | Tang Length(TL)            | 44          | 46     |
| 9.5  | Width(W)                   | 15.1        | 16.1   |
| 9.6  | Thickness(T)               | 3.25        | 3.95   |
| 9.7  | No. of Up-cut/Inch         | 52          | 54     |
| 9.8  | Up-cut inclination         | 640         | 660    |
| 9.9  | No. of Overcut/Inch        | 46          | 47     |
| 9.10 | Overcut Inclination        | 440         | 460    |
| 9.11 | No. of Edgecut/Inch        | 55          | 56     |
| 9.12 | Edgecut Inclination        | 890         | 910    |
| 9.13 | Hardness                   | 60 HRC      | 64 HRC |
| 9.14 | Rake Angle                 | -70         | -120   |



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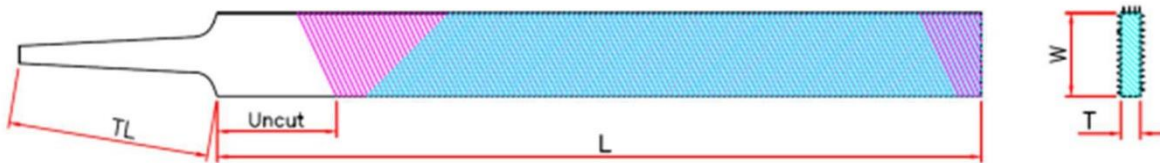
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

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#### 10. File flat smooth safe edge 200 mm with Handle:-

##### 10.1 Basic Indicative Diagram:-



|       |                            | Range (In MM) |        |
|-------|----------------------------|---------------|--------|
|       |                            | From          | To     |
| 10.2  | Generally conforming to IS | 1931          | 2000   |
| 10.3  | Body Length (L)            | 198           | 202    |
| 10.4  | Tang Length (TL)           | 54            | 56     |
| 10.5  | Width (W)                  | 19.6          | 20.6   |
| 10.6  | Thickness (T)              | 3.7           | 4.4    |
| 10.7  | No. of Up-cut / Inch       | 34            | 35     |
| 10.8  | Up-cut inclination         | 640           | 660    |
| 10.9  | No. of Overcut / Inch      | 29            | 30     |
| 10.10 | Overcut Inclination        | 440           | 460    |
| 10.11 | No. of Edge cut / Inch     | 36            | 37     |
| 10.12 | Edge cut Inclination       | 890           | 910    |
| 10.13 | Hardness                   | 60 HRC        | 64 HRC |
| 10.14 | Rake Angle                 | -70           | -120   |



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#### 11. File half-round bastard 300 mm with Handle:-

##### 11.1 Basic Indicative Diagram:-



|                                 | Range (In MM) |             |
|---------------------------------|---------------|-------------|
|                                 | From          | To          |
| 11.2 Generally conforming to IS | 1931          | 2000        |
| 11.3 Body Length (L)            | 300           | 302         |
| 11.4 Tang Length (TL)           | 60            | 61          |
| 11.5 Width (W)                  | 23.70         | 24.7        |
| 11.6 Thickness (T)              | 6.55          | 7.25        |
| 11.7 No. of up-cut / Inch       | (23-24 F/S)   | (23-24 R/S) |
| 11.8 Up-cut inclination         | 650           | 650         |
| 11.9 No. of Overcut / Inch      | (17-18 F/S)   | (17-18 R/S) |
| 11.10 Overcut Inclination       | 500           | 500         |
| 11.11 No. of Edge cut / Inch    | 23            | 24          |
| 11.12 Edge cut Inclination      | 650           | 650         |
| 11.13 Hardness                  | 60 HRC        | 64 HRC      |
| 11.14 Rake Angle                | -70           | -120        |



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### 12. File half round smooth 250 mm with handle;-

#### 12.1 Basic Indicative Diagram:-



|       |                            | Range(InMM) |             |
|-------|----------------------------|-------------|-------------|
|       |                            | From        | To          |
| 12.2  | Generally conforming to IS | 1931        | 2000        |
| 12.3  | Body Length (L)            | 200         | 202         |
| 12.4  | Tang Length (TL)           | 55          | 56          |
| 12.5  | Width (W)                  | 18.90       | 19.90       |
| 12.6  | Thickness (T)              | 5.15        | 5.85        |
| 12.7  | No. of up-cut / Inch       | (44-45 F/S) | (45-46 R/S) |
| 12.8  | Up-cut inclination         | 65°         | 65°         |
| 12.9  | No. of Overcut / Inch      | (40-41 F/S) | (40-41 R/S) |
| 12.10 | Overcut Inclination        | 500         | 500         |
| 12.11 | o. of Edge cut / Inch      | 45-46       | 45-46       |
| 12.12 | Edge cut Inclination       | 65°         | 65°         |
| 12.13 | Hardness                   | 60 HRC      | 64 HRC      |
| 12.14 | Rake Angle                 | -70         | -120        |





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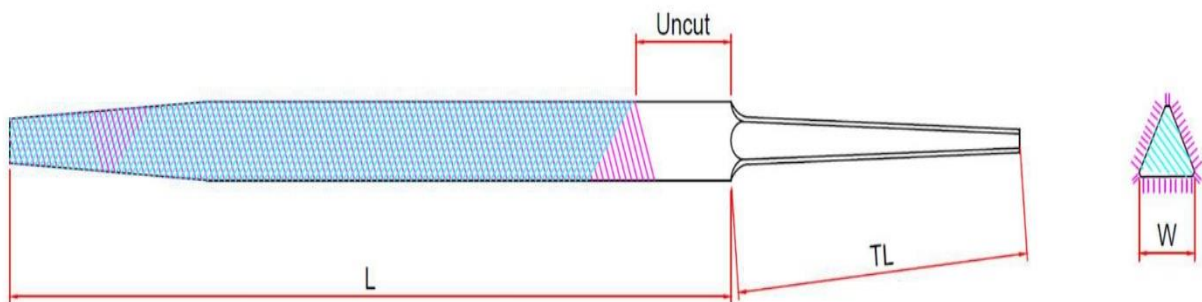
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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### 13. File triangular smooth 200 mm with Handle:-

#### 13.1 Basic Indicative Diagram:-



|       |                               | Range (In MM)   |                 |
|-------|-------------------------------|-----------------|-----------------|
|       |                               | From            | To              |
| 13.2  | Generally conforming to IS    | 1931            | 2000            |
| 13.3  | Body Length (L)               | 198             | 202             |
| 13.4  | Tang Length (TL)              | 58              | 59              |
| 13.5  | Equilateral Triangle Side (W) | 11.05           | 11.75           |
| 13.6  | No. of Up-cut / Inch          | 480             | 490             |
| 13.7  | Up-cut inclination            | 57              | 63              |
| 13.8  | No. of Overcut/Inch           | 38              | 39              |
| 13.9  | No. of Edge cut / Inch        | 51              | 52              |
| 13.10 | Edge cut Inclination          | 76 <sup>0</sup> | 78 <sup>0</sup> |
| 13.11 | Hardness                      | 60 HRC          | 64 HRC          |
| 13.12 | Rake Angle                    | -70             | -120            |



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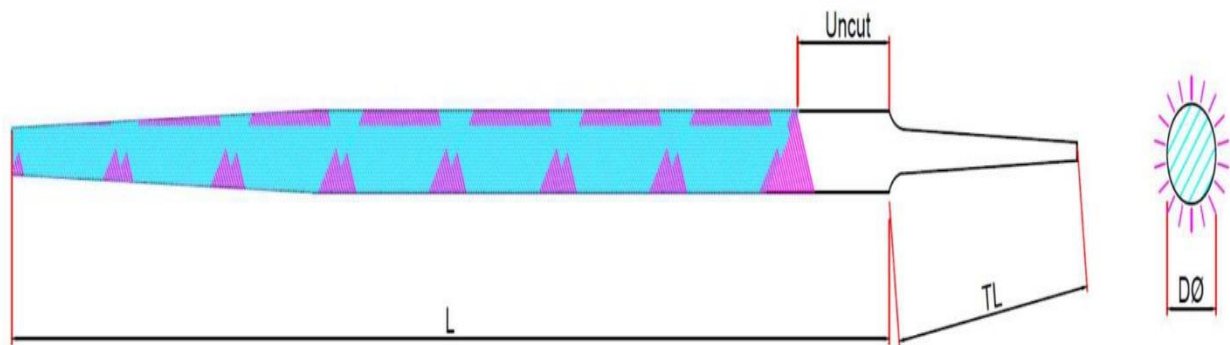
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 14. File round bastard 250 mm with handle:-

##### 14.1 Basic indicative Diagram:-



|                                 | Range (In MM)   |                 |
|---------------------------------|-----------------|-----------------|
|                                 | From            | To              |
| 14.2 Generally conforming to IS | 1931            | 2000            |
| 14.3 Body Length ( L)           | 248             | 252             |
| 14.4 Tang Length (TL)           | 59              | 61              |
| 14.5 Diameter (Ø)               | 8.35            | 9.35            |
| 14.6 No. of Up-cut / Inch       | 20              | 21              |
| 14.7 Up-cut inclination         | 64 <sup>0</sup> | 66 <sup>0</sup> |
| 14.8 No. of Overcut / Inch      | 20              | 21              |
| 14.9 Overcut Inclination        | 49 <sup>0</sup> | 51 <sup>0</sup> |
| 14.10 Hardness                  | 60 HRC          | 64 HRC          |
| 14.11 Rake Angle                | -70             | -120            |



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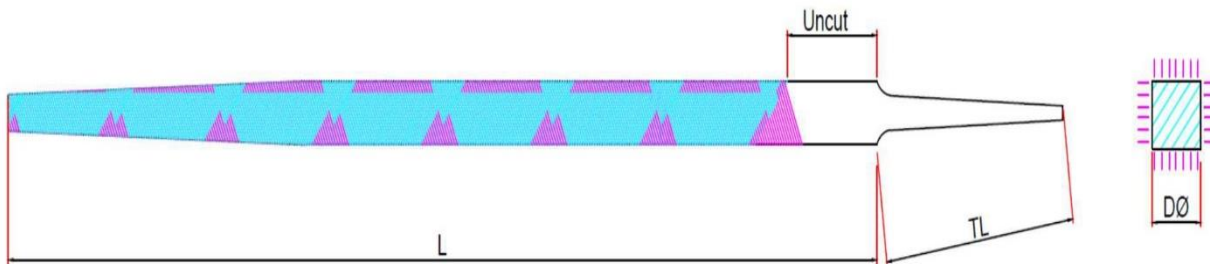
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 15. File square smooth 250 mm with handle:-

##### 15.1 Basic indicative Diagram:-



|                                 | Range (In MM)   |                  |
|---------------------------------|-----------------|------------------|
|                                 | From            | To               |
| 15.2 Generally conforming to IS | 1931            | 2000             |
| 15.3 Body Length (L)            | 248             | 252              |
| 15.4 Tang Length (TL)           | 59              | 61               |
| 15.5 Diameter (Ø)               | 8               | 9                |
| 15.6 No. of Up-cut / Inch       | 41              | 43               |
| 15.7 Up-cut inclination         | 64 <sup>0</sup> | 66 <sup>0</sup>  |
| 15.8 No. of Overcut / Inch      | 36              | 37               |
| 15.9 Overcut Inclination        | 49 <sup>0</sup> | 51 <sup>0</sup>  |
| 15.10 Hardness                  | 60 HRC          | 64 HRC           |
| 15.11 Rake Angle                | -7 <sup>0</sup> | -12 <sup>0</sup> |



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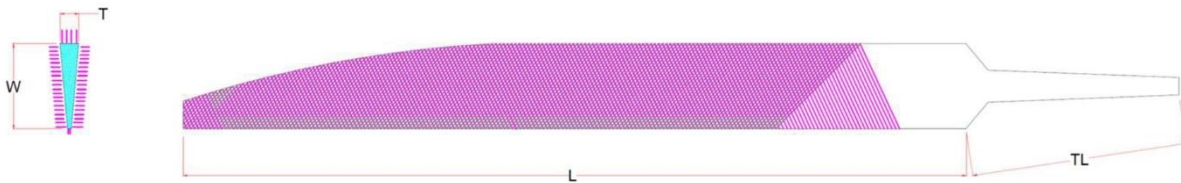
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 16. Knife edge file 150 mm with handle:-

##### 16.1 Basic indicative Diagram:-



|       | Range (In MM)                        |        |        |
|-------|--------------------------------------|--------|--------|
|       | From                                 | To     |        |
| 16.2  | Generally conforming to IS 1931-2000 |        |        |
| 16.3  | Body Length (L)                      | 150    | 152    |
| 16.4  | Tang Length (TL)                     | 50     | 51     |
| 16.5  | Width (W)                            | 19     | 19.4   |
| 16.6  | Thickness (T)                        | 3      | 4      |
| 16.7  | No. of Up-cut / Inch                 | 53     | 54     |
| 16.8  | Up-cut inclination                   | 64°    | 66°    |
| 16.9  | No. of Overcut / Inch                | 46     | 47     |
| 16.10 | Overcut Inclination                  | 49°    | 51°    |
| 16.11 | No. of Edge cut / Inch               | 55     | 56     |
| 16.12 | Edge cut Inclination                 | 89°    | 91°    |
| 16.13 | Hardness                             | 60 HRC | 64 HRC |
| 16.14 | Rake Angle                           | -70    | -120   |



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### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 17. Needle file assorted (12 nos.) 160 mm:-

##### 17.1 Basic indicative Diagram:-

|      |            |  |  |
|------|------------|--|--|
| 17.1 | Barrete    |  |  |
| 17.2 | Crossing   |  |  |
| 17.3 | Flat       |  |  |
| 17.4 | Half Round |  |  |
| 17.5 | Hand Tre   |  |  |
| 17.6 | Hand       |  |  |
| 17.7 | Knife      |  |  |
| 17.8 | Marking    |  |  |

#### 17.1 NeedleFile-Barrette-160mm

|  |               |
|--|---------------|
|  | Range (in mm) |
|--|---------------|



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|       |              |   |  |
|-------|--------------|---|--|
| 17.9  | Round        |    |    |
| 17.10 | Slitting     |    |    |
| 17.11 | Square       |    |    |
| 17.12 | Three Square |  |  |

| Sr .No. | Particulars         | From   | To     |
|---------|---------------------|--------|--------|
| 1       | Total Length ( L)   | 158    | 162    |
| 2       | Tang Diameter       | 3.2    | 3.25   |
| 3       | Width (W)           | 5.1    | 5.9    |
| 4       | Thickness (T)       | 2      | 2.4    |
| 5       | Length of cut       | 77.5   | 82.5   |
|         | a) 0 Cut            | 61     | 67     |
|         | b) 2 Cut            | 76     | 84     |
| 6       | Up-cut inclination  | 650    | NA     |
|         | a) 0 Cut            | 53     | 57     |
|         | b) 2 Cut            | 65     | 71     |
| 7       | Overcut Inclination | 550    | NA     |
| 8       | Hardness            | 60 HRC | 64 HRC |
| 9       | Grade               | 2nd    |        |

#### 17.2 Needle File - Crossing - 160 mm

|  |               |
|--|---------------|
|  | Range (in mm) |
|--|---------------|



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| S.N. | Particulars                   | From   | To     |
|------|-------------------------------|--------|--------|
| 1    | Total Length ( L)             | 158    | 162    |
| 2    | Tang Dia                      | 3.2    | 3.25   |
| 3    | Width (W)                     | 5.15   | 5.95   |
| 4    | Thickness (T)                 | 1.8    | 2.2    |
| 5    | Length of cut                 | 77.5   | 82.5   |
| 6    | No. of Up-cut / Inch Etching  |        |        |
|      | a) 0 Cut                      | 61     | 67     |
|      | b) 2 Cut                      | 76     | 84     |
| 7    | Up-cut inclination            | 600    | NA     |
| 8    | No. of Overcut / Inch Etching |        |        |
|      | a) 0 Cut                      | 53     | 57     |
|      | b) 2 Cut                      | 65     | 71     |
| 9    | Overcut Inclination           | 500    | NA     |
| 10   | Hardness                      | 60 HRC | 64 HRC |
| 11   | Rake Angle                    | NA     | NA     |
| 12   | Grade                         | 2nd    |        |

#### 17.3 NeedleFile-Flat-160mm

| S.N. | Particulars                | Range(inmm)     |      |
|------|----------------------------|-----------------|------|
|      |                            | From            | To   |
| 1    | TotalLength(L)             | 158             | 162  |
| 2    | Tang Dia                   | 3.2             | 3.25 |
| 3    | Width(W)                   | 5.5             | 6.3  |
| 4    | Thickness(T)               | 1.2             | 1.6  |
| 5    | Lengthofcut                | 77.5            | 82.5 |
| 6    | No.ofUpcut/InchChiselCut   |                 |      |
|      | a) 0Cut                    | 61              | 67   |
|      | b) 2Cut                    | 76              | 84   |
| 7    | Upcutinclination           | 65 <sup>U</sup> | NA   |
| 8    | No.ofOvercut/InchChiselCut |                 |      |
|      | a) 0Cut                    | 53              | 57   |
|      | b) 2Cut                    | 65              | 71   |



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|    |                            |                 |        |
|----|----------------------------|-----------------|--------|
| 9  | OvercutInclination         | 55 <sup>0</sup> | NA     |
| 10 | No.ofEdgecut/InchChiselCut |                 |        |
|    | a) 0Cut                    | 61              | 67     |
|    | b) 2Cut                    | 76              | 84     |
| 11 | EdgecutInclination         | 65 <sup>0</sup> | NA     |
| 12 | Hardness                   | 60 HRC          | 64 HRC |
| 13 | Grade                      | 2 <sup>nd</sup> |        |

#### 17.4 Needle File – Half Round-160mm

| S.N. | Particulars  | Range(inmm)           |                           |
|------|--|-----------------------|---------------------------|
|      |  | From                  | To                        |
| 1    | TotalLength(L)   | 158                   | 162                       |
| 2    | Tang Dia   | 3.2                   | 3.25                      |
| 3    | Width(W)   | 5.2                   | 6                         |
| 4    | Thickness(T)   | 1.6                   | 2                         |
| 5    | Lengthofcut  | 77.5                  | 82.5                      |
| 6    | No.ofUp-cut/InchFor FlatSideChiselCut(ForRoundSideEtching) |                       |                           |
|      | a) 0Cut  | 61                    | 67                        |
|      | b) 2Cut  | 76                    | 84                        |
| 7    | Up-cutinclination  |                       |                           |
|      | a) ChiselCut(FlatSide)                                     | 65 <sup>0</sup>       | NA                        |
|      | b) Etching(RoundSide)                                      | 60 <sup>0</sup>       | NA                        |
| 8    | No.ofOvercut/Inch  |                       |                           |
|      | a) 0Cut  | 53(FlatSideChiselCut) | 57(For RoundSideEtching)  |
|      | b) 2Cut  | 65(FlatSideChiselCut) | 71(For RoundSide Etching) |
| 9    | OvercutInclination   |                       |                           |
|      | a) ChiselCut(FlatSide)                                     | 55 <sup>0</sup>       | NA                        |
|      | b) Etching(RoundSide)                                      | 50 <sup>0</sup>       | NA                        |
| 10   | Hardness   | 60 HRC                | 64 HRC                    |
| 11   | Grade  | 2 <sup>nd</sup>       |                           |

#### 17.5 Needle File – Hand Tre-160mm

| S.N. | Particulars | Range(inmm) |    |
|------|-------------|-------------|----|
|      |             | From        | To |





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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

|    |   |                 |        |
|----|---|-----------------|--------|
| 1  | TotalLength(L)                                    | 158             | 162    |
| 2  | Tang Dia  | 3.2             | 3.25   |
| 3  | Width(W)  | 5.4             | 6.2    |
| 4  | Thickness(T)                                      | 1.3             | 1.7    |
| 5  | Lengthofcut                                       | 77.5            | 82.5   |
| 6  | No.ofUp-cut/InchChiselCut(Onlyedgecutting)        |                 |        |
|    | a) 0Cut   | 61              | 67     |
|    | b) 2Cut   | 76              | 84     |
| 7  | Up-cutinclination(Only edgecutting)               | 65 <sup>U</sup> | NA     |
| 8  | No.ofOvercut/InchOnedgeChiselcut(Onlyedgecutting) |                 |        |
|    | a) 0Cut   | 53              | 57     |
|    | b) 2Cut   | 65              | 71     |
| 9  | OvercutInclination(Onlyedgecutting)               | 55 <sup>U</sup> | NA     |
| 10 | Hardness  | 60 HRC          | 64 HRC |
| 11 | Grade   | 2 <sup>nd</sup> |        |

#### 17.6 Needle File–Hand-160mm

|    | Particulars                | Range(inmm)     |      |
|----|----------------------------|-----------------|------|
|    |                            | From            | To   |
| 1  | TotalLength(L)             | 158             | 162  |
| 2  | Tang Dia                   | 3.2             | 3.25 |
| 3  | Width(W)                   | 5               | 5.8  |
| 4  | Thickness(T)               | 1.4             | 1.8  |
| 5  | Lengthofcut                | 77.5            | 82.5 |
| 6  | No.ofUp-cut/InchChiselcut  |                 |      |
|    | a) 0Cut                    | 61              | 67   |
|    | b) 2Cut                    | 76              | 84   |
| 7  | Up-cutinclination          | 65 <sup>U</sup> | NA   |
| 8  | No.ofOvercut/InchChiselCut |                 |      |
|    | a) 0Cut                    | 53              | 57   |
|    | b) 2Cut                    | 65              | 71   |
| 9  | OvercutInclination         | 55 <sup>U</sup> | NA   |
| 10 | No.ofEdgecut/InchChiselcut |                 |      |
|    | a) 0Cut                    | 61              | 67   |



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|    |                    |                 |        |
|----|--------------------|-----------------|--------|
|    | b) 2Cut            | 76              | 84     |
| 11 | EdgecutInclination | 65 <sup>U</sup> | NA     |
| 12 | Hardness           | 60 HRC          | 64 HRC |
| 13 | Grade              | 2 <sup>nd</sup> |        |

#### 17.7 Needle File–Knife-160mm

| S.N. | Particulars                | Range(inmm)     |        |
|------|----------------------------|-----------------|--------|
|      |                            | From            | To     |
| 1    | TotalLength(L)             | 158             | 162    |
| 2    | Tang Dia                   | 3.2             | 3.25   |
| 3    | Width(W)                   | 5.45            | 6.35   |
| 4    | Thickness(T)               | 2               | 2.4    |
| 5    | Lengthofcut                | 77.5            | 82.5   |
| 6    | No.ofUp-cut/InchChiselCut  |                 |        |
|      | a) 0Cut                    | 61              | 67     |
|      | b) 2Cut                    | 76              | 84     |
| 7    | Up-cutinclination          | 65 <sup>U</sup> | NA     |
| 8    | No.ofOvercut/InchChiselCut |                 |        |
|      | a) 0Cut                    | 53              | 57     |
|      | b) 2Cut                    | 65              | 71     |
| 9    | OvercutInclination         | 55 <sup>U</sup> | NA     |
| 10   | No.ofEdgecut/InchChiselCut |                 |        |
|      | a) 0Cut                    | 61              | 67     |
|      | b) 2Cut                    | 76              | 84     |
| 11   | EdgecutInclination         | 65 <sup>U</sup> | NA     |
| 12   | Hardness                   | 60 HRC          | 64 HRC |
| 13   | Grade                      | 2 <sup>nd</sup> |        |

#### 17.8 Needle File–Marking-160mm

| S.N. | Particulars | Range(inmm) |    |
|------|-------------|-------------|----|
|      |             | From        | To |



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(NSQF LEVEL- 4)

Regional Office, Pune

|    |   |                 |        |
|----|---|-----------------|--------|
| 1  | TotalLength(L)  | 158             | 162    |
| 2  | Tang Dia  | 3.2             | 3.25   |
| 3  | Width(W)  | 5.4             | 6.2    |
| 4  | Thickness(T)  | 1.55            | 1.95   |
| 5  | Lengthofcut   | 77.5            | 82.5   |
| 6  | No.ofUp-cut/InchEtching(CuttingonRoundsideflatsidenocutting)  |                 |        |
|    | a) 0Cut   | 61              | 67     |
|    | b) 2Cut   | 76              | 84     |
| 7  | Up-cutinclination(CuttingonRoundsideflat                      | 0               | NA     |
| 8  | No.ofOvercut/InchEtching(CuttingonRoundsideflatsidenocutting) |                 |        |
|    | a) 0Cut   | 53              | 57     |
|    | b) 2Cut   | 65              | 71     |
| 9  | OvercutInclination(CuttingonRoundside flatsidenocutting)      | 0               | NA     |
| 10 | Hardness  | 60 HRC          | 64 HRC |
| 11 | Grade   | 2 <sup>nd</sup> |        |

#### 17.9 Needle File-Round-160mm

| S.N. | Particulars              | Range(inmm)     |        |
|------|--------------------------|-----------------|--------|
|      |                          | From            | To     |
| 1    | TotalLength(L)           | 158             | 162    |
| 2    | Tang Dia                 | 3.2             | 3.25   |
| 3    | BodyDia                  | 2.9             | 3.7    |
| 4    | Lengthofcut              | 77.5            | 82.5   |
| 5    | No.ofUp-cut/InchEtching  |                 |        |
|      | a) 0Cut                  | 61              | 67     |
|      | b) 2Cut                  | 76              | 84     |
| 6    | Up-cutinclination        | 60 <sup>U</sup> | NA     |
| 7    | No.ofOvercut/InchEtching |                 |        |
|      | a) 0Cut                  | 53              | 57     |
|      | b) 2Cut                  | 65              | 71     |
| 8    | OvercutInclination       | 50 <sup>U</sup> | NA     |
| 9    | Hardness                 | 60 HRC          | 64 HRC |
| 10   | Grade                    | 2 <sup>nd</sup> |        |

#### 17.10 Needle File-Slitting-160mm

| S.N. | Particulars | Range(inmm) |    |
|------|-------------|-------------|----|
|      |             | From        | To |



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Regional Office, Pune

|    |                           |                 |        |
|----|---------------------------|-----------------|--------|
| 1  | TotalLength(L)            | 158             | 162    |
| 2  | Tang Dia                  | 3.2             | 3.25   |
| 3  | Width(W)                  | 5.55            | 6.35   |
| 4  | Thickness(T)              | 2               | 2.4    |
| 5  | Lengthofcut               | 77.5            | 82.5   |
| 6  | No.ofUp-cut/InchChiselCut |                 |        |
|    | a) 0Cut                   | 61              | 67     |
|    | b) 2Cut                   | 76              | 84     |
| 7  | Up-cutinclination         | 65 <sup>U</sup> | NA     |
| 8  | No.ofOvercut/InchEtching  |                 |        |
|    | a) 0Cut                   | 53              | 57     |
|    | b) 2Cut                   | 65              | 71     |
| 9  | OvercutInclination        | 50 <sup>U</sup> | NA     |
| 10 | Hardness                  | 60 HRC          | 64 HRC |
| 11 | Grade                     | 2 <sup>nd</sup> |        |

#### 17.11 NeedleFile-Square-160mm

| S.N. | Particulars               | Range(inmm)     |        |
|------|---------------------------|-----------------|--------|
|      |                           | From            | To     |
| 1    | TotalLength(L)            | 158             | 162    |
| 2    | Tang Dia                  | 3.2             | 3.25   |
| 3    | Width(W)                  | 2.5             | 3.3    |
| 4    | Lengthofcut               | 77.5            | 82.5   |
| 5    | No.ofUp-cut/InchChiselCut |                 |        |
|      | a) 0Cut                   | 61              | 67     |
|      | b) 2Cut                   | 76              | 84     |
| 6    | Up-cutinclination         | 65 <sup>U</sup> | NA     |
| 7    | No.ofOvercut/InchEtching  |                 |        |
|      | a) 0Cut                   | 53              | 57     |
|      | b) 2Cut                   | 65              | 71     |
| 8    | OvercutInclination        | 50 <sup>U</sup> | NA     |
| 9    | Hardness                  | 60 HRC          | 64 HRC |
| 10   | Grade                     | 2 <sup>nd</sup> |        |

#### 17.12 NeedleFile-ThreeSquare-160mm



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| S.N. | Particulars               | Range(inmm)     |        |
|------|---------------------------|-----------------|--------|
|      |                           | From            | To     |
| 1    | TotalLength(L)            | 158             | 162    |
| 2    | Tang Dia                  | 3.2             | 3.25   |
| 3    | Width(W)                  | 3.5             | 4.3    |
| 4    | Lengthofcut               | 77.5            | 82.5   |
| 5    | No.ofUp-cut/InchChiselCut |                 |        |
|      | a) 0Cut                   | 61              | 67     |
|      | b) 2Cut                   | 76              | 84     |
| 6    | Up-cutinclination         | 60 <sup>o</sup> | NA     |
| 7    | No.ofOvercut/InchEtching  |                 |        |
|      | a) 0Cut                   | 53              | 57     |
|      | b) 2Cut                   | 65              | 71     |
| 8    | OvercutInclination        | 50 <sup>o</sup> | NA     |
| 9    | Hardness                  | 60 HRC          | 64 HRC |
| 10   | Grade                     | 2 <sup>nd</sup> |        |

#### 18. File card (spattle):-



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#### 18.1 Basic Indicative Diagram:-



- 18.2 File Brush: Used to clean debris and material build-up from metal files and rasp teeth
- 18.3 Steel File Card: Steel fills material
- 18.4 Steel File: The brush has wooden handle with hole for easy storage
- 18.5 Dimensions: 3 x 5 inches
- 18.6 Weight: 0.32 ounce
- 18.7 wire size die 1mm, 1cmX1cm total 20 no's
- 18.8 Material Type: Brass OR steel wire



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#### 19. Scraper flat 250mm:-

##### 19.1 Basic Indicative Diagram:-



19.2 TotalLength: 380mm  $\pm$ 2 mm

19.3 BladeLength: 250mm  $\pm$ 1 mm

19.4 BladeWidth: 25 mm  $\pm$ 1 mm



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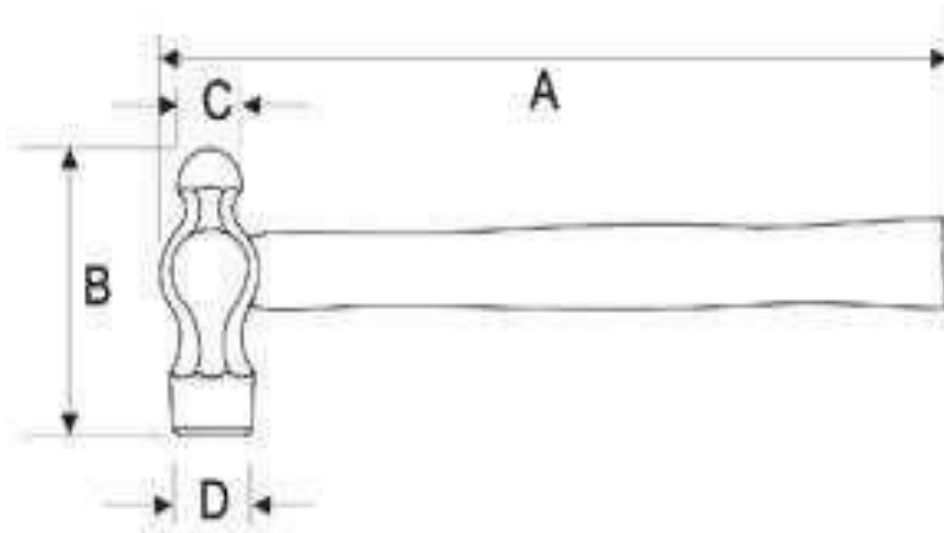
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 20. Hammer Ball Peen 0.5 kg with handle:-

##### 20.1 Basic Indicative Diagram:-



20.2 Generally conform to I.S. 841- 1983

20.3 Ball Peen Hammer

20.4 Length: 300 mm + 10%

20.5 Weight: 500 grams

20.6 Drop forged from high grade carbon Steel

20.7 Material: EN – 9

20.8 Partially hardened upto 46 - 56 HRC on striking surface

20.9 Depth of Hardness: 6 mm

20.10 Phosphate and painted

20.11 Handle

20.11.1 Material: Hickory Wood/ Red Wood/ Babul Wood/ Indestructible Handle

20.11.2 Handle fixed firmly to hammer head so that it does not come out after long use





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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 21. Hammer Cross Peen 0.75 kg with handle:-

##### 21.1 Basic Indicative Diagram:-



21.2 Generally conform to I.S.841- 1983

21.3 Cross peen

21.4 Weight: 750 grams

21.5 Drop forged from high grade carbon Steel

21.6 Partially hardened upto 46 - 56 HRC on striking surface

21.7 Depth of Hardness: 6.0 mm

21.8 Phosphate and painted

21.9 Handle

21.9.1 Material: Hickory Wood/ Red Wood/ Babul Wood / Indestructible Handle

21.9.2 Handle fixed firmly to hammer head so that it does not come out after long use



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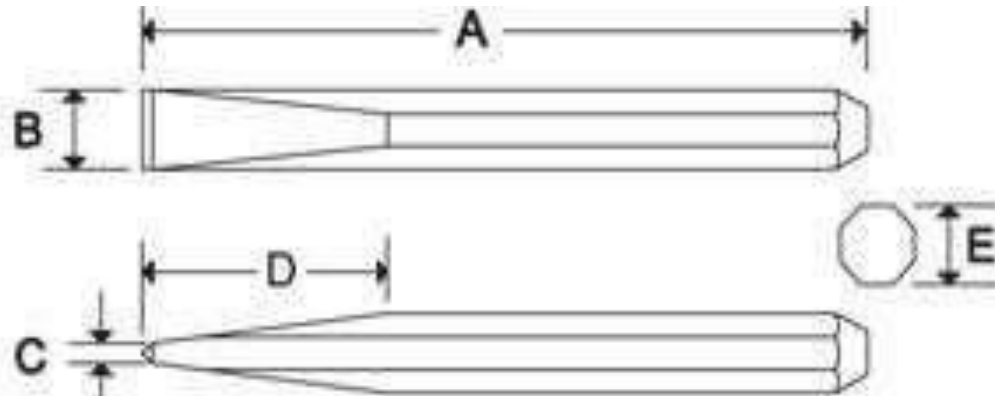
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

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#### 22. Chisel cold flat 18 x 150 mm:-

##### 22.1 Basic Indicative Diagram:-



22.2 Generally Conform to I.S 402 - 1990

22.3 Dimensions in mm: A: 150, B: 16, C: 3.25, D: 70

22.4 Drop forged from high-grade carbon Steel

22.5 Hardness

22.5.1 Cutting Portion: 55 - 57 HRC

22.5.2 Striking Portion: 35 - 45 HRC

22.6 Octagonal Body to facilitate comfortable holding while in use

22.7 Cutting edges should be ground accurately to the appropriate angle for metal cutting

22.8 Should be Phosphated & painted to provide anti-rusting properties



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### 23. Chisel Cross Cut 10 x 3 x 200 mm:-

#### 23.1 Basic Indicative Diagram:-



23.2 Size 10 X 3 X 200mm

23.3 Made from high carbon Steel 45#

23.4 Heat treated

23.5 Hardness

23.5.1 Cutting Portion: 55 - 57 HRC

23.5.2 Striking Portion: 35 - 45 HRC

23.6 Spraying Surface

23.7 Hardened and Tempered Edges to Cut Steel and Concrete easily



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#### 24. Chisel Half Round 10 X 250 mm:-

##### 24.1 Basic Indicative Diagram:-



24.2 Size:10 mmX250 mm

24.3 Made from high carbon Steel 45#

24.4 Heat treated

24.5 Hardness

24.5.1 Cutting Portion: 55 - 57 HRC

24.5.2 Striking Portion: 35 - 45 HRC

24.6 Spraying Surface

24.7 Hardened and Tempered Edges to Cut Steel and Concrete easily



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#### 25. Chisel diamond point 10 x 200 mm:-

##### 25.1 Basic Indicative Diagram:-



25.2 Size:10 mmX200 mm

25.3 Made from high carbon Steel 45#

25.4 Heat treated

25.5 Hardness

25.5.1.1 Cutting Portion: 55 - 57 HRC

25.5.1.2 Striking Portion: 35 - 45 HRC

25.6 Spraying Surface

25.7 Hardened and Tempered Edges to Cut Steel and Concrete easily



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#### 26. Scribing block 300 mm:-

##### 26.1 Basic Indicative Diagram:-



26.2 Base should be made from case hardened steel, ground on bottom and at one end.

26.3 Should have provision for Fine adjustment. This adjustment should be made by a knurled Thumbscrew

26.4 Height: 450 mm

26.5 Base length: 100 mm

26.6 Width: 85 mm

26.7 Scriber: 150 mm

26.8 Should be supplied in Wooden / Plastic Box with proper cushioning



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#### 27. Cast Iron Surface plate 300 x 300 mm:-

##### 27.1 Basic Indicative Diagram



27.2 Total Length: 300 mm  $\pm$  1 mm

27.3 Total Width: 300 mm  $\pm$  1 mm

27.4 Total Height: 700 mm  $\pm$  0.5 mm

27.5 Plate Thickness: 40 mm  $\pm$  0.2 mm

27.6 Surface Plate Material: Cast Iron

27.7 Surface Finish: Precision Lapped Finish.

27.8 Uniformity in Hardness, Low Porosity, Non Magnetic, Easy To Clean, Rust Proof, Non-Corrosive

27.9 Should be useful for measuring area flatness.

27.10 Suitable plywood cover should provided



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#### 28. Granite Surface plate 450 X 450 X 80 mm minimum

##### 28.1 Basic Indicative Diagram: -



- 28.2 TotalLength: 30 inch 430±2mm
- 28.3 TotalWidth: 36 inch 135±1Mm
- 28.4 Height: 05 inch 173±1mm
- 28.5 TotalWeight: 600Kg
- 28.6 Material: Seasoned Natural Granite
- 28.7 Natural Granite seasoned for thousands of years is free from deterioration or Dimensional change over time
- 28.8 Granite surface plate has many advantages over cast iron surface plates: Twice as hard as cast iron.
- 28.9 Minimal changes in dimension due to temperature changes.
- 28.10 Free from wringing, so there is no interruption of work. Free from burrs or protrusions Because of the fine grain structure and insignificant stickiness; this ensures a high Degree of flatness over a long service life and causes
- 28.11 No damage to other parts or instruments.
- 28.12 Trouble free operation for use with magnetic materials.





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### 29. Tap extractor 3 mm to 12 mm x 1.5 mm (ezzy out)

#### 29.1 Basic Indicative Diagram:-



29.1 It should extract broken taps when broken partway through threading without damaging the screw threads.

29.2 The claw uses a special steel wire with high torsion strength that is not easily broken, so it can be used to easily remove broken taps which have caught strongly.

29.3 Even if the claw is broken, it can be used repeatedly until it becomes too short. Also, it can be simply exchanged with a replacement jaw.

29.4 Dedicated for hand tapping.

29.5 Screw Extractor - Made of superior high speed steel, high hardness and anti-corrosion.

29.6 Stripped Screw - Each tap extractor is specifically engineered for speedy grab-it and easy out broken screw taps.

29.6 Stripped Screw Tap - Works for removing stripped, rusted, broken, or corroded screws and Bolts.

29.7 Steel Screw Extractor - Every tap extractor goes through rigorous quality testing, durable to use.

29.8 Tap Extractor - Suitable for industrial screw and bolt removal and for everyday home repair work.

29.9 10 pieces of Size 3mm to 12mm varying by 1mm

29.10 All above should be contained in a wooden/Plastic box



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### 30. Screw extractor sizes 1 to 8:-

#### 30.1 Basic Indicative Diagram:-



30.2 Five Pieces Set: Size 3 mm, 6 mm, 8 mm, 11 mm, 14 mm

30.3 Heat treated Cr - Mo Steel

30.4 All pieces should be kept in wooden/plastic box



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### 31. Hand Taps and dies Stock metric 5 mm to 12 mm complete set in a box:-

#### 31.1 Basic Indicative Diagram:-



31.2 Tap and Die Set - M3 to M18 Taps Set and Die Sets, Die Stock and Tap Wrench

31.3 Made of High Speed Steel

31.4 HRC 56 - 60

31.5 13 Hand Tap Set consisting of 3 Hand Taps viz. First, Second and Third of sizes Specified below

31.6 13 Round Dies of sizes specified below

31.7 Hand Tap and Round Dies Sizes:

|         |                   |
|---------|-------------------|
| 31.7.1  | 3.00 - 0.50 mm    |
| 31.7.2  | 4.00 - 0.70 mm    |
| 31.7.3  | 5.00 - 0.80 mm    |
| 31.7.4  | 6.00 - 1.00 mm    |
| 31.7.5  | 7.00 - 1.00 mm    |
| 31.7.6  | 8.00 - 1.00 mm    |
| 31.7.7  | 9.00 - 1.25 mm    |
| 31.7.8  | 10.00 - 1.50 mm   |
| 31.7.9  | 12.00 - 1.75 mm   |
| 31.7.10 | 14.00 - 2.00 mm   |
| 31.7.11 | 16.00 - 2.00 mm   |
| 31.7.12 | 18.00 - 2.50 mm   |
| 31.7.13 | 1/8 inch - 28 BSP |

31.8 T Handle Tap Wrench M2 - M6, M6 - M10

31.9 Adjustable bar Type Tap wrench M1 - M12, M4 - M20 (forged body)

31.10 Die Stock Holder for Round Dies 13/16 inch, 1 inch & 1.1/2 inch

31.11 Thread Pitch Gauge - 16 leaves 0.35mm - 3mm

31.12 60 Pieces Set

31.13 Provided with suitable Wooden/ Plastic/ Metal Box



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### 32. Bench Vice 100 mm jaw:-

#### 32.1 Basic Indicative Diagram:-



32.2 Total Length: 330 mm  $\pm$  2 mm

32.3 Height: 130 mm  $\pm$  2 mm

32.4 Jaw Width: 100 mm  $\pm$  2 mm

32.5 Jaw depth: 55 mm  $\pm$  2mm

32.6 Jaw opening: 130 mm + 2mm



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### 33. Machine reamer set up to 12 mm:-

#### 33.1 Basic Indicative Diagram:-



#### 33.2 Dimensions with tolerance

| S.N. | SIZE  | TOTAL LENGTH | FLUTE DIAMETER | FLUTE LENGTH | SHANK TAPER |
|------|-------|--------------|----------------|--------------|-------------|
| 1    | 6 mm  | 128 ± 2 mm   | 6 ± 0.05 mm    | 50 ± 3 mm    |             |
| 2    | 8 mm  | 140 ± 2 mm   | 8 ± 0.05 mm    | 60 ± 3 mm    | MT-1        |
| 3    | 10 mm | 146 ± 2 mm   | 10 ± 0.05 mm   | 65 ± 3 mm    |             |
| 4    | 12 mm | 155 ± 2 mm   | 12 ± 0.05 mm   | 75 ± 3 mm    |             |

33.3 Compliance: Confirming to IS 5445-1978

33.4 Cutting Portion Material:HSS-M2

33.5 Finish:Milled flute

33.6 Hardness:

33.6.1 Cutting Portion:62 – 65 HRC

33.6.2 Shank Portion: 30 – 40 HRC

33.7 Surface Treatment: Sand Blast or Steam Blue finish

33.8 Helix Angle: 7° Left Hand Helix / Right Hand Cut

33.9 Finished Hole Tolerance: H7

33.10 Holding: Taper Shank

33.11 Bevel Lead:45°

33.12 Applications: Intended to finish existing holes to H7 tolerance in most ferrous & non-ferrous metals

33.13 Suitable Wooden/Plastic/Metal Box for storage



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 34. Machine tap set upto M12mm (with std. pitch):-

##### 34.1 Basic Indicative Diagram:-



34.2 Tap and Die Set - M3 to M18 Taps Set and Die Sets, Die Stock and Tap Wrench

34.3 Made of High Speed Steel

34.4 HRC 56 - 60

34.5 13 Hand Tap Set consisting of 3 Hand Taps viz. First, Second and Third of sizes specified below

34.6 13 Round Dies of sizes specified below

34.7 Hand Tap and Round Dies Sizes:

34.7.1 3.00 - 0.50 mm

34.7.2 4.00 - 0.70 mm

34.7.3 5.00 - 0.80 mm

34.7.4 6.00 - 1.00 mm

34.7.5 7.00 - 1.00 mm

34.7.6 8.00 - 1.00 mm

34.7.7 9.00 - 1.25 mm

34.7.8 10.00 - 1.50 mm

34.7.9 12.00 - 1.75 mm

34.7.10 14.00 - 2.00 mm

34.7.11 16.00 - 2.00 mm

34.7.12 18.00 - 2.50 mm

34.7.13 1/8 inch - 28 BSP

34.8 T Handle Tap Wrench M2 - M6, M6 - M10

34.9 Adjustable bar Type Tap wrench M1 - M12, M4 - M20 (forged body)

34.10 Die Stock Holder for Round Dies 13/16 inch, 1 inch & 1.1/2 inch

34.11 Thread Pitch Gauge - 16 leaves 0.35mm - 3mm

34.12 60 Pieces Set

34.13 provided with suitable Wooden/ Plastic/ Metal Box



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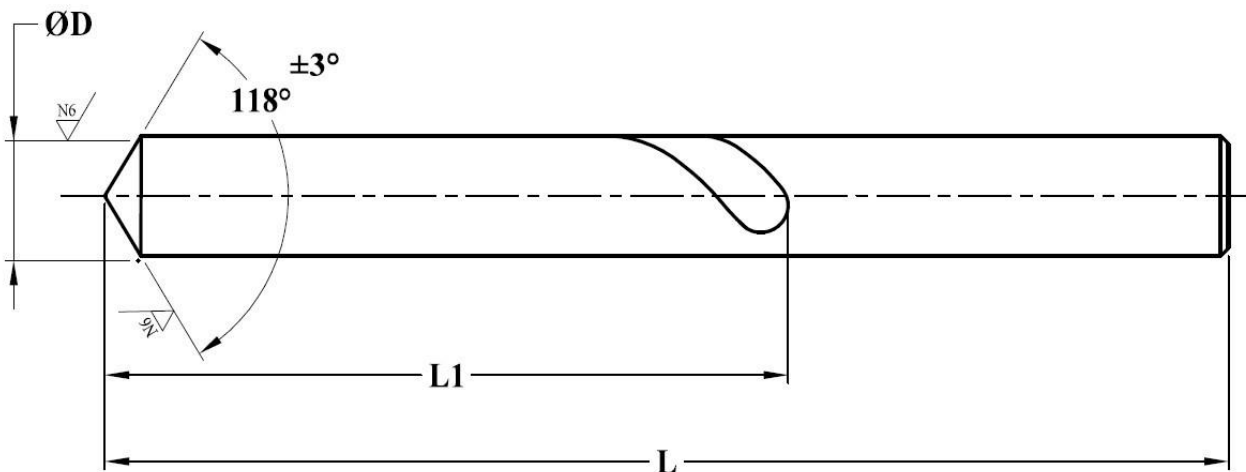
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 35. Twist Drill straight Shank $\varnothing$ 5 to $\varnothing$ 12 mm in steps of 0.5 mm:-

##### 35.1 Basic Indicative Diagram:-



- 35.2 Compliance: Confirming to IS:5101-1991
- 35.3 Drill Diameter ' $\varnothing$ D':  $\varnothing$ 1.0mm to  $\varnothing$ 13.0mm
- 35.4 Shank: Parallel
- 35.5 Material: HSS-M2
- 35.6 Finish: Milled/Ground
- 35.7 Hardness: 760HV to 900HV
- 35.8 Surface Treatment: Bright finish
- 35.9 Suitable Wooden/ Plastic/ Metal Box for storage



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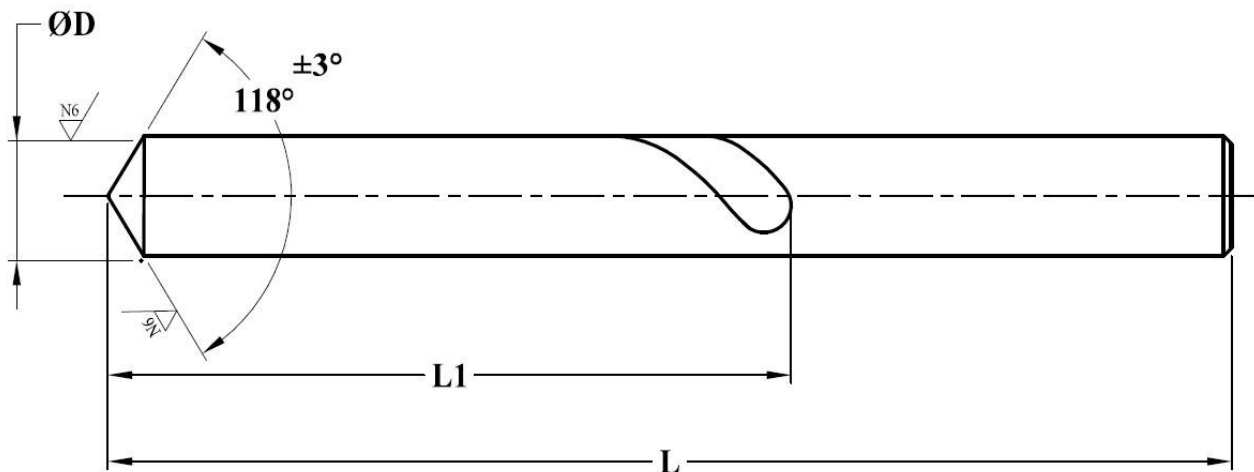
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

### 36. Twist Drill straight Shank $\varnothing$ 8 to $\varnothing$ 12 mm in steps of 2 mm:-

#### 36.1 Basic Indicative Diagram:-



36.2 Compliance: Confirming to IS:5101-1991

36.3 Drill Diameter 'ØD':  $\varnothing$ 8.0mm to  $\varnothing$ 12.0mm

36.4 Shank: Parallel

36.5 Material: HSS-M2

36.6 Finish: Milled/Ground

36.7 Hardness: 760HV to 900HV

36.8 Surface Treatment: Bright finish

36.9 Suitable Wooden/ Plastic/ Metal Box for storage





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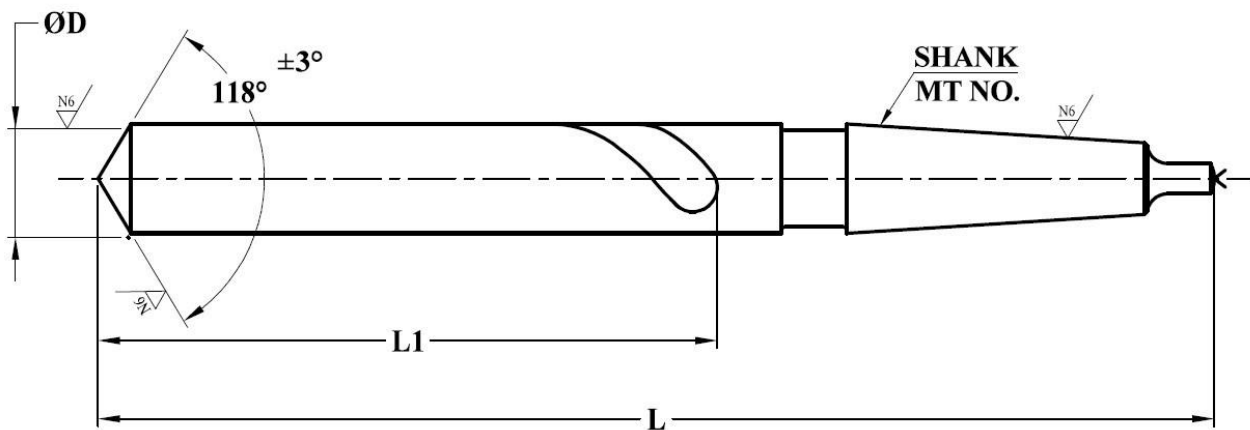
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

### 37. Taper shank drills Ø 6 mm to Ø 20 mm in steps of 1 mm:-

#### 37.1 Basic Indicative Diagram:-



|       |                             |   |
|-------|-----------------------------|---|
| 37.2  | Compliance:                 | Confirming to IS:5103-1969 (Reaffirmed 1997)    |
| 37.3  | Drill Diameter 'ØD':        | Ø6 mm to 20 mm h8 (+0.0/-0.027)                 |
| 37.4  | Overall Length 'L':         | 62.00 mm  |
| 37.5  | Flute Length 'L1':          | 108.00 mm                                       |
| 37.6  | Shank:                      | MT-1  |
| 37.7  | Cutting Portion Material:   | HSS-M2  |
| 37.8  | Finish:                     | Milled/Ground                                   |
| 37.9  | Hardness                    |   |
|       | 64.9.1 Cutting Portion:     | 760HV to 900HV                                  |
|       | 64.9.2 Shank Portion:       | 185HV Min.                                      |
| 37.10 | Surface Treatment:          | Flutes should be Steam Tempered for better wear |
|       | Resistance and performance. |   |



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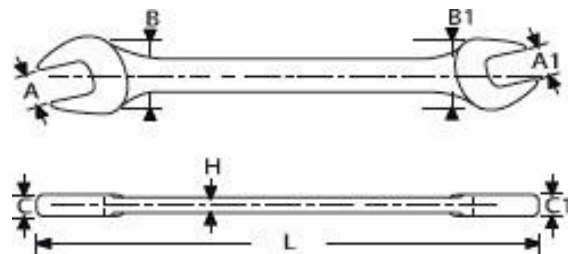
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#### 38.D.E spanners 3-4 , 6-8, 10-12, 13-14, 15-16, 18-19, 20-22, 24-26 (8-spanners):-

##### 38.1 Basic Indicative Diagram:-



38.2 Generally Conform to IS 2028- 1998

38.3 Sizes: 3X4, 6X8, 10X12, 13X14, 15X16, 18X19, 20X22, 24X26

38.4 Slightly Rounded handles- Sand Blasted

38.5 Non Damaging Grip on nut due to close wrench opening tolerances

38.6 I - section design of handle and heads to combine strength and low weight

38.7 Thoroughly corrosion protected with Nickel chrome finish

38.8 Deep forged from Chrome vanadium Steel (31CrV3)

38.9 Hardness: 42- 45 HRC

38.10 Head at each end are of different sizes and set at an angle of 15 degrees

38.11 Web should be provided in forging

38.12 Minimum Torque Values in Kg.m

38.12.1 Nominal Width A/F 6 - 0.6, 7-0.9, 8-1.3, 9 - 1.9, 10-2.5, 11 - 3.3, 12 - 4.2

38.12.2 Nominal Width A/F 13-5.3, 14 - 6.5, 15 - 7.8, 16 - 9.4, 17- 10.9, 18 -13.0

38.12.3 Nominal Width A/F 19-15.2, 20- 17.50, 21- 20.20, 22 - 22.9



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#### 39. Letter punch 5 mm set:-

##### 39.1 Basic Indicative Diagram:-



39.2 Manufactured from select quality carbon Steel

39.3 Individual Punches should be induction hardened for durability and extended life

39.4 Hardness at Stamping end: 58 – 62 HRC

39.5 Hardness at Striking end: 38–42 HRC. This prevents splintering of the punch

39.6 Chamfered striking end to prevent breakage and accidents due to flying splinters

39.7 Number Punch Set should contain 9 pieces – '0' to '9'. Numbers '6' & '9' can be

39.8 Interchangeable

39.9 Letter Punch Set should contain 27 pieces, alphabets 'A' through 'Z' and

Ampersand '&'



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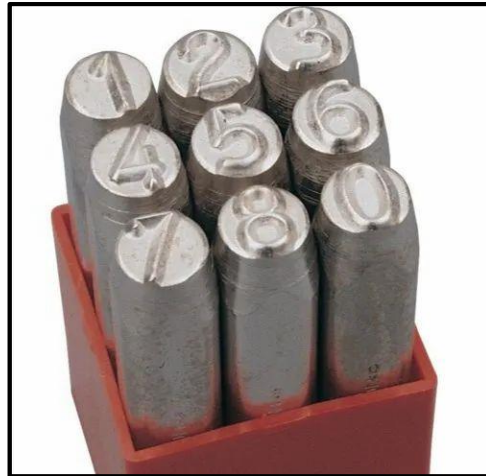
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#### 40. Number punch 5 mm set:-



Number punch sets suitable for automotive and industrial applications

Long shank for safety and stability

Number punch set contains 0 – 9 Numbers

Applicable for most metal surfaces, including wood and plastic

Compact sets supplied in plastic storage case

Manufactured from hardened chrome vanadium steel with special sand blasting finish

9 Piece set

Punch size: 5 mm (3/16")



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

#### 41. Parallel block Standard sets:-

##### 41.1 Basic Indicative Diagram:-



- |      |   |                     |
|------|---|---------------------|
| 41.2 | Material:   | Steel               |
| 41.3 | Hardness:   | HRC55-62            |
| 41.4 | Accuracy:   | $\pm 0.01\text{mm}$ |
| 41.5 | Length:   | 150mm               |
| 41.6 | Shouldbesupplied in Wooden /PlasticBoxwith propercushioning |                     |



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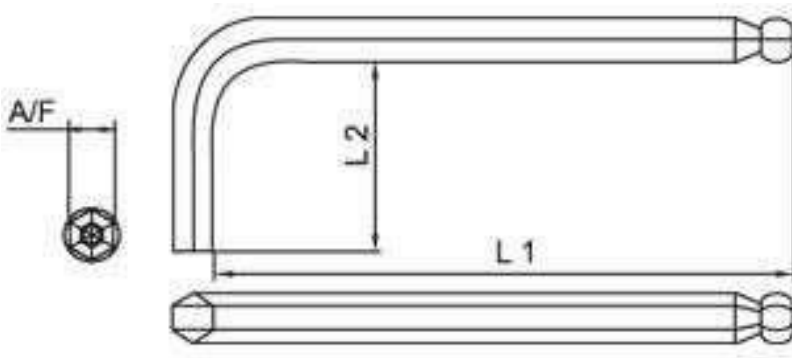
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 42. Allen key metric 3 to 12 mm set:-

##### 42.1 Basic Indicative Diagram:-



42.2 Generally conform to I.S 3082-1988 pipe 90.3 Sizes in mm: 3, 4, 5, 6, 8, and 9, 10, 11, 12

42.3 Made from high grade alloy Steel - Chrome Vanadium Molybdenum (S2) which Enables 30% higher torque as compared to Allen keys made from Cr- V Steel

42.4 Higher Hardness 57-62 HRC

42.5 Ball Head on one side to facilitate tightening & loosening of screws at 15 degree

42.6 Precision drawn and machined

42.7 Specially coated and Oiled for rust prevention



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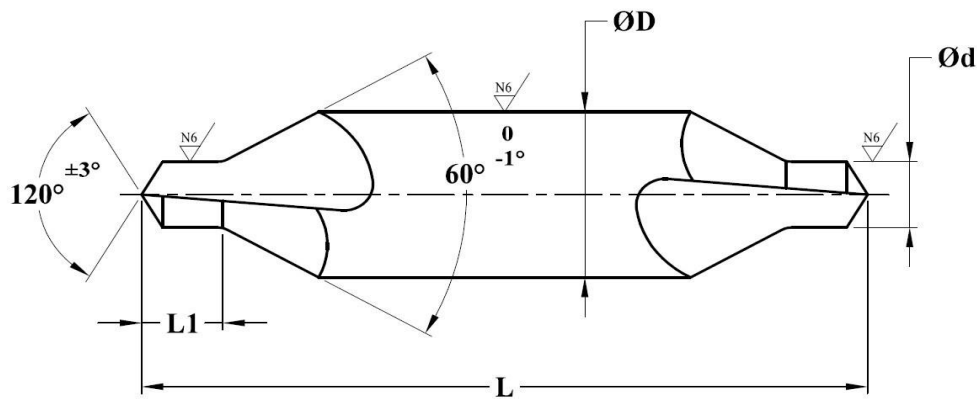
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 43. Centre drills 3, 4, 5 mm:-

##### 43.1 Basic Indicative Diagram:-



|       |                      |                                |
|-------|----------------------|--------------------------------|
| 43.2  | Compliance:          | Confirming to BS328:Part2:1950 |
| 43.3  | Body Diameter 'ØD':  | Ø5/16" (+0.0/-0.002")          |
| 43.4  | Pilot Diameter 'Ød': | Ø1/8" (±0.003")                |
| 43.5  | Overall Length 'L':  | 2.1/4"                         |
| 43.6  | Pilot Length 'L1':   | 3/16" to 5/32"                 |
| 43.7  | Material:            | HSS-M2                         |
| 43.8  | Finish:              | Milled/Ground                  |
| 43.9  | Hardness:            | 760HV to 900HV                 |
| 43.10 | Surface Treatment:   | Bright Finish                  |



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 44.Parallel hand reamer 6 mm to 12 mm in steps of 1 mm with handle:-

##### 44.1 Basic Indicative Diagram:-



##### 44.2 Dimension with tolerance

| S.N. | SIZE  | TOTAL LENGTH | FLUTE DIAMETER | FLUTE LENGTH |
|------|-------|--------------|----------------|--------------|
| 1    | 6 mm  | 97 ± 4mm     | 6 ± 0.05 mm    | 50 ± 4 mm    |
| 2    | 8 mm  | 115 ± 4mm    | 8 ± 0.05 mm    | 60 ± 4 mm    |
| 3    | 10 mm | 135 ± 4mm    | 10 ± 0.05 mm   | 65 ± 4 mm    |
| 4    | 12 mm | 150 ± 4mm    | 12 ± 0.05 mm   | 75 ± 4 mm    |
| 5    | 14 mm | 163 ± 4mm    | 14 ± 0.05 mm   | 80 ± 4 mm    |
| 6    | 16 mm | 176 ± 4mm    | 16 ± 0.05 mm   | 87 ± 4 mm    |

- 44.3 Compliance: Confirming to IS 5444-1978  
44.4 Material: HSSM2  
44.5 Helix Angle: 7° Left Hand Helix/Right Hand Cut  
44.6 Finished Hole Tolerance: H7  
44.7 Holding: Straight Shank with Square end  
44.8 Bevel Lead: 45°  
44.9 Applications: Intended to finish existing holes to H7 tolerance in  
44.10 Should be manufactured with Milled Flute  
44.11 Surface Treatment: Sand blast or Steam Blue finish  
44.12 Hardness: 35-40 HRC  
44.13 Suitable Wooden/ Plastic/ Metal Box for storage





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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 45. Star dresser:-

##### 45.1 Basic Indicative Diagram:-



45.2 Type: Star Dresser

45.3 Material: Aluminium alloy handle

45.4 Type: Star Dresser

45.5 Key Features:-

45.5.1 For truing, cleaning, sharpening and shaping grinding wheels. Each dresser should comprise of six individual wheels.

45.5.2 Extends the life of grinding wheels to keep them sharp and true.

45.6 Suitable for cleaning, sharpening and truing grinding wheel surfaces.

45.7 Suitable for use with any grinder.



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 46. Diamond dresser with holder:-

##### 46.1 Basic Indicative Diagram:-



46.2 Total Length: 150 mm  $\pm$  1 mm

46.3 Diameter:  $\varnothing$  12.5 mm  $\pm$  0.1 mm

46.4 Material: En8

46.5 Should be suitable for clamping on work piece or piece of material chucked in lathe.

46.6 Hardness: 20 to 25 HRC

46.7 Carat: 2 Carat



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#### 47. Surface gauge:-

##### 47.1 Basic Indicative Diagram:-



47.2 Base should be made from case hardened steel, ground on bottom and at one end.

47.3 Should have provision for Fine adjustment. This adjustment should be made by a knurled

Thumbscrew

47.4 Height: 450 mm

47.5 Base length: 100 mm

47.6 Width: 85 mm

47.7 Scriber: 150 mm

47.8 Should be supplied in Wooden / Plastic Box with proper cushioning



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 48. Angle plate-adjustable 250x250x300 mm:-

##### 48.1 Basic Indicative Diagram:-



##### 48.2 Dimensions

48.2.1 Length:  $250 \pm 4$  mm

48.2.2 Width:  $250 \pm 4$  mm

48.2.3 Height:  $300 \pm 4$  mm

48.3 Body should be made of ductile Cast Iron.

48.4 Tilting Angle: 0-90 degree

48.5 Smooth tilting movement

48.6 Should be provided with swivelling face with machined "T" slots.

48.7 Working face flatness: 12 microns per 300 mm

48.8 Base of angle should be adjustable and with cutting slot for fixing.

48.9 "T" Slot of plate: M12



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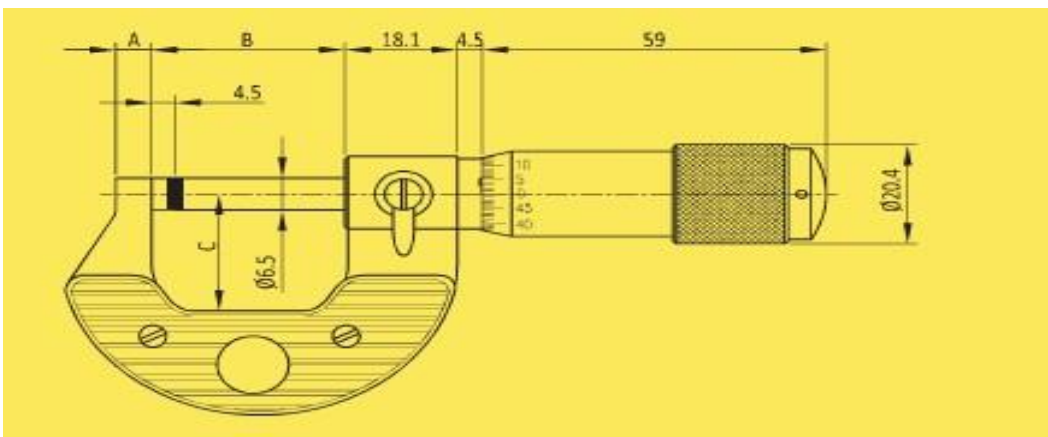
(NSQF LEVEL- 4)

Regional Office, Pune

#### 49. Micrometer –inside – outside depth range up to 75mm each:-`

##### 49A: Micrometer outside 50 to 75mm:-

##### 49.1 Basic indicative Diagram:-



49.2 Compliance: Generally Compliant to IS 2967 / 1938

49.3 Range: 50 mm -75 mm

49.4 Reading: 0.01 mm

49.5 Accuracy: 4  $\mu$ m

49.6 Spindle Material: Stainless Steel / Alloy Steel

49.7 Standard Accessories:

49.7.1 Suitable spanner

49.7.2 Distance Piece

49.7.3 Wooden/Plastic Box with proper cushioning

49.7.4 Operating Manual



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

49. Micrometer –inside – outside depth range up to 75mm each:-  
49B Micrometer inside 50 to 75mm:-



- 49.3 Range: 50 mm -75 mm  
49.4 Reading: 0.01 mm  
49.5 Accuracy: 7  $\mu$ m  
49.6 Spindle Material: High Grade Steel  
49.7 Standard Accessories:  
49.7.1 Suitable spanner  
49.7.2 Standard Ring  
49.7.3 Wooden/Plastic Box with proper cushioning  
49.7.4 Operating Manual



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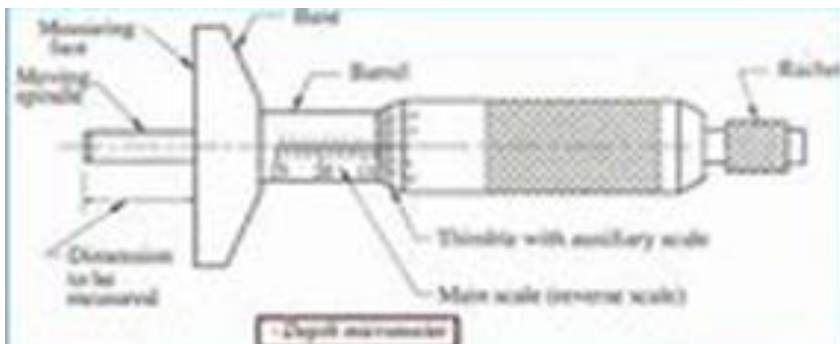
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 49. Micrometer –inside – outside depth range up to 75mm each:-`

##### 49.3 Micrometer depth range up to 75mm:-



Micrometer - Depth - 0 - 100 mm,

LC = 0.01 mm with standard set of extension rods

49.1 Basic Indicative Diagram:

49.2 Compliance: Generally Compliant to DIN 863

49.3 Range: 0 mm -100 mm

49.4 Reading: 0.01 mm

49.5 Accuracy: 10  $\mu$ m

49.6 Measuring Depth: 100 mm

49.7 Material: Stainless Steel / Alloy Steel

49.8 Standard Accessories:

49.8.1 Suitable spanner

49.8.2 Interchangeable rods

49.8.3 Wooden / Plastic Box with proper cushioning

49.8.4 Operating Manual



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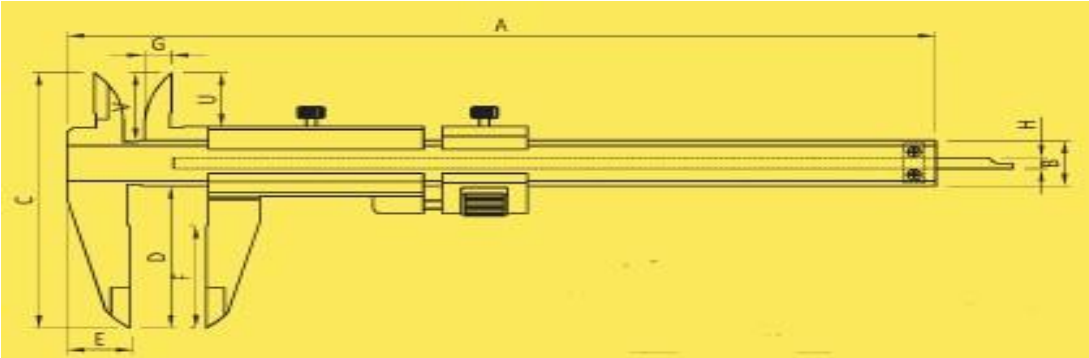
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Regional Office, Pune

#### 50. Vernier calliper with 0.02mm least Count 150mm and 200 mm each:-

##### 50.1 Basic indicative Diagram:-



50.2 Compliance: Generally Compliant to DIN 862

50.3 Range: 0 mm – 150 & 200 mm

50.4 Overall Length: 280 mm

50.5 Lower jaw length: Min. 50 mm

50.6 Upper jaw length: Min. 24 mm

50.7 Graduation: 0.02 mm

50.8 Accuracy:  $\pm 0.05$  mm

50.9 Material: Stainless Steel / Alloy Steel

50.10 Standard Accessories:

50.10.1 Operating Manual

50.10.2 Wooden/Plastic box with proper cushioning





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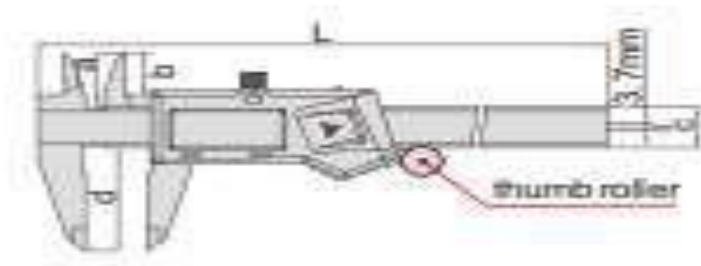
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 51. Vernier calliper with 0.02mm least Count 150mm and 200 mm each:-

##### 51.1 Basic indicative Diagram:-



51.2 Compliance: Should generally comply with DIN 862

51.3 Material: Stainless steel

51.4 Length: 285 mm (+ 5%)

51.5 Resolution: 0.01 mm

51.6 Range: 0 - 200 mm

51.7 Accuracy: 0.03 mm

51.8 Should be supplied with a thumb roller

51.9 Buttons: On or Off, Zero, mm or inch

51.10 Automatic Power Off

51.11 Can turn on Power by moving the digital unit

51.12 High moving speed should be allowed

51.13 Should have the facility of USB data output

51.14 Standard Accessories:

51.14.1 Operating Manual

51.14.2 Wooden / Plastic Box with proper cushioning



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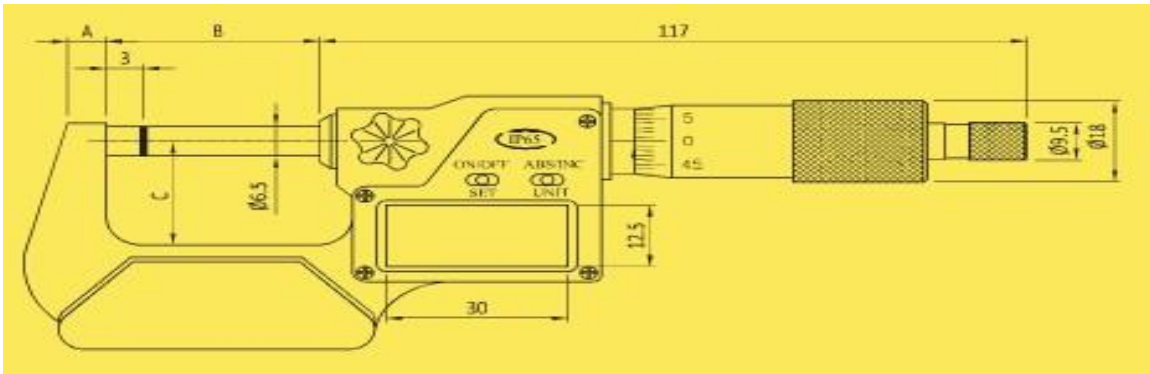
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

## 52. Digital Micrometer (inside, outside):-

### 52.1 Basic indicative Diagram:-



52.2 Compliance: Generally Compliant to DIN 863

52.3 Range: 0 mm -25 mm

52.4 Reading: 0.001 mm

52.5 Accuracy: 4  $\mu$ m

52.6 Protection level against dust and water: IP 65

52.7 Material: Stainless Steel / Alloy Steel

52.8 Standard Accessories

52.8.1 Suitable spanner

52.8.2 Should be supplied in Wooden / Plastic Box with proper cushioning



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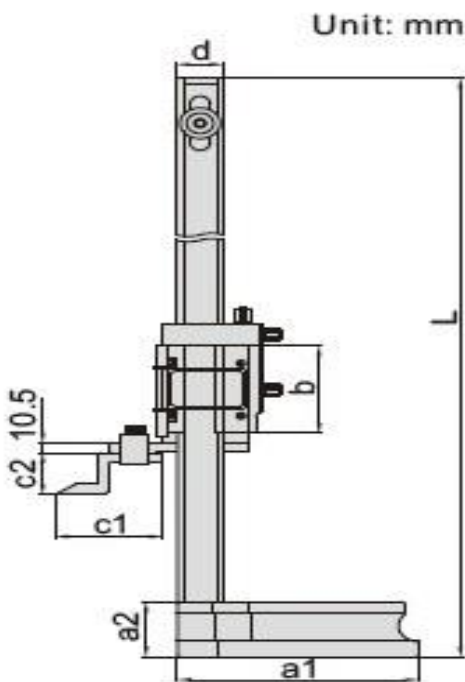
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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### 53.Height Gauge 300mm with 0.02 mm least count:-

#### 53.1 Basic indicative Diagram:-



- |      |                          |   |
|------|--------------------------|---|
| 53.2 | Range:                   | 0mm - 300 mm  |
| 53.3 | OverallLength:           | 545mm(Approx.)  |
| 53.4 | OverallWidth (Base)inmm: | 135mm(Approx.)  |
| 53.5 | NetWeight- Kg:           | 3.1Kg (Approx.)   |
| 53.6 | Accuracy:                | $\pm 0.04$ mm   |
| 53.7 | Material:                | StainlessSteel/AlloySteel   |
| 53.8 | StandardAccessories      |   |
|      | 53.8.1                   | FineAdjustingUnit.  |
|      | 53.8.2                   | Carbide Tip Scriber point with clamping unit  |
|      | 53.8.3                   | Operating Manual  |
|      | 53.8.4                   | Magnifying Glass  |
|      | 53.8.5                   | Wooden / Plastic Box with proper cushioning and corrugated box with proper cushioning for magnetic stand. |



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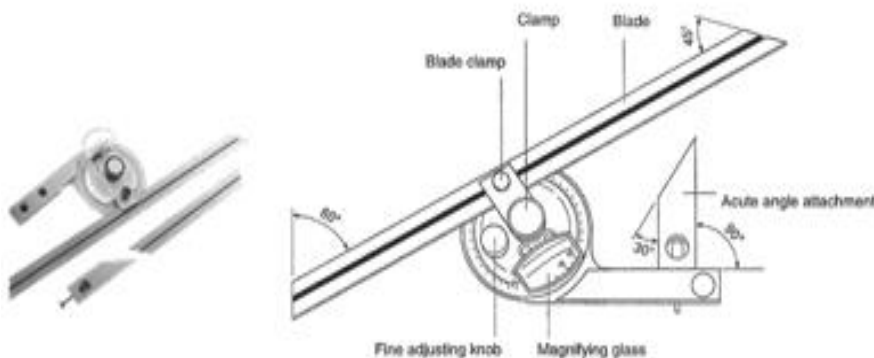
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 54. Vernier bevel protractor 150 mm blade:-

##### 54.1 Basic indicative Diagram:-



54.2 Should consist of Centre head, Protractor head, Square head, Blade

54.2 Centre head:

54.2.1 Should be able to locate centre of cylinder of diameter 30 to 100 mm

54.2.2 Accuracy: + 0.15 mm

54.3 Protractor head:

54.3.1 Should be able to set the blade at desired angle to an edge of work piece

54.3.2 Should be able to measure angles

54.3.3 Range: 0 to 180 Degree

54.3.4 Accuracy: 7 min

54.4 Square head:

54.4.1 Should be able to set the blade at 90 or 45 Degree to an edge of an work piece

54.4.2 Accuracy: + 8 min for 90 Degree

54.4.3 Accuracy: + 10 min for 45 Degree

54.5 Blade:

54.5.1 Range: 300 mm

54.5.2 Graduation: 0.5 mm and 1 /32 inch on front face

54.5.3 1 mm and 1 /64 inch on back face

54.6 Should be supplied in Wooden / Plastic Box with proper cushioning



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#### 55. Sine bar and Sine Centre each:-

##### 55.1 Sine bar: Basic indicative Diagram:-



55.2 Total length: 245 mm  $\pm$  2 mm

55.3 Total width: 60 mm  $\pm$  2 mm

55.4 Distance between Rollers: 200 mm  $\pm$  1.0 mm

55.5 Hardness: 55 to 60 HRC

55.6 Material Quality Tool Steel, Hardened & Ground of extreme



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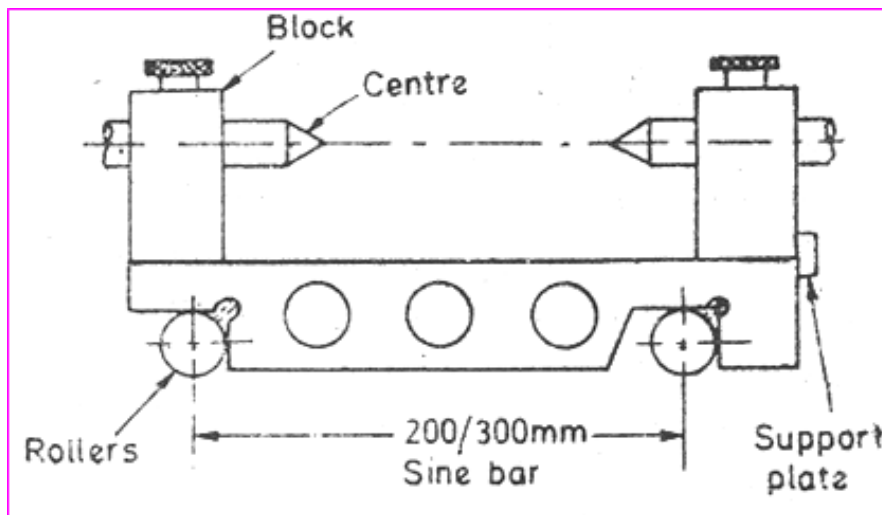
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SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

### 55. Sine Centre: -Basic indicative Diagram:-



#### Specifications

|                   |                 |
|-------------------|-----------------|
| Roller Distance:  | 200 mm          |
| Centre Height:    | 65 mm           |
| Sinebar accuracy: | +/-5 seconds    |
| Material:         | Stainless Steel |



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#### 56. Sprit level:-

##### 56.1 Basic indicative Diagram:-



56.2 Size: 300 mm

56.3 Accuracy: 0.50 mm/ meter

56.4 Precision milled base for high accuracy

56.5 Have a solid spirit bulb which doesn't break easily.

56.6 The Aluminium frame should be strong and precision extruded which increases Accuracy and strength of the Spirit levels.

56.7 Two spirit bulbs to be provided so that it can be used horizontally & vertically

56.8 Rubber moulding is provided on the sides of the spirit levels to prevent damage to the body

Of the spirit levels.

56.9 Magnet should be provided at the base



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

#### 57. Slip gauge set (STD):-

##### 57.1 Basic indicative Diagram:-



- 57.2 Made of high-quality alloy steel
- 57.3 Ultra-micro-lapped surface finish heat treated and aged to give good wear resistance.
- 57.4 Should have inter-set wringing properties.
- 57.5 Each gauge should be marked with an identification number
- 57.6 Blocks should be heat treated to HRC65 / HV820
- 57.7 All edges should be Chamfered edges
- 57.8 Each set should be supplied with a UKAS 5 point Calibration Certificate (or equivalent)
- 57.9 Should be supplied in Wooden / Plastic Box with proper cushioning
- 57.10 Grade – 2





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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

#### 58. Magnetic stand with magnetic base 60 x 47.5 mm and with universal swivel clamp, dial holding rod (150 mm) scriber

##### 58.1 Basic indicative Diagram:-



58.2 Applicable for Used as holding device for dial indicator

58.3 Magnetic Force (kgf) 40 kgf

58.4 Type of Product Magnetic Stand

58.5 Material Steel

58.5.1 Magnetic force for stand: 600 N (Approx.)

58.5.2 Stand (LxWxH): 60 X 50 X 55 mm (Approx.)

58.5.3 Stand Weight: 1.5 Kg (Approx.)

##### 58.6 Standard Accessories:-

58.6.1 Spanner

58.6.2 Wooden / Plastic Box with proper cushioning for Plunger Type Dial Gauge and Corrugated Box with proper Cushioning for Magnetic Stand

58.6.3 3mm Diameter T.C. ball Anvil fitted to the gauge.

58.6.4 Operating Manual



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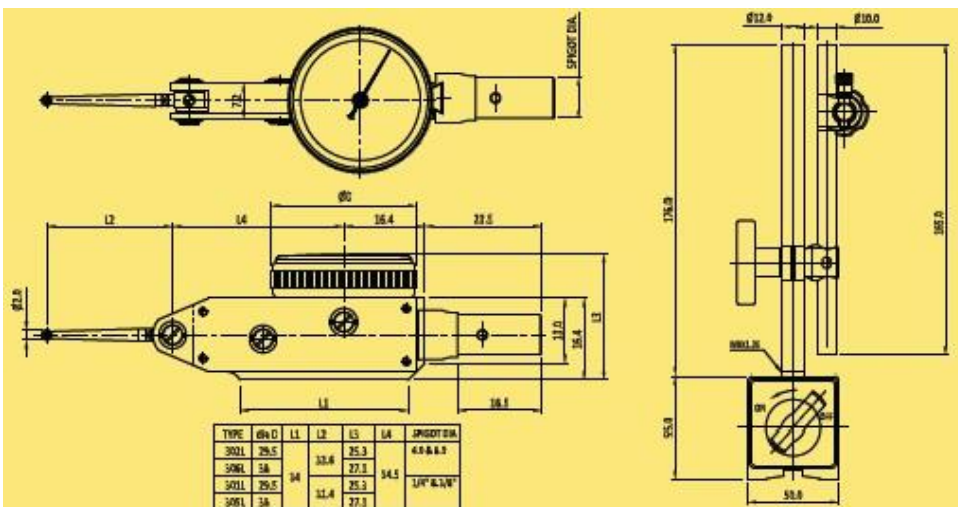
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

#### 59. Dial test indicator Lever type- Range 0-0.8 mm – Graduation 0.01mm, reading 0-50-0 with accessories:-

##### 59.1 Basic indicative Diagram:-



##### 59.2 Compliance

59.2.1 Dial: Generally Conforming to IS 11498 / 1985

59.3 Reading: 0.01mm

59.4 Range: 0.8 mm

59.5 Graduation: 0-40-0

59.6 System of Measurement: Metric

59.7 Accuracy: 15 µm

59.8 Anvil Length: 33.6 mm

59.9 Magnetic force for stand: 600 N (Approx.)

59.10 Stand (L X W X H): 58 X 60 X 50 55 X 50 X 55mm

59.11 Stand weight: 1.5 Kg (Approx.)

59.12 Standard Accessories:

59.12.1 Spanner

59.12.2 Plastic Box with proper cushioning for Lever Type Dial Gauge and Corrugated Box with proper Cushioning for Magnetic Stand

59.12.3 2mm Diameter T.C. ball stylus fitted to the gauge

59.12.4 8mm dovetail spigot assembly fitted to the gauge



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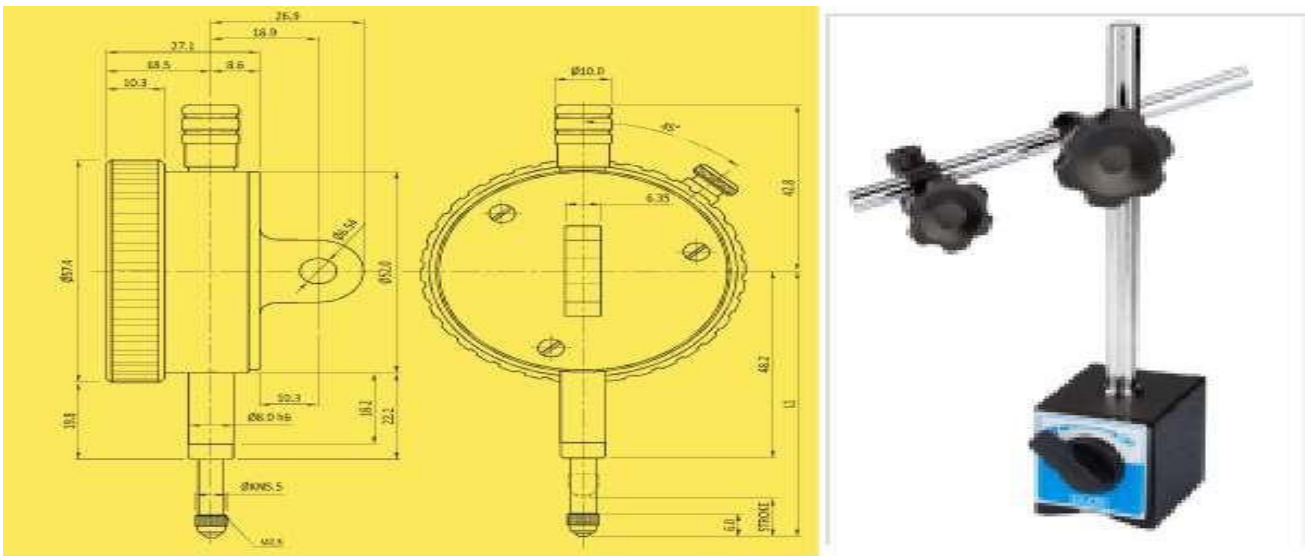
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

### 60. Dial test indicator Plunger type-Range 0-10 mm, Graduation 0.01 mm, Reading 0-100:-

#### 60.1 Basic indicative Diagram:-



#### 60.2 Compliance

60.2.1 Dial: Generally Compliant to IS 2092 / 1983

60.3 Reading: 0.01 mm

60.4 Range: 0-10 mm

60.5 Graduation: 0-100

60.6 System of Measurement: Metric

60.7 Accuracy: 20  $\mu$ m

60.8 Magnetic force for stand: 600 N (Approx.)

60.9 Stand (LxWxH): 60 X 50 X 55 mm (Approx.)

60.10 Stand Weight: 1.5 Kg (Approx.)

60.11 Standard Accessories:

60.11.1 Spanner



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

#### 61. Bore gauge dial indicator (1 mm range, 0-0.01, mm graduation)-Range of bore gauge 18-70 mm:-

##### 61.1 Basic indicative Diagram:-



##### 61.2 Compliance

61.2.1 Dial: Generally Conforming to JISB 7503 / 1997

61.2.2 Stem: Generally Conforming to IS JISB 7515 / 1982

61.3 Range: 18 mm - 50 mm

61.4 Reading: 0.01 mm

61.5 Graduation: 0 - 50 - 0

61.6 Measuring Depth: 150 mm

61.7 Material: Stainless Steel / Alloy Steel

61.8 Standard Accessories:

61.8.1 Suitable spanner set

61.8.2 Washers 0.3mm, 0.5mm, 1mm and extension Rods

61.8.3 Wooden / Plastic Box with proper cushioning

61.8.4 Operating Manual



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#### 62. Straight edge-Single bevelled Size 150 mm and 250 mm each:-

##### 62.1 Basic indicative Diagram:-



- 62.2 Length: 150 and 250 mm  $\pm$  1 mm
- 62.3 Width: 25 mm  $\pm$  1 mm
- 62.4 Thickness: 8 mm  $\pm$  0.1 mm
- 62.5 Angle: 30 Degree
- 62.6 Hardness: 35 HRC
- 62.7 Material: Steel
- 62.8 Finishing: Precision Ground Tool Steel



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 63. Tool maker's clamp 50 mm and 75 mm each:-

##### 63.1 Basic indicative Diagram:-



63.2 Total Length: 153 mm  $\pm$  2 mm

63.3 Jaw Width:

90.3.1 50 mm  $\pm$  2mm for 50mm clamp

90.3.2 75 mm  $\pm$  2mm for 70mm clamp

63.4 Total Height: 80 mm  $\pm$  2mm

63.5 Body material: Ductile Cast Iron

63.6 Spring should easily go up & down

63.7 Should be used during grinding, hammering etc.



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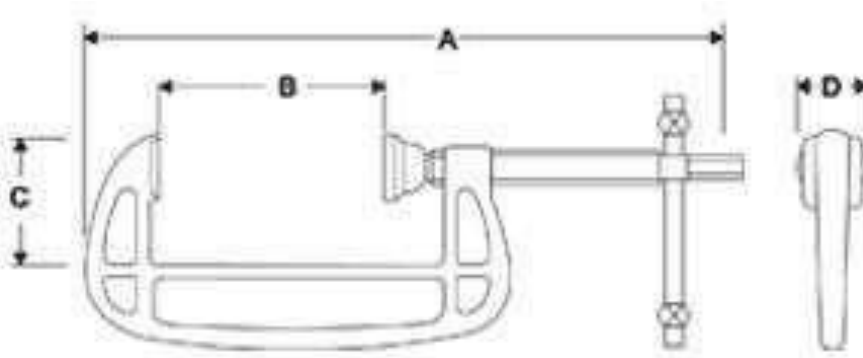
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 64.C clamp- 50 mm and 75 mm:-

##### 64.1 Basic indicative Diagram:-



64.2 Generally conform to I.S 9181 - 1988

64.3 Capacity (B):

64.3.1 50 mm for 50mm clamp

64.3.2 75 mm for 70mm clamp

64.4 Throat Depth (C):

64.4.1 49 mm for 50mm clamp

64.4.2 70 mm or 75mm clamp

64.5 Body hot drop forged from high grade Steel

64.6 All parts fully heat treated and black phosphate for long free trouble service

64.7 Hardness: 27 - 38 HRC

64.8 I - section frame for strength and toughness

64.9 Swivel Head on ball end of operating screw to ensure good grip on angle work pieces

64.10 Acme thread on screw to provide higher, quicker, easier movement for clamping/  
Unclamping

64.11 Hex Head on screw to facilitate use of spanners for tightening as and when required

64.12 Serrations provided on PAD & C - clamp body for better gripping

64.13 Tension Load Test (Min): 1835 Kg



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 65. Bearing Puller 10 mm to 100 mm:-

##### 65.1 Basic indicative Diagram:-



65.2 Should generally conform to I.S 9193 - 1988

65.3 No of Jaws: 3

65.4 Minimum Spread: 10 mm

65.5 Maximum Spread: 100 mm

65.6 Drop forged jaws made of carbon Steel

65.7 Hardness: 35 - 45 HRC

65.8 Reversible Jaw design to enable inside and outside operation

65.9 Jaw Design should allow flexibility of use in shallow or deep spaces

65.10 Screw threads should be precision maintained

65.11 The Pulling force should be equally distributed evenly on the bearing or gear to Facilitate smooth and fast operation without any damage to bearing or gear

65.12 Protective cap on screw end to increase life of screw tip. The centre screw is provided with a

Special adjustable cap for better gripping.

65.13 Screws should be black anodized

65.14 Jaws, link plates, protective cap and connecting bolts should be plated





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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

#### 66. Ammeter 0 - 500mA:-

##### 66.1 Basic indicative Diagram:-



- 66.2 Range: 0 - 500 mA
- 66.3 Type: Moving Iron AC - Analog
- 66.4 Input: 500 mA Accuracy: Class 1.5
- 66.5 Should be moving iron, panel meters
- 66.6 Should be housed in moulded polycarbonate cases
- 66.7 Should be suitable for the measurement of AC currents and voltages in the usual frequency  
Range of 15...100Hz.
- 66.8 Front window glass and bezel should be easily replaceable. Should have nearly linear scale
- 66.9 Scale should have interchangeability
- 66.10 Should be easy installation with swivel screws
- 66.11 Should have glass filled polycarbonate housing (UL 94-V-0) Knife edge pointer.
- 66.12 Should have self-lifting terminal clamp assembly. Should have IP 52 protection
- 66.13 Movement
- 66.13.1 Moving Iron movement should have pivots of very high hardness
- 66.13.2 Movement should have suspended between springs loaded Sapphire Jewels
- 66.13.3 Movement should have properly shielded & critically damped by eddy currents  
Induced in coil former
- 66.14 Reference Standards
- 66.14.1 Performance Standard: IEC 60051 & IS 1248
- 66.14.2 Safety standard: IEC 61010
- 66.14.3 Nominal case and cut-out dimensions: IS 2419 & DIN 43700
- 66.14.4 Scale and Pointer: DIN 43802
- 66.14.5 Connection and Terminal markings: DIN 43807
- 66.14.6 Terminal bolts / leads: DIN 46200 / 46282
- 66.14.7 Safety requirements and protective measures: IS 9249 - 1979
- 66.14.8 Front frames dimensions: DIN 43718
- 66.14.9 Environmental conditions specifications: IS 9000 part 5, 7, 8
- 66.15 Certifications
- 66.15.1 ERDA Type tested
- 66.15.2 CE Certified
- 66.15.3 UL Approved
- 66.15.4 Rosh complied



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

#### 67. Ammeter 0 – 1 Amp DC:-

##### 67.1 Basic indicative Diagram:-



- 67.2 Range: Moving Coil, 0 - 1 a, Analog
- 67.3 Type: Moving Coil DC,
- 67.4 Analog Input: 1 A
- 67.5 Accuracy: Class 1.5
- 67.6 Should have linear scale
- 67.7 Should be easily replaceable glass and bezel
- 67.8 Scale should have interchangeability
- 67.9 Should be easy installation with swivel screws
- 67.10 Should have Glass filled polycarbonate housing (UL 94-V-0) Knife edge pointer
- 67.11 Self lifting terminal clamp assembly.IP 52 protection
- 67.12 Wide measurement band: 10 to 100% of FSD
- 67.13 Movement:
  - 67.13.1 Moving coil movement should have pivots of very high hardness
  - 67.13.2 Movement should have suspended between springs loaded Sapphire Jewels
  - 67.13.3 Movement should have properly shielded & critically damped by eddy currents Induced in coil former
- 67.14 Reference standards:
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  - 67.14.9 Environmental conditions specifications: IS 9000 part 5, 7, 8
- 67.15 Certifications:
  - 67.15.1 ERDA Type tested
  - 67.15.2 CE Certified
  - 67.15.3 UL Approved
  - 67.15.4 Rosh complied



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 68. Voltmeter 0 – 300/600V AC:-

##### 68.1 Basic indicative Diagram:-



68.2 Range: 0 - 300 - 600 V

68.3 Type: Moving Iron AC - Analog

68.4 Input: 600 V

68.5 Accuracy: Class 1.5

68.6 Should be moving iron, panel meters. Should be housed in moulded polycarbonate cases

68.7 Should be suitable for the measurement of AC currents and voltages in the usual frequency

Range of 15...100Hz.

68.8 Front window glass and bezel should be easily replaceable.

68.9 Should have nearly linear scale

68.10 Scale should have interchangeability. Should be easy installation with swivel screws

68.11 Should have glass filled polycarbonate housing (UL 94-V-0) Knife edge pointer.

Should have

Self-lifting terminal clamp assembly

68.12 Should have IP 52 protection

68.13 Movement

68.13.1 Moving Iron movement should have pivots of very high hardness.

68.13.2 Movement should be suspended between springs loaded Sapphire Jewels.

68.13.3 Movement should have properly shielded & critically damped by eddy currents Induced in coil former.

68.14 Reference Standards:

68.14.1 Performance Standard:

IEC 60051 & IS 1248

68.14.2 Safety standard:

IEC 61010

68.14.3 Nominal case and cut-out dimensions:

IS 2419 & DIN 43700

68.14.4 Scale and Pointer:

DIN 43802

68.14.5 Connection and Terminal markings:

DIN 43807

68.14.6 Terminal bolts / leads:

DIN 46200 / 46282

68.14.7 Safety requirements and protective measures:

IS 9249 - 1979

68.14.8 Front frames dimensions:

DIN 43718

68.14.9 Environmental conditions specifications:

IS 9000 part 5, 7, 8

68.15 Certifications:

68.15.1 ERDA Type tested

68.15.2 CE Certified

68.15.3 UL Approved

68.15.4 Rosh complied



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 69. PF Meter:-

##### 69.1 Basic indicative Diagram:-



69.2 Should have On Site Programmable PT/CT Ratios

69.3 Should work on 230 V AC Supply

69.4 Should have User Selectable Power Parameter (Active / Reactive /Apparent

69.5 True RMS Measurement: The instrument should measure distorted waveform up to 15th harmonic.

69.6 LED Display

69.6.1 High Brightness

69.6.2 Single line four digit

69.6.3 Digit heights 20 mm

69.7 Enclosure Protection for Dust and Water: Should Conform to IP 54 (front face) as per IEC60529. Should be Compliant to International Safety standard IEC 61010-1 - 2001

69.8 EMC Compatibility: Should be Compliant to International standard IEC 61326

69.9 The instrument should have very low back depth (behind the panel) of less than 80 mm.

69.10 Input Voltage

69.10.1 Nominal Input Voltage (AC RMS): Phase-Neutral 57.7 - 277V L-N (Line-Line 100 - 480V L-L)

69.10.2 Max Continuous Input Voltage: 120% of rated value

69.11 Input Current

69.11.1 Nominal Input Current: 5A AC RMS

69.11.2 External CT (20/5) to be connected to meter to step down current to 5A

69.12 Operating Range

69.12.1 Voltage: 5%....120% rated Value

69.12.2 Current: 5%....120% rated Value

69.12.3 Frequency: 45.....70Hz

69.12.4 P.F: 0.5 Lag...1...0.5 lead for kW, car DPM / 0.1 Lag...1...0.1 lead for PF DPM

69.13 Accuracy-Power Factor:  $\pm 2^\circ$  (0.1 Lag...1...0.1 Lead)

69.14 Environmental:

69.14.1 Operating Temperature:-10 to + 55°C

69.14.2 Storage temperature: -20 to + 65°C

69.14.3 Relative humidity: 0...90% non-condensing

69.14.4 Warm up time: Minimum 3 minute

69.14.5 Shock: 15g in 3 planes

69.14.6 Vibration: 10...55 Hz, 0.15mm amplitude

69.14.7 Enclosure: IP54 (front face only)



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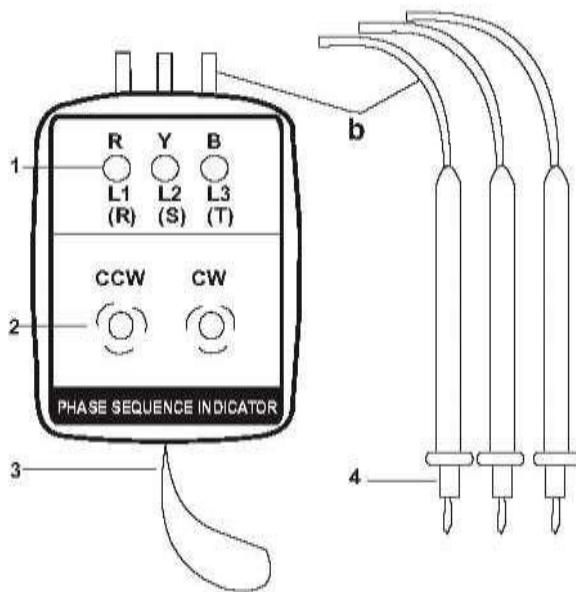
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

### 70.Phase Sequence Meter:-

#### 70.1 Basic indicative Diagram:-



70.2 Should measure the Phase sequence (R, Y, and B) & Open phase Condition through LED?

And Buzzer.

70.3 Operational Voltage: 60 ~ 600V (3 phase AC)

70.4 Dielectric Strength (internal design): 2000V / minute (impulse Voltage 4000V)

70.5 Measuring Frequency Range: 20Hz ~ 400Hz

70.6 Time limit for continuous: 60 min. at 200V AC, 4 min. at 600V AC Test

70.7 Leads: 3 colour Test leads for Phase identification

LED 70.8 Indications with Buzzer: Correct Phase, Reverse Phase, and Open

Phase

70.9 Accessories

70.9.1 Test leads (fit to meter) with Pin Terminal

70.9.2 Separate Insulated Crocodile Clips

70.9.3 Carrying Case

70.9.4 User Manual

70.10 Dimensions: 85 (L) X 60 (W) X 25 (H) (excluding the test leads) ( $\pm 10\%$ )

70.11 Net Weight: Approx. 160 Grams ( $\pm 10\%$ )



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

### 71. Digital Multimeter 2.5 Amps/5Amps:-

#### 71.1 Basic indicative Diagram:-



Digital Multimeter, 200mV - 1000V,  $\pm 0.5\%$   $\pm 2$ Digit

Large, LCD, 3 1/2 digit display

Battery, testing leads and instructions included

Digital Multimeter. Great tool for any physics or home laboratory. Multimeter measures 5" tall, 2.75" wide and 1" long. Includes testing leads.

1. D.C. Voltage: 200 mV - 1000 V  $\pm 0.5\%$   $\pm 2$  digit
2. A.C. Voltage: 200 V - 750 V  $\pm 1.2\%$   $\pm 10$  digit
3. D.C. Current: 200 $\mu$ A - 10A  $\pm 1\%$   $\pm 2$  digit
4. Resistance: 200 Ohms - 2000 kOhms  $\pm 1.2\%$   $\pm 8$  digit
5. Max. Display: 1999
6. Display size: 16 x 48 mm, 3½ digit LCD
7. Range: Manual
8. Transistor Test: Yes
9. Diode Measurement: Yes
10. Accessories Included: Battery, testing leads and instruction manual.



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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Regional Office, Pune

## 72. Energymeter, Single / Three phase:-

### 72.1 Basic indicative Diagram:-



72.2 Type: 96mm X 96mm Panel Mounted Kilowatt Hour Meter

72.3 3 Phase, 4 Wire

72.4 Should work on 230 V AC Supply

72.5 Accuracy: Class 1.0 accuracy

72.6 Should have auto-resetting 8 digit seven segment LED counter

72.7 Should provide LED indication for healthy phase, load reverse current.

72.8 Applicable to Standards IEC 62053-21 Ø

72.9 True RMS measurement

72.10 Fully programmable CT ratios

72.11 Fully programmable PT ratios

72.12 On site programmable 3 phase 4 wire or 3phase 3 wire

72.13 Fully isolated current input

72.14 Built in transient protection

72.15 State of art SMD technology

72.16 Pulse output: one potential free relay contact

72.17 Remote data reading through mod bus (RS 485)

72.18 Programmable Energy format & Energy rollover count Input Voltage

72.19 PT Secondary Settable Range:

72.19.1 110V L-L (63.5V L-N)

72.19.2 100V - 120V L-L (57V - 69V L-N)

72.19.3 230V L-L (133V L-N)

72.19.4 121V - 239V L-L (70V - 139V L-N)

72.19.5 415V L-L (239.6V L-N)

72.19.6 240V - 480V L-L (140V - 277V L-N)

72.20 Input Current:

72.20.1 Nominal input current 5A AC RMS



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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- 72.20.2 External CT(30/5) to be connected to meter to stepdown current to 5A
- 72.21 Display
- 72.21.1 Counter: 8 Digit seven segment LED display
- 72.21.2 Reading resolution: Auto ranging
- 72.21.3 Display Height: 9 mm
- 72.22 Environmental
- 72.22.1 Operating temperature:-10 to +55°C
- 72.22.2 Storage temperature:-20 to +65°C
- 72.22.3 Relative humidity: 0... 90% noncondensing
- 72.22.4 Warm up time Minimum: 3 minute
- 72.22.5 Shock: 15g in 3 planes
- 72.22.6 Vibration: 10... 55 Hz, 0.15mm amplitude
- 72.22.7 Enclosure: IP54 (front face only)
- 72.23 Standards
- 72.23.1 EMC IEC 61326 Immunity IEC 61000-4-3: 10V/m min - Level 3 industrial low level
- 72.23.2 Safety: IEC 61010-1-2001
- 72.23.3 Permanently connected use IP for water & dust: IEC60529
- 72.23.4 Pollution degree: 2
- 72.23.5 Installation category: CAT III 300V ac rMs
- 72.23.6 High Voltage Test: 2.2 kV AC, 50Hz for 1 minute between all electrical Circuits





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### 73. Clamp on meter 0 – 50 Amps:-

#### 73.1 Basic indicative Diagram:-



73.2 Display: 3½ digit 1999 counts LCD display with automatic sign & functions.

73.3 Jaw opening size: 32 mm

73.4 Sensing: Average sensing.

73.5 DC Voltage: 2V / 200V / 1000V.

73.6 AC Voltage: 200V / 750V.

73.7 AC Current: 20A / 200A / 300A.

73.8 Resistance: 200 Ω / 200k Ω.

73.9 Diode & Continuity Test: Required

73.10 Over range indication: OL / (1) or (-1) should be displayed.

73.11 Low battery indication: Low Battery Symbol should be displayed when the Battery voltage drops below the operating Voltage.

73.12 Measurement rate (internal design): 3 measurements per second nominal

73.13 Operating Temperature & Humidity: 0°C to 50°C; < 70% R.H.

73.14 Storage Temperature & Humidity: -20°C to 60°C; < 80% R.H. With battery removed.

#### 73.15 Features

73.15.1 Overload protection on all ranges

73.15.2 Recessed safety designed input jacks

73.15.3 Data Hold switch to freeze reading

73.15.4 Tough ABS plastic housing

73.16 Power Supply: Single standard 9V battery.

73.17 Dimensions: 190 mm (L) x 80mm (W) x 35mm (H) (±10%)

73.18 Net Weight: 220 Grams (Excluding battery) (±10%)

#### 73.19 Accessories

73.19.1 Test leads (Pair)

73.19.2 Battery

73.19.3 Carrying Case

73.19.4 Drop Proof Wrist Strap



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#### 74. Ammeter portable type 0 – 15 Amps AC:-

##### 74.1 Basic indicative Diagram:-



74.2 Range: 0 - 15 A

74.3 Type: Moving Iron AC - Analog

74.4 Input: 15 a Accuracy: Class 1.5

74.5 Should be moving iron, panel meters

74.6 Should be housed in moulded polycarbonate cases

74.7 Should be suitable for the measurement of AC currents and voltages in the usual frequency

Range of 15...100Hz.

74.8 Front window glass and bezel should be easily replaceable. Should have nearly linear scale

74.9 Scale should have interchangeability

74.10 Should be easy installation with swivel screws

74.11 Should have glass filled polycarbonate housing (UL 94-V-0) Knife edge pointer.

74.12 Should have self-lifting terminal clamp assembly. Should have IP 52 protection

74.13 Movement

74.13.1 Moving Iron movement should have pivots of very high hardness

74.13.2 Movement should have suspended between springs loaded Sapphire Jewels

74.13.3 Movement should have properly shielded & critically damped by eddy currents Induced in coil former

74.14 Reference Standards

74.14.1 Performance Standard: IEC 60051 & IS 1248

74.14.2 Safety standard: IEC 61010

74.14.3 Nominal case and cut-out dimensions: IS 2419 & DIN 43700

74.14.4 Scale and Pointer: DIN 43802

74.14.5 Connection and Terminal markings: DIN 43807

74.14.6 Terminal bolts / leads: DIN 46200 / 46282

74.14.7 Safety requirements and protective measures: IS 9249 - 1979

74.14.8 Front frames dimensions: DIN 43718

74.14.9 Environmental conditions specifications: IS 9000 part 5, 7, 8

74.15 Certifications

74.15.1 ERDA Type tested

74.15.2 CE Certified

74.15.3 UL Approved

74.15.4 Rosh complied



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#### 75. Test Lamp:-

RAW MATERIAL AS PER STANDARD



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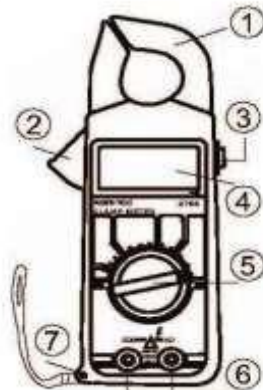
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 76. Tong Tester:-

##### 76.1 Basic indicative Diagram:-



- 76.2 Display: 3½ digit 1999 counts LCD display with automatic sign & functions.
- 76.3 Jaw opening size: 32 mm
- 76.4 Sensing: Average sensing.
- 76.5 DC Voltage: 2V / 200V / 1000V.
- 76.6 AC Voltage: 200V / 750V.
- 76.7 AC Current: 20A / 200A / 300A.
- 76.8 Resistance: 200 Ω / 200k Ω.
- 76.9 Diode & Continuity Test: Required
- 76.10 Over range indication: OL / (1) or (-1) should be displayed.
- 76.11 Low battery indication: Low Battery Symbol should be displayed when the Battery voltage drops below the operating Voltage.
- 76.12 Measurement rate (internal design): 3 measurements per second nominal
- 76.13 Operating Temperature & Humidity: 0°C to 50°C; < 70% R.H.
- 76.14 Storage Temperature & Humidity: -20°C to 60°C; < 80% R.H. With battery removed.
- 76.15 Features
- 76.15.1 Overload protection on all ranges
- 76.15.2 Recessed safety designed input jacks
- 76.15.3 Data Hold switch to freeze reading
- 76.15.4 Tough ABS plastic housing
- 76.16 Power Supply: Single standard 9V battery.
- 76.17 Dimensions: 190 mm (L) x 80mm (W) x 35mm (H) (±10%)
- 76.18 Net Weight: 220 Grams (Excluding battery) (±10%)
- 76.19 Accessories
- 76.19.1 Test leads (Pair)
- 76.19.2 Battery
- 76.19.3 Carrying Case
- 76.19.4 Drop Proof Wrist Strap



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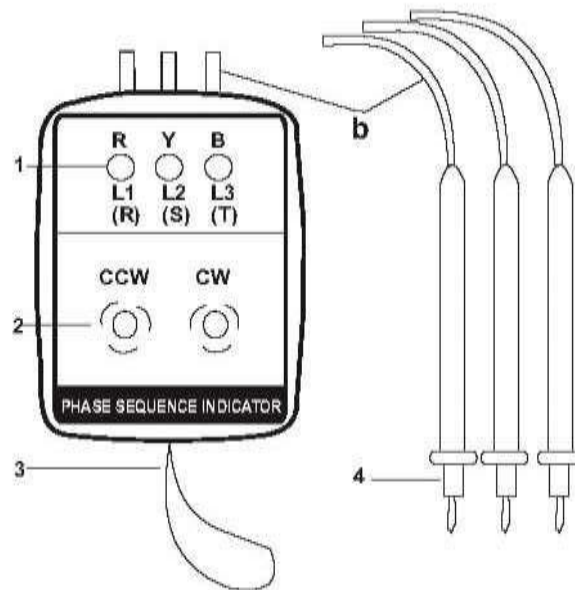
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 77. Line Tester:-

##### 77.1 Basic indicative Diagram:-



77.2 Should measure the Phase sequence (R, Y, and B) & Open phase Condition through LED?

And Buzzer.

77.3 Operational Voltage: 60 ~ 600V (3 phase AC)

77.4 Dielectric Strength (internal design): 2000V / minute (impulse Voltage 4000V)

77.5 Measuring Frequency Range: 20Hz ~ 400Hz

77.6 Time limit for continuous: 60 min. at 200V AC, 4 min. at 600V AC Test

104.7 Leads: 3 colour Test leads for Phase identification LED

104.8 Indications with Buzzer: Correct Phase, Reverse Phase, and Open Phase

77.9 Dimensions: 85 (L) X 60 (W) X 25 (H) (excluding the test leads) ( $\pm 10\%$ )

77.10 Net Weight: Approx. 160 Grams ( $\pm 10\%$ )

77.11 Accessories

77.11.1 Test leads (fit to meter) with Pin Terminal

77.11.2 Separate Insulated Crocodile Clips

77.11.3 Carrying Case

77.11.4 User Manual



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#### 78. Battery Tester:-

##### 78.1 Basic indicative Diagram:-



- 78.2 Input: 230 V AC / 50 HZ
- 78.3 Charging Mode: Manual
- 78.4 Output: 6/12 V
- 78.5 Charging current: 2/10/40 A
- 78.6 Boost/Start: 200 A
- 78.7 Meter Display should be available
- 78.8 Adapter battery capacity range: 4-400 AH
- 78.9 Adapter battery: GEL/AGM/STD lead battery
- 78.10 12V FUL detection
- 78.10.1 GEL Model: Voltage  $>13.8 \pm 0.2V$  & Current  $<0.8 \pm 0.5A$ , FUL
- 78.10.2 AGM Model: Voltage  $>14.8 \pm 0.2V$  & Current  $<0.8 \pm 0.5A$ , FUL
- 78.10.3 STD Model: Voltage  $>14.5 \pm 0.2V$  & Current  $<0.8 \pm 0.5A$ , FUL
- 78.11 6V FUL detection
- 78.11.1 GEL Model: Voltage  $> 6.9 \pm 0.3V$  & Current  $<0.8 \pm 0.5A$ , FUL
- 78.11.2 AGM Model: Voltage  $> 7.4 \pm 0.3V$  & Current  $<0.8 \pm 0.5A$ , FUL
- 78.11.3 STD Model: Voltage  $> 7.2 \pm 0.3V$  & Current  $<0.8 \pm 0.5A$ , FUL



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### 79. Electrician Tool Kit:-

#### 79.1 Basic Indicative Diagram:



79.2 It should contain the tools as per specification mention below in this file:-

79.2.1 Insulated Screw driver 150mm. Generally conform to IS 844-1979

79.2.2 Hammer 1 lbs. generally conform to IS. 841– 1983

79.2.3 Long Nose plier 150 mm generally conform to IS 3650

79.2.4 Combination plier 150 mm generally conform to IS 3650

79.2.5 Diagonal cutter 150mm generally conform to IS 4378 – 1990

79.2.6 Electrician knife

79.2.7 Wire stripper generally conform to IS. 5995–1971

79.2.8 Neon tester 500V generally conforming to IS 5579– 1985

79.2.9 Soldering Iron 25watt

79.2.10 Clamp meter

79.2.11 all above item should be kept in Box



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#### 80. Rechargeable Battery:-

#### RAW MATERIAL





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#### 81. Pressure Transducers panel board to demonstrate pressure gauge, Load cell, Bourdon tube, Capacitive transducers:-

##### 81.1 Basic Indicative Diagram:-



81.1 Operating voltage: - 110V to 230V

81.2 Compressor to supply dry clean air at 4Kg/Cm<sup>2</sup>

81.3 LCD/SSD display to show the output of pressure gauge, load cell, & capacitive transducer

81.4 Buzzer to indicate high pressure

81.5 Specification of:-

81.5.1 Pressure Gauge:-

81.5.1.1 Max Pressure : - 30 PSI

81.5.1.2 Accuracy : - +/- 25% of full scale

81.5.1.3 Operating voltage : - 3V

81.5.2 Load Cell:-

81.5.2.1 Maximum excitation: - 15VDC

81.5.2.2 Rated output : - 2 +/- 0.2mV/Volt

81.5.2.3 Maximum capacity: - 5Kg

81.5.2.4 Input/output resistance: - 400/300 ohm

81.5.3 Capacitive transducer:-

81.5.3.1 Operating input voltage: 10-30 V DC

81.5.3.2 Sensor Type: PNP

81.5.3.3 Output Voltage: 10-30V DC

81.5.3.4 Sensing Range: 2-8 mm

81.6 Experiment to show the following:-

81.6.1 To study characteristics of above transducer

81.6.2 To study application and calibration of load cell



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81.6.3 to study Bourdon tube and capacitive transducer

81.7 Accessories:-

81.7.1 Pressure gauge

81.7.2 Load cell

81.7.3 Manua

81.7.4 Patch's cords

#### 81A. Bourdon tube Capacitive Transducers:-

- Capacitances type pressure Sensor with seven segment display, with 4-20mA output and RS485 Communication Facility.
- mA and voltage Display with 4 digit, 7 segment digital display Keys ,3 keys for digital setting , Input Selection of 0-10V or 4-20mA.
- Load cell with Strain gauge/shear beam type of 5kg Maximum bearable weight and its Output : 10 gram/10mV and different Standard weights 20 gram - 1 no., 50 gram - 2 nos., 100 gram - 2 nos. & 200 gram - 2 nos.
- SS Pressure vessel with. Pressure gauge range 0 to 100 psi , Pressure vessel capacity of 0 to 100 psi Safety valve of 0 to 100 psi and Non returning valve
- Bourdon tube pressure gauge with Range of 0-100 psi
- Castor wheel (with locking mechanism) is provided at legs of Test bench so that it can be easily moved.
- Air compressor with. of 0.75 HP Power and 100 psi maximum Pressure with auto cut off facility



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### 82. Flow Transducers panel board to demonstrate Flow nozzle, Vane Anemometer, Rota meter.-

#### 82.1 Basic Indicative Diagram:-



#### 82.2 Sump tank-

82.2.1 Material: Stainless Steel, 1.5 mm thick/P.P 5mm thick

82.2.2 Capacity: 30 liters,

82.2.3 Dimension: 1ft (L) x1ft (W) x1 ft. (H)

82.3 Piping- 1" GI, Class B, with 1" ball valves: 10 nos.

82.4 Centrifugal Pump- 1"/ ½" H.P., 1φ 230 V AC supply

82.5 Rota meter- Range: 0-500 LPH, Glass tube type/acrylic Body, Bob Material: SS 304

Connection: 1", Mounting: Inlet Bottom Outlet Top

82.6 Flow nozzle

82.7 Flow Indicator 3 ½ digit display, 230 V AC operated, cut out: 92 mmx 92 mm x144 mm,

82.8 Vane anemometer

82.9 Practical:-

82.9.1 To study the flow sensor

82.9.2 To measure the flow with the help of sensor.

#### It should have following features

Should have different types of sensors like: Flow nozzle, Vane Anemometer, Rota meter.



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Should be provided with SS Sump Tank and Measuring Tank

On panel Digital voltmeter, digital ammeter Toggle switches for Pump and Solenoid with indicator.

Should be provided with Castor Wheel (with locking mechanism) is provided at legs of workstation.

Should have following Technical Specifications

Rota meter

Range : 0-500LPH

Line Size : 1/2"

Flow Nozzle.

Vane Anemometer

Wind Chill Indication; Data Hold Function; Auto/ Manual Power Off; High Precision Pressure Sensor

Wind Temperature Range: -10 - 45 Centigrade (14-113F);

Storage Temperature: -40~60 Centigrade

Wind Speed Range: 0-30m/s;

Wind Speed Unit: m/s, Km/h, ft/min, Knots, mph

Air Velocity:

Range: 0 - 30m/s, 0 - 90km/h, 0 - 5860ft/min, 0 - 65mph, 0 - 55Knots

Digital Voltmeter

Digital Ammeter.

Toggle Switches

Indicator

Pump

Supply : 230VAC



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### 83. Temperature Transducers panel board to demonstrate bimetallic strip, RTD, Thermocouple, Thermistor:-

#### 83.1 Basic Indicative Diagram:



83.2 Operating Voltage 110 to 240 Volt

82.3 Interface circuit for bimetallic, RTD, Thermocouple, thermistor and PT100 sensors

82.4 LCD/ SSD display to show temperature and output voltage of sensors

82.5 Provision to give variable heat to sensor for example temperature controlled oven

82.6 On board test points to observe signals

82.7 All sensors to be fitted on panel board

82.8 Sensors Specification:-

82.8.1 Bimetallic strip: -  $-10^{\circ}\text{C}$  TO  $200^{\circ}\text{C}$  accuracy  $\pm 2\%$

82.8.2 RTD :  $--250$  to  $1000^{\circ}\text{C}$   $\pm 1\%$

82.8.3 Thermocouple: -J type:  $0^{\circ}\text{C}$  to  $750^{\circ}\text{C}$

82.8.4 Thermistor : - R25  $\pm 5\%$

82.9 Experiment to be done as follows:-

82.9.1 Operate the switch with the help of bimetallic strip showing temperature

82.9.2 Characteristics of RTD, Thermocouple and Thermistor

82.9.3 One application of each transducer

82.10 Suitable patch cords

82.11 Manual

#### It should have following features

- Should have different temperature sensors like Bimetallic strip, RTD, Thermocouple, Thermistor.
- Should be provided with Heater Box with fan for cooling
- Should have on panel Digital voltmeter , digital ammeter , RTD/Thermocouple Temperature Display , NTC Temperature Display, Toggle switch for Heater and Fan with indicator
- Should be provided with Castor Wheel (with locking mechanism) is provided at legs of workstation



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#### Should have following Technical Specifications

- RTD/Thermocouple Temperature Display with 230V supply Voltage 4 Digit, 7 segment digital displays , Display Input RTD (PT100) & Thermocouple , 1 or 0.1 degree Resolution ,
- Thermistor Temperature Display with 230V supply Voltage 4 Digit, 7 segment digital displays ,
- 3 Keys for digital setting , for Thermistor type temperature sensor 1 or 0.1 degree Resolution
- Wire PT100 RTD Sensors for Temperature Range (-99 to 850°C)
- K Type Thermocouple Sensors for Temperature Range : -200 to 1250°C
- Thermistor for Temperature measuring range: -50 – 99°C.
- Bimetallic Thermometer with Range : 0-150°C.

#### Should be able to perform following experiments

- Temperature Measurement using RTD and Temperature Display.
- Temperature Measurement using K Type Thermocouple and Temperature Display.
- Temperature Measurement using Thermistor (NTC) and Temperature Display.



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#### 84. Level Transducers panel board to demonstrate capacitive and float switch:-

##### 84.1 Basic Diagram



84.2 Level Tank- Dimension: 6"X 6"X24", Material P.P. 5mm thick, With Acrylic Front Fascia

84.3 Sump tank (Optional) - Dimension: 1'X1'X1', Material P.P. 5 thick

84.4 Level Transmitter- Input: 0-500 mm, Output: 4-20 mA

84.5 Supply: 24 V DC, 100 mA. Type: 2-wire Capacitance Type.& float type

Mounting: Top 2" Screwed Connection

84.6 Level Indicator- 3 ½ Digit Display, Inbuilt 24VDC Supply, 1φ 230 VAC Power Supply

84.7 Control Panel- MS Powder Coated Frame with Indicator, Switches & Level Indicator on Front.

84.8 Experiments to be carried:-

84.8.1. To measure the Level with the given level sensor.

84.8.2. To study the level sensor

#### **It should have following features**

- Should have different types of Level Sensors : like: Capacitive type and Float type
- Should be provided with SS Sump Tank and Measuring Tank



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- Should have on panel Digital voltmeter , digital ammeter , 4-20mA display , 0-10V DC Display , Toggle switch for Pump and Solenoid valve with indicator
- Should be provided with Castor Wheel (with locking mechanism) is provided at legs of workstation

#### Should have following Technical Specifications

- Capacitive Transducer with 24VDC Supply voltage , Cast Aluminum weather proof
- Housing Enclosure 0.5s to 5 sec ,Response Time , 4 to 20mA Output , 230mm measuring range , 4 Digit display with 4 keys and LED User Interface .
- mA and voltage Display with 4 digit, 7 segment digital display Keys ,3 keys for digital setting , Input Selection of 0-10V or 4-20mA.

#### Float Switch: 1 No.

Pump

Single in single out Solenoid Valve with 230 Supply voltage line size ½”

Should perform following experiments

- Capacitive Level transducer Characteristics.
- Study and use of float switch
- Study and use of solenoid valve.





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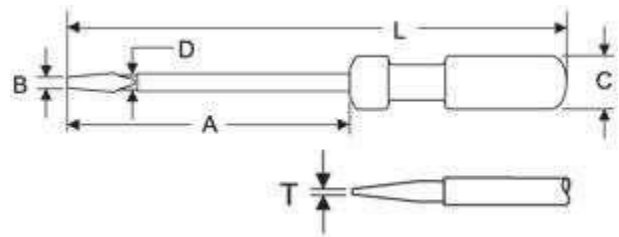
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 85. Insulated Screw Diver 200 mm:-

##### 85.1 Basic indicative Diagram:-



85.2 Generally conform to IS 844 - 1979

85.3 Insulated Blade

85.4 Dimensions:

85.4.1 Size: 8 mm X 200 mm (A - 200 mm, D - 8 mm)

85.4.2 Tip Bit Size: B X T: 8.0 mm X 1.2 mm

85.5 Blade:

85.5.1 Blade made of high grade Silicon - Manganese Steel (EN 45 A)

85.5.2 Blade should be differentially hardened & tempered to resist wear, bending & meet high torque requirement

85.5.3 Hardness on Tip: 55 - 58 HRC

85.5.4 Minimum Torque Value: 1.17 Gm.

85.5.5 Bright and Smooth Nickel Chrome plating finish to effectively protect blade against Corrosion

85.6 Handle:

85.6.1 Material of Handle: Cellulose Acetate

85.6.2 Handle should be made of high grade CA Plastic, which is non - flammable & Unaffected by oil, petrol, grease, water - practically anything

85.6.3 Handle should withstand rough use including hammering

85.6.4 Handle design should be such that it gives comfortable grip even at higher Torques

85.6.5 Handle & blade assembly should be insert moulded

85.7 Tip:

85.7.1 Tip should be formed by Forging & Trimming

85.7.2 Tip should be precision - ground to 10 degree angle to ensure firm grip in the screw Slot.

85.7.3 The Blade tip should be magnetized to lift small screw from confined places or

to

Hold the screw in position

85.7.4 Tip sides & faces should be well ground with good finish

85.7.5 Double ear coining should be provided for the blade.



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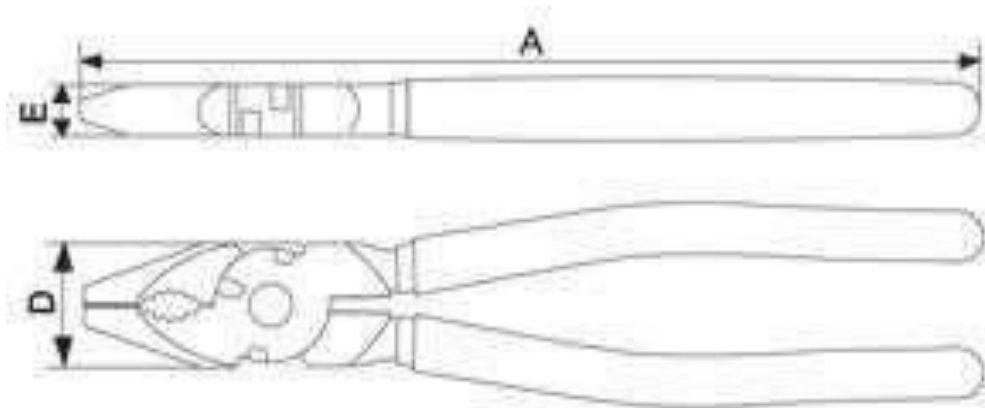
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 86. Insulated combination cutting plier 200 mm:-

##### 86.1 Basic indicative Diagram:-



86.2 Generally conform to IS 3650 - 1981

86.3 Material: C - 70

86.4 Finish: Polished / Chrome plated / satin finish

86.5 Length (A): 200 mm

86.6 Drop forged, hardened tempered

86.7 Differential hardening

86.8 Radius Gap from front side: up to 0.2 mm

86.9 Play between shanks: up to 0.3 mm

86.10 Shank Material: C70 / EN9

86.11 Rivet material: SAE 1541 / 40Cr4

86.12 Cutting Edge Hardness: 60 - 62 HRC

86.13 Shank Hardness: 40 - 48 HRC

86.14 Rivet Hardness: 38 - 42 HRC

86.15 High Voltage Insulation: Should be able to withstand 4000 V DC or 2800 V AC

86.16 Insulation Sleeves made from High Quality CA Plastic

86.17 Thicker Sleeves for comfortable Grip

86.18 Special thumb protector for sleeves to minimize the risk of electric shock in case plier Slips while in use.

86.19 Should be able to cut soft (74 to 84 Kg/mm<sup>2</sup>) & hard (140 Kg/mm<sup>2</sup>) wires

86.20 Should be able to cut 2 mm of hardwire Diameter & 1 mm of soft wire Diameter



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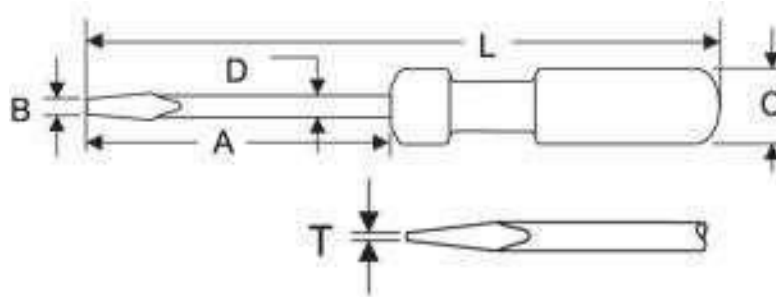
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 87. Small Screw Driver:-

##### 87.1 Basic indicative Diagram:-



87.2 Generally conform to IS 844 - 1979

87.3 Insulated Blade

87.4 Dimensions:

87.4.1 Size: 3 mm X 75 mm (A - 75 mm, D - 3 mm)

87.4.2 Tip Bit Size: B X T:3.0 mm X 0.5 mm

87.5 Blade:

87.5.1 Blade made of high grade Silicon - Manganese Steel (EN 45 A)

87.5.2 Blade should be differentially hardened & tempered to resist wear, bending & meet high torque requirement

87.5.3 Hardness on Tip: 55 - 58 HRC

87.5.4 Minimum Torque Value: 0.08Gm.

87.5.5 Bright and Smooth Nickel Chrome plating finish to effectively protect blade Against corrosion

87.6 Handle:

87.6.1 Material of Handle: Cellulose Acetate

87.6.2 Handle should be made of high grade CA Plastic, which is non - flammable & unaffected by oil, petrol, grease, water - practically anything

87.6.3 Handle should withstand rough use including hammering

87.6.4 Handle design should be such that it gives comfortable grip even at higher Torques

87.6.5 Handle & blade assembly should be insert moulded

87.7 Tip:

87.7.1 Tip should be formed by Forging & Trimming

87.7.2 Tip should be precision - ground to 10 degree angle to ensure firm grip in the Screw slot.

87.7.3 The Blade tip should be magnetized to lift small screw from confined places Or to hold the screw in position

87.7.4 Tip sides & faces should be well ground with good finish

87.7.5 Double ear coining should be provided for the blade.



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

#### 88. Digital Multimeter 0 – 400 Volt:-

##### 88.1 Basic indicative Diagram:-



|         |  |  |
|---------|--|--|
| 88.2    | Display Count:   | 4000   |
| 88.3    | DC Voltage:  | 400mV-500V (Accuracy $\pm 0.8\%$ +1)                 |
| 88.4    | AC Voltage:  | 400mV-500V (Accuracy $\pm 1.2\%$ +3)                 |
| 88.5    | AC Current:  | 400 $\mu$ A -10A (Accuracy $\pm 1\%$ +2)             |
| 88.6    | DC Current:  | 400 $\mu$ A- 10A (Accuracy $\pm 1.5\%$ +5)           |
| 88.7    | Resistance:  | 400 $\Omega$ to 40M $\Omega$ (Accuracy $\pm 1\%$ +2) |
| 88.8    | Capacitance  | 4nF to 100uF (Accuracy $\pm 4\%$ +3)                 |
| 88.9    | Auto Range:  | Should be available                                  |
| 88.10   | Diode Measurement:                                       | Should be available                                  |
| 88.11   | Continuity Buzzer:                                       | Should be available                                  |
| 88.12   | Low Battery Indication:                                  | Should be available                                  |
| 88.13   | Input impedance for DCV                                  | should be available                                  |
| 88.14   | Protection:  | Dual Fuse Protection                                 |
| 88.15   | Size:  | 130 mm X 75 mm X 35mm ( $\pm 10\%$ )                 |
| 88.16   | Compliance:  | CE Certificate, CAT II, ETL Certified                |
| 88.17   | Accessories  |  |
| 88.17.1 | Test Lead  |  |
| 88.17.2 | Manual   |  |
| 88.17.3 | Required Batteries                                       |  |
| 88.17.4 | Calibration Certificate                                  |  |
| 88.17.5 | Plastic or Wooden Carrying Case with required cushioning |  |



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#### 89. Variable Resistance Box, Resistors with 220Ω, 150Ω, 1kΩ, 33Ω, 100Ω, 1.2Ω:-

##### 89.1 Basic indicative Diagram:-



- 89.2 Range: 1 Ohms to 100K ohms
- 89.3 Dials: 4/5 Dials
- 89.4 Steps: 10 steps in each dial
- 89.5 Accuracy:  $\pm 1\%$
- 89.6 Type of Resistors: Resistor (2.5)
- 89.7 Output: 4.0 mm plug Terminals
- 89.8 0°C to 40°C at <70% R.H.
- 89.9 Should have having higher wattage wire wound resistors
- 89.10 Should have low resistance contact rotary switches



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#### 90.9V DC Battery with Cap:-

#### RAW MATERIAL



|                         |          |
|-------------------------|----------|
| Type                    | Alkaline |
| IEC name                | 6LR61    |
| ANSI/NEDA name          | 1604A    |
| Typical capacity in mAh | 550      |
| Nominal voltages        | 9        |



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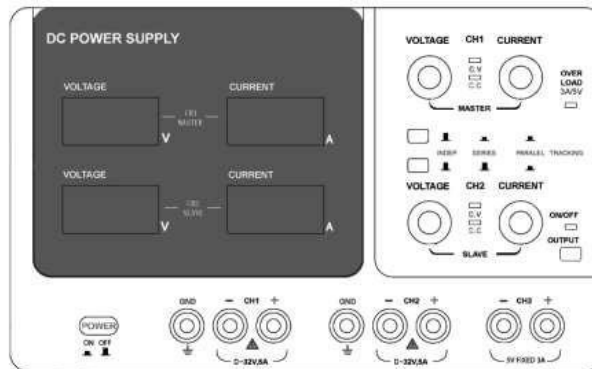
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### 91. Dual Power Supply (230V, 50Hz, Fuse-800mA):-

#### 91.1 Basic Indicative Diagram:-



- 91.2 Type: Variable Dual Channel + One Channel Fixed Bench Type
- 91.3 Output Voltage: 0 - 32 V (CH1 & CH2), 5V (CH3)
- 91.4 Output Current: 0 - 5 A (CH1 & CH2), 3A (CH3)
- 91.5 Load Regulation
- 91.5.1 Voltage:  $\leq 0.01\% + 3\text{mV}$  (CH1 & CH2),  $\leq 3\% + 5\text{mV}$  (CH3)
- 91.5.2 Current:  $\leq 0.2\% + 3\text{mA}$  (CH1 & CH2)
- 91.6 Line Regulation
- 91.6.1 Voltage:  $\leq 0.01\% + 3\text{mV}$  (CH1 & CH2),  $\leq 3\% + 5\text{mV}$  (CH3)
- 91.6.2 Current:  $\leq 0.1\% + 5\text{mA}$  (CH1 & CH2)
- 91.7 Ripple & Noise: 1mVrms (CH1 & CH2), 2mVrms (CH3), 3mArms
- 91.8 Display Accuracy:  $\leq \pm 1\% \text{rdg} + 2 \text{digits}$
- 91.9 Reliability (MTBF):  $\geq 2000$  Hrs.
- 91.10 Insulation: 200V (Maximum voltage to earth Case: Output terminal –  $\leq \pm 30\text{M}\Omega$  (500Vdc) AC Cable:  $\leq \pm 1.14$ ,  $30\text{M}\Omega$  (500Vdc)
- 91.11 Overload Protection: Required
- 91.12 Inversion Polarity Protection: Required
- 91.13 Power Button: Required
- 91.14 Indication light for constant current & Voltage: Required
- 91.15 Display panel for both Voltage & Current: Required
- 91.16 Overload Indication: Required
- 91.17 Certification: CE Compliance
- 91.18 Power: 230V AC, 50Hz
- 91.19 Product Size: 260 X 176 X 317mm ( $\pm 10\%$ )
- 91.20 Accessories
- 91.20.1 Power Cord
- 91.20.2 Manual
- 91.20.3 Calibration Certificate



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92. Solder Iron, Solder Lead, PCB Board (Groove Board), Solder Wick):-

**RAW MATERIAL**





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93. Inductor (400 Turns, 200 Turns, 600 Turns, and 1200 Turns), I-Core, E-Core, U-Core, Laminated Core:-

#### RAW MATERIAL





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94. Relay, LED (5V):-

### RAW MATERIAL





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### 95. Function Generator (230V, 50Hz, Watts-12VA, and Fuse- 150mA):-

#### 95.1 Basic Indicative Diagram:-



|         |                                     |  |
|---------|-------------------------------------|--|
| 95.2    | Waveforms:                          | Sine, Square, Triangle, Pulse, Ramp etc. |
| 95.3    | Range (no load):                    | from 1mVpp to 20Vpp                      |
| 95.4    | Accuracy:                           | $\leq \pm 5\%$                           |
| 95.5    | Resolution:                         | 0.1mV Frequency                          |
| 95.6    | Range of Sine Wave:                 | 0.5Hz to 5MHz                            |
| 95.7    | Accuracy:                           | $\leq \pm 1\%$                           |
| 95.8    | Output Impedance:                   | 50 $\Omega$                              |
| 95.9    | Attenuator:                         | 20dB + 40dB                              |
| 95.10   | DC Offset:                          | -10V to +10V                             |
| 95.11   | Display Frequency:                  | 4-digits-LED, Amplitude: 3-digits-LED    |
| 95.12   | Duty Cycle:                         | from 10% to 90%                          |
| 95.13   | Rise time of Square:                | $\leq 35\text{ns}$                       |
| 95.14   | Frequency Counter                   |  |
| 95.15   | Frequency Range:                    | 0.2Hz to 10MHz                           |
| 95.16   | Amplitude Range:                    | 0.5Vp-p to 5Vp-p                         |
| 95.17   | Input Impedance:                    | 10 Ki                                    |
| 95.18   | Power:                              | AC 220V, 50Hz                            |
| 95.19   | Weight:                             | 2.5kg (Apex)                             |
| 95.20   | Size:                               | 300mm X 250mm X 100mm ( $\pm 10\%$ )     |
| 95.21   | Should be supplied with accessories |  |
| 95.21.1 | BNC to Alligator Clips              |  |
| 95.21.2 | Power Cord                          |  |
| 95.21.3 | BNC to BNC cord                     |  |



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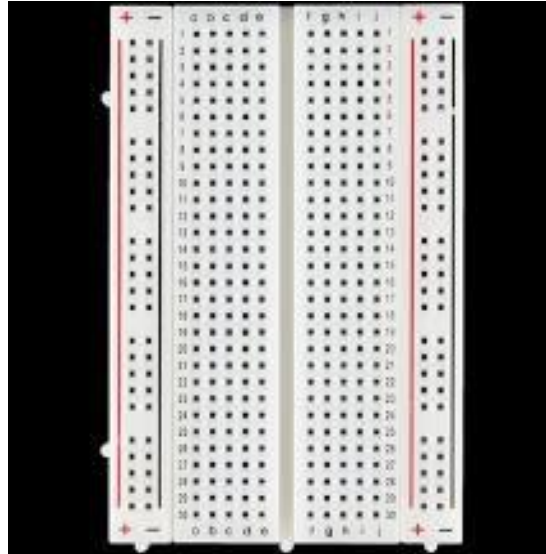
SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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### 96. Bread Board:-

#### RAW MATERIAL



- Height / Thickness: 0.5118 inch.
- Length: 7.87 to 47.24 inch.
- Units: Metric.
- Width: 7.87 to 47.24 inch.



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### 97. SYNCHRONOUS MOTOR:-

#### 97.1 Basic Indicative Diagram:-



#### 97.2 SPECIFICATION:-

- I) OPERATING VOLTAGE: - 220V TO 240 V A.C.
  - ii) SPEED OF MOTOR: - 60 R.P.M.
  - iii) Number of phase: - Single
  - iv) TORQUE: - 25 KG C.M.
  - v) OPERATING FREQUENCY: 50 Hz.
  - vi) Size: - 86X 86 mm
  - vii) Current: - 1A max.



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#### 98. Power Chord, Connecting Probes, Single Strand & Multi strand Wires:-

RAW MATERIAL





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#### 99. Power Supply (0-30V DC, 3A):-

##### 99.1 Basic Indicative Diagram:-



- 99.2 Output voltage: 0 to 30 Volt
- 99.3 Output Current: 0-5A
- 99.4 Load effect:  $CV \leq 1 \times 10^{-4} + 2mV$ ,  $CC \leq 2 \times 10^{-4} + 3mA$
- 99.5 Ripple and Noise:  $\leq 0.3mVrms$
- 99.6 Output Regulation Resolution: CV: 100mV (Typical), CC: 10mA (Typical)
- 99.7 Display Accuracy: 4 digit  $\leq \pm (0.1\% + 5)$ , 3 digit  $\leq \pm (0.4\% + 3)$
- 99.8 Reliability (MTBF):  $< 2000$  Hours
- 99.9 Display: LED should display the voltage and current values
- 99.10 Power Input Voltage: 115VAC/ 230VAC (Optional)
- 99.11 Frequency: 50Hz/ 60Hz
- 99.12 Product Size (W X H X D): 105mm X 160 mm X 240mm ( $\pm 10\%$ )
- 99.13 Should be supplied with Power Cord



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#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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#### 100. Sensor Kit

- i. Mounting Plate,
- ii. Power Distribution Box (24V DC, 4A)
- iii. Counter Box (10-30V DC/0.05A),
- iv. Indication Box (24V Dc),
- v. Material Box,
- vi. Inductive Sensor (10-30 V DC, PNP, NO, 5mm, (Range)),
- vii. Capacitive Sensor (10-30 V DC, PNP, NO, 2-8mm, (Range)),
- viii. Magnetic Sensor (10-60 V DC, PNP, NO, 60mm, (Range))
- ix. Ultrasonic Sensor (10-30 V DC, PNP, NO, 80-300mm, (Range))
- x. Connecting Wires, xi. Motor with Control Unit (24V DC, 1A):-

##### 100.1 Basic Indicative Diagram



100.2 Inductive Sensor, Capacitive Sensor, Magnetic Sensor, Ultrasonic Sensor should be Mounted on panel along with DAQ and Counter Box.

100.3 Precise Signal conditioning

100.4 Real-time DAQ interface with ADC, DAC & digital input/output

100.5 Supplied with Dashboard Software for supervisory control of the process with Data acquisition

100.6 Computer Based Data Logging

100.7 Interface with Ethernet based DAQ

100.8 Sensitive, linear, stable and accurate

100.9 Industrial look & feel

100.10 User friendly, self-explanatory system

100.11 Experiments configurable through patch board

100.12 Enhanced electrical safety considerations

100.13 Practice troubleshooting skills

100.14 Compact table top ergonomic design

100.15 Ready Experimental details

100.16 Robust design and construction

100.17 Online Product Tutorial





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|          |                                |                             |
|----------|--------------------------------|-----------------------------|
| 100.18   | Data Acquisition System (DAQ): | 1 No                        |
| 100.18.1 | Analog Inputs:                 | 8 Nos.                      |
| 100.18.2 | Digital Inputs:                | 8 Nos.                      |
| 100.18.3 | Digital Outputs:               | 8 Nos.                      |
| 100.18.4 | ADC Resolution:                | 24 Bit                      |
| 100.18.5 | RS485 Interface:               | Yes                         |
| 100.18.6 | USB Interface:                 | Yes                         |
| 100.18.7 | Ethernet Interface:            | Yes                         |
| 100.18.8 | Data Logging:                  | Yes                         |
| 100.19   | Inductive Sensor               | 1 No.                       |
| 100.19.1 | Operating input voltage:       | 10-30 V DC                  |
| 100.19.2 | Sensor type:                   | PNP                         |
| 100.19.3 | Output voltage:                | 10-30V DC                   |
| 100.19.4 | Sensing Range:                 | 0-5 mm                      |
| 100.19.5 | Switch Type:                   | No                          |
| 100.19.6 | Body:                          | Cubical/Cylindrical         |
| 100.20   | Capacitive Sensor              | 1 No.                       |
| 100.20.1 | Operating input voltage:       | 10-30 V DC                  |
| 100.20.2 | Sensor Type:                   | PNP                         |
| 100.20.3 | Output Voltage:                | 10-30V DC                   |
| 100.20.4 | Sensing Range:                 | 2-8 mm                      |
| 100.20.5 | Switch Type:                   | No                          |
| 100.20.6 | Body:                          | Cubical/Cylindrical         |
| 100.21   | Magnetic Sensor:               | 1 No.                       |
| 100.21.1 | Operating input voltage:       | 10-30 V DC                  |
| 100.21.2 | Sensor Type:                   | PNP                         |
| 100.21.3 | Output Voltage:                | 10-30V DC                   |
| 100.21.4 | Sensing Range:                 | 60 mm (approximately)       |
| 100.21.5 | Switch Type:                   | No                          |
| 100.21.6 | Body:                          | Cubical/Cylindrical         |
| 100.22   | Ultrasonic Sensor:             | 1 No.                       |
| 100.22.1 | Operating Input Voltage:       | 10-30 V DC                  |
| 100.22.2 | Sensor Type:                   | PNP                         |
| 100.22.3 | Output Voltage:                | 10-30V DC                   |
| 100.22.4 | Sensing Range:                 | 80 - 300 mm (approximately) |
| 100.22.5 | Switch Type:                   | No                          |
| 100.23   | Connecting Wires:              | 15 Nos. (Patch cord)        |
| 100.24   | Motor:                         | 1 No.                       |
| 100.24.1 | Operating Voltage:             | 24V DC                      |
| 100.24.2 | Current Rating:                | 1A (Approx.)                |
| 100.25   | Motor Driver:                  | 1 No.                       |



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- 100.26 Power Distribution Box: 1 No.  
100.26.1 Operating Voltage: 24V DC  
100.26.2 Current Rating: 4A (approx.)
- 100.27 Counter Box: 1 No.  
100.27.1 Supply Voltage: 90-230V AC  
100.27.2 Display Configuration: 6 Digits Counts, 5 Digits RPM Indicator  
100.27.3 Counting Direction: Up, Down, Bi directional  
100.27.4 Sensor Type: PNP  
100.27.5 Sensor Output Voltage: 10-30 VDC  
100.27.6 Current Rating: 0.05A
- 100.28 Indication Box: 1 No.  
100.28.1 Supply: 24V DC  
100.28.2 Colour: Green  
100.28.3 Panel: Vertical Mounting Plate of at least W 600 X H 390 X D 300
- 100.29 The trainer should support to perform following lab experiments:  
100.29.1 DAQ Digital Input  
100.29.2 DAQ Digital Outputs  
100.29.3 DAQ Analog Inputs  
100.29.4 Inductive Sensor  
100.29.5 Capacitive Sensor  
100.29.6 Magnetic Sensor  
100.29.7 Ultrasonic Sensor  
100.29.8 Counter Box  
100.29.9 RPM Counting of DC Motor using Counter box and Sensors  
100.29.10 Motor Speed Control using DAQ

- Learn the detailed fundamentals of sensors
- Table Top Portable Training Kit with suitable type of Top enclosure to prevent from dust /dirt /accidental damage /moisture.
- All sensors mounted with 3 electrical terminals (24V, 0V, Output).
- All sensor modules are enclosed and coupled with compatible latch arrangement to secure into position.
- Facility of using a bread board enabling custom made circuit design and testing.
- Different Types of sensors module included Photoelectric through beam sensor Photoelectric retro reflective sensor with reflective plate , Fiber optic sensor with amplifier ,Diffuse reflective sensor ,Distance settable sensor ,8 Pin Din Mounted 24V Coil electromagnetic relay ,Digital Counter ,Tachometer ,Cylindrical Capacitive sensor ,Flat Capacitive sensor ,Cylindrical inductive sensor Switch and Sensor Module,
- Actuator included Motorized Module with speed controller sensors.
- The kit has facility for easily connecting different sensor modules for study /testing
- Built-in DC Power Supply



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- Easy to operate
- Compact tabletop ergonomic design.
- Ready assignment details.
- Robust construction.

#### Technical Specification

##### **Photoelectric Through beam Sensor : 1 No.**

Sensing Method : Through beam

Maximum Sensing Distance :15 Meter

Control Output : PNP

Operating Voltage : 12 – 24VDC

##### **Photoelectric retro reflective Sensor with reflective sensor : 1 No.**

Maximum Sensing Distance :2 Meter

Control Output : PNP

Operating Voltage : 10 – 30VDC

##### **M6 Reflective fiber coupled with Fiber sensor amplifier : 1 No.**

Control Output : PNP

Operating Voltage: 12 – 24VDC

Diffuse Reflective Sensor : 1 No.

Maximum Sensing Distance:50 – 70cm (approximately)

Control Output : PNP

Operating Voltage : 10 – 30VDC

##### **Diffuse Reflective Sensor adjustable sensitivity : 1 No.**

Maximum Sensing Distance: 10 – 30cm (approximately)

Control Output : PNP

Operating Voltage : 10 – 30VDC

Distance Settable Sensor : 1 No.

Maximum Sensing Distance:2mm – 80mm (approximately)

Control Output : PNP

Operating Voltage : 10 – 30VDC

##### **8 Pin Din Mounted 24V Coil Electromagnetic Relay : 1 No.**

Coil Voltage : 24VDC

Type : DPDT

##### **Digital Counter : 1 No.**

Display : Single Display : 4 digit, 0.56", 7 Segment, Red LED Display

Input : PNP Senso/ Switch

Range : 0-999999 count

Supply : 230V AC

##### **Tachometer : 1 No.**

Range : 4-5000RPM

Supply : 230V AC

Display : Single Display : 4 digit, 0.56", 7 Segment, Red LED Display



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Input : PNP Senso/ Switch

**Switch and LED Module : 1 No.**

LED Light : 3 Nos.

Momentary Switch : 2 Nos.

Supply : 24VDC

**Motorized (24VDC) Rotary disc (with 2 Set of Black and White Region : 1 No.**

Supply:24VDC

**Motorized (24VDC) Rotary disc : 1 No.(with 2 Set of Black and White Region : 1 No.**

Supply:24VDC

**Cylindrical Capacitive Sensor : 1 No.**

Maximum Sensing Distance:10 mm (approximately)

Control Output : PNP

Operating Voltage : 10 – 30VDC

**Flat Capacitive Sensor : 1 No.**

Maximum Sensing Distance:8mm (approximately)

Control Output : PNP

Operating Voltage : 10 – 30VDC

**Cylindrical Inductive Sensor : 1 No.**

Maximum Sensing Distance:8mm (approximately)

Control Output : PNP

Operating Voltage : 10 – 30VDC

**Analog Inductive Proximity Sensor : 1 No.**

Analog Voltage output : 0-10 VDC

Supply : 10-30VDC

**Power Supply : 24VDC , 2A**

**Weight : 3 kgs approximately**

**Dimensions (mm) : W 326 x D 252 x H 52**

**Mains Supply : 110-220V  $\pm$ 10%, 50/60Hz**

Scope of Learning

**Study and use of**

- Photoelectric through beam sensor
- Photoelectric retro-reflective sensor with reflective plate
- M6 reflective fiber coupled with fiber sensor amplifier
- Diffuse reflective sensor (approx. 10mm detecting distance)
- Diffuse reflective sensor (adjustable sensitivity)
- Distance settable sensor (can approximate distance 2mm – 80mm)
- 8pin DIN mounted 24V coil electromagnetic relay
- Digital counter
- Tachometer
- Led light indicator
- Momentary push button
- Motorize (24VDC) rotary disc (D50mm) c/w 2 sets of alternate black and white region



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- Motorize (24VDC) rotary disc (D50mm) c/w 2 sets of the alternate yellow, green, blue, and red region
- Cylindrical capacitive sensor (detecting distance 8mm or more)
- Flat capacitive sensor (detecting distance 8mm or more)
- Cylindrical inductive sensor
- Analog Inductive Proximity Sensor



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### Mechatronics Lab Outfit

#### 1. Discrete component tester Trainerkit:-

##### 1.1 Basic Indicative Diagram:-



- 1.2 Flexibility of making circuit connections
- 1.3 Online learning material for step by step procedure to perform the experiment and other Details related to theory and experiments.
- 1.4 Trainer should be RoHS compliant
- 1.5 Trainer should be compact, lightweight and housing should be made of ABS material.
- 1.6 DC Power Supplies: + 5V, 1 A (Fixed), + 12V, 500 mA (Fixed), -12V, 500 mA (Fixed), + 12V, 500 mA (Variable), -12V, 500 mA (Variable)
- 1.7 AC Supply: 9V-0V-9V, 500mA
- 1.8 Breadboard: Breadboard for making various circuits and testing them.
- External
  - 1.9 Components/IC can be fitted conveniently.
  - 1.9 Function Generator: Operating modes Sine, Square and Triangular. Frequency range 1 Hz to 100 KHz.
  - 1.10 Volt/ Current/ Frequency Measurement: Voltage Range +12V to -12V DC, Current Range 0 to 500mA DC, Frequency Range DC to 100 KHz (All with respect to Ground)
  - 1.11 Display: LCD
  - 1.12 Computer Interface: Acquisition from two Analog input channels (Max. input 1Volt, Frequency 300Hz to 3.4 kHz)
  - 1.13 Continuity Tester: For testing the continuity. Provided with beeper sound.
  - 1.14 Power Supply: 110-220 V, 50Hz.
  - 1.15 Ready to use experiment board should be fitted in place of bread board to perform Following experiments on Diode Characteristics (Si, Zenger, and LED)



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- 1.15.1 Study of V-I characteristics of Silicon Diode
- 1.15.2 Study of V-I characteristics of Zener Diode
- 1.15.3 Study of V-I characteristics of Light Emitting Diode (LED)
- 1.16 The trainer should include online single user Classroom / laboratory teaching, learning And simulation software module on Analog Electronic with following key features:
  - 1.16.1 The content should be designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Various technologies in electronics including advance technologies, the Software should comprise simulations, animations, videos, graphs, Charts, along with mandatory rich content and theory to understand Fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Analog Electronic with following topics:
    - 1.16.2 Understand the fundamental concept of Electronic Components, Series and Parallel Circuits, Voltage Divider and Current Divider Circuit, Circuit Analysis: Ohm's Law, Kirchhoff's Law, Loop and Mesh Analysis, Star and Delta Network, Network Theorems: Thevenin's, Norton's, Superposition, Maximum Power Transfer, Millman's, Reciprocity, Magnetism, Electromagnetism, Alternating Current Circuits, Transformer, Rectifier, Filter, Semiconductor Devices: Diode, BJT, FET, Operational Amplifier, Power Amplifier, Thermistor Family, Measuring Instruments: Oscilloscope, Multimeter.



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## 2. Analog circuit trainer kit:-

### 2.1 Basic Indicative Diagram:-



2.2 Flexibility of making circuit connections

2.3 Online learning material for step by step procedure to perform the experiment and other Details related to theory and experiments.

2.4 Trainer should be RoHS compliant

2.5 Trainer should be compact, lightweight and housing should be made of ABS material.

2.6 DC Power Supplies: + 5V, 1 A (Fixed), + 12V, 500 mA (Fixed), -12V, 500 mA (Fixed),

+ 12V, 500 mA (Variable), -12V, 500 mA (Variable)

2.7 AC Supply: 9V-0V-9V, 500mA

2.8 Breadboard: Breadboard for making various circuits and testing them. External Components/IC can be fitted conveniently.

2.9 Function Generator: Operating modes Sine, Square and Triangular.

Frequency range 1 Hz to 100 KHz.

2.10 Volt/ Current/ Frequency Measurement: Voltage Range +12V to -12V DC, Current Range 0 to 500mA DC, Frequency Range DC to 100 KHz (All with respect to Ground)

2.11 Display: LCD

2.12 Computer Interface: Acquisition from two Analog input channels (Max. input 1V, Frequency 300Hz to 3.4 kHz)

2.13 Continuity Tester: For testing the continuity. Provided with beeper sound.

2.14 Power Supply: 110-220 V, 50Hz.

2.15 Ready to use experiment board should be fitted in place of bread board to perform





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Following experiments on Zenger Voltage Regulator board:

- 2.15.1 Study of Zenger diode as a voltage regulator, when input voltage  $V_{IN}$  is fixed while Load resistance  $R_L$  is variable
- 2.15.2 Study of Zenger diode as a voltage regulator, when input voltage  $V_{IN}$  is variable While Load resistance  $R_L$  is fixed
- 2.16 The trainer should include online single user Classroom / laboratory teaching, learning And simulation software module on Analog Electronic with following key features:
  - 2.16.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Various technologies in electronics including advance technologies, the Software should comprises simulations, animations, videos, graphs, Charts, along with mandatory rich content and theory to understand Fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Analog Electronic with following topics:
    - 2.16.2 Understand the fundamental concept of Electronic Components, Series and Parallel Circuits, Voltage Divider and Current Divider Circuit, Circuit Analysis: Ohm`s Law, Kirchhoff`s Law, Loop and Mesh Analysis, Star and Delta Network, Network Theorems: Thevenin`s, Norton`s, Superposition, Maximum Power Transfer, Millman`s, Reciprocity, Magnetism, Electromagnetism, Alternating Current Circuits, Transformer, Rectifier, Filter, Semiconductor Devices: Diode, BJT, FET, Operational Amplifier, Power Amplifier, Thyristor Family, Measuring Instruments: Oscilloscope, Multimeter.



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### 3. Soldering and de soldering Station:-

#### 3.1 Basic indicative Diagram:-



It should consist:-

#### 3.2 Power unit with LCD display.

- 3.2.1 No. Of Channel: - 2 nos
- 3.2.2 Power supply: - 230V A.C.
- 3.2.3 Power Consumption: - 250 watt
- 3.2.4 It should be ESD safe
- 3.2.5 Provision for setting standby time and standby temperature
- 3.2.6 Menu option provided for selecting Temperature window
- 3.2.7 Product complies with the guidelines. 2011/65/EU (RoHS), 2004/108/EG, 2006/42/EG
- 3.2.8 2 independent channels with automatic tool recognition
- 3.3 80 watt Soldering gun,
  - 3.3.1 Heating output 80 W
  - 3.3.2 Heat-up time 1Aprox. 10 s (50°C – 350°C)
  - 3.3.4 Temperature range adjustable from 50°C – 450°C
  - 3.3.5 Safety Rest with dry cleaner required
- 3.4 Desoldering gun & accessories.
  - 3.4.1 Heating output 80 W
  - 3.4.2 Heat-up time 1Aprox. 10 s (50°C – 350°C)
  - 3.4.3 Temperature range adjustable from 50°C – 450°C
  - 3.4.4 Safety Rest with dry cleaner required
  - 3.4.5 Nozzle Size: - Outer- 2.5mm, inner- 1.2
- 3.5 Accessories:-
  - 3.5.1 2.4mm tip : - 5 nos.
  - 3.5.2 0.3x0.1mm tip : - 5 nos.
  - 3.5.3 Nozzle for Disorderinggun: - 10 nos.



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### 3.1 Power Electronic Trainer (with all components for performing control rectifiers, Converter, Inverter experiments):-

#### 3.1.1 Basic Indicative Diagram:-



3.1.2 On Platform Breadboard to circuit design-2Nos.

3.1.3 On board DC Power Supply:  $\pm 5V/500mA$ ;  $\pm 12V/500mA$ ;  $+15V/250mA$ ;  $\pm 35V/250mA$

3.1.4 On board AC power Supply: 18V-0V-18V; 0V-15V

3.1.5 On board firing circuit with Frequency range: 30Hz to 900Hz variable; Amplitude: 12V; PWM control of G1, G2, G3 & G4; Duty cycle control of Gate signal is 0 to 100%

3.1.6 SCR Assembly: 4 SCRs 2P4M, 400V/2A

3.1.7 Power Devices: IGBT-G4BC20S, MOSFET-IRFZ44N, UJT-2N2646, DIAC-DB3, TRIAC- BT136, PUT-2N6027

3.1.7 Circuit Components on Board: Electrolytic Capacitor-10 $\mu$ F, 63V, 1 $\mu$ F, 63V; Met.

Capacitor 0.33 $\mu$ F, 63V; Resistances-1K/1W, 1K/10W, 10K/10W, 120E/5W, 2K2/2W; Diode 1N4007, Inductor 220 $\mu$ H, 4.7 $\mu$ H, 10mH.

3.1.8 Pulse transformer on board: 2 nos. PT4502 1:1 and one is PT4503 1:1:1

3.1.9 AC power Supply: 220V/110V, 50Hz

3.1.10 Trainer should be RoHS compliant

3.1.11 Trainer should be compact, lightweight and housing should be made of ABS material.

3.1.12 The trainer should be supplied with following application boards:

3.1.12.1 MOSFET Characteristics: Should have to perform experiment like-To study the Characteristics of n channel MOSFET

3.1.12.2 SCR Characteristics: Should have to perform experiment like:-Study of Characteristics of SCR and Plotting V-I Characteristics

3.1.12.3 SCR-LAMP Flasher: Should have to perform experiment like: - Study the Application of SCR as a lamp flasher measurement of frequency, time, and voltage.

3.1.12.4 SCR Alarm Circuit: Should have to perform experiment like: - study the Application Of SCR in alarm circuit and measurement of gate current and gate voltage.

3.1.12.5 The training should include online single user Classroom /laboratory



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teaching,

### 3.2. AC Squirrel cage Induction Motor DOL Starter and star –Delta starter assembly:-

#### 3.2.1 BASIC INDICATIVE DIAGRAM:-



- 3.2.2 3 phase AC squirrel cage induction motor: - 3 H.P. 440 V.
- 3.2.3 A.C. Voltmeter 0 to 500V panel meter
- 3.2.4 A.C. Ammeter 0 to 15 A panel meter
- 3.2.5 Indicating lamp for R, Y and B phase
- 3.2.6 DOL starter to run 3 H.P. squirrel cage motor.
- 3.2.7 Star-Delta starter to run 3 H.P. squirrel cage motor.
- 3.2.8 Protection Devices such as FUSE, ELCB etc. fitted on panel board
- 3.2.9 Provision of Banana terminals to connect wires
- 3.2.10 It should have provision to run motor using both D.O.L and star- delta starter.
- 3.2.11 Size of panel: - 900mm X 600mm X 250mm
- 3.2.12 Panel should be supplied with panel stand
- 3.2.13 Trainer should have following technical specifications
- 3.2.14 Mains Supply : Three Phase, 415V  $\pm$ 10%, 50Hz
- 3.2.15 Three Phase Induction Motor
- 3.2.16 Type : Squirrel Cage
- 3.2.17 Rating : 3HP
- 3.2.18 Voltage Rating : 415V



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- 3.2.19 Speed : 1440 RPM  $\pm$ 5%
- 3.2.20 Insulation : Class 'F'
- 3.2.21 Loading arrangement : Mechanical
- 3.2.22 Brake Drum/Pulley : Aluminum Casted
- 3.2.23 PC Interface – Through wireless connectivity
- 3.2.24 Wireless technology :- Zigbee
- 3.2.25 Product should be provided with user friendly software for monitoring & measurement of run time electrical parameters like Voltage , Current and Speed and Torque , Power, Power factor, Frequency, etc.
- 3.2.26 Sensors – Voltage, Current , Speed , Strain
- 3.2.27 Three Phase parameters Measurement -Line to Neutral Voltage , Line to Line Voltage Line Current , Active Power , Reactive Power , Apparent Power ,Frequency , Power Factor , CT is used as Current Transducer
- 3.2.28 Fully isolated measurement
- 3.2.29 Communication range : - 10 meter
- 3.2.30 Frequency :- 2.4 GHz
- 3.2.31 Digital Meters
- 3.2.32 Wattmeter : 4500W (2 nos.)
- 3.2.33 AC Voltmeter : 450V
- 3.2.34 AC Ammeter : 10A
- 3.2.35 MCB (TPN) : 40A
- 3.2.36 Star delta starter – to be provided externally
- 3.2.37 BS 10 terminals and specially designed patch cords to be provided to protect from danger. BS10 safety terminals should be in compliance with IS302-1/IEC60335-1, tested from NABL accredited Lab
- 3.2.38 Control Panel should be consist of high grade FRP material for better safety and in compliance with IS302-1/IEC60335-1, tested from NABL accredited Lab



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#### 4. DC motor Trainer board:-

This is covered in item no 143 of this syllabus

Trainer should have following technical specifications

DC Machine

|                |   |  |
|----------------|---|--|
| Type           | : | Shunt  |
| Rating         | : | 3HP  |
| Voltage rating | : | 220V $\pm$ 10% (Please refer specification on machine) |
| Speed          | : | 1500 RPM $\pm$ 5%                                      |
| Insulation     | : | Class 'F'  |

#### **Loading Arrangement : Mechanical**

**Brake Drum/Pulley** : Aluminum Casted

PC Interface – Through wireless connectivity

Wireless technology :- Zigbee

Product should be provided with user friendly software for monitoring & measurement of run time electrical parameters like Voltage , Current and Speed and Torque

Sensors – Voltage, Current , Speed , Strain

Communication range : - 10 meter

Frequency :- 2.4 GHz

#### **Digital Meters used**

DC Voltmeter : 300V

**DC Ammeter (2 No.) : 10A**

#### **Other Accessories**

Power Supply

Technical Specifications :-

Input Mains : 230 V AC  $\pm$ 10%, 50 Hz

Outputs 220 V  $\pm$  10%, 12 A Fixed DC

0-220 V  $\pm$  10%, 12 A Variable DC

Digital Voltmeter 300 V

Digital Ammeter 20 A

Single Phase MCB 32 A

BS 10 terminals and specially designed patch cords to be provided to protect from danger.

• BS10 safety terminals should be in compliance with IS302-1/IEC60335-1, tested from NABL accredited Lab

•Control Panel should be consist of high grade FRP material for better safety and in compliance with IS302-1/IEC60335-1, tested from NABL accredited Lab



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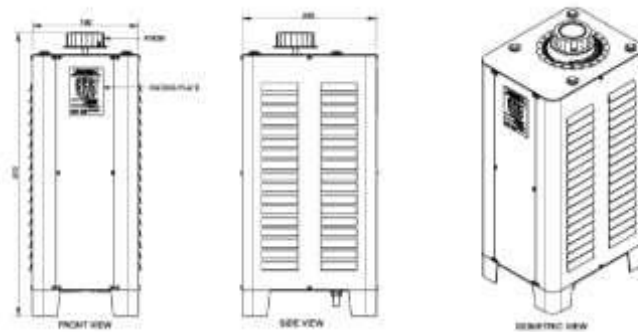
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#### 5. Auto transformer 0 – 300 v, 8 Amp:-

##### 5.1 Basic Indicative Diagram:-



5.2 Three Phase, 5KVA Input:                      415 V Output:                      0 - 470 V

5.3 Should be wound with electrolytic grade Class F insulated super enamelled copper wire

5.4 Should be fitted with High grade - Low Loss CRGO

5.5 Should be fully covered with sheet steel enclosure powder coated

5.6 Should have Knob showing 0 to 100% and Terminal at Top

5.7 Class F insulated, double vacuum impregnated with class H Varnish

5.8 CE marked



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#### 6. C.R.O, 50 M Hz:-

##### 6.1 Basic Indicative Diagram:-



- 6.2 Display Type and Size: - 6 inch CRT
- 6.3 Bandwidth: - 50 MHz
- 6.4 Rise Time: - 7 nanoseconds
- 6.5 Sweep Time: - 0.5 microseconds to 0.1 seconds per division (3% error)
- 6.6 Power Ratings: - 100/240 Volt Ac - 50/60 Hz - 40 Watts
- 6.7 Input Impedance Selection: - 1 M $\Omega$
- 6.8 Accelerating voltage: - 2000 V Approx.
- 6.9 Stabilised Power supply for all circuits including EHT
- 6.10 Trace rotation and intensity control on front panel
- 6.11 Calibrator: - Square wave 0.2 V & 2V +- 1%
- 6.12 Input coupling: - DC, AC, GND
- 6.13 Input Volts (max):- 300 Vrms.
- 6.14 Accuracy: - +- 2% (in cal position)





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## 7. Digital and Analog IC Tester:-

### 7.1 Basic Indicative Diagram:-



- 7.2 Supply Input Voltage: 230V AC
- 7.3 ZIF: Two Nos. of 40 pin DIP ZIF sockets for Digital & Analog IC's 136, 4 Keys: Key pad with numerical & functional keys
- 7.5 Display: 16x2 Backlit LCD Display
- 7.6 It should test a wide range of Digital IC's such as 74 Series, 40/45 Series of CMOS IC's.
- 7.7 It should test Microprocessor 8085, 8086, Z80.
- 7.8 It should tests Peripherals like 8255, 8279, 8253, 8259, 8251, 8155, 6264, 62256, 8288, 8284.
- 7.9 It should tests a wide range of Analog IC's such as ADC, DAC, Pomp, 555, Transistor Arrays, Analog Switches, Waveform Generator, Line Drivers, Voltages Regulators, PLL's, VCO, PWM Generator, Sample & Hold, Voltages References, Opt couplers, Comparators, Voltages Followers and Others
- 7.10 It should tests seven segment display of common cathode & common anode type.
- 7.11 It should have Auto search facility for Digital IC's.
- 7.12 User manual describing about how to test IC and specification of unit



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### 8. Digital Tachometer:-

#### 7.1 Basic Indicative Diagram:-



- 8.2 Display: 5 digits 18mm LCD White Backlight display
- 8.3 Sampling Time (internal design): 0.8 Sec (Over 120 RPM)
- 8.4 Test Range: Auto Ranging
- 8.5 Range I: Non-contact: 2.5 to 99999 RPM
- 8.6 Range II: Contact: 0.5 to 19999 RPM (Surface speed 0.05 to 1999.9 m/min)
- 8.7 Accuracy:  $\pm (0.05\% + 1 \text{ digits})$
- 8.8 Resolution: Non-contact, 2.5 to 99999 RPM - 0.1 (2.5 ~ 999.9) / 1 RPM (over 1000 RPM)
- 8.9 Contact: 0.1 RPM (0.5 to 999.9 RPM) / 1 RPM over 1000 RPM
- 8.10 Surface speed: 0.01 m/min (0.05 to 99.99 m/min), 0.1 m/min (over 100 m/min)
- 8.11 Memory: Last value, Max Value, Min Value
- 8.12 Detecting Distance: 50 to 500 mm (photo)
- 8.13 Operating Temperature: 0 - 50 °C
- 8.14 Operating Humidity: Less than 80% RH
- 8.15 Power Consumption (Internal Design): Approx. 65 mA
- 8.16 Dimensions with Adaptor: 210 (L) X 70 (W) X 43 (H) mm ( $\pm 10\%$ )



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- 8.17 Net Weight: Approx. 175 Grams excluding batteries ( $\pm 10\%$ )
- 8.18 Power Supply: 3 x 1.5 V AA Size Battery
- 8.19 Other Features:-
  - 8.19.1 Photo Light Pointer
  - 8.19.2 Automatic Data Hold
  - 8.19.3 Auto Power Off
  - 8.19.4 Low Battery Indication
- 8.20 Response Time 500ms
- 8.21 Accessories:-
  - 8.21.1 Carrying Case
  - 8.21.2 Surface speed Test Wheel
  - 8.21.3 RPM Adapter (Cone)
  - 8.21.4 RPM Adapter (Funnel)
  - 8.21.5 2 Pieces of Reflecting Tape (350mm)
  - 8.21.6 User Manual
  - 8.21.7 Type:
    - 8.21.8 Non – Contact, Optical RPM
    - 8.21.9 Measurement Tachometer
    - 8.21.10 Tachometer Range:
      - 8.21.11 0.5 to 19999 RPM
      - 8.21.12 Resolution:
        - 8.21.13 1 rpm or better
        - 8.21.14 Display:
          - 8.21.15 LCD / LED
          - 8.21.16 Accessories:
            - 8.21.17 Protective cap for safe storage
            - 8.21.18 Reflective markers
            - 8.21.19 Operating supply:
              - 8.21.20 Battery (included)
              - 8.21.21 Battery life:  $\geq 20$  hr



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### 9. Signal Generator:-

#### 7.1 Basic Indicative Diagram:-



9.2 Strongly steady electro-circuit.

9.3 Digital Display about frequency & operate conveniently.

9.4 Frequency Range: 6-phases from 0.2Hz ~ 2MHz.

9.5 Output for empty carry arrive at 5V, 600Ω carried will be higher than 2V (sine wave).

9.6 Output Voltage balance may be adjusted by 2 groups of attenuator every 20dB & 40dB, total 60dB or potentiometer in continuity.

9.7 Sine wave or square wave may be chosen to output.

9.8 Frequency Range:

9.8.1 X1 Shift: 0.2Hz ~ 20Hz

9.8.2 X10 Shift: 2Hz ~ 200Hz

9.8.3 X100 Shift: 20Hz~ 2 KHz

9.8.4 X1K Shift: 200Hz ~ 20 KHz

9.8.5 X10K Shift: 2 KHz ~ 200 KHz

9.8.6 X100K Shift: 20 KHz ~ 2MHz

9.9 Sine Wave Nature: Output Voltage: Minimum 5V, in MΩ: 2.7V

9.10 Square wave nature: Output Voltage: >9V (highest point), in MΩ: 2.7V

9.11 Power:

9.11.1 Input Voltage: 110V or 220V AC

9.11.2 Burden: About 10 VA

9.12 The Nature of Output: Output impedance: 600Ω ±10%

9.13 Attenuator: 20dB, 40dB & in 60dB series

9.14 Dimension: 270 x 250 x 100 mm (±10%)

9.15 Accessories: User Manual, BNC to crocodile, BNC to BNC & Mains Power Cord



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#### 10. DC Power supply unit 0 - 30 v, 2 Amps:-

As Per DVET, Maharashtra State SPECIFICATION FOR ELECTRICAL AND ELECTRONICS TOOLS AND EQUIPMENTS GROUP ITEMS **Sr.No:- 81 Page No.:-91**

##### 10.1 Basic Indicative Diagram:-



- |  |   |
|--|---|
| 10.2 Output voltage:                     | 0 to 30 Volt  |
| 10.3 Output Current:                     | 0-5A  |
| 10.4 Load effect:                        | $CV \leq 1 \times 10^{-4} + 2mV$ , $CC \leq 2 \times 10^{-4} + 3mA$ |
| 10.5 Ripple and Noise:                   | $\leq 0.3mV_{rms}$  |
| 10.6 Output Regulation Resolution:       | CV: 100mV (Typical), CC: 10mA (Typical)                             |
| 10.7 Display Accuracy:                   | 4 digit $\leq \pm (0.1\% + 5)$ , 3 digit $\leq \pm (0.4\% + 3)$     |
| 10.8 Reliability (MTBF):                 | < 2000 Hours  |
| 10.9 Display:                            | LED should display the voltage and current values                   |
| 10.10 Power Input Voltage:               | 230VAC/ 115VAC (Optional)   |
| 10.11 Frequency:                         | 50Hz/ 60Hz  |
| 10.12 Product Size (W X H X D):          | 105mm X 160 mm X 240mm ( $\pm 10\%$ )                               |
| 10.13 Should be supplied with Power Cord |   |



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### 11. Digital Earth Tester:-

#### 10.1 Basic Indicative Diagram:-



|         |                                     |  |
|---------|-------------------------------------|--|
| 11.2    | Display:                            | 4 Digit LCD Backlight Display.           |
| 11.3    | Should also measure leakage current |  |
| 11.4    | Jaw Size:                           | 65 x 32 mm                               |
| 11.5    | Span of Jaw:                        | 32mm.                                    |
| 11.6    | Operating Temperature:              | -10 C ~ 55 C                             |
| 11.7    | Relative humidity:                  | 10% ~ 90%RH                              |
| 11.8    | Protection grade:                   | Double Insulation                        |
| 11.9    | Range selection:                    | Automatic                                |
| 11.10   | PC interface:                       | RS232 interface                          |
| 11.11   | Sampling Time:                      | 1 second                                 |
| 11.12   | Earth Resistance Measurement Range: | 0.100 ~ 1200Ω                            |
| 11.13   | Resistance Measurement Resolution:  | 0.001 Ω                                  |
| 11.14   | Resistance Measurement Range:       | 0.10 mA ~ 20.0A                          |
| 11.15   | Dimensions (LxWxH) in mm (±10%):    | Approx. 300 X 90X 55                     |
| 11.16   | Net Weight (±10%):                  | Approx. 1000 Grams (Excluding batteries) |
| 11.17   | Power Supply:                       | 6VDC (4 x AAA Alkaline Dry Battery).     |
| 11.18   | Accessories                         |  |
| 11.18.1 | Standard 5.1 ohm Testing Coil       |  |
| 11.18.2 | Batteries                           |  |
| 11.18.3 | Operating Manual                    |  |
| 11.18.4 | Software CD                         |  |
| 11.18.5 | Interface Cable                     |  |
| 11.18.6 | Heavy Duty Carrying Case            |  |



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### 12. Fire Fighting Equipment:-

#### 10.1 Basic Indicative Diagram:-



12.2 Ring Handle Mount

12.3 ABC Types Fire extinguishers are effective for all types of fire like Class A, B&C types of fires as well as Electrical fires & also ABC Powder Type (Stored Pressure) Fire Extinguisher, Multipurpose uses

12.4 Clear Instruction Label and No Maintenance required

12.5 operating temperature (-0) °C to (+55) °C

12.6 Fire Extinguisher Type CO<sub>2</sub> Based 97.3 Brand 3Kg

12.7 Certification ISO, ISI 97.5 It ISI Marked ISI Marked 97.6 It ISI Certified ISI Certified



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### 13. Linear IC Trainer Kit:-

#### 10.1 Basic Indicative Diagram:-



- 13.2 It should have built-in Function Generator, Continuity Tester, Toggle Switch, Potentiometer, Frequency Measurement, Computer Interface
- 13.3 Functional Blocks indicated on board mimic
- 13.4 On board DC and AC Power Supply, Function Generator, Continuity Tester
- 13.5 On board Toggle Switches and Potentiometers
- 13.6 Solder less Breadboard
- 13.7 On Board Voltage/ Current/Frequency Measurement
- 13.8 Trainer should be RoHS compliant
- 13.9 Trainer should be compact, lightweight and housing should be made of ABS material.
- 13.10 Regulated DC power supplies: +5V-1A (Fixed),  $\pm 12V$ -500mA (Fixed),  $\pm 12V$ -500mA (Variable)
- 13.11 AC supply: 9V-0V-9V/500mA
- 13.12 Function Generator
  - 13.12.1 Operating modes: Sine, Square, Triangular
  - 13.12.2 Frequency range: 1 Hz to 100 KHz
- 13.13 Volt/Current/Frequency Measurement: Voltage Range +12V to -12V DC  
Current Range 0 to 500mA DC





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- 13.14 Display: LCD
- 13.15 Computer Interface: Acquisition from two Analog input channels  
(Max. input 1Volt, Frequency 300Hz to 3.4 kHz)
- 13.16 Continuity Tester: For testing the continuity. Provided with Beeper Sound.
- 13.17 The training should include online single user Classroom / laboratory teaching, learning and simulation software module on Analog Electronic with following key features:
- 13.17.1 The content should designed by using platforms like Visual Basic, Dot Net, Flash etc. and Should be useful to understand the basic concepts of Analog Electronics, the software Should comprises simulations, animations, videos, graphs, charts, along with Mandatory rich content and theory to understand fundamental concepts, interactive Learning objects, FAQ, MCQ etc. of Analog Electronic with following topics:
- 13.17.2 Understand the fundamental concept of Electronic Components, Series and Parallel Circuits, Voltage Divider and Current Divider Circuit, Circuit Analysis: Ohm`s Law, Kirchoff`s Law, Loop and Mesh Analysis, Star and Delta Network, Network Theorems: Thevenin`s, Norton`s, Superposition, Maximum Power Transfer, Millman`s, Reciprocity, Magnetism, Electromagnetism, Alternating Current Circuits, Transformer, Rectifier, Filter, Semiconductor Devices: Diode, BJT, FET, Operational Amplifier, Power Amplifier, Thyristor Family, Measuring Instruments: Oscilloscope, Multi meter.



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#### 14.A.C./D.C. ( UNIVERSAL ) MOTOR SPEED CONTROLLER TRAINER :-

##### 10.1 BASIC INDICATIVE DIAGRAM:-



10.2 Input supply: - 230V A.C.

14.3 Motor : 1 H.P. Both A.C. & D.C.

14.4 SCR and Triac control circuit.

14.5 Provision to control firing angle of thyristor

14.6 Display showing speed of motor.

14.7 Voltmeter and ammeter to show the voltages and current of circuit.

14.8 Must be able to show practical of speed control of both AC and DC motor

14.9 Adequate no. of patch cords stackable 4 mm spring loaded plug length  
1 metre

14.10 Good Quality, reliable terminal/sockets are provided at appropriate places on  
Panel for connections/ observation of waveforms.

#### Specifications :

|                                 |   |                      |
|---------------------------------|---|----------------------|
| Mains Supply                    | : | 230V $\pm$ 10%, 50Hz |
| Single Phase AC universal Motor | : |                      |
| Type                            | : | Universal            |
| Rating                          | : | 1HP                  |
| Voltage rating                  | : | 230V $\pm$ 10%       |
| Speed                           | : | 1500 RPM             |
| Insulation                      | : | Class 'F'            |
| Loading Arrangement             | : | Mechanical           |
| Brake drum/Pulley               | : | Aluminum Casted      |



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#### Analog Meters Used

|                 |   |  |
|-----------------|---|--|
| Voltmeter       | : | 0 - 300V   |
| Ammeter         | : | 0 - 10A  |
| Wattmeter       | : | 1500W  |
| MCB (SP)        | : | 10A  |
| DC Power Supply | : | To be provided externally of rating 12A, 0-220Volt |

BS 10 terminals and specially designed patch cords to be provided to protect from danger.

- BS10 safety terminals should be in compliance with IS302-1/IEC60335-1, tested from NABL accredited Lab

- Control Panel should be consist of high grade FRP material for better safety and in compliance with IS302-1/IEC60335-1, tested from NABL accredited Lab



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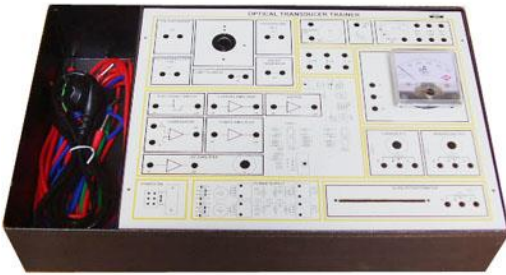
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### 15. Optical Transducer Trainer kit.-

#### 10.1 Basic Indicative Diagram:-



#### 15.2 SALIENT FEATURES :

Optical transducers trainer kit play a very important role in today's industrial and domestic applications. Optical transducer trainer is unique in design as it covers, study of 4 different types of transducers. Experiments covering fundamental characteristics of transducers and study of transducer controlled switching / alarm systems can be performed. The manual consists of various chapters covering Introduction, Theory Types and selection of transducers, their applications and Glossary of terms.

#### 15.3 TECHNICAL SPECIFICATIONS

Transducers : 04 nos.

- a. Photoconductive Cell.
- b. Photovoltaic Cell.
- c. Phototransistor.
- d. PIN Photodiode.

Light Source : Filament Lamp.

- ? Signal Conditioning Circuitry :
1. Power Amplifier.
  2. Current Amplifier.
  3. DC Amplifier.
  4. Comparator.
  5. Electronic Switch.
  6. Buffer.

Input Circuits : Rotary and Slide Potentiometers.



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Output Circuits :

1. Moving Coil Meter.
2. Relay.
3. LED.

Interconnections : 4 mm banana sockets.

Power Supply : 230 V + 10 % 50 Hz.

Standard Accessories : Detailed Instruction Manual



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#### 16. Simple Servomotor trainer kit:-

##### 10.1 Basic Indicative Diagram:-



16.2 Closed loop and Open loop speed control of AC Servo motor

16.3 Slotted disk for speed measurement

16.4 Separate unit for Motor in a see through cabinet

16.5 DPM for speed and voltage display

16.6 Precise signal conditioning

16.7 Instrumentation Power supply with DPM panel:

16.7.1 +/-12 V, 500 mA

16.7.2 +5V, 300mA

16.7.3 Unregulated DC supply

16.7.4 Line synchronizing signal.

16.7.5 DPM for digital display of speed, etc.

16.8 SCR Actuator/ Drive based (variable DC):

16.8.1 Full bridge SCR based 0V-195V / 12 Amp with linear characteristics.

16.8.2 Supports signal conditioning circuit for speed to give output 0-2.5Vdc (FS).

This supply is required for DC Armature.

16.8.3 IGBT/MOSFET based Panel for variable PWM controlled power

For armature supply.

16.9 DC voltmeter and DC ammeter panel

16.9.1 DC voltmeter (0-300V)

16.9.2 DC Ammeter 0-2A) with polarity protection diode

16.9.3 Field failure relay to control Armature supply.

16.10 A.C. servo Motor with process setup.

16.11 The trainer should support to perform following experiments:

16.11.1 Effect of loading on the speed of the Motor in the open loop

16.11.2 Effect of loading on the speed of the Motor in the closed loop

16.11.3 Speed control of an AC Servo Motor

AC Servo Motor : 1 no. It should have following features and specifications

AC Servo Motor: 1 no.



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Power : 400W

Rated Voltage : 220V

Rated Speed: 0 to 3000 r/min.

Current : 1.0Ampere

Control Type : PWM control using Drive

Encoder : 2048 / 2500 / 10000 Pulse / Rev. ( Incremental , Absolute)

Dynamic Brake : Servo/Controller off Operable with the built-in alarm activated

Servo Drive System: 1 no.

LED Display : 5 digit seven segment display

Function Key: 5 nos. (Mode , Shift , UP, Down , Set)

IO Interface Port : 1 no

Should be able to perform following experiments

- Installation of AC servo drives and motors
- Control functions and adjusting methods of AC servo drives, Parameter settings of drives
- Study and use of AC Servo motor and drive, AC Servo Drive Function, AC Servo motor in Jogg mode,
- Servo motor speed control using Potentiometer,



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#### 17. Simple stepper motor trainer kit:-

##### 10.1 Basic Indicative Diagram:-



##### 17.2 Different modes of operation

##### 17.3 Half and Full step angle

##### 17.4 Visual indication of the coil excitation

##### 17.5 External connector for programming with different controllers

##### 17.6 Separate unit for Motor in a see through cabinet.

##### 17.7 Motor Type: Unipolar

##### 17.8 Torque: 6 Kg-cm

##### 17.9 Phase Current: 0.8 Amp.

##### 17.10 Stepping Angle: 1.8° /0.9°

##### 17.11 Operating Voltage: 12 V DC

##### 17.12 Input Pulse: 5V TTL Compatible

##### 17.13 Test Points: 20

##### 17.14 Cabinet for Motor

##### 17.15 Power Supply: 110 / 230V, 50Hz

##### 17.16 Operating Conditions: 0-40° C, 80% RH

##### 17.17 Learning Material: Online learning material including Theory, Procedure, reference results, etc.)

##### 17.18 The trainer should support to perform the following experiments:

##### 17.18.1 Study and use of Stepper Motor in Wobble Mode

##### 17.18.2 Study of Stepper Motor in Full Step, Single Phase, Free Running Mode

##### 17.18.3 Study of Stepper Motor in Full Step, Single Phase, Step Running Mode

##### 17.18.4 Study of Stepper Motor in Full Step, Two Phase, Free Running Mode

##### 17.18.5 Study of Stepper Motor in Full Step, Two Phase, Step Running Mode

##### 17.18.6 Study of Stepper Motor in Half Step, Free Running Mode

##### 17.18.7 Study of Stepper Motor in Half Step, Step Running Mode

#### Technical Specifications:

Should consist of the following items:

- 2 phase stepper motor with stand and disk- (Refer Fig for phase stepper motor diagrams)





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The motor shall have these specifications: -

Number of phases = 2

- Step angle = 1.8 deg
- Holding torque = 0.1Nm

Stepper control circuit board

Should consist of the following minimum components/accessories;

- Pulse speed range = 20Hz to 1040Hz (approx.)
- Non-volatile memory to store settings and rotor position
- 4x toggle switches to activate A+, A-, B+, B- of the stepper motor
- 1x Selector switch (0-8 or more) to select the step sequence number of coil activation
- 1x Potentiometer to change the rotational speed of the stepper motor
- 1x Selector (0-9 or more) switch to select the mode of the controller
- 1x Toggle switch to change direction rotation of stepper from clockwise (CW) to counter clockwise (CCW)
- 1x Momentary push button to start a demo mode of the control kit
- LED lights for A+, A-, B+, B- respectively. LED lights up when the respective phase is activated when the motor rotates.
- 1x Eight segment numeric display / 16X2 LCD Display / or better for STEP No display 1x LED to indicate input DC power supply
- 1x LED (TIM) to indicate beginning stepper phase i.e. when A+ and B+ is turned ON
- 1x LED (Busy) to indicate motor rotation in progress

The control unit shall have these selectable mode (unless stated, the stepper is at full step mode, 1.8 step angle)

• Mode 1

• When START/SET button is depressed, the motor will turn CW 50pulses@200Hz, 8 times with 0.2secs interval. After that, it will pause 1sec then, it will turn CCW 400pulses@300Hz, 720deg.

• Mode 2

• Each time START/SET button is depressed; the motor will advance CW 10 pulses@1Hz. After 8 times CW, advancement, each time START/SET button is depressed, the motor will advance CCW 10 pulses@1Hz.

• Mode 3

• When the START/SET button is depressed, the motor will rotate CW 300pulses@100Hz and then stop for 1 second. Then motor will rotate CCW 500pulses@200Hz.

• Mode 4 (Half step)

• When the START/SET button is depressed, the motor will rotate CW 600pulses@200Hz and then stop for 1 second. Then motor will rotate CCW 1000pulses@400Hz.



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- Mode 5 – Jog drive
- When the START/SET button is depressed, the motor will rotate 1pulse@100Hz. Direction of turn is determined by CW/CCW toggle switch. The number of pulses is saved into the controller memory for motor to return to starting position in mode 7.

#### Mode 6 – Continuous drive

- When the START/SET button is depressed, the motor will rotate continuously. The speed of rotation is determined by the potentiometer. The pulse frequency of the controller is from 20Hz to about 1040Hz. When the START/STEP button is depressed again, the motor will stop rotating. The number of pulses is saved into the controller memory for motor to return to starting position in mode 7.

#### • Mode 7 – Return drive

- When the START/SET button is depressed, the controller will move to the internal initial position, that was saved into memory under Mode 5 or Mode 6.

#### • Mode 8 – Excitation sequence

- This mode saves the phase activation sequence of A+, A-, B+, B- and will be used for Mode 5. An incorrect sequence will prevent the motor from rotating properly.
- When START/SET button is depressed, the controller will save the current STEP NO and the toggle switch state of A+, A-, B+, B-.
- STEP NO 0 to 7 is the specifies the sequence of phase activation. The sequence will start from 0 to 7 and then repeats when Mode 5 is running.
- For example,
- STEP NO is 1 and A+, B+ are ON and A-, B- are OFF and
- STEP NO is 0 and A-, B- are ON and A+, B+ are OFFIn mode 5, the phase activation will begin with step 0 then step 1 as in the following: -
- Step 0 – A-, B- ON, A+, B+ OFF
- Step 1 – A+, B+ ON, A-, B- OFF

#### • Mode 9 – Roulette

- When the START/SET is depressed, the motor will start to rotate. When START/SET is depressed again, the motor will stop after a delay that is random.

#### • Mode 0 – Stepper driver

- In the mode, the control circuit board acts as a pure 2 phase stepper motor driver.

#### □ Battery holder

1.5V x 4 battery holder with suitable DC connector / external regulated power supply



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#### 18. Linear scale setup for positional accuracy check:-

##### 10.1 Basic Indicative Diagram:-



- 18.2 It should be used in vertical, horizontal or any position with the mounting hardware.
- 18.3 It should be suitable for lathes, milling machines, router tables, planer, table saw fence and other machine tools.
- 18.4 Fast response (3m/s), no speeding fault occurred.
- 18.5 Can set "zero" anywhere within operating range for determining relative distances.
- 18.6 LCD Display with inch, decimal, fractional and metric readings facility
- 18.7. Magnetic remote display with 50" cord for easy installation and access.
- 18.8 Remote reading display, easy to read and operation.
- 18.9 Material: Aluminium Alloy
- 18.10 Battery: CR2032 (3V)
- 18.11 Measuring range: 0-150mm
- 18.12 Resolution: 0.01mm
- 18.13 Accuracy: 0.06mm
- 18.14 Accessories required or performing above function.
- 18.15 Suitable carry case



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### 19. A/D and D/A Trainer kit:-

#### 10.1 Basic Indicative Diagram:-



#### 19.2 ADC Trainer Card:

- 19.2.1 4 bit discrete & 8 bit Monolithic converters
- 19.2.2 Unipolar & Bipolar DC voltages
- 19.2.3 O/P status displayed by LED
- 19.2.4 Functional block indicated on board mimic.
- 19.2.5 Built in DC power supply
- 19.2.6 Trainer should be RoHS compliant
- 19.2.7 Trainer should be compact, lightweight and housing should be made of ABS material.

19.2.8 Technical chart should be pasted on the trainer to learn and understand More about applications and technical details.

#### 19.2.9 A/D Conversion:

- 19.2.9.1 4 Bit discrete (ramp)
- 19.2.9.2 8 Bit Monolithic converter
- 19.2.10 Signal source: Unipolar & Bipolar DC voltages
- 19.2.11 O/P Indication: By LEDs separate for each type
- 19.2.12 Inter connections: 2mm banana socket
- 19.2.13 Power Supply: 230V, 50Hz.

#### 19.3 DAC Trainer Card

- 19.3.1 4 bit weighted resistor-4 R-2R network
- 19.3.2 10 bit monolithic D/A converters.
- 19.3.3 On board Sine Generator
- 19.3.4 Functional block indicated on board mimics
- 19.3.5 Built in DC power supply



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19.3.6 Trainer should be Rosh compliant

19.3.7 Trainer should be compact, lightweight and housing should be made of ABS material.

19.3.8 Technical chart should be pasted on the trainer to learn and understand More about applications and technical details.

19.3.9 D/A Conversion:

19.3.9.1 4 Bit weighted resistor

19.3.9.2 4 Bit R-2R ladder network

19.3.9.3 8 Bit Monolithic D/A Converter

19.4 Signal: DC supply with toggle switches

19.5 O/P indication: On DMM or Oscilloscope

19.6 Inter Connections: 2mm. banana sockets

19.7 Power Supply: 230V, 50Hz

A/D Conversion 4 bit discrete (ramp) 8 bit monolithic converter Signal Source : Unipolar & Bipolar DC voltages O/P Indication : By LEDs separate for each type Inter connections : 2 mm banana socket Power Supply : 110-220 V,  $\pm 10\%$ , 50/60 Hz Power Consumption : 3 VA approximately Product Tutorial : Online on Included Accessories : Patch cord 16" (2mm) : 16 nos. Mains cord : 1 no

D/A Conversion : 2.4 bit R-2R ladder network : 1.4 bit weighted resistor : 3.8 bit monolithic D/A Converter Signal Source : DC Supply with toggle switches O/P Indication : On DMM or Oscilloscope Interconnections : 2mm banana sockets Power Supply : 110-220 V  $\pm 10\%$ , 50/60 Hz Included Accessories : Patch cord 16" (2mm) : 17 nos. Mains cord : 1 no.



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#### 20. UPS:-

##### 20.1 Basic Indicative diagram:-



- 20.2 Type : - Online UPS
- 20.3 Rating in VA, Watts : - 2KVA, 1.6KW
- 20.4 Battery module : - Inbuilt
- 20.5 Numbers of battery : - 6 Nos.
- 20.6 Voltage & current rating of battery: - 12v, 7AH
- 20.7 DC Voltage : - 72V
- 20.8 Indication of overvoltage, overload, low battery, Trip & Mains on front panel
- 20.9 Battery module should be easily removed and fitted with connectors
- 20.10 Four Three pin socket output at back side
- 20.11 Trip facility in case of overload
- 20.11 Dimension : - 420 X 200 X 320 in mm
- 20.12 Weight : - 25 Kg approx.
- 20.13 Warranty:-
  - 20.13.1 ; - 24 months for UPS
  - 20.13.2 :- 48 months for battery



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#### 21. Stabilizer Trainer kit:-

##### 21.1 Basic Indicative Diagram:-



21.2 Phase: - Single

21.3 Power: - 550 V to 5KVA

21.4 Input voltage: - 100V To 280 V

21.5 Output voltage: - 220V +/- 5 %

21.6 Trainer kit should include with Dimmer stat to vary input voltage (0 To 280 V)

21.7 Voltmeter and Ammeter to show voltage and current indication.

21.8 Facility to do experiment of voltage and Line regulation

21.9 Facility of Overload and Overcurrent trip

21.10 Indication of shortcircuit and overvoltage

21.11 Manual describing experiment related of voltage and line regulation

21.12 Power cord and patch cord should be provided.

21.13 Should be provided with protection such as MCB, ELCB etc.

21.14 Output should be provided on front panel



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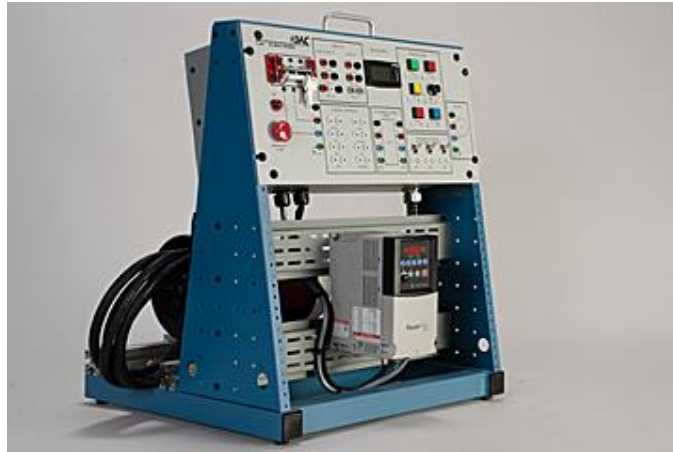
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## 22.AC Drive:-

### 22.1 Basic Indicative Diagram:-



- 22.1 Size - 3 meter x1 meter with 0.5 meter
- 22.2 With projection on the top
- 22.3 Panel Board must include:-
  - 22.3.1 Push Button (Both ON & OFF), Panel indicating lamps
  - 22.3.2 Channels to run the wires
  - 22.3.3 Panel ammeter and voltmeter
  - 22.3.4 Output to run both Single phase and three phase motor
  - 22.3.5 One application to demonstrate the panel wiring
  - 22.3.6 Variable frequency Drive for Single Phase and Three phase motor
  - 22.3.7 Protective devices like MCB, ELCB, and RCCB
  - 22.3.8 One application to demonstrate variable speed like walking trade mill.
  - 22.3.9 VFD parameter setting Hand held Terminal
  - 22.3.10 Trainer should have following technical specifications
  - 22.3.11 Mains Supply : Three phase, 415V AC  $\pm$  10%, 50Hz
  - 22.3.12
  - 22.3.13 Input Voltage : Three phase, 415V AC  $\pm$  10%
  - 22.3.14 Output frequency range :0to599Hz(default range)with resolution of 0.01Hz
  - 22.3.15 Protection Class : IP20
  - 22.3.16 Three Phase Inverter duty Induction Motor
  - 22.3.17 Type :Squirrel Cage
  - 22.3.18 Rating :3HP
  - 22.3.19 Voltage Rating :415V AC
  - 22.3.20 Speed :1440 RPM  $\pm$  5%





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- 22.3.21 Insulation :Class F
- 22.3.22 Loading arrangement : Mechanical
- 22.3.23 Brake Drum/Pulley :Aluminum Casted
- 22.3.24 Digital Meters should be use
- 22.3.25 AC Voltmeter :450V AC
- 22.3.26 AC Ammeter :20A AC
- 22.3.27 MCB (TPN) :16A AC
- 22.3.28
- 22.3.29 BS 10 terminals and specially designed patch cords to be provided to protect from danger.
- 22.3.30 BS10 safety terminals should be in compliance with IS302-1/IEC60335-1, tested from NABL accredited Lab



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### 23. DC Drive:-

#### 23.1 BASIC INDICATIVE DIAGRAM:-



- 23.2 PMDC Motor- 12V DC, 1500 RPM, 1.5 Amp, Torque: ½ Kgcm, Mounting Horizontal
- 23.3 Optical Sensor / Inductive Proximity Sensor-
- 23.4 RPM Indicator/ Tachometer-
- 23.5 3 Wire, Sensing Distance: 10cm/ 7mm, 24 VDC
- 23.6 Speed: 0-1500 RPM, Supply: 230V AC, Cut out size: 92 X 92
- 23.7 Retransmission O/P: 4-20mA according 0-1500rpm, 3 ½ digital display.
- 23.8 DC Drive- Power Supply: 230 V AC, Input: 4-20mA, Output Voltage. 0-12 V DC.
- 23.9 Voltmeter Supply: 230VAC, 0-20VDC
- 23.10 Ammeter Supply: 230VAC, 0-2ADC
- 23.11 Electrical Control Panel- MS Powder coated panel with switches, indicator, test

Points, controller On front fascia, UK 2.5 Terminal Connectors mounted on DIN

rail channel, Use of 1sq mm multi-strand wire with proper insulated Lugs, Feruling & Neat wire dressing & clamping. Wires & power cables are seated through 1"×1"PVC cable tray. Dimension: 1ft (L) ×1ft (W) ×1ft (H) Key Features and Technical Specifications: Type: 12V DC, 1500 RPM, 1.5 Amp, The DC Drive Training system should consist of the following minimum items;

- PMDC Motor coupled with belt and pulley mechanism and its Drive and control panel with necessary meters must be provided
- Box enclosure with power lock down switch, MCB, RCCB, control



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components

- Control panel with 'START', 'STOP', Emergency stop and connections
- Electrical wiring
  - 600mm, 0.75mm<sup>2</sup> cable with banana connections at both ends (10pcs)
  - 1000mm, 0.75mm<sup>2</sup> cable with banana connections at both ends (8pcs)
  - Banana connectors shall be stackable
- Should include Training manual with solutions

Accessories:

All accessories required for the functioning of the Unit.



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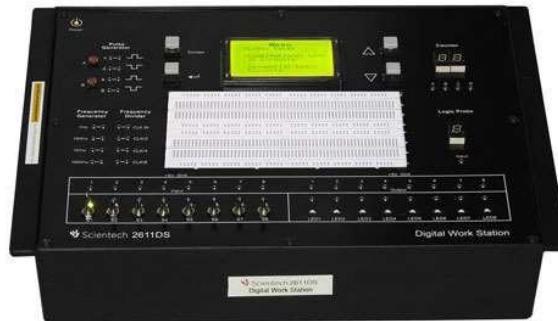
#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

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### 24. Digital circuits trainer Kit.-

#### 23.1 Basic Indicative Diagram:-



- 24.2 Trainer should be RoHS compliant
- 24.3 Trainer should be compact, lightweight and housing should be made of ABS material.
- 24.4 Size of Breadboard: 43.5 mm x 68mm
- 24.5 DC Supply: +5 V, 500 mA
- 24.6 Clock Frequency: 1 Hz, 100 Hz, 1 KHz, 100 KHz
- 24.7 Amplitude: 3.3V (TTL)
- 24.8 Duty Cycle: 50 %, TTL output
- 24.9 Pulsar Switches: 2 Nos.
- 24.10 Graphical LCD: 128 X 64 dots (To display pin diagram of various digital ICs so that Students can make by their own digital circuits)
- 24.11 Data switches: 8 Nos. (Toggle switches for both TTL modes)
- 24.12 Digital Circuits: Virtual, should be interfaced with real time Inputs/outputs
- 24.13 LED display: 8 Nos. (TTL)
- 24.14 Seven Segment Display: 3 Nos.
- 24.15 ZIF Socket: ZIF socket consists of 40 pins with 2mm output socket for each pin 8, 14, 16, 20, 40 pin ICs can be inserted without force. Supply Inputs can Be connected to the ZIF socket through 2mm patch Cord.
- 24.16 Main Supply: 100V - 240V AC, 50Hz
- 24.17 The trainer should include online single user Classroom / laboratory teaching, learning and Simulation software module on Digital Electronic with following key features:
- 24.17.1 The content should be designed by using platforms like Visual Basic, Dot Net, Flash etc. and should be useful to understand the basic concepts of Digital electronics, the software should comprise simulations, animations, videos, graphs, charts, along with mandatory rich content and theory to understand fundamental concepts, interactive learning objects, FAQ, MCQ etc. of Digital Electronic with following topics:
- 24.17.2 Number Systems, Codes, Complements, Boolean algebra, Logic Gates, Arithmetic Circuits: Adder, Subtract or, Combinational Circuits: Multiplexer, De multiplexer, Encoder, Decoder, Sequential Circuits (Flip- Flops): S-R Flip-Flop, Flip-Flop, J-K Flip-Flop, T Flip-Flop, Registers and Counters



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#### 25.8051 Microcontroller trainer board with LED, Switches, Buzzer, DC motor and Stepper motor interfacing circuits:-

##### 25.1 Basic Indicative Diagram:-



25.2 Trainer should be RoHS compliant

25.3 Trainer should be compact, lightweight and housing should be made of ABS material.

25.4 Trainer should come with technical chart pasted on it to learn and understand more About applications and technical details.

25.5 Communication: USB

25.6 Programming mode: PC mode, Hex keypad mode

25.7 MCU: 8051 core

25.8 Crystal Frequency: 11.0592 MHz

25.9 DC Power Supplies: +12V, -12V, +5V & - 5V

25.10 Programmer: Ready to run programmer will program 8051 devices

25.11 Interconnection for modules: 2 mm patch cords and FRC cables

25.12 Online Product Manual: Should include Theory, procedure, reference, results etc.

25.13 Power Supply: 110V - 260VAC, 50Hz

25.14 Accessories: USB cable, Mains cord, Patch cords, 20 Pin FRC Cable and & Power



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#### Supply

##### 25.15 Input Interface Module

25.15.1 Keyboard: ASCII keyboard

25.15.2 LED'S: 12 Nos.

25.15.3 Switches: 4 Nos.

25.15.4 Keypad: 4 X 4 matrix hex keypad

25.15.5 Power Supply: From Microcontroller development platform

25.15.6 Study Material: Online - Include theory, procedure, reference

Results, etc.

25.15.7 Interface: 20 pin FRC cable

25.15.8 Test points: 2 Nos.

##### 25.16 Display Module

25.16.1 Display: 16 x 2 character LCD

25.16.2 Contrast control: 0 - 5 V (Variable)

25.16.3 Backlight control: 0 - 5 V (Variable)

25.16.4 Seven segment display: 4 Nos.

25.16.5 LED bar graph: 1 No.

25.16.6 Interface: 20 pin FRC cable

25.16.7 Test points: 25 Nos. or more

25.16.8 Power Supply: From Microcontroller development platform

25.16.9 Learning Material: Online-include theory, procedure, reference

Results, etc.

##### 25.17 ADC/DAC Module

25.17.1 ADC: ADC0808

25.17.2 DAC: DAC0808

25.17.3 Power Supply: From Microcontroller development Platform

25.17.4 Interface: 20 pin FRC cable

25.17.5 Test Points: 25 Nos. or more



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#### 25.18 Computer Interface Module

25.18.1 Serial Communication: RS232 Port

25.18.2 USB Communication: USB port

25.18.3 Baud Rate: Configurable (Default 9600)

25.18.4 Power Supply: From Microcontroller development platform

25.18.5 Interface: 20 pin FRC cable

25.18.6 Test points: 6 No's

25.18.7 Banana socket: 15 No's or more

#### 25.19 Motor Drive Module

25.19.1 Stepper Motor: +5 V

25.19.2 DC Motor: +12 V

25.19.3 Servo Motor: +5 V

25.19.4 Interface: 20 pin FRC cable

25.19.5 Test points: 13

25.19.6 Power Supply: From Microcontroller development platform

#### 25.20 Data Acquisition System

25.20.1 Analog Inputs: 4 Inputs with 10 bit resolution

25.20.2 Analog Outputs: 2 Outputs with 10 bit resolution

25.20.3 Digital Inputs: 11 TTL Inputs

25.20.4 Digital Outputs: 11 TTL Outputs

25.20.5 Unity gain amplifiers: 2 (0-5V DC)

25.20.6 Counter: 0 to 6MHz (square wave)

25.20.7 Power Supply: USB Powered

25.20.8 Computer Interface: USB 2.0

25.21 The training should include online single user Classroom /laboratory teaching, learning

And simulation software module with following key features:

25.21.1 The content should be designed by using platforms like Visual Basic, Dot Net,



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Flash etc. and should be useful to understand the basic concepts of Microcontroller, Embedded and its Applications, the software should Comprises simulations, animations, videos, graphs, charts, along with Mandatory rich content and theory to understand fundamental concepts, Interactive learning objects, FAQ, MCQ etc. with following topics:  
25.21.2 Embedded System: Module on Embedded system should cover following





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### 26. PLC with IO simulation panel and programming software with PLC Application module:-

#### 25.1 Basic Indicative Diagram:-



#### 26.2 Basic Item Features:-

26.2.1 Electronic desk with ergonomically designed ABS moulded enclosure with slick Looking replaceable experimental panel.

26.2.2 Can learn about different applications of Industrial PLC using simulated Building blocks / replaceable static application panels (SAPs) & simulation cum Extension panels (SEPs).

26.2.3 SEPs to provide input switches, push buttons, O/P LED

26.2.4 Analog I/O with potentiometer for AI simulation & Bar graph for AO Simulation...

26.2.5 Connection through sturdy 4mm Banana sockets & Patch cords.

26.2.6 Student's workbook & Instructor's Guide should be provided.

26.3 CPU (DIO): Model S7-1200

26.4 DIO: 24 DI + 16 DO



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26.5 AIO

26.5.1 4AI + 2AO

26.5.2 Input range- +10V, Resolution- 10 bit

26.6 Software: TIA PORTAL support Ladder /Function Blocks Diagram

Programming & monitoring troubleshooting & instruction set, Simulation Software.

26.7 Com Ports: Ethernet Port (RJ45) for Ladder Programming, RS485 for HMI

26.8 Converter cum Distribution Panel

26.8.1 Converts screw driver terminal strip of PLC into 4mm sockets total 16 nos.

26.8.2 Provided for input ion AIO panel located on top board.

26.9 Panel 1 - Simulation cum Extension Panel

26.9.1 Located on left side panel, consisting of 16 nos. of digital inputs. (8 slider Switches + 8 push to ON switches, No. of 4mm banana sockets=16.

26.10 Panel 2 - Simulation cum Extension Panel

26.10.1 Located on right side panel, 16 nos. of output LED indications, 4 nos. of Relay panel with coil rating 24V & contact rating of 230VAC /5A, no. of 4mm banana sockets =20, shrouded sockets for relay contact = 8 nos.

26.11 Panel 3 - Simulation cum Extension Panel

26.11.1 Located on Top board, 4 nos. of simulation pots & 4 nos. of AI,

26.11.2 2 nos. of Analog outputs, Led bar graph of 10 led for AO simulation, Settable range 5V/10V. No. of 4mm banana sockets =19

26.12 Operating Voltage

26.12.1 SMPS Power Supply inside main unit with Power ON /OFF switch on Hind panel

26.12.2 SMPS I/P: 110/20/230Vac + 10% 50/60 Hz, O/P: 24V / 2 A

26.12.3 6 Nos. of 4mm Banana Sockets (3nos. for +24V, 3nos. for common)

For extension provided on AIO/SEP Panel

26.1337 Pin D Connector (f)

26.13.1 Provided 37 pin D type connector for complex working models like



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Lift elevator to save on wiring time. It supports DI= 21, DO=13, +24V= 1,  
GND=2

26.14 Static Application Panel - SAPs

26.14.1 Common Base Board consisting of 54 LEDs, with 10 LEDs for Bar Graph  
for AO.No. of 4mm banana sockets =32

26.14.2 Replaceable 19 Nos. of Static Application Panel which may be inserted  
onto common baseboard panel with selectively leds exposed:-

26.14.2.1 Door Bell Operation,

26.14.2.2 Switching of lights,

26.14.2.3 Silo Control,

26.14.2.4 Seven Segment Display,

26.14.2.5 Starter Control,

26.14.2.6 Sequential Control of Motors,

26.14.2.7 Star Delta Control,

26.14.2.8 Resistance Welding,

26.14.2.9 Tank Level Control,

26.14.2.10 Traffic Light Control,

26.14.2.11 Bottling Plant,

26.14.2.12 Drink Dispenses,

26.14.2.13 Reaction Vessel,

26.14.2.14 Oven,

26.14.2.15 Parking Garage

26.14.2.16 Combination Lock

26.14.2.17 Elevator Simulator

26.14.2.18 Process Control Trainer

26.14.2.19 Washing Machine

26.15 Accessories

26.15.1 Mains cord



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26.15.2 Ethernet cable 1.5m

26.15.3 Patch cords red & black 600mm length 15nos. each

Following experiment perform using PLC Platform

- Can learn about different aspects of application trainers like Industrial PLC, SCADA.
- Analog I/O channel with potentiometer for AI simulation
- Design HMI Screen, Uploading and Downloading the Program and communication with PLC.
- Operating manual provided with each unit
- PLC interfacing with different Static Module Water Level Control, Elevator Control, Traffic Light control, start Delta Starter module and Real Time module Temperature Control, Conveyor Control, DC Motor Speed Control and Stepper motor module.

Technical Specification

PLC with 24 Digital Inputs, 16 Digital Outputs and 4 Analog Inputs and 2 Analog Output with Ethernet Communication.

- 7" HMI with Ethernet Communication and USB Port

Human Machine Interface (HMI) with CPU : 32-bits 400MHz RISC, Interface : Ethernet, Storage

Flash : 128MB, DDRAM : 64MB, Display size : 7 inch

Resolution : 800 x 480 TFT LCD 65, 536 colors

Touch screen : High precision four-wire resistive

- Toggle switches push to ON switch, proximity sensor, selector switch, visual indicator, audio indicator, DC motor, relay card, contactor and voltage display.
- PLC Gateway with cloud based PLC gateway CPU-Cortex A8 600MHz, Storage Flash : 128MB, RAM: 128MB, with SUB Port, Serial Port and RS485 Port, Ethernet Port and Wi-fi module, Store upto 50000nos. data point in cloud, Live data monitoring and control worldwide (remote operation), Create animation and graphical web SCADA for process, API Interface and app monitoring, Real time interface of web SCADA with PLC, Account management for admin and user for authentication and permission.

List of Experiments

- PLC Ladder Programming
- HMI Programming
- PLC Communication With HMI
- PLC Interface with Different application module



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#### 27. Ethernet to Profibus converter:-

##### 25.1 Basic Indicative Diagram:-



27.2 POWER SUPPLY: - 24VDC nominal, (In between 15 to 32 VDC)

Positive, Negative, GND Terminals, 2.5 mm screwdriver blade

27.3 Current Load : - 500 mA max @ 32 VDC max

27.4 LED Indicators : - Power and Module Status

Application Status

Serial Port Activity

Serial Port Error Status

Link and Activity LED indicators

27.5 Configuration Serial Port: - DB-9M RS-232 only

27.6 Ethernet Port (Ethernet modules only):- 10Base-T half duplex RJ45 Connector

27.7 Application Ports: - Modbus Plus Connector, Two DB9 Female Standard Modbus Plus connectors

27.8 Accessories: - Mini-DIN to DB-9M serial cables, 6 ft. RS-232 configuration cable, 2.5mm screwdriver RS-422/485 DB-9 to Screw Terminal Adaptor

(1 or 4, depending on ports), CD (docs and Configuration utility)

27.9 It must connect some PROFIBUS Slaves devices (for example sensors, valves...)

With an Ethernet net (for example an Allen-Bradley PLC...) in order to exchange

The information's between the networks.

27.10 It's internal database must consists of areas for application data, status information And configuration information



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#### 28.HMI:-

##### 25.1 Basic Indicative Diagram:-



##### 28.2 Technical specifications

Power Supply: - 230 V AC/24 V DC

Hardware: ARM9 2416 CPU 400MHZ, 128MB FLASH, 64MB DDRII RAM

◇Display size: 7 inch

◇Resolution: 800×480 TFT LCD 65,536 colours

◇Interface: RS232/RS485/RS422

◇Ethernet: 10/100Mbps Ethernet interface

◇Storage: Support Data Storage, SD Card, and U Disk

HMI can provide best instrumentation, technical assistance and services in any Automation requirements

- Touch screen : High precision four-wire resistive
- Remote Monitoring
- Control using App
- Wi-Fi Enabled



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**29. Personal Computers CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM:-4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 24 Inch.) Licensed Operating System and Antivirus compatible with trade related software**

25.1 Basic indicative Diagram:-



CPU: i9 or latest processor,

Speed: 4.5 GHz or Higher.

Cache Memory: - Minimum 3 MB or better.

RAM: - 16 GB DDR-IV or Higher.

Graphics card:- 4gb .

Monitor:- 4K

Hard Disk Drive: 1TB (SSD) or Higher, 7200rpm (minimum) or Higher, Wi-Fi Enabled.

Network Card: Integrated Gigabit Ethernet (10/100/1000) -

Wi-Fi, USB Mouse, USB Keyboard and Monitor (Min. 17 Inch)

Standard Ports, HDMI, and connectors. DVD Writer, Speakers and Mic.

Operating System: - Licensed Windows Operating System / OEM Pack (Preloaded),

Antivirus licensed



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**30. Operating system (Windows latest version):-**

**AS PER STANDARDS**





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31. Portable Hard Disk. (1 TB SSD):-

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**32. MS-Office:-**

**AS PER STANDARDS**



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### 33. RJ45, BNC, D-Shell, And Edge Connector Crimping Tool:-

#### 33.1 Basic Indicative Diagram



#### 33.2 Should have the following functions

33.2.1 Wire cutter

33.2.2 Wire stripper

33.2.3 Bolt cutter

33.2.4 Insulation crimping

33.2.5 Non insulation Crimping

33.2.6 BNC, D-shell & Edge connector crimping

33.3 Size: 225 mm

33.4 Induction hardened cutting edges

33.5 Finger Guard for Better Control & Added Safety

33.6 Bi - material Grip for comfort



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#### 34. Megger:-

##### 25.1 Basic Indicative Diagram:-



- 34.2 Resistance 100 Mega ohms
- 34.3 Body Material Metal Body
- 34.4 Warranty 1 Year
- 34.5 Voltage 500V
- 34.6 Standard IS 2992-1980
- 34.7 Rotation Speed 160 R.P.M.
- 34.8 Standard Accessories:
  - 34.8.1 Measurement Probe
  - 34.8.2 Carrying Case
  - 34.8.3 User Manual



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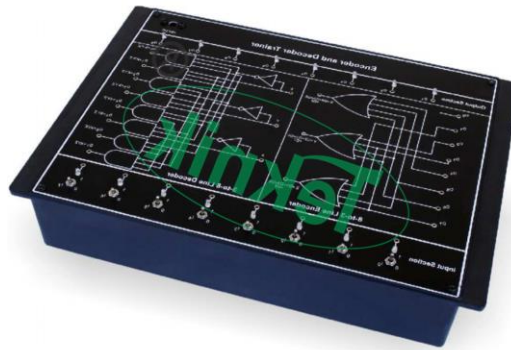
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#### 35. Encoder Trainer Kit:-



Encoder and Decoder Trainer have been designed specifically for the study of 8-to-3 Line Encoder and 3- to-8 Line Decoder. The Training board explains the phenomena which encodes 8 data lines to 3 lines and decodes 3 data lines to 8 lines. The board is absolutely self-contained and requires no other apparatus.

#### FEATURES:-

- +5V SMPS Adaptor provided with the trainer for power supply
  - Easy illustration of Encoder and Decoder
  - LEDs for visual indication of inputs and outputs status
  - SPDT switches for logic selection
  - Good quality, reliable sockets are provided at appropriate places on board for connections
  - Strongly supported by systematic operating instructions
  - A low cost training system
- SCOPE OF LEARNING:-

Study and verification of the Truth Table of 8-to-3 Line Encoder.  
Study and verification of the Truth Table of 3-to-8 Line Decoder.

#### TECHNICAL SPECIFICATIONS:-

- Input : +5V DC
- Logic levels
- +5V : HIGH (Logic 1)
- 0V : LOW (Logic 0)
- LED Indication : LED will be ON (glow) for 1 state and will be OFF for 0 state



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#### 36. Panel Wiring Work bench:-

##### 25.1 Basic Indicative Diagram:-



- 36.1 The Work Bench is made of M.S. Powder coated mild steel with Laminated Wood based Top on the working area.
- 36.2 The basic frame work is made of 30 x 30 x 2 mm tubular mild steel
- 36.3 The complete Work Bench is made of M.S. (except the Top) and Powder Coated in two Colours for better aesthetic looks
- 36.4 The overall dimensions of Work Bench / Test Bench W = 1500 mm; D = 900 mm; H = 1500mm
- 36.5 Top: 25mm thick work top made from laminated wood based plain particle board with one Side post forming (round profile). Remaining three sides of the work top is lipped with PVC Edge band.
- 36.6 Wiring panel at the back above the table top height with 6 separate Modular sets of 5 Amp Switch & 5 pin Child proof protective Socket are provided on the panel.
- 36.7 1 set of 4 Pole MCB (32A) for 3 $\Phi$  ON / OFF for the whole table and Hi Bright 3. R, Y, B Phase indicators & 15A fuse for each phase are provided on the panel
- 36.8 Instruments fitted on panel:-
- 36.8.1 **AC Source (Mains):**  
Output: Three Phase Mains Output (R, Y, B, N) with 4 Pole MCB & BTI 15 as Output Terminations
- 36.8.2 **Digital Meters:-**
- Digital Voltmeter 0 – 500 V AC – 3 nos. (1 for each phase) with BTI 15 as Input Terminations
  - Digital Current Meter 0 – 10A AC – 3 nos. (1 for each phase) with BTI 15 as Input Terminations
  - Digital Frequency Indicator with BTI 15 as Input Terminations
- 36.9 ON/OFF Push-Button to operate 3 phase motor
- 36.10 Electronic circuit board for overload, over current, single phase failure of motor



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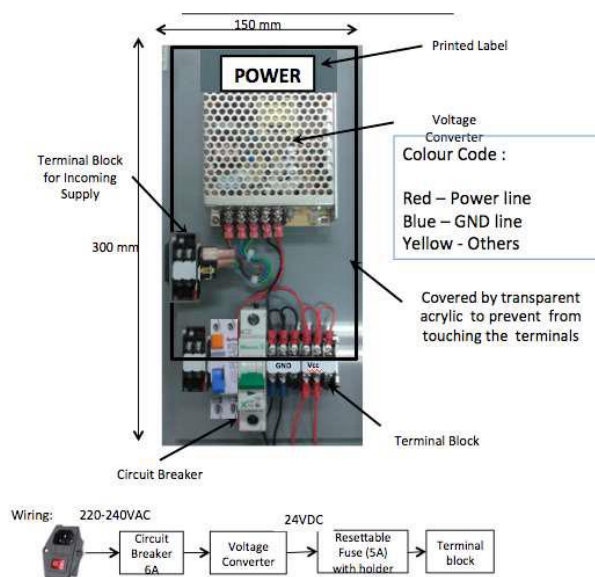
36.11 Students must be able to wire all electrical equipment fitted on panel board

36.12 Accessories:-

- 1) Patch cords
- 2) Set of wires terminated with appropriate lugs to fit I instrument
- 3) User manual which should include wiring diagram of above electrical component.
- 4) User manual should include different experiment showing wiring of panel to drive 3 $\Phi$  Motor.

- Should be custom built as shown in Figure and drawings using it as reference only. Should be on a Metal frame, powder coated as per approximate dimensions given.
- The table top should be a thick wooden plank with white / light grey 1mm thick laminate sheet.
- Two Bottom cabinet with hinged doors (one on each side of the table (see figure)
- Large Top frame (as in figure) usable from both sides.
- Four training panels of suitable size (see figure) with;
  - 8 pcs retaining clips per trainer panel
  - 2 pcs power socket per trainer panel 2 set
  - MCB, RCCB power box: 1 set
- Top cover of suitable size for mounting illuminating lights. Should consist of the following minimum components/modules/ accessories: (Refer figure)

#### 36.1 POWER MODULE



36.2 1x printed label (must be engraved) "Power" as shown in the picture.

36.3 1x 3-pin power cable (220-240V AC)

36.4 1x terminal block to connect in-coming wires



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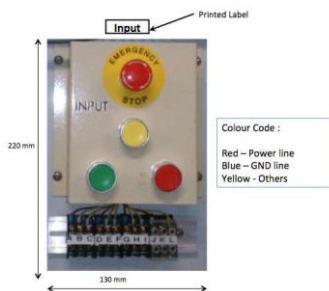
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- 36.5 1x Miniature Circuit breaker (100-240V AC) 6A
- 36.6 1x RCCB 32A 30mA
- 36.7 1x DC power supply from 220-240V AC to 24V DC min 2.2A
- 36.8 1x resettable Fuse with holder (24V, 2A)
- 36.9 1x 35-mm width DIN Mounting Rail (length 130mm)
- 36.10 3 x 3-way Terminal block mounted on the 35-mm DIN Rail  
1 x transparent plastic layer to cover the area which include 3-pin power socket, part of circuit breaker, voltage converter and part of terminal blocks as indicated by the black box in Annex B to avoid physical contact from users
  - Complete and neat wiring connection among the 3-pin socket, circuit breaker, voltage converter, fuse and terminal blocks as in the picture
  - Printed Labels on terminal block as below:
    - i. "Vcc" for 24 V supply
    - ii. "GND" for Ground.
  - Use red wire for power and blue wire for ground.

#### 36.1 INPUT MODULE



- 36.2 Follow the design, dimension and component layout (including the position and orientation) as shown in the picture
  - 1x printed label (must be engraved) "Input" as seen in the picture.
  - 3 momentary buttons - Green, Red & Black
  - 1 E-Stop switch
  - 1 x aluminium piece (thickness at least 2mm) for mounting of the above switches
  - 1x 35-mm width DIN Mounting Rail (length 120mm)
  - 4 x 3-way Terminal Blocks mounted on the 35-mm DIN Rail
  - Printed labels on terminal block for each terminal. I.e. from A to L
  - Complete and neat wiring connection in such the way that:
    - i. A connected to E-Stop (C) – Blue wire
    - ii. B connected to E-Stop (NC) – Yellow wire
    - iii. D to Green Button (C) – Blue wire
    - iv. E to Green Button NO) – Red wire
    - v. F to Green Button (NC) – Yellow wire
    - vi. G to Black Button (C) – Blue wire
    - vii. H to Black Button NO) – Red wire





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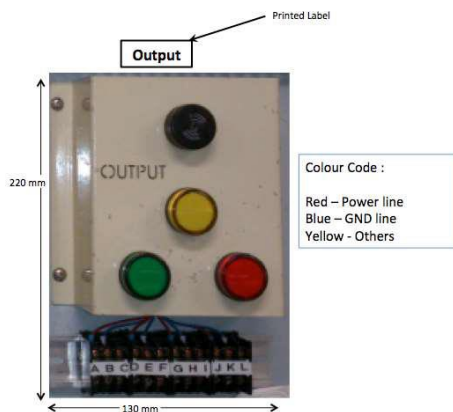
viii. I to Black Button (NC) – Yellow wire

ix. J to Red Button (C) – Blue wire

x. K to Red Button (NO) – Red wire

36.1 xi. L to Red Button (NC) – Yellow wire

#### OUTPUT MODULE



Follow the design, dimension and component layout (including the position and orientation) as shown in the picture

• 1x printed label (must be engraved) “Output” as seen in the picture.

• 3x 24V-lights - Green, Yellow & Red

36.1 • 1x Buzzer (24V)

1 x aluminium piece (thickness at least 2mm) for mounting of the lights and buzzer

• 1x 35-mm width DIN Mounting Rail (length 120mm)

• 4 x 3-way Terminal Blocks to be mounted on the 35-mm DIN Rail

• Printed labels on terminal block for each terminal. I.e. from A to L

• Complete and neat wiring connection in such the way that:

i. A & B connected to Green Light – Blue & Red wire

ii. D & E connected to Yellow Light – Blue & Red wire

iii. G & H connected to Red Light – Blue & Red wire

iv. J & K connected to Buzzer – Blue & Red wire

36.1 CONTROL MODULE



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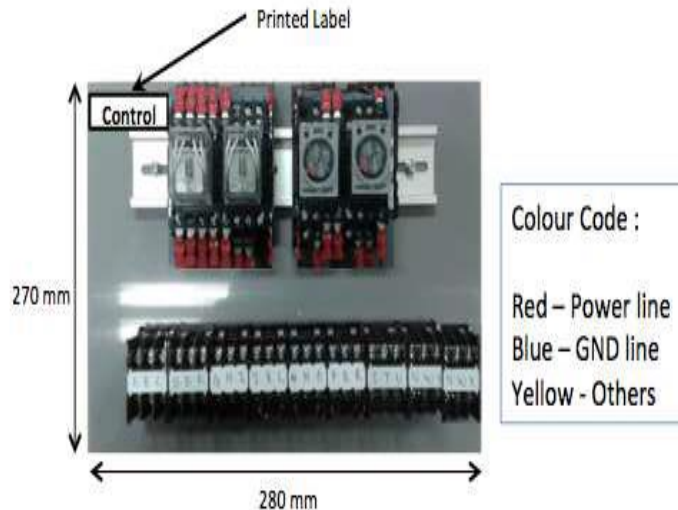
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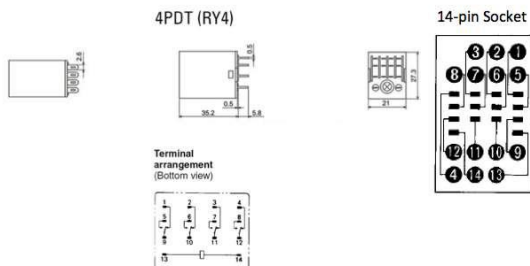
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36.2

#### Pin Configuration for Relay, Timer & Socket



Follow the design, dimension and component layout (including the position and orientation) as shown in the picture

- 1x printed label (must be engraved) "Control" as seen in the picture.
  - 2x 35-mm width DIN Mounting Rail (length 270mm)
  - 4 x PYF14A-E Socket w/ pin configuration as in the picture. The socket can be mounted onto the 35-mm DIN Rail
  - 2 x relay (4 poles, 5A,24VDC) w/ pin configuration as in the picture. It can be mounted onto the above PYF14A-E Socket
  - 2 x timer (4 poles, 5A,24VDC, 60 sec) w/ pin configuration as in the picture. It can be mounted onto the above PYF14A-E Socket
  - 9 x 3-way Terminal Blocks mounted on the 35-mm DIN Rail
  - Printed labels on terminal block for each terminal. I.e. from A to Z
- MOTOR & FAN MODULE



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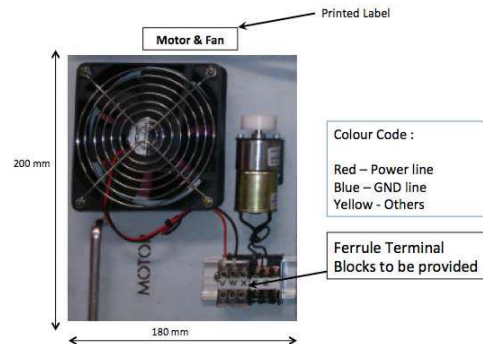
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Follow the design, dimension and component layout (including the position and orientation) as shown in the picture

- 1x printed label (must be engraved) “Motor & Fan” as seen in the picture.
- 1x 35-mm width DIN Mounting Rail (length 120mm)
- 1 DC motor (24VDC) with reduction gear mounted to drive a wheel as shown in the picture. The output shaft should run at 120 to 200 rpm on 24VDC.
- 1 DC Fan (24VDC) as shown in the picture.
- 3 x 3-way Ferrule Terminal Blocks mounted on the 35-mm DIN Rail for motor and fan.
- Printed labels on terminal block for each terminal. I.e. from A to I
- The wiring follows the specified colour code.

Accessories: Complete set of accessories required for the full feature functioning of the Wiring board for the intended purpose of Training.



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#### 37. Protection Devices Trainer Board:-

Basic Indicative Diagram:-



- 37.1 Size - 3 meter x1 meter with 0.5 meter
- 37.2 With projection on the top
- 37.3 Push Button (Both ON & OFF), Indicating lamps
- 37.4 Channels to run the wires
- 37.5 Panel ammeter (10A) and voltmeter (440V)
- 37.6 Output to run both Single phase and three phase motor
- 37.7 One application to demonstrate the panel wiring
- 37.8 Protective devices like various types of fuses, MCB, ELCB, RCCB and MCCB  
16A/32A  
37.9 Load banks of 5A, 10A each 166, 10all protective devices should be fitted in transparent cases so that student can easily Understood the operation of protection devices
- 37.11 Connection of all protecting devices should be brought on front side so that it can easily Connect to the load bank with the help of patch cords
- 37.12 Experiment to cover:-
  - 37.12.1 Construction of all above protecting devices
  - 37.12.2 Working of MCB, ELCB, and RCCB& MCCB.
- 37.13 Must include digital meter which will show steady reading of voltage and current at which Above Protecting device operate.
- 37.14 Accessories:-
  - 37.14.1 Patch cords of 2mtr
  - 37.14.2 User Manual including wiring diagram of above experiments and panel wiring.



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**38. Limit switch, Pressure switch, Micro switch, and Float switch, Footswitch:-**

RAW MATERIAL



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### 39. Application trainer kit of proximity sensor, float switch, and reed switch:-

#### 25.1 Basic Indicative Diagram:-



#### 39.2 Inductive proximity switch

##### 39.2.1 DC 2-wire type

##### 39.2.2 Type GXL-15 type

##### 39.2.3 Long sensing range (For mounting on non-magnetic body)

##### 39.2.4 Supply voltage:-12 to 24 V DC $\pm$ 10 % Ripple P-P 10 % or less

##### 39.2.5 Current consumption:-0.8 mA or less

##### 39.2.6 Output: -Non-contact DC 2-wire type • Load current: 3 to 100 mA

Residual voltage: 3 V or less

#### 39.3 Float switch

#### 39.4. Reed switch

#### 39.5 Experiments

39.5.1 To study the proximity sensor & its function.

39.5.2 to study & use of the float & reed switch.

39.5.1 Compact, Light Weight

39.5.2 Self Contained and easy to operate



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- 39.5.3 Proximity Sensor, Float switch and reed switch
- 39.5.4 Indicator LED
- 39.5.5 Controller I/O pins
- 39.5.6 +24V DC onboard power supply

#### Capacitive Proximity Sensor

Operating Voltage : +24VDC

Output Voltage : +24VDC

#### Float Switch

Operating Voltage : +24VDC

Output Voltage : +24VDC

#### Reed Switch

Operating Voltage : +24VDC

Output Voltage : +24VDC

Indicator Operating Voltage : +24VDC



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#### 40. LVDT Trainer kit:-



#### SPECIFICATION

Instrumentation trainer has been designed specifically for to study Linear Variable Differential Transducer (L.V.D.T.). The board is absolutely self contained & require no other apparatus. Practical experience on this set up carries great educative value for Science and Engineering Students.

#### Object:

Study of Linear Variable Differential Transducer (L.V.D.T.)

#### Features:

The instrumentation trainer consists of the following

01. One board having the following built in parts.

± 12V D.C. at 50mA I.C. regulated Power Supply for Sine wave Oscillator.

4KHz fixed Sine wave Oscillator having variable amplitude 0–10V (P–P).

Digital Panel meter 3½ digits range 200mV.

Detector circuit with output adjustment pot.

Transducer : Linear variable differential transducer (L.V.D.T.).

Range : ± 20mm. (Accuracy ± 1mm, ± 1 Digit)

Moving action : 6 wires, spring loaded type axial.

Mains ON/OFF switch and fuse.

Adequate no. of patch cords stackable 4mm spring loaded plug length ½ metre.

Good Quality, reliable terminal/sockets are provided at appropriate places on panel for connections /observation of waveforms.

Strongly supported by detailed Operating Instructions, giving details of Object, Theory, Design procedures, Report Suggestions and Book References.





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#### 41. Actuators Application Trainer (Servo, stepper motor, and Solenoid):-

##### 25.1 Basic Indicative Diagram:-



#### 41.2 Hydraulic Actuators

41.2.1 Floor standing powder coated MS Structure with castor wheels with locking System, on which cylinder, power pack and piping are mounted. Seamless Piping should be used to make a circuit such that Double Acting Cylinder Operation can be demonstrated using Direction control valve. Oil tank to be Mounted under the table top. All hose pipes should be provided with quick Change coupling.

41.2.2 All valves and cylinders should be of reputed make like Bosch Rexroth, Eaton, Hydec, Parker, Yuken etc.

41.2.3 Power pack Unit: 1 No.

41.2.3.1 Electric Motor: 0.5 HP, Single Phase, flange mounted

41.2.3.2 Pressure: 70 Bar (max)

41.2.3.3 Operating Pressure: 35 bar

41.2.3.4 Tank: 10 litre capacity

41.2.3.5 Top mounted electrical motor design

41.2.3.6 Pressure relief valve, pressure gauge, level gauge

41.2.3.7 Hydraulic Oil

41.2.3.8 Gear Pump



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- 41.2.4 Double Acting Cylinder: 2 No.
  - 41.2.4.1 Bore: 40 mm X 18
  - 41.2.4.2 Stroke: 100 mm
  - 41.2.4.3 with mounting Bracket
  - 41.2.4.4 1/4" BSP connections
  - 41.2.4.5 Operating pressure: 30 Bar
- 41.2.5 Valve
  - 41.2.5.1 4/3 Hand-lever operated Valve, spring return cantered with sub plate.
- 41.3 Pneumatic Actuators
  - 41.3.1 Floor standing powder coated MS Structure on which cylinder, Pneumatic Compressor and with PVC piping Connected. PVC Piping should be used to Makea circuit such that Double Acting Cylinderoperation can be Demonstrated using Direction control valve and Pressure Gauge Mounted.
  - 41.3.2 All Valves & Cylinders should be of reputed make such as Bosch Rexroth, Festo, Janatics, SMC, Emerson etc
- 41.4 Air Compressor Unit: 1 No.
  - 41.4.1
    - 41.4.1.1 10 bar gage & shut off valve with 8 mm Brass male connector hose
    - 41.4.1.2 Displacement: 3 cfm or more
    - 41.4.1.3 FRL unit
    - 41.4.1.4 Working pressure: 7 Kg/cm<sup>2</sup> (7 Bar)
    - 41.4.1.5 Electric Motor: 0.5HP or more, 1440 RPM, 230V, 50Hz, Single Phase
    - 41.4.1.6 Safety Valve
    - 41.4.1.7 Pressure Switch
    - 41.4.1.8 Storage Tank: 35-50 litres
    - 41.4.1.9 Pressure Gauge
  - 41.4.2 Double Acting Cylinder: 2 No
    - 41.4.2.1 Bore: 32 mm
    - 41.4.2.2 Stroke: 250 mm
    - 41.4.2.3 with mounting Bracket Valve
    - 41.4.3. 15/3 way directional control valve mid position closed, hand-lever Operated



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#### 42. Simple Servomotor trainer kit:-

##### 25.1 Basic Indicative Diagram:-



16.2 Closed loop and Open loop speed control of AC Servo motor

16.3 Slotted disk for speed measurement

16.4 Separate unit for Motor in a see through cabinet

16.5 DPM for speed and voltage display

16.6 Precise signal conditioning

16.7 Instrumentation Power supply with DPM panel:

16.7.1 +/-12 V, 500 mA

16.7.2 +5V, 300mA

16.7.3 Unregulated DC supply

16.7.4 Line synchronizing signal.

16.7.5 DPM for digital display of speed, etc.

16.8 SCR Actuator/ Drive based (variable DC):

16.8.1 Full bridge SCR based 0V-195V / 12 Amp with linear characteristics.

16.8.2 Supports signal conditioning circuit for speed to give output 0-2.5Vdc (FS).

This supply is required for DC Armature.

16.8.3 IGBT/MOSFET based Panel for variable PWM controlled power

For armature supply.

16.9 DC voltmeter and DC ammeter panel

16.9.1 DC voltmeter (0-300V)

16.9.2 DC Ammeter 0-2A) with polarity protection diode

16.9.3 Field failure relay to control Armature supply.

16.10 A.C. servo Motor with process setup.

16.11 The trainer should support to perform following experiments:

16.11.1 Effect of loading on the speed of the Motor in the open loop

16.11.2 Effect of loading on the speed of the Motor in the closed loop

16.11.3 Speed control of an AC Servo Motor

AC Servo Motor : 1 no. It should have following features and specifications

AC Servo Motor: 1 no.



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Power: 400W

Rated Voltage: 220V

Rated Speed: 0 to 3000 r/min.

Current: 1.0Ampere

Control Type : PWM control using Drive

Encoder : 2048 / 2500 / 10000 Pulse / Rev. ( Incremental , Absolute)

Dynamic Brake : Servo/Controller off Operable with the built-in alarm activated

Servo Drive System: 1 no.

LED Display : 5 digit seven segment display

Function Key: 5 nos. (Mode , Shift , UP, Down , Set)

IO Interface Port : 1 no

Should be able to perform following experiments

- Installation of AC servo drives and motors
- Control functions and adjusting methods of AC servo drives, Parameter settings of drives
- Study and use of AC Servo motor and drive, AC Servo Drive Function, AC Servo motor in Jogg mode,
- Servo motor speed control using Potentiometer,



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#### 43. Simple stepper motor trainer kit:-

##### 25.1 Basic Indicative Diagram:-



17.2 Different modes of operation

17.3 Half and Full step angle

17.4 Visual indication of the coil excitation

17.5 External connector for programming with different controllers

17.6 Separate unit for Motor in a see through cabinet.

17.7 Motor Type: Unipolar

17.8 Torque: 6 Kg-cm

17.9 Phase Current: 0.8 Amp.

17.10 Stepping Angle: 1.8° / 0.9°

17.11 Operating Voltage: 12 V DC

17.12 Input Pulse: 5V TTL Compatible

17.13 Test Points: 20

17.14 Cabinet for Motor

17.15 Power Supply: 110 / 230V, 50Hz

17.16 Operating Conditions: 0-40° C, 80% RH

17.17 Learning Material: Online learning material including Theory, Procedure, reference results, etc.)

17.18 The trainer should support to perform the following experiments:

17.18.1 Study and use of Stepper Motor in Wobble Mode

17.18.2 Study of Stepper Motor in Full Step, Single Phase, Free Running Mode

17.18.3 Study of Stepper Motor in Full Step, Single Phase, Step Running Mode

17.18.4 Study of Stepper Motor in Full Step, Two Phase, Free Running Mode

17.18.5 Study of Stepper Motor in Full Step, Two Phase, Step Running Mode

17.18.6 Study of Stepper Motor in Half Step, Free Running Mode

17.18.7 Study of Stepper Motor in Half Step, Step Running Mode

#### Technical Specifications:

Should consist of the following items:

- 2 phase stepper motor with stand and disk- (Refer Fig for phase stepper motor diagrams)



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The motor shall have these specifications: -

Number of phases = 2

- Step angle = 1.8 deg
- Holding torque = 0.1Nm

□ Stepper control circuit board

Should consist of the following minimum components/accessories;

- Pulse speed range = 20Hz to 1040Hz (approx.)
- Non-volatile memory to store settings and rotor position
- 4x toggle switches to activate A+, A-, B+, B- of the stepper motor
- 1x Selector switch (0-8 or more) to select the step sequence number of coil activation
- 1x Potentiometer to change the rotational speed of the stepper motor
- 1x Selector (0-9 or more) switch to select the mode of the controller
- 1x Toggle switch to change direction rotation of stepper from clockwise (CW) to counter clockwise (CCW)
- 1x Momentary push button to start a demo mode of the control kit
- LED lights for A+, A-, B+, B- respectively. LED lights up when the respective phase is activated when the motor rotates.
- 1x Eight segment numeric display / 16X2 LCD Display / or better for STEP No display 1x LED to indicate input DC power supply
- 1x LED (TIM) to indicate beginning stepper phase i.e. when A+ and B+ is turned ON
- 1x LED (Busy) to indicate motor rotation in progress

The control unit shall have these selectable mode (unless stated, the stepper is at full step mode, 1.8 step angle)

• Mode 1

• When START/SET button is depressed, the motor will turn CW 50pulses@200Hz, 8 times with 0.2secs interval. After that, it will pause 1sec then, it will turn CCW 400pulses@300Hz, 720deg.

• Mode 2

• Each time START/SET button is depressed; the motor will advance CW 10 pulses@1Hz. After 8 times CW, advancement, each time START/SET button is depressed, the motor will advance CCW 10 pulses@1Hz.

• Mode 3

• When the START/SET button is depressed, the motor will rotate CW 300pulses@100Hz and then stop for 1 second. Then motor will rotate CCW 500pulses@200Hz.

• Mode 4 (Half step)

• When the START/SET button is depressed, the motor will rotate CW 600pulses@200Hz and then stop for 1 second. Then motor will rotate CCW 1000pulses@400Hz.



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- Mode 5 – Jog drive
- When the START/SET button is depressed, the motor will rotate 1 pulse @ 100Hz. Direction of turn is determined by CW/CCW toggle switch. The number of pulses is saved into the controller memory for motor to return to starting position in mode 7.

#### Mode 6 – Continuous drive

- When the START/SET button is depressed, the motor will rotate continuously. The speed of rotation is determined by the potentiometer. The pulse frequency of the controller is from 20Hz to about 1040Hz. When the START/STEP button is depressed again, the motor will stop rotating. The number of pulses is saved into the controller memory for motor to return to starting position in mode 7.

#### • Mode 7 – Return drive

- When the START/SET button is depressed, the controller will move to the internal initial position, that was saved into memory under Mode 5 or Mode 6.

#### • Mode 8 – Excitation sequence

- This mode saves the phase activation sequence of A+, A-, B+, B- and will be used for Mode 5. An incorrect sequence will prevent the motor from rotating properly.
- When START/SET button is depressed, the controller will save the current STEP NO and the toggle switch state of A+, A-, B+, B-.
- STEP NO 0 to 7 is the specifies the sequence of phase activation. The sequence will start from 0 to 7 and then repeats when Mode 5 is running.
- For example,
- STEP NO is 1 and A+, B+ are ON and A-, B- are OFF and
- STEP NO is 0 and A-, B- are ON and A+, B+ are OFF In mode 5, the phase activation will begin with step 0 then step 1 as in the following: -
- Step 0 – A-, B- ON, A+, B+ OFF
- Step 1 – A+, B+ ON, A-, B- OFF

#### • Mode 9 – Roulette

- When the START/SET is depressed, the motor will start to rotate. When START/SET is depressed again, the motor will stop after a delay that is random.

#### • Mode 0 – Stepper driver

- In the mode, the control circuit board acts as a pure 2 phase stepper motor driver.

#### □ Battery holder

1.5V x 4 battery holder with suitable DC connector / external regulated power supply



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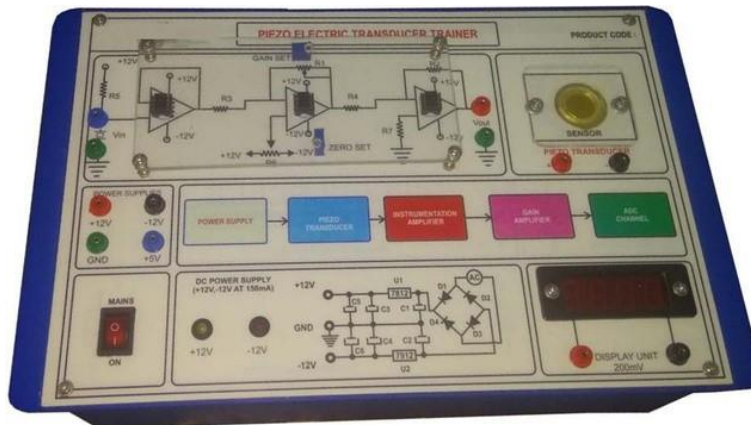
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### 44. Piezoelectric transducer/actuator trainer kit...:-



#### Scope Of Learning:

Study of Piezo Electric Transducer

**Technical Specification:-Digital Meters:**

**Digital Voltmeter:**200mVDC.

**Power Supplies:**

- DC Supply IC Regulated  $\pm 12$ VDC, 150mA.
- DC Supply IC Regulated +5VDC, 150mA.
- Operated on Mains power 230V, 50Hz  $\pm 10\%$
- **Components are mounted on the panels are:**
- Variable Resistor (Presets)
- 741 IC
- Piezo Electric Sensor.
- **Salient Features:**
- Front panel built with high class insulated Printed Circuit Board sheet with well printed circuits and symbols.
- Fuse for Short Circuit protection
- Protection Covers.
- Connections are brought out through 2mm Colored Sockets.
- Patch Cords 2mm.
- The trainer is housed in ABS Plastic cabinet.
- Size of the trainer set 12" x 8"





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#### 45. Pneumatic control trainer kit with required pneumatic components

##### 25.1 Basic Indicative Diagram:-



45.2 All valves and other components should be mounted on FRP/Plastic plate (Of 80 mm X 130 mm size) fitted with plastic base (to avoid scratching on the Aluminium anodized work table) and with inbuilt button operated Push-to-lock/ unlock Mechanism for easy clamping & unclamping with the work table

25.2 Should use actual new industrial standard valves and components like Air Distribution? & Manual control, Control Element, Actuating devices, Logic Control, Flow control & Accessories should be of reputed make like Bosch Rexroth, Fest, SMC, Jana tics, Emerson etc.

45.4 Profile plate: 1 No.

45.4.1 Work station with vertically mounted Frame unit (made of extruded Aluminium profiles) with provision to work on both sides of the work station

45.4.2 Overall occupied Size (W x H x D): 800 mm X 1300 mm X 750 mm

45.4.3 Effective work area per side on the Frame unit: 800 mm X 700 mm

45.4.4 Profile groove width: 10.2 mm

45.4.5 Groove to groove distance: 20 mm

45.4.6 Material: Aluminium, anodized finish

45.4.7 Foot base: Wheel with locking arrangement

45.5 Air distribution & manual control

45.5.1 Flow & Pressure Regulator (FRL) unit with pressure gauge (10 bar), 1/4" 9BSP (F): 1 No.

45.5.2 Manifold 4 way, 1/4" BSP (F) with 4 ball on/off valve: 1 No.

45.5.3 One-way flow control adjustable valve: 1 No.



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- 45.5.4 Ball valve 1/4" BSP for ON-OFF [M-F]: 1 No.
- 45.5.5 Silencer: 1 No.
- 45.6 Control Element
  - 45.6.1 3/2 way directly actuated valve with push button, M5, 1/8 or 1/4 " BSP (F)
  - 45.6.2 3/2 way single pilot valve, M5, 1/8 or 1/4" BSP (F)
  - 45.6.3 5/2 way valve with roller lever valve, M5, 1/8 or 1/4" BSP (F)
  - 45.6.4 5/2 way pilot operated spring return valve, M5, 1/8 or 1/4" BSP (F)
  - 45.6.5 5/3 way double pilot valve (with manual override), M5, 1/8 or 1/4" BSP (F)
  - 45.6.6 3/2 way roller lever valve, M5, 1/8 or 1/4" BSP (F)
  - 45.6.7 3/2 way directional control valve with 24V DC operated.
  - 45.6.8 5/3 way directional control valve mid position closed, hand-lever operated
  - 45.6.9 5/2 way directional control valve, hand-lever operated
  - 45.6.10 5/2 way directional control valve with 24V DC operated, spring return
- 45.7 Actuating Devices (O/P)
  - 45.7.1 Single acting cylinder - Bore 25 mm, Stroke 100mm: 1 no.
  - 45.7.2 Double acting cylinder Bore 25 mm, Stroke 150mm: 1 no.
  - 45.7.3 Pneumatic motor: The component should be an application of pneumatic Motor in an industry, Maximum pressure – 10 Bar: 1 No.
- 45.8 Logic Control
  - 45.8.1 OR gate / shuttle valve 1/8" BSP (F): 1 No.
  - 45.8.2 AND gate 1/8" BSP (F): 1 No.
- 45.9 Flow Control
  - 45.9.1 one way flow control valve, inline type: 2 Nos.
  - 45.9.2 Non return valve, Brass/Aluminium body: 1 No.
- 45.10 Accessories.
  - 45.10.1 Pneumatic Counter Balance Valve, The counterbalance valve will hold a load  
In position until pressure is applied to move the load, turning the adjusting Screw clockwise will increase the load carrying capacity of the valve, Pressure Range: 1 to 8 bar, Max. Pilot Pressure: 7 bar: 1 No.
  - 45.10.2 Weight + Protection Hood, to suit double acting pneumatic cylinder, with Weight, 5 Kg.: 1 No.
  - 45.10.3 PU tube, Red Blue and Yellow colour, 20 meter each
  - 45.10.4 T-Connector: 2 Nos.
  - 45.10.5 Pneumatic Quick change couplers (one touch fittings) mounted on each Pneumatic component. The fittings should be suitable for 4 mm/ suitable OD PU tube Electrical connections
  - 45.11.1 Mains cord with stackable connection Air Compressor
  - 45.12.1 Air Compressors Displacement: 3 came or more
  - 45.12.2 Working Pressure: 7 kg/cm<sup>2</sup> (7 Bar)
  - 45.12.3 Electric Motor: 0.5 HP or more, 1440 RPM, 21740 V/ 50Hz, Single Phase
  - 45.12.4 10 bar gage & shut off valve with 8 mm Brass male connector hose



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#### 45.12.5 Safety Valve

45.12.6 Pressure Switch

45.12.7 Storage Tank: 35-50 litres

#### Cut section components

The cut section of following components should be supplied. All the components should be sectioned out of actual industrial components.

45.13.1 5/2 way Hand Lever Operated Valve

45.13.2 3/2 way Roller Lever Actuated Valve

45.13.3 5/2 way Solenoid Operated Spring Return

45.13.4 5/2 way Double pilot Valve

45.13.5 Quick Exhaust Valve

45.13.6 One-Way Flow Control Adjustable Valve

45.13.7 OR Function valve

#### List of Experiments

45.14.1 Working of Air filter, Lubricator & Regulator

45.14.2 Use of manifold block

45.14.3 Working of Single acting cylinder

45.14.4 Working of Double acting cylinder

45.14.5 Working of 5/2 way valve

45.14.6 Working of 5/174 way mid position closed

45.14.7 Working of 5/2 way double pilot valve air operated with manual override

45.14.8 Working of one way flow control valve

45.14.9 Working of 5/2 way valve solenoid operated

45.14.10 Working of OR gate / Shuttle valve

45.14.11 working of & gate

45.14.12 working of counter balance circuit

45.14.13 Working of STEPPER MOTOR and SERVO motor

45.14.14 Working of Indirectly actuation of single acting single

45.15 Manual

45.15.1 Instructional Manuals and an Exercise Manual should be provided with each system. Detailed theory and practical exercises should be included in the Exercise Manual.



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#### 46. Hydraulic control trainer kit with required hydraulic components. :-

##### 25.1 Basic Indicative Diagram:-



25.2 Use of anodized extruded aluminium profile (40 X 40 mm) table with shelves (3 Nos.) to Store components when not in use Mounted on 4 Nos. of caster wheels for free Movement. Work station with vertically mounted Frame unit (made of aluminium Profiles).

- 46.2.1 Overall occupied Size (W x H x D): 1000 mm X 1300 mm X 800 mm,  
46.2.2 Working area Frame dimensions: 1000 mm x 700 mm  
46.2.3 Working area grid: 50mm X 50 mm  
46.2.4 Material: SS, 5mm Diameter
- 46.3 Oil Collection Tray: 2 Nos. + (01no for hydraulic power pack of s.s material) Mounted on the horizontal plane of the work station, Made of Stainless Steel, 14 SWG with oil drain arrangement.
- 46.4 Quick release socket plug arrangement for building circuits, all hydraulic components Are mounted using lever operated moulded adapters or hook-in type adapters for Quick release & placement.
- 46.5 Industrial standard Valves and all components of reputed make like Bosch Rexroth, Eaton, Hydec, Parker, Yuken etc. should be used for the trainer kit.
- 46.6 All the components are fixed with QRC for easy and quick hydraulic connections.
- 46.7 All Quick Release Fittings used are with double check valve, ¼” BSP connection
- 46.8 Quick Release Male Adaptors as per the QRC required on the following components
- 46.9 Oil Distribution: Manifold: Sub plate (1 station manifold) with 4 ports: 2 Nos.  
46.10 Pressure relief valve (sub plate mounted) with 40 Bar: 1 No.  
46.11 Pressure relief valve (in-line type) with 40 Bar: 1 No.



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- 46.12 Glycerine filled pressure gauge with facility to connect to A, B, P or T ports: 1 No.
- 46.13 Throttle cum check valve sub plate mounted: 1 No.
- 46.14 Throttle cum check valve in-line mounted: 1 No.
- 46.15 Direction Control Element:
  - 46.15.1 4/2 way DC valve lever operated spring return, sub plate mounted: 2 Nos.
  - 46.15.2 4/3 way DC valve, lever operated spring return, sub plate mounted: 1 No.
  - 46.15.3 4/3 way DC valve lever operated detented, sub plate mounted: 1 No.
  - 46.15.4 3/2 Stem actuated valve, sub plate mounted: 2 Nos.
  - 46.15.5 4/2 way DC valve, 24VDC solenoid operated spring return: 1 No.
  - 46.15.6 4/3 way DC valve, 24VDC, Spring Centred, Closed center, solenoid operated Spring return: 1 No.
  - 46.15.7 4/3 way DC valve, 24VDC, Spring Centred, Tandem Centre, solenoid Operated spring return: 1 No.
- 46.16 Actuating Devices (Output)
  - 46.16.1 Double acting cylinder 40mm X 150 mm stroke: 2 Nos.
  - 46.16.2 Bi directional Hydraulic motor: 1 No.
- 46.17 Pressure control and Other Valves
  - 46.17.1 Non Return Valve: 1 No.
  - 46.17.2 Inline Type, Size ¼": 1 No
  - 46.17.3 Non Return Valve: 1 No.
  - 46.17.4 Sub-plate mounting type: 1 No
  - 46.17.5 Pressure Sequence Valve, Max operating Pressure: 40 Bar, Sub-plate Mounting type: 2 Nos.
  - 46.17.6 Pressure Relief Valve, Max. Pressure 100 Bar, Knob/screw operated, Size: ¼", Inline type, with QRC, Vendor should be able to demonstrate the operation of this Valve from 20 bar to 80 bar at different settings.
  - 46.17.7 Pressure Reducing Valve, Max operating Pressure: 40 bar, Sub-plate Mounting Type: 2 Nos.
  - 46.17.8 Flow divider Valve, Threaded body, Pressure compensated spool, 50:50 ratio, Inlet flow 10 lpm. (Max): 1 No.
- 46.18 Accessories
  - 46.18.1 Weight + Protection Hood, 10 kg, to suit hydraulic cylinder: 1 No.
  - 46.18.2 Accumulator: 1 No.
    - 46.18.2.1 Should be of reputed Makelike Bosch Rexroth, Eaton, Hydec, Parker, Yuken etc.
    - 46.18.2.2 Diaphragm type, Capacity: 1 litre
    - 46.18.2.3 Working pressure: 20 kg/cm<sup>2</sup>
    - 46.18.2.4 Pre-charge pressure: 35 kg/cm<sup>2</sup>, Nitrogen gas, With Safety Block With valve and QRC
- 46.19 Connections
  - 46.19.1 Flexible hoses, R1 type ¼" ID with Quick release sockets on both ends
  - 46.19.2 Length 1000 mm: 8 Nos.



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- 46.19.3 Length 1500 mm: 2 Nos.
- 46.19.4 T-Connector with one Female QRC socket and two male QRC plugs: 2 Nos.
- 46.20 Electrical Connection
- 46.20.1 Mains cord for 230 VAC
- 46.20.2 Solenoid Cables: 5 Nos.
- 46.21 Electronic Control Unit
- 46.21.1 Should comprise of 24VDC power supply with current rating of minimum 4.5Amps, Distributor for 24V and GND (minimum 6 points each), 1 x toggle Switch with 1 NO and 1 NC contacts, 3 X push button switch with 1 NO and 1 NC contacts, 2 X LED Indicators for connecting outputs of the circuit, 1 X Buzzer for connecting outputs of the circuit, 5 X 3 change over relays, 1 X 1 Change over relay, 1 X On delay timer with 1 NO and 1 NC contact, 1 X OFF Delay timer with 1 NO and 1 NC contact.
- 46.22 Power Generation
- 46.22.1 Power pack (50 Bar) consist of
  - 46.22.1.1 Variable Vane Pump with minimum 10 LPM
  - 46.22.1.2 Relief valve.
  - 46.22.1.3 Electric Motor: 1.0 HP 1440 RPM 230VAC
  - 46.22.1.4 Cast Aluminium Tank: 40 litres
  - 46.22.1.5 Oil Breather
  - 46.22.1.6 Oil level indicator
  - 46.22.1.7 Suction filter / Strainer
- 46.22.2 Variable Vane Pump & Relief valve
- 46.23 Cut section components The cut section of following components should be supplied. All the components Should be sectioned out of actual industrial components.
  - 46.23.1 4/3 Way lever Operated 3 position Valve,
  - 46.23.2 4/3 Solenoid Operated NG06/Cetop 3 valve
    - 46.23.2.1 Closed Cantered
    - 46.23.2.2 Tandem Centre
  - 46.23.3 Non Return Valve
  - 46.23.4 Pressure Relief Valve, sub plate mounted type with knob to set pressure
  - 46.23.5 shut off valve,
  - 46.23.6 External Gear Pump
  - 46.23.7 Diaphragm Accumulator: 1 litre
  - 46.23.8 Flow control Valve
  - 46.23.9 Line operated Check valve
- 46.24 List of Experiments
  - 46.24.1 Study of Hydraulic Power Pack
  - 46.24.2 Study of Pressure Relief valve
  - 46.24.3 Study of Directional control valve
  - 46.24.4 Study of D.A. Cylinder



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- 46.24.5 Study of S.A. cylinder
- 46.24.6 Study of Meter in/out flow control
- 46.24.7 Study of Regenerative circuit
- 46.24.8 Study of Bleed of Circuit
- 46.24.9 Study of direct operated pressure relief valve
- 46.25 Training Material
- 46.25.1 Suitable Training Manual must be supplied



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#### 47. Electro-Pneumatic control trainer kit using PLC with required components.:-

##### 25.1 Basic Indicative Diagram:-



Objective: To impart training on basic as well as advance pneumatic components. Students are also expected to have hands on experience on pneumatic circuit design as well as online circuit simulation. The entire training kit should be operated from PLC with the help of solenoid valves. The control panel should be an integral part of the training kit. Hands on experience on IIOT based operation with remote monitor control.

Electrohydraulic training kit should be a two faced training kit made in aluminium extrusions. Workface should be a vertical face and should have a minimum dimensions of 1200mm x 900mm. Front face should have a provision for mounting of electropneumatic components such as Solenoid valves and Reed switches. The back face should be mounted with basic pneumatic valves so that 4 students (2 students on each side) can work on the training kit at a time.

The I/O connections to the PLC is made through a plug in type connections, which is called interfacing modules. These are to be divided majorly into four input / output interface modules in each Electropneumatic

Training work station. PLC input interfacing module. This module is connected with PLC inputs. This module consists of 16 inputs, each of which is provided with override button. With this push button, user can manually override desired PLC input. Field input





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**Interfacing Module:** This section is to connect with field automation components with a plug-in connector. This module shall have provision to connect at least 24 field input devices. A plug in type 3pins connectors for Source, Signal has to be provided for trainee connections.

**PLC output interfacing module:** This module also shall contain I/O sockets. 14-16 connections are to be provided with surface mounted relays. **Field output interfacing module:** This module is to be provided with 16 connections connected to field output devices through plug-in connectors.

Provision like for Workstation with mounting arrangement for monitor, mouse & key board for program PLC shall be provided.

Each valve should have a pressure rating of at least 10 Bar. Each valve should be provided with suitable quick push pull connectors. PU tube provided should be of either 4mm or 6mm.

Work face of the training kit should be made in the aluminium extrusions. All valves along with mounting plates should be mounted on the training kit with the help of T Nuts and bolts or with a similar arrangement which will enable easy assembly and disassembly of valves on the work surface.

Sensor terminals should be provided for input and output connections which will enable the input and output connections with the help of M12 / M18 connectors and it will also enable the future connection of input / output devices.

#### Detailed Technical Specifications:

| Description  | Qty      |
|--|----------|
| <b>Structure</b>   |          |
| Advance Pneumatic Trainer Base with Aluminum extrusion based work surface (Double Sided) of 1200mm x 900mm. MDF based wooden base of 1200mm x 800mm. MS based structure with castor wheels and load bearing capacity of 300 KG | <b>1</b> |
| <b>Basic Pneumatic Module 1</b>  |          |
| FRL Unit with Pressure Gauge   | 1        |
| Junction Box with 8 ports  | 2        |
| Isolation box with 8 ports   | 1        |
| Three Way Two Position Hand Slide Valve  | 1        |
| Two way Flow control valve   | 4        |
| Single acting cylinder (Stroke: 50 mm, with One Way Flow Control Valve)  | 1        |
| Double acting cylinder (Stroke: 200mm, with One Way Flow Control Valve)  | 2        |



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|  |          |
|--|----------|
| PU Tube Dia 6mm - Blue Color   | 10 Meter |
| PU Tube Dia 6mm - Red Color  | 10 Meter |
| PU Tube Dia 6mm - Black Color  | 10 Meter |
| Blanking Plug Dia 6  | 12       |
| Union Tee Dia 6mm  | 5        |
| Union Y Dia 6mm  | 5        |
| Tube Cutter  | 1        |
| <b>Basic Pneumatic Module 2</b>  |          |
| Two Pressure Valve   | 2        |
| Shuttle Valve  | 2        |
| Quick Exhaust Valve  | 1        |
| Three Way Two Position Way Push Button (Three Port) Valve  | 2        |
| Three Way Two Position Knob Operated Direction Control Valve (NC Type)                                     | 1        |
| Three Way Two Position Roller Operated Direction Control Valve (NC Type)                                   | 2        |
| Five Way Two Position Mushroom Head Switch Operated Direction Control Valve                                | 1        |
| Five Way Two Position Lever Operated Direction Control Valve   | 1        |
| Five Way Two Position Lever Operated Direction Control Valve (Spring Return)                               | 1        |
| Five Way Three Position Lever Operated Direction Control Valve   | 1        |
| <b>Basic Pneumatic Module 3</b>  |          |
| Three Way Two Position Pilot Operated Direction Control Valve (NC Type)                                    | 1        |
| Five Way Two Position Single Pilot Direction Control Valve   | 1        |
| Five Way Two Position Double Pilot Direction Control Valve   | 4        |
| Five Way Three Position Double Pilot Direction Control Valve   | 1        |
| Three Way Two Position idle return Valve   | 1        |
| <b>Basic Pneumatic Module 4</b>  |          |
| Pneumatic Motor  | 1        |
| Pressure Regulator   | 1        |
| Vacuum generator   | 1        |
| Vacuum Cup   | 1        |
| Vacuum Generator based pick and drop assembly module   | 1        |
| Three Way Two Position Time Delay Valve  | 1        |
| <b>Design and Circuit Simulation software:</b>   |          |
| Software should be able to simulate / design a complete pneumatic circuit                                  | 01 Seat  |
| All components used in the trainer kit should be available in the software library                         |          |
| Students should be able to design a Pneumatic circuit that they are executing on the Pneumatic trainer kit |          |
| Software should completely simulate the circuit and mention the flaws in the designed circuit              |          |



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|  |         |
|--|---------|
| An exe file should be generated of the simulated Pneumatic circuit which can be opened on any computer (Even on computers without the license of this software)  |         |
| All circuits performed on the training kit should be dynamically demonstrated on the software. Students should be able to simulate the circuits on the software before executing them on the hardware kit. |         |
| Software License Type: (perpetual)   |         |
| <b>Advance Pneumatics (Electropneumatic) Module 1</b>  |         |
| Three Way Two Position Solenoid Operated Direction Control Valve (NC Type)   | 1       |
| Five Way Two Position Single Solenoid Direction Control Valve  | 1       |
| Five Way Two Position Double Solenoid Direction Control Valve  | 3       |
| Five Way Three Position Double Solenoid Direction Control Valve  | 1       |
| Magnetic Reed Switch with bracket for Cylinders  | 6       |
| Digital Pressure Switch with Analog Output   | 1       |
| <b>Advance Pneumatics (Electropneumatic) PLC Based operation module</b>  |         |
| PLC with 24 digital inputs and 16 digital outputs  | 1       |
| Power supply and control panel for PLC   | 1       |
| Control panel box with mounting for Advance Electropneumatic Training Kit (1200 x 400 x 300mm)   | 1       |
| PLC Input module with input override switches (24 inputs)  | 1       |
| Field input module (24 inputs)   | 1       |
| PLC output module (24 outputs)   | 1       |
| Field output module (24 outputs)   | 1       |
| Remote operation unit with 2 selector switches, 2 push buttons and 2 mushroom head switches  | 1       |
| 2mm Patch cord connector set   | 1 set   |
| <b>Workstation with Simulation software and licensed PLC software</b>  |         |
| Intel Mother board Computer with 21 inch LED Monitor (Acer / Dell) and bluetooth keyboard and mouse  | 1       |
| Pneumatic circuit design and simulation software with perpetual license  | 1       |
| Software should be able to simulate / design a complete pneumatic circuit  | 01 Seat |
| All components used in the trainer kit should be available in the software library   |         |
| Students should be able to design a Pneumatic circuit that they are executing on the Pneumatic trainer kit   |         |
| Software should completely simulate the circuit and mention the flaws in the designed circuit  |         |
| An executable file should be generated of the simulated Hydraulic circuit which can be opened on any computer (Even on computers without the license of this software)                                     |         |



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|  |   |
|--|---|
| All circuits performed on the training kit should be dynamically demonstrated on the software. Students should be able to simulate the circuits on the software before executing them on the hardware kit.           |   |
| Software License Type: (perpetual)   |   |
| Necessary interface for direct operation of training kit from simulation software (Dynamic realtime simulation and operation). Software should be able to upload the PLC ladder directly without any other software. |   |
| <b>Compressor</b>  |   |
| 1HP, 50 Ltr capacity Twin cylinder Silent Compressor (Single Phase Supply)   | 1 |
| <b>Automation Module - Color based sorting with conveyor</b>   |   |
| Rotary Motor with Sorting Arm (16mm Bore)  | 1 |
| Rejection Bin  | 1 |
| Guided Cylinder  | 1 |
| Vacuum Generator with Vacuum Cup   | 1 |
| Rotary Motor (20mm Bore)   | 1 |
| Color Sensor   | 1 |
| Guided Cylinder for job loading (60mm) - Auto Loader   | 1 |
| Photo Sensor for job loading   | 1 |
| Photo Sensor for job unloading   | 1 |
| Conveyor 70 x 500mm  | 1 |
| AC Motor for Conveyor Drive with Gearbox   | 1 |
| Sorting Bin (Vertical)   | 1 |
| <b>Manuals for Advance(Electro) Pneumatics</b>   |   |
| Operation Manual   | 1 |
| Electrical Connection Manual   | 1 |
| Experiment Manual with at least 35 experiments   | 1 |
| <b>IIOT Module - HMI</b>   |   |
| IIOT HMI with remote operation facility and 2 GB cloud space (Perpetual) should be provided.   | 1 |
| User should be able to operate the entire kit from a mobile / tab / computer from anywhere in the world (Necessary internet connection will be provided by the institute)  |   |
| IIOT HMI should be Wifi Enabled  |   |



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#### 47.33 Compressor unit:



Suitable for Pressure: 8 bar, Delivery: 50 LPM (or more), Reservoir capacity: 24 Litres (or more), 230V, 50 Hz, with pressure regulator and water separator, With Pressure Gauge, Safety Valve, Air Control Valve, Drain Valve and Pressure switch. Silent type, suitable to be used in Laboratory

The Workbench must be compatible with PLC having following features:

PLC with 12 Digital Inputs, 8 Digital Outputs, USB Communication facility with PLC Programming Software.

- It should comprise different types of Pneumatic components like double acting cylinder, solenoid valve, flow control valve, manifold, hand lever valve, limit switch, proximity sensor, IR sensor, palm actuator, OR valve, roller lever valve, FRL, pressure gauge, TEE, single acting cylinder, air compressor , Proximity sensor and Limit Switch.
- Identification of Pneumatic Component and Its Symbol.



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#### 48. Electro-Hydraulic control trainer kit using PLC with required components.:-

25.1 Basic Indicative Diagram:-

25.2



Objective: To impart training on basic as well as advance hydraulic components. Students are also expected to have hands on experience on hydraulic circuit design as well as online circuit simulation. The entire training kit should be operated from PLC with the help of solenoid valves. The control panel should be an integral part of the training kit. Hands on experience on IIOT based operation with remote monitor control.

The hydraulic valves should be CETOP 3 / CETOP 5 mounted valves provided with a manifold / subplate in mild steel. Quick connect couplings should be provided for all ports. P, T, A and B ports should be clearly marked on the subplate / mounting plate. Subplate / mounting plate should be coated with a suitable coating which will prevent it from rusting. The I/O connections to the PLC is made through a plug in type connections, which is called interfacing modules. These are to be divided majorly into four input / output interface modules in each PLC – HMI Training work station. PLC input interfacing module. This module is connected with PLC inputs. This module consists of 16 inputs, each of which is provided with override button. With this push button, user can manually override desired PLC input. Field input Interfacing Module: This section is to connect with field automation components with a plug-in connector. This module shall have provision to connect at least 24 field input devices. A plug in type 3pins connectors for Source, Signal has to be provided for trainee connections.



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PLC output interfacing module: This module also shall contain I/O sockets. 14-16 connections are to be provided with surface mounted relays. Field output interfacing module: This module is to be provided with 16 connections connected to field output devices through plug-in connectors.

Provision like for Workstation with mounting arrangement for monitor, mouse & key board for program PLC shall be provided.

Each valve should have a pressure rating of at least 120 Bar. Hoses provided along with the training kit should be tested at least 200 Bar. Pressure and Tank Lines from Hydraulic powerpack should be separately provided through a sub plate. P and T connections should be clearly visible.

Separate Pressure and Tank Manifolds (Each with at least 4 ports) should be provided on both sides of the training kit.

Test Manifold (Minimum 3 ports) with pressure gauge mounted on it should be provided on both faces of the training kit.

Work face of the training kit should be made in the aluminium extrusions. All valves along with sub plates should be mounted on the training kit with the help of T Nuts and bolts.

Sensor terminals should be provided for input and output connections which will enable the input and output connections with the help of M12 / M18 connectors and it will also enable the future connection of input / output devices.

#### Detailed Technical Specifications:

| Description   | Qty      |
|---|----------|
| Advance Hydraulic Trainer Base with Aluminum extrusion based work surface (Double Sided) of minimum dimensions: | <b>1</b> |
| Horizontal work area on front face : 1200mm x 450mm   |          |
| Horizontal work area on back face : 1200mm x 450mm  |          |
| Vertical work area on front face : 1200mm x 720mm   |          |
| Vertical work area on back face : 1200mm x 720mm  |          |
| MS based structure with castor wheels and load bearing capacity of 380 KG                                       |          |
| Drip Tray: 1200mm x 850mm   |          |
| <b>Hydraulic Power Pack Module</b>  |          |
| Hydraulic tank with 60 Litre capacity, Oil cleanliness: Level 8   | 1        |
| Three Phase flange mounted electric motor 2 HP -1500 rpm  | 1        |
| Gear Pump (Flow Rate: 8 LPM, Max Pressure: 70 Bar)  | 1        |
| Pressure Gauge 0 to 100 Bar, Glycerin filled, 2 inch  | 2        |



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|   |       |
|---|-------|
| Pressure Relief Valve (Subplate Mounted) with Locking Arrangement                                     | 1     |
| Suction Line Filter   | 1     |
| Return Line Filter  | 1     |
| Pressure Line Manifold with 4 Ports (Hard piped with powerpack and mounted on the front work surface) | 1     |
| Pressure Line Manifold with 2 Ports (Hard piped with powerpack and mounted on the rear work surface)  | 1     |
| Return Line Manifold with 4 Ports (Hard piped with powerpack and mounted on the front work surface)   | 1     |
| Return Line Manifold with 2 Ports (Hard piped with powerpack and mounted on the rear work surface)    | 1     |
| Test Line Manifold with 2 Ports (Hard piped with powerpack and mounted on the front work surface)     | 1     |
| Pressure Gauge 0 to 100 Bar, Glycerin filled, 4 inch  | 1     |
| Tray for Hydraulic Powerpack  | 1     |
| <b>Basic Hydraulic Module 1</b>   |       |
| Pressure Relief Valve (Direct operated relief valve)  | 2     |
| Flow Control Valve (Non Pressure Compensated) with Check Valve .                                      | 2     |
| Flow Control Valve (Pressure Compensated) with Check Valve  | 1     |
| Four way Three position manually operated direction control valve - Tandem Center                     | 2     |
| Four way Three position manually operated direction control valve - Closed Center                     | 1     |
| Three way Two position manually operated direction control valve - Closed Center                      | 1     |
| Vertical Weight loading arrangement for hydraulic cylinder  | 1 set |
| Set of weights for loading arrangement  | 1 set |
| Single Acting Cylinder (Stroke: 100mm, Dia: 25mm, Test Pressure: 70 Bar)                              | 1     |
| Double Acting Cylinder (Stroke: 200 mm minimum Test Pressure 130 Bar)                                 | 2     |
| Proximity Sensor Assmby for Hydraulic Cylinder  | 6     |
| Cut Section models for Hydraulic components   | 1     |
| 1. Double Acting Hydraulic Cylinder   |       |
| 2. Pressure Relief Valve  |       |
| Direction Control Valve   |       |
| <b>Basic Hydraulic Module 2</b>   |       |
| Hydraulic Motor Bidirectional .   | 1     |
| Needle Valve  | 2     |
| Pressure Sequence Valve   | 1     |
| Pressure Reducing Valve   | 1     |
| Four way Two position manually operated direction control valve                                       | 1     |
| Check Valve Direct Operated   | 1     |
| Single Pilot Operated Check Valve   | 1     |
| <b>Manuals for Basic Hydraulics</b>   |       |





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|  |         |
|--|---------|
| Operation Manual (Basic Hydraulics)  | 1       |
| Experimentation Manual (Basic Hydraulics)  | 1       |
| Hydraulics Text Book (Basic Hydraulics)  | 1       |
| <b>Advance Hydraulics (Electrohydraulic) Module 1</b>  |         |
| Pressure Switch  | 1       |
| Four Way Three Position Double solenoid operated direction control valve   | 3       |
| Four Way Two Position Single solenoid operated direction control valve   | 1       |
| <b>Advance Hydraulics (Electrohydraulic) PLC Based operation module</b>  |         |
| PLC with 24 digital inputs and 16 digital outputs. Perpetual License to operate the PLC.   | 1       |
| Power supply and control panel for PLC   | 1       |
| Control panel box with mounting for Advance Electrohydraulic Training Kit (1200 x 400 x 300mm)   | 1       |
| PLC Input module with input override switches (24 inputs)  | 1       |
| Field input module (24 inputs)   | 1       |
| PLC output module (24 outputs)   | 1       |
| Field output module (24 outputs)   | 1       |
| Remote operation unit with 2 selector switches, 2 push buttons and 2 mushroom head switches  | 1       |
| 2mm Patch cord connector set   | 1 set   |
| <b>Workstation with Simulation software and licensed PLC software</b>  |         |
| Intel Mother board Computer with 21 inch LED Monitor and bluetooth keyboard and mouse  | 1       |
| Hydraulic circuit design and simulation software with perpetual license  | 01 Seat |
| Software should be able to simulate / design a complete hydraulic circuit  |         |
| All components used in the trainer kit should be available in the software library   |         |
| Students should be able to design a Hydraulic circuit that they are executing on the Hydraulic trainer kit   |         |
| Software should completely simulate the circuit and mention the flaws in the designed circuit  |         |
| An executable file should be generated of the simulated Hydraulic circuit which can be opened on any computer (Even on computers without the license of this software)                               |         |
| All circuits performed on the training kit should be dynamically demonstrated on the software.   |         |
| Students should be able to simulate the circuits on the software before executing them on the hardware kit.  |         |
| Software License Type: (perpetual)   |         |
| Necessary interface for direct operation of training kit from simulation software (Dynamic realtime simulation and operation). Software should be able to upload the PLC ladder directly without any |         |



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|  |   |
|--|---|
| other software.  |   |
| <b>I IOT Module</b>  |   |
| I IOT HMI with remote operation facility and 2 GB cloud space (Perpetual) should be provided.  | 1 |
| User should be able to operate the entire kit from a mobile / tab / computer from anywhere in the world (Necessary internet connection will be provided by the institute)  |   |
| I IOT HMI should be Wifi Enabled   |   |
| <b>Mobile Hydraulics Module - Proportional Direction Control Valve (Hydraulic Steering)</b>  |   |
| This module should be designed to offer understanding as well as hands on experience of proportional hydraulic direction control valve. Separate PLC should be provided along with this training module. Basic design is to convert the mechanical movement of steering into hydraulic movement of Bi - Direction Hydraulic motor. |   |
| The movement as well as the speed of the movement of steering wheel should be transmitted to the hydraulic motor with the help of proportional valve and incremental encoders with necessary PLC ladder logic  |   |
| Minimum requirements:  |   |
| Hydraulic Proportional Direction Control Valve Acceptable Makes: EATON / YUKEN / Argo / Atos   | 1 |
| Incremental Encoder with minimum 1000 PPR  | 2 |
| Mechanical steering with locking arrangement at every 30 degrees or less   | 1 |
| Hydraulic Bidirection Motor with clear indication of rotation in degrees   | 1 |
| PLC with necessary requirement of Digital Inputs - Outputs as well as Analog Inputs - Outputs  | 1 |

- 48.2 Hydraulic Workstation with 40 square mm aluminium profile legs, wooden work surface, and one pedestal drawer unit having 5 drawers, each with handles and individual locks, on metallic full panel drawer slide: (1) Work Table – Size(Approx.) L1200mm X W900mm X H900mm, with four castor wheels including two lockable wheels at the front side, (2) Drawer – Size (Approx.) – L460mm x W495mm x H158mm each, and overall size of Drawer unit(Approx.) - L470mm x W495mm x H825mm and (3) Drawer slide height (Approx.) 85mm.
- 48.3 Profile plate: Anodized Aluminium, 1100x700 mm, with carriers, mounting frames and mounting accessories (To be fitted onto the Hydraulic workstation)



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- 48.4 Hydraulic Power pack: with (1) external gear pump having a delivery rate of 2.5 LPM, (approx.) @ 1400 rpm operating pressure 60 bar, coupled to a single-phase AC motor (230 V AC) having start capacitor and ON/OFF switch and overload protection, (2) pressure relief valve adjustable from 0 – 60 bar, (3) oil reservoir,  $\geq 5$  liters capacity having sight glass, drain screw, air filter, and P and T ports.
- 48.5 Single Acting Hydraulic Cylinder: 40  $\varnothing$  x 22 x 50 mm Stroke, spring return: 01 No.
- 48.6 Double Acting Hydraulic Cylinder: 40  $\varnothing$  x 22 x 100 mm Stroke: 01 No.
- 48.7 4/3 Way Double Solenoid valve: -  $\frac{1}{4}$ " , 24V DC: 01 No.
- 48.8 4/2 Way Double Solenoid valve: -  $\frac{1}{4}$ " , 24V DC: 01 No.
- 48.9 4/2 Way Single Solenoid valve: -  $\frac{1}{4}$ " , 24V DC
- 48.10 4/3 Way Spring cantered Hand lever valve: -  $\frac{1}{4}$ "
- 48.11 4/2 Way Hand lever valve: -  $\frac{1}{4}$ "
- 48.12 Sequence Valve:  $\frac{1}{4}$ "
- 48.13 Electro-Hydraulic Proportional Control Valve with controller: 01 No
- 48.14 Variable Voltage Source: 0-10V DC: 01 No.
- 48.15 One Way Flow Control Valve:  $\frac{1}{4}$ " (F), Square Body.
- 48.16 Non return valve: -  $\frac{1}{4}$ " connection
- 48.17 Ball Valve:  $\frac{1}{4}$ " connection for Bleed-off circuit,
- 48.18 Pressure relief valve:  $\frac{1}{4}$ " , 60 Kg / Cm<sup>2</sup>
- 48.19 Pulley arrangement to carry the load, with 9 kg weight
- 48.20 Block manifold: -  $\frac{1}{4}$ " Connection, 4-Way: for Tank: 01 No.
- 48.21 Block manifold: -  $\frac{1}{4}$ " Connection, 4-Way: For Pressure: 01 No.
- 48.22 Proximity sensor: Inductive type, two wire: 02 No.
- 48.23 Tee: 02 No.
- 48.24 Pressure gauge: 0-100 Kg/cm<sup>2</sup>, dial Size: 2  $\frac{1}{2}$ " : 01 No.
- 48.25 Oil hydraulic power pack: - MS Powder Coated sump tank, capacity: 25 Liters, with Oil level Indicator, Breather, Oil filter & suction: 01 No.
- 48.26 Hydraulic Gear Pump: Any make, 2.5 LPM at working pressure 35 kg/cm<sup>2</sup>, coupled to AC Induction Motor (1440 RPM), 1 HP, 230V AC. : 01 No.
- 48.27 Push button station Module for electrical signal input: with 3 illuminated momentary contact switches (1 NO+1NC) and 1 illuminated maintained contact switches (1 NO+1NC), contact load 2A. – 01 no.
- 48.28 Relay Station Module: with 3 relays each with 4 contact sets (3 NO + 1 NC or change over type), 5A – 01 no.
- 48.29 Power Supply Unit: input voltage 85-265 V AC, output voltage: 24 V DC, output current max. 4.5A, short circuit proof – 01 no.
- 48.30 On & OFF Delay timer module
- 48.31 Electrical buzzer with indicator Module
- 48.32 Quick Relief Coupling Hydraulic Hoses: 08No's with 1 meter & 08 Nos with 1.5



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meter Length The Workbench must be compatible with PLC having following features:

- PLC with 12 Digital Inputs , 8 Digital Outputs, USB Communication facility with PLC Programming simulation Software.
- It should comprise different types of Hydraulic components like Toggle switches, Push to On switch, Visual Indicator, Audio Indicator, double acting cylinder, solenoid valve, flow control valve, manifold, hand lever valve, limit switch, hydraulic motor, single acting cylinder, proximity sensor, power pack
- Identification of Hydraulic Component and Its Symbol.



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#### 49. Linear scale setup for positional accuracy check:-

##### 25.1 Basic Indicative Diagram:-



- 18.2 It should be used in vertical, horizontal or any position with the mounting hardware.
- 18.3 It should be suitable for lathes, milling machines, router tables, planer, table saw fence and other machine tools.
- 18.4 Fast response (3m/s), no speeding fault occurred.
- 18.5 Can set "zero" anywhere within operating range for determining relative Distances.
- 18.6 LCD Display with inch, decimal, fractional and metric readings facility
- 18.7. Magnetic remote display with 50" cord for easy installation and access.
- 18.8 Remote reading display, easy to read and operation.
- 18.9 Material: Aluminium Alloy
- 18.10 Battery: CR2032 (3V)
- 18.11 Measuring range: 0-150mm
- 18.12 Resolution: 0.01mm
- 18.13 Accuracy: 0.06mm
- 18.14 Accessories required or performing above function.
- 18.15 Suitable carry case



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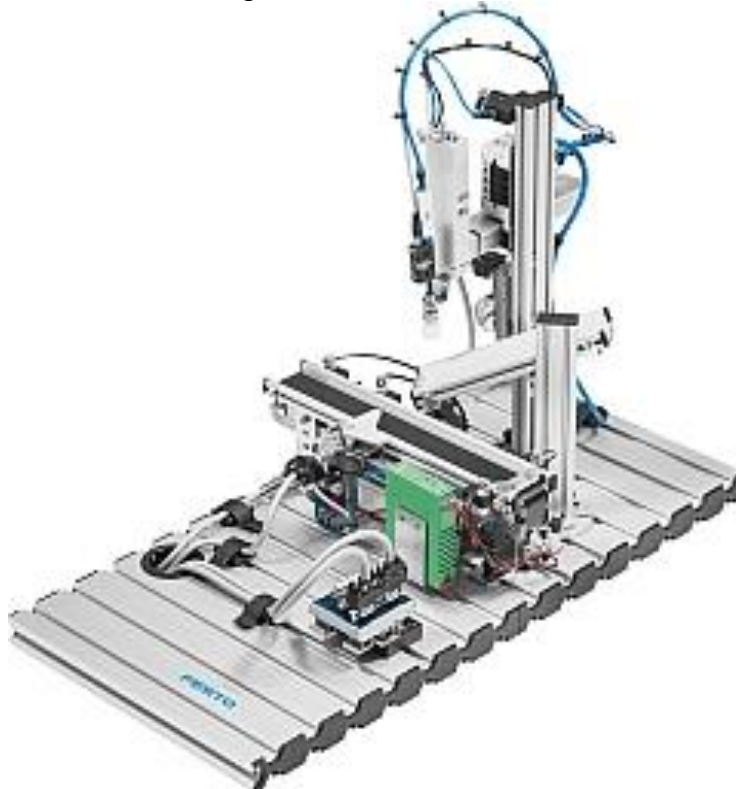
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#### 50. PLC Based Conveyor System with Pick and Place and Sorting of Objects (Pneumatic and Hydraulic):-

##### 25.1 Basic Indicative Diagram:-



##### 50.2 Pick&Place station should cover following topics,

50.2.1 The basic principles of vacuum technology and how to use it in an automated Process.

50.2.2 A pneumatic gripper

50.2.3 The conveyor module are used to transport work pieces.

50.3 The station has a two-axis Pick Place module and a conveyor module. Opto sensors, diffuse sensors or light barriers detect a work piece housings when it is on the conveyor. The conveyor transports the work piece to the electric feed separator. The Pick Place module picks up a work piece insert from the material supply slide and places it in the work piece housing. The complete work piece (housing and insert) is passed on by the feed separator. The conveyor module transports the work piece to the end position. Pick & Place station can be used to perform a number of different handling tasks: Feeding work pieces (housings or basic bodies) Rejection of work pieces (housing or basic bodies) It can also be used to perform custom handling tasks. Station provides a clear overview of the main components for the vacuum application: the vacuum



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- generator, the pressure switches, the vacuum filters and the suction cups with connections are harmonized for optimum performance.
- 50.4 General Technical data:
- 50.4.1 Operating pressure: 600 kPa (6 bar)
- 50.4.2 Power supply: 24 V DC,
- 50.4.3 Square/round work piece dimensions: max. 40 mm,
- 50.4.4 Min 7 digital sensors,
- 50.4.5 Min 6 digital actuators
- 50.5 Conveyor module: mounting on a profile plate, profile foot or slotted mounting frame with freely positionable DC motor. It is suitable for transporting and separating work pieces with a diameter of 40 mm (e.g. “Bodies” or “Cylinder for assembly” work piece sets). The module is supplied fully assembled.
- 50.5.1 Technical data:
- 50.5.1.1 Power supply: 24 V DC,
- 50.5.1.2 Maximum work piece width: 40 mm,
- 50.5.1.3 Length: 300, 350 or 700 mm,
- 50.5.1.4 Conveyor height above profile: approx. 117 mm, 3 digital sensors, 3 digital actuators
- 50.5.1.5 Scope of delivery Conveyor module including: DC motor: 24 V DC/1.5 A with motor controller right/left 2 diffuse sensors, Light barrier, Mini I/O terminal, Mounting material for profile plate, Feed separator/stopper, electric with PLC16DI,16DO,2AI,2AO with Input Switches and Output Indicators(LED 10 mm)and For Analog Source input and Analog Output Indicator , Software ,communication cable and control panel Provision to be made for external I/O connection both Digital and Analog (BS4 connectors) with 50 nos moulded Patch cords of length 1meter
- 50.6 Pick Place module: 2-axis handling device for Pick Place tasks. The position of the end-position switches, as well as mounting position and height, can be adjusted on this module. The module is supplied complete with vacuum generator, pressure switch, vacuum filter and suction gripper, valve terminal, pressure limiter and electrical interface. In another version, a parallel gripper is used instead of vacuum technology. Technical data Operating pressure: 600 kPa (6 bar) ; Power supply: 24 V DC,4 digital sensors,4 digital actuators, Stroke length, X-axis: 80 mm, Stroke length, Z-axis: 50 mm, Pick & Place unit, height-adjustable, Pressure limitation along the Z-axis, mounted on trolley
- 50.7 Scope of delivery: Mini I/O terminal, Valve terminal with 2 x 5/2-way single solenoid valves and 1 x 5/2-way double solenoid valve,2 double-acting cylinders with guide,3 magnetic limit switches, Mounting accessories for profile plate, Vacuum switches, venturi nozzle.



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### 51. Cut section Models of Pneumatic and Hydraulic Motors, Pumps:-

#### 51.1 Basic Indicative Diagram:-



#### 51.2 Following components should include in the Cut section Models of Pneumatic Display Board:

- 51.2.1 Single Acting Cylinder (spring return)
- 51.2.2 Double Acting cylinder
- 51.2.3 Flow Control Valve
- 51.2.4 3/2 Way Hand Lever Valve
- 51.2.5 5/2 Way Hand Lever Valve
- 51.2.6 5/2 Way Pilot Valve
- 51.2.7 3/2 Way Roller Lever Valve
- 51.2.8 5/2 way Solenoid operated Direction control valve
- 51.2.9 3/2 way Solenoid operated Direction control valve
- 51.2.10 Dual Pressure / AND Valve

#### 51.3 Shuttle / OR Valve

#### 51.4 Following components should include in the cut section Models of Hydraulic Display Board:

- 51.4.1 Single Acting Cylinder (spring return)
- 51.4.2 Double Acting cylinder
- 51.4.3 Pressure relief valve
- 51.4.4 Flow control valve
- 51.4.5 4/2 Way Hand Lever operated DC Valve
- 51.4.6 4/3 Way Hand Lever operated DC Valve
- 51.4.7 Sequence valve
- 51.4.8 Non-Return / Check Valve
- 51.4.9 Cut section of Gear pump





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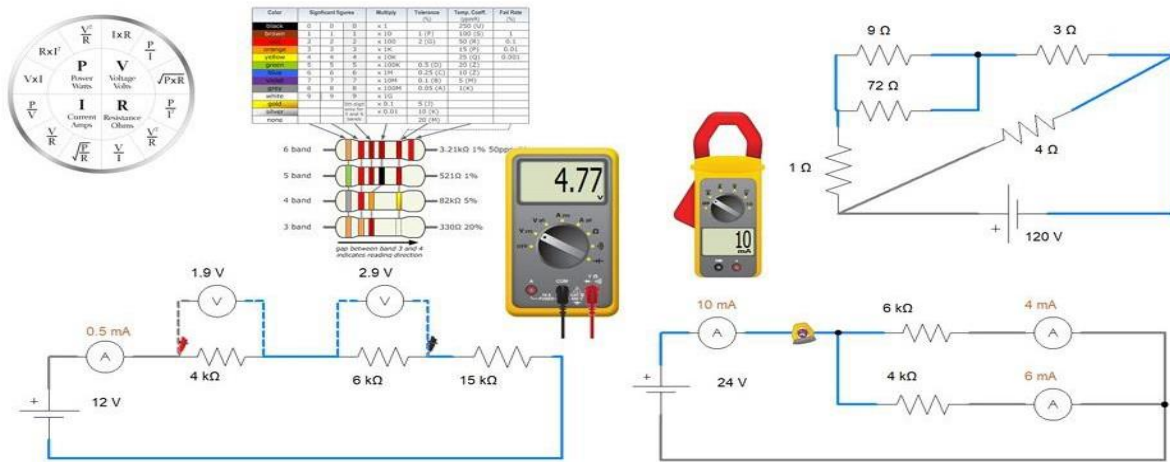
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### 52. Electrical simulator software:-

#### 25.1 Basic Indicative Diagram



- 52.2 The software should have facility of circuit simulation and electrical circuit design of SLD, Power Wiring Diagram, control wiring diagrams.
- 52.3 It should have a library of at least 20 thousand electrical components & circuit elements.
- 52.4 It should have a library of at least 20 thousand electrical symbols circuit elements.
- 52.5 The software should have facility of fault creation in the components, Automatic Calculation of the component value for the optimization of designed circuit.
- 52.6 It should also have 3D capability to preview the physical parts already on the Schematic diagram with run time animation in 2D and 3D view, visualizations of electrical Circuit design with Enclosures in 3D, 3D printer support, Importing Footprints in 2D and 3D In industry standard formats.
- 52.7 It should a wide array of components to create AC/DC and motor control circuits, from Basic to advance.
- 52.8 It supports IEC, NEMA, JIC and SAE standards.
- 52.9 Realistic measuring tools such as a multimeter, clamp meter and oscilloscope, can be used To reproduce real-life measuring and fault-finding experiences, enhancing students Troubleshooting skills.
- 52.10 Users also have access to Illustrated Libraries (DC Electrical, Residential Electricity, Renewable Energy) that includes real looking components so students can also create a Wiring diagram in complement of the regular ISO Symbols circuit.
- 52.11 Activate component failures by pre-set conditions or manually during



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- simulation using the Troubleshooting feature.
- 52.12 Soft Starters & Variable Frequency Drives from manufacturers such as Siemens™, Allen Bradley™, WEG™, etc., are pre-made and ready to simulate
- 52.13 Users must be able to place a picture of a real component in front of a symbol to create a Wiring diagram view.
- 52.14 Ready to use content for teaching and training on specific electrical components and Equipments should be publicly available following OEMs' specifications from the Manufacturers' Catalogues.



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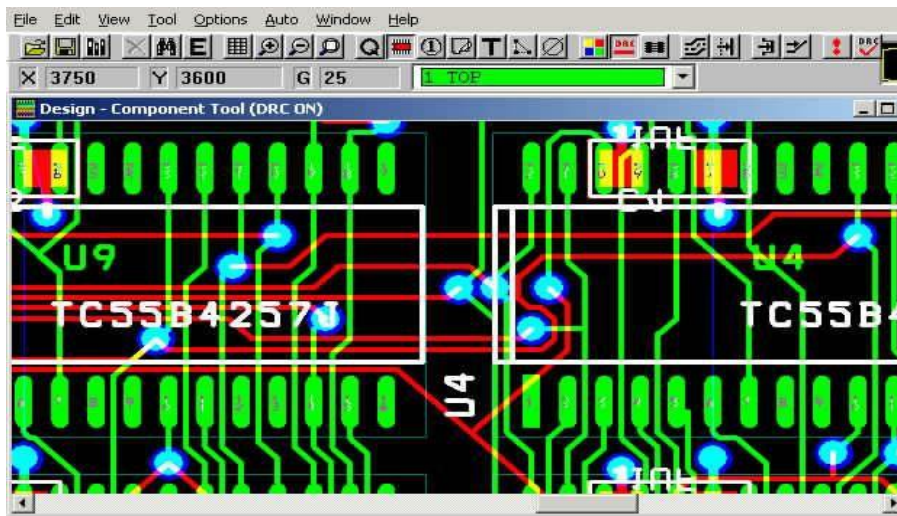
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### 53. Electronics simulator software:-

#### 53.1 Basic Indicative Diagram



1. Software should be Proven, scalable, easy-to-use PCB editing and routing solution that grows as design challenges and requirements evolve
2. Constraint Manager provides real-time validation and status of physical/spacing, samenet, region, differential pair, and length rules to help ensure first-time success
3. Automatic and interactive etch editing delivers intelligent automation to maintain user control while maximizing productivity
4. Dynamic real-time copper pour lowing and healing to eliminate error-prone manual voiding and rework
5. Rigid-Flex design support with cross-section stackup by zone, Flex bend editor, ARC route editing, and Rigid-Flex-specific DRCs
6. Support for IPC-2581, STEP, and IDX brings a level of intelligence and integration that streamlines manufacturing and MCAD-ECAD flows
7. The software should contain a PCB Editor, which is an easy-to-use, interactive place- and-route environment for creating and editing small contemporary Internet of Things (IoT) and wireless-type Rigid-Flex designs to complex multi-layer datacom PCBs.
8. The software should contain design's bill-of-materials (BOM) can be optimized based on cost, lead time, inventory, life cycle, and material compliance.
9. The software should contain PSpice® the industry leader when it comes to commercial-grade analog and mixed-signal circuit simulation, solving virtually any design challenge, from high-frequency systems to low-power IC designs.
10. Software should be able to integrate with Autodesk® Fusion™, Dassault Systèmes® SOLIDWORKS and CATIA, Siemens® NX, and PTC® Creo provides a bidirectional pathway for



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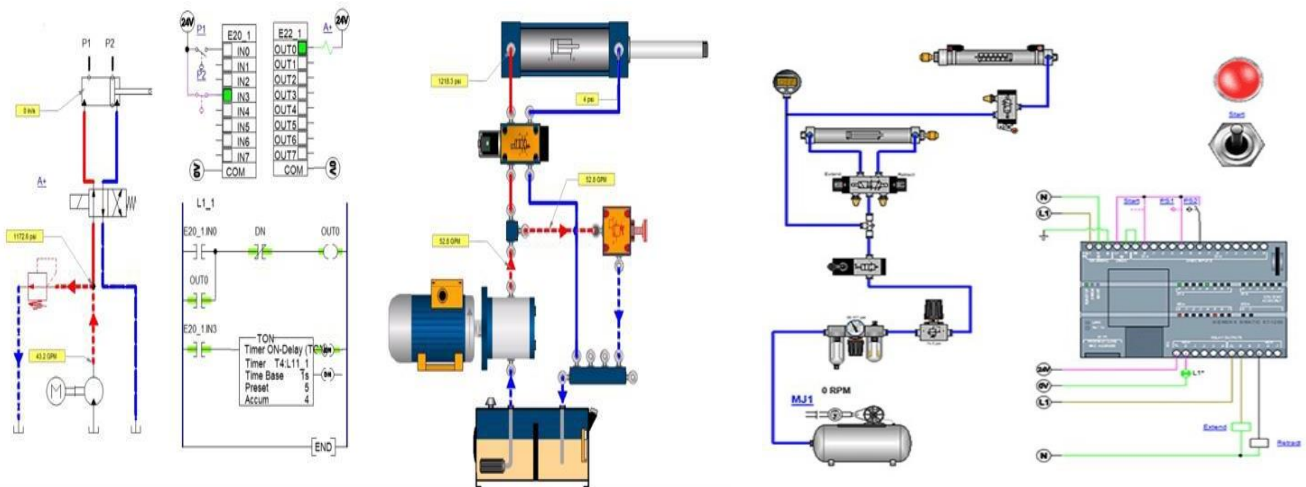
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mechanical and electrical changes to occur across design domains



### 54. Hydraulics and Pneumatics simulator software:-

#### 54.1 Basic Indicative Diagram



- 54.2 The software should have facility of circuit simulation and hydraulic and Pneumatic circuit Design of SLD, Power Wiring Diagram, control wiring diagrams.
- 54.3 It should have a library of at least 20 thousand hydraulic and Pneumatic components & Circuit elements.
- 54.4 It should have a library of at least 20 thousand hydraulic and Pneumatic symbols circuit Elements.
- 54.5 The software should have facility of fault creation in the components, Automatic Calculation of the component value for the optimization of designed circuit.
- 54.6 It should also have 3D capability to preview the physical parts already on the Schematic diagram with run time animation in 2D and 3D view, visualizations of electrical Circuit design with Enclosures in 3D, 3D printer support, Importing Footprints in 2D and 3D in industry standard formats.
- 54.7 The Hydraulic and pneumatic library should be compliant with ISO 1219-1:1991/2012 and 1219-2:1991/2012 standards.
- 54.8 User must create, simulate and troubleshoot hydraulic circuits, Pneumatic circuits or Electro-hydraulic circuits. It must offer a wide array of components to create basic to Advanced systems or reproduce your Hydraulic trainer.



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- 54.9 Configure simulation parameters, such as external loads, leaks, viscosity and thermal Characteristics, as needed to illustrate the effect on flow and pressure
- 54.10 Users must have access to a Cut-Away library to create cut-away circuits. These circuits Can then be simulated to display the flow movement within each components
- 54.11 Activate component failures by pre-set conditions or manually during simulation using the Troubleshooting feature.
- 54.12 Visualize simulation data curves on the **plotter** live during simulation.
- 54.13 Ready to use content for teaching and training on specific electrical components and Equipment should be publicly available following OEMs' specifications from the Manufacturers' Catalogues.



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### 57. SENSITIVE DRILLING MACHINE CAPACITY 1 TO 13MM MOTORIZED – WITH DRILL CHUCK AND KEY ETC.

#### 57.1 Basic Indicative Diagram



Capacity 1 to 12mm Motorized –with drill chuck and key etc.

#### **Base:**

- The base is a heavy casting that supports the machine structure.
- It provides rigid mounting for the column and also stability to the machine.
- The base is usually provided with holes and slots which help to bolt the base to a table or bench and allow the work-holding device or the work piece to be mounted on the base.

#### **Column:**

- The column is a vertical post that holds the worktable and the head containing the driving mechanism.
- The column may be of round or box section.

#### **Table:**

- The table may be rectangular or round.
- It supports the work piece and is carried by the vertical column.
- The surface of the table is 90-degree to the column axis and it can be raised, lowered



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- and swivelled around it and
- It can be held at any position by various levers provided.
  - Slots are provided in most of the tables to allow the jigs, fixtures or large work pieces to be securely fixed directly to the table.
  - **Drilling Head:**
    - The drilling head is mounted close to the top of the column and houses the driving arrangement and variable speed pulleys.
    - This unit transmits rotary motion at different speeds to the drill spindle.
    - The hand feed lever is used to control the vertical movement of the spindle sleeve and the cutting tool.
    - The system is called the sensitive drilling machine as the operator is able to sense the progress of drill with hand.

| 57.7  | DETAILS                          | CAPACITY       |
|-------|----------------------------------|----------------|
|       | Drilling Capacity                | 1 to 13MM      |
| 57.8  | Spindle Speed                    | FOUR SPEED     |
| 57.9  | Speed Range                      | 650to2400      |
| 57.10 | Spindle Nose                     | MT-2           |
| 57.11 | Spindle Centre to Column         | 150MM          |
| 57.12 | Spindle Travel                   | 75MM           |
| 57.13 | Maxi. Distance Spindle to Table  | 420MM          |
| 57.14 | Maximum Distance Spindle to Base | 620MM          |
| 57.15 | Working Surface of Base          | 240X190MM      |
| 57.16 | Working Surface of Table         | 205MM          |
| 57.17 | Column Diameter                  | 47MM           |
| 57.18 | Machine Base                     | 300X200        |
| 57.19 | Motor                            | 0.75KW/1440RPM |
| 57.20 | V-Belt Size                      | FHP-2350       |





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### 58. PILLAR /COLUMN TYPE DRILLING MACHINE 25 MM CAPACITY- MOTORIZED WITH DRILL CHUCK, KEY ETC

#### 58.1 Basic Indicative Diagram



| Sr. No | Item Descriptions                | Specification             |
|--------|----------------------------------|---------------------------|
| 1      | Drilling Capacity                | 25mm                      |
| 2      | Spindle Centre to Back Distance  | 150 TO 200mm              |
| 3      | Spindle Nose to Table Distance   | 405mm                     |
| 4      | Spindle Nose Taper               | MT2                       |
| 5      | No of Speed                      | 8 Speed                   |
| 6      | Range of Speed                   | 86 -3360                  |
| 7      | Table Size                       | 260*260mm                 |
| 8      | Base Size                        | 250x250mm                 |
| 9      | Overall Base                     | 450x295mm                 |
| 10     | Spindle Travel                   | 125mm                     |
| 11     | Column Length                    | 900-1200mm                |
| 12     | Overall Height with Pulley Guard | 1160mm                    |
| 13     | Motor RPM/Volt                   | 75KW 1440,440 Volt 0.5 Hp |
| 14     | Spindle Nose for Table Distance  | 405mm                     |



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|    |              |       |
|----|--------------|-------|
| 15 | Coolant pump | 0.1kv |
|----|--------------|-------|

#### **STANDARD ACCESSORIES**

- 1) Drill chuck-**16mm** with arbore & key:-1
- 2) Machine vice swivel type (100mm):-1
- 3) Coolant system suitable for machine
- 4) Co-ordinate table (optional)**
- 5) Reverse switch Equipment (optional)
- 6) Boring head (optional)**
- 7) Tool tray (optional)**
- 8) Drill reduction sleeve (optional)**
- 9) Quick positioning vice (optional)**
- 10) Drill collet for quick change chuck (optional)**
- 11) Spindle Centre to Column 150MM
- 12) Spindle Travel 75MM
- 13) Maximum Distance Spindle to Table 420MM
- 14) Maximum Distance Spindle to Base 620MM
- 15) Working Surface of Base 240X190MM
- 16) Working Surface of Table 205MM
- 17) Column Diameter 47MM
- 18) Machine Base 300X200
- 19) V-Belt Size FHP-2350
- 20) Weight of Machine (Approx.) 100kg
- 21) Quick change chuck (optional)**



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Regional Office, Pune

### FEATURES

The machine should be suitable for tapping, reaming, boring & spot facing has min. 5 spindle speed

The spindle should be made of alloy steel accurately machine and ground, supported in precision ground

Alloy steel quill carrying 2 taper rollers bearing and spindle has 4-6 splines as per machine tool spline standard and drive through broached sleeve.

Properly balance spindle pulley is mounted on double ball bearing with one bearing each in body cup and Bracket for trouble free and long-life belt load. Spindle should be hardened & Ground.

Independent worm and gear and square rack in work table arm for longer and trouble-free life.

Head should be made from cast iron of Grade FG260 accurately machine to ensure perfect parallelism between the column and spindle.

The quill carrying spindle is precisely ground to slide in precisely honed bore.

A precision ground column should be made from heavy section seamless steel tube which ensures rigidity and resists deflection.

Work table T-slots should be machined as per IS Standards.

All moving parts should be accurately machined and ground to close tolerance.

The pillar type drilling machine shall comply with the rest requirements given in IS 2425:1982/ISO2773-1:1973 Reaffirmed in Jan.2005.

All the castings used in machine should be certified by NABL approved lab.

Casting grade and hardness of part should be highest grade (cast iron grade FG260IS210)

Handles and levers should be chrome plated main component should be excellently surfaced and treated staving enamel.



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### 59. POWER HACKSAW MACHINE TO 21" OR MORE LENGTH

#### BLADE ACCOMMODATE

##### 59.1 Basic Indicative Diagram



- 59.9 : Electric Motor with D.O.L. Starter  
: 2HP, 3 Phase, ISI MARK
- 59.10 : Blade Size 16" to 28"
- 59.11 : Weight Approx.: - 550 to 600 kg. (Light Weight Offer Will Not Be.  
Consider)
- 59.12 : Cutting for Round Bar M.S.: - 14"
- 59.13 : Cutting for Square Bar M.S.: - 12"
- 59.14 : Coolant Pump Mechanical (0.1hp)
- 59.15 : Floor Space: - 1200 X 650 approx.



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- 59.16 : Length Gauge, Guards, Spout Fittings
- 59.17 : Maintenance Manual Book
- 59.18 : With Auto feed Hydraulic system and stopper
- 59.19 : With Adjustable Vice
- 59.20 : Cutting Capacity AT 45 degree - 250 mm (10")
- 59.21 : Stroke Adjustment - 88 mm x 175 mm (3.5" x 7")



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### 60. DOUBLE ENDED PEDESTAL GRINDER WITH 178 MM WHEELS

(ONE FINE AND ONE ROUGH WHEEL)

#### 60.1 Basic Indicative Diagram



#### 60.2 178 mm wheels (one fine and one rough wheel)

Supply of Double ended Pedestal Grinding Machine with standard accessories and suitable electrical as per the following Specification:-

#### I. Heavy duty Double ended Pedestal grinder -Quantity One Number

##### A. Wheel

60.3. Wheel Diameter 250 mm

60.4. Wheel Bore Diameter 25.4 mm

60.5. Width of the wheel 25 mm

60.6. Centre Distance 600 mm

60.7. Wheel 2 nos. Coarse & fine

##### B. Spindle

60.8. RPM of the Spindle 2250 / 2800

60.9. Centre Height from GL 910 mm

##### C. Motor HP 1

##### D. Accessories required



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60.10. Tool rests adjustable type in both direction Vertical and Horizontal

60.11. Wheel guard for both wheels

60.12. Eye shield for both wheels

#### **Other Requirements:-**

60.13. The body shall be made up of Heavy duty Cast iron with attractive appearance.

60.14. The motor shall be enclosed in the body which is readily accessible.

60.15. The spindle shall be mounted on heavy duty ball bearings. The spindle bearings and motor bearings are greased adequately.

60.16. Wheel flanges shall be balanced in design.

60.17. The drive shall be through V belts to the spindle by an electric Motor.

60.18. Two speeds are to be provided to maintain the peripheral speeds when the wheels 60.19. The motor shall be 400/440 Volts 3 phase 50 cycles with ISI marks.

60.20. L&T push button starter direct on line with overload, under voltage is preferable.

60.21. Standard accessories shall be mentioned separately to ensure the machine.

60.22. The machine shall have the ease provision for mounting the special accessories.

Pedestal Body made up of Heavy duty selected cast iron to ensure maximum strength, accuracy & Reliability

With motor enclosed in the body which is readily accessible.

Push button type Starter with Overload relays for motor protection

Casting Grade: -FG260IS210

Casting grade should be certified by NABL approved Labs.

**187.23 Bench Grinding Machine mounted on Rigid steel Frame.**

**187.24 Low Noise: Below allowable noise level.**

**187.25 High Filtering efficiency even for the fine stdusts.**

| <u>Sr No.</u> | <u>Features</u>  |
|---------------|--|
| 1             | Spindle Hardened ground and vibration free                         |
| 2             | SKF/FAG/TATA Or Marked Heavy duty ball bearing totally sealed type |
| 3             | Wheel Flanges and Guard  |
| 4             | Pedestal Rigid and casted in one Piece C.I.                        |



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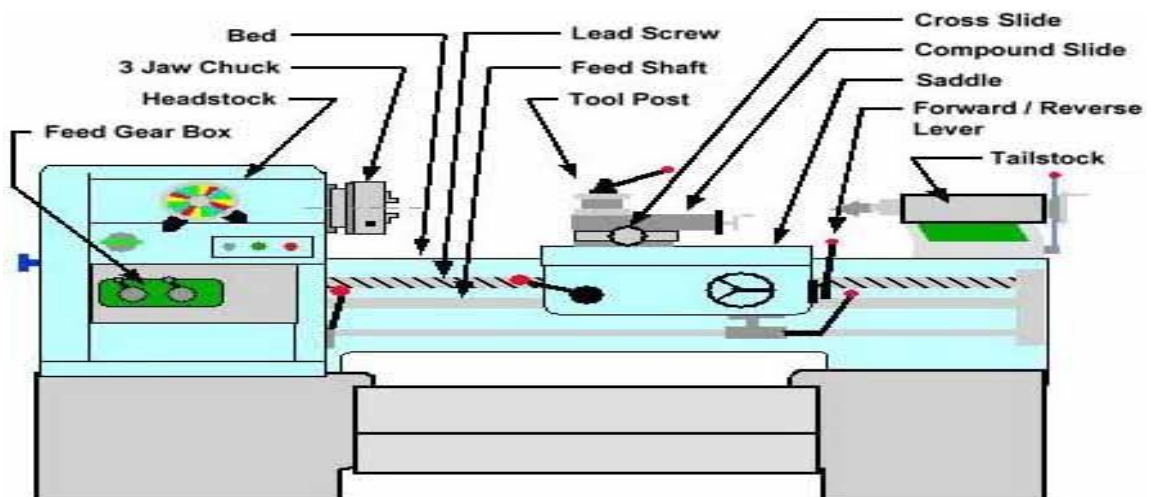
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|   |            |
|---|------------|
| 5 | Eye Shield |
|---|------------|

**61. SS AND SC CENTRE LATHE (ALL GEARED) WITH CENTRE HEIGHT 150 MM AND CENTRE DISTANCE 1000 MM ALONG WITH 3 JAWS, 4 JAW CHUCK, AUTO FEED SYSTEM, TAPER TURNING ATTACHMENT, COOLANT PUMP, SAFETY GUARD AND MACHINE LIGHT ARRANGEMENT.**

61.1 Basic Indicative Diagram

### A. BASIC DIAGRAM







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### B.BASIC ITEM SPECIFICATION:

| Sr.No                       | Particular                    | Range       |           | Remark |
|-----------------------------|-------------------------------|-------------|-----------|--------|
|                             |                               | From        | To        |        |
| Name of Parts / Particulars |                               |             |           |        |
| CAPACITY                    |                               |             |           |        |
| 1                           | Centre height                 | 150mm       | -         | --     |
| 2                           | Swing over bed                | Min. 350mm  | -         | -      |
| 3                           | Swing over cross slide        | Min. 190mm  | -         | -      |
| 4                           | Distance between centre       | 1000mm      | -         | -      |
| 5                           | Maximum facing diameter       | Min. 350mm  | -         | -      |
| <b>HEADSTOCK</b>            |                               |             |           |        |
| 6                           | Spindle nose cam-lock         | A2-4/D1-4   | -         | -      |
| 7                           | Spindle taper bore            | No. 5 M.T.  | -         | -      |
| 8                           | Spindle sleeve                | No. 3 M.T.  | -         | -      |
| 9                           | Bore in spindle               | 40mm        | 44mm      | -      |
| 10                          | No. of Spindle Speeds         | 2 x 8 or 16 | -         | -      |
| 11                          | Range of Spindle Speeds (RPM) | 20-50       | 1600-2000 | -      |
| <b>TAILSTOCK</b>            |                               |             |           |        |
| 12                          | Tailstock quill travel        | Min. 110mm  | -         | -      |
| 13                          | Tailstock quill diameter      | 50mm        | -         | -      |



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|                   |   |                                      |             |   |
|-------------------|---|--------------------------------------|-------------|---|
| 14                | Taper bore in sleeve  | No. 3 M.T.                           | -           | - |
| 15                | Maximum offset of tailstock on either side of the centre line | 13 mm                                | -           | - |
| <b>CARRIAGE</b>   |   |                                      |             |   |
| 16                | Max. Cross slide travel                                       | 175 mm                               | 190mm       |   |
| 17                | Max.Tool or compound slide travel                             | Min. 100mm                           | -           | - |
| 18                | Tool shank capacity   | 20 mm                                | -           | - |
| 19                | Type of tool post   | Quick change tool post               | -           | - |
| <b>BED</b>        |   |                                      |             |   |
| 20                | Width   | Min. 230mm                           | -           | - |
| 21                | Depth   | Min. 300 mm                          | -           | - |
| 22                | Standard bed way design                                       | 2v & 2flat or 3 V ways & 1 flat ways | -           | - |
| 23                | Main motor  | 3 H.P.                               | 5 H.P.      |   |
| <b>ELECTRICAL</b> |   |                                      |             |   |
| 24                | coolant Motor   | 0.1 H.P.                             | 0.15 H.P.   | - |
| <b>FEED BOX</b>   |   |                                      |             |   |
| 25                | Thread capacity inches( number of threads )                   | 2-4 TPI                              | 72-112 TPI  | - |
| 26                | Thread capacity metric( number of threads )                   | 0.2-0.25 mm                          | 6-14 mm     | - |
| 27                | Thread capacity module  | 0.1-0.4 mm                           | 3-3.5 mm    | - |
| 28                | Longitudinal feed   | 0.03-0.04 mm                         | 0.7-1 mm    | - |
| 29                | Cross feed  | 0.015-0.025 mm                       | 0.35 -0.5mm | - |
| 30                | Lead screw pitch  | 6mm                                  | -           | - |
| 31                | Nos. of feed range  | 24 Nos.                              | -           | - |
| <b>OTHERS</b>     |   |                                      |             |   |
| 32                | Noise level of machine  | 85 Db.                               | -           | - |

#### C.STANDARD ACCESSORIES:

| S.N                       | Particular | Range |    | Remark |
|---------------------------|------------|-------|----|--------|
|                           |            | From  | To |        |
| Name of part/Particulars: |            |       |    |        |



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|    |   |   |   |       |
|----|---|---|---|-------|
| 1  | Coolant Pump with separate tank & complete fitting.   | - | - | 1 Set |
| 2  | Full length rear flash guard  | - | - | 1 Set |
| 3  | Chip tray/swarf tray fitted on machine  | - | - | 1 No. |
| 4  | Drive plate   | - | - | 1 No. |
| 5  | Centre sleeve   | - | - | 1 No. |
| 6  | 2 dead centre, M.T.3  | - | - | 1 Set |
| 7  | Electrical equipment's suitable for 415V, 3 Phase 50Hz A.C. Supply along with ammeter, starter for over load protection and single phase prevention fitted on control panel | - | - | 1 Set |
| 8  | Machine light suitable for 415 V operations with machine lamp.  | - | - | 1 Set |
| 9  | Full length foot brake  | - | - | 1 No. |
| 10 | Self-cantering chuck – Ø160 mm  | - | - | 1 No. |
| 11 | Four jaw chuck – Ø200 mm  | - | - | 1 No. |
| 12 | Face plate – Ø300 mm  | - | - | 1 No. |
| 13 | Revolving centre( MT-3)   | - | - | 1 No. |
| 14 | Chuck safety guard  | - | - | 1 No. |
| 15 | Steady rest   | - | - | 1 No. |
| 16 | Follow rest   | - | - | 1 No. |
| 17 | Instruction & spare parts manual  | - | - | 1 No. |
| 18 | Free preventive maintenance visit for three years as per our requirement  | - | - | -     |
| 19 | On side training for two days & centralized training for one week about machine to trained our staff.   | - | - | -     |
| 20 | Lubrication System  | - | - | -     |
| 21 | Coolant System  | - | - | -     |

#### D.OTHER FEATURES:

| S.N                       | Particular | Range |    | Remark |
|---------------------------|------------|-------|----|--------|
|                           |            | From  | To |        |
| Name of part/Particulars: |            |       |    |        |



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|   |  |   |   |  |
|---|--|---|---|--|
| 1 | <b>LUBRICATION:</b> High pressure automatic lubrication exclusively to head. One shot lube to carriage, cross-slide & cross-slide screw  | - | - |  |
| 2 | <b>APRON:</b> Totally enclosed double wall type apron with adjustable trip control to allow maximum accuracy when turning shoulder lengths. Apron should be made of high grade cast iron of grade FG260 IS210. Forward –off-reverse spindle control provided by gated lever at apron. Feed reverse from the apron from independent control for longitudinal feed & cross feed engagement. Left hand wheel location can be disengaged for threading operation.  | - | - |  |
| 3 | <b>CARRIAGE &amp; CROSS-SLIDE:</b> Carriage should be designed wide enough to give maximum bearing surface area for rigid tool support & made of high quality cast iron of grade FG260 IS210. Wide full length cross slide externally dovetailed for quick & easy mounting accessories. Micrometer dial (inch & metric) with direct reading for cross & compound feeds immediate change over from inch to metric reading through dial window. Pressure one shot lube for carriage & cross slide. Cross-lead screw with back lashes eliminator carriage with anti- friction/vibration material turcite on the sliding surfaces to eliminate stick up & dampen cutting vibration. Hardness & 55 to 60 HRC, Surface finish should be accurately finished & minimum thickness of wedges and walls should be 12mm | - | - |  |



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|   |   |   |   |  |
|---|---|---|---|--|
| 4 | <b>TAILSTOCK</b> :Body & base made of cast iron grade FG260 IS210 class G4.It moves on separate VEE & flat guide ways, further it can be set over either side to turn small tapers maximum tolerance maintained within .02 mm. Spindle have tang slot & inch/metric graduation on quill.  | - | - |  |
| 5 | <b>MAIN SPINDLE:</b> Main spindle is made of forged alloy steel & it is dynamically balanced by using taper roller bearings. Spindle taper bore bearing surface (internal & external), taper nose & chuck mounting face are case hardened to 55 to 60 HRC. It should be ground precisely to give run out within 10 micron                         | - | - |  |
| 6 | <b>BED:</b> Bed should be hardened & precision ground bed ways 2 or 3 “V” ways. Bed should be heavily ribbed with rectangular wide opening. It should be made of Nickel Chromium alloy cast iron of grade FG260 IS210Hardness & 55 to 60 HRC, Surface finish should be accurately finished & minimum thickness of wedges and walls should be 12mm | - | - |  |



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|    |   |   |   |  |
|----|---|---|---|--|
| 7  | <b>HEADSTOCK:</b> Head stock should be made of high quality cast iron of grade FG260 IS210.Heavily ribbed with wall thickness 12-15mm for anti-vibration strength. Heavy duty gear head with forged alloy steel spindle. All gears & shaft are hardened & ground supported by bearing. Gears are hardened-shaft turn on anti-friction bearing –mechanism runs in oil bath. Separate rod for power feeds lead screw is used. For thread cutting only clutch in apron & shear pin in lead screw protect against over load. Hardness & 55 to 60 HRC, Surface finish should be accurately finished & minimum thickness of wedges and walls should be 12mm | - | - |  |
| 8  | The lathe machine shall comply with the requirement given in IS 11118-1997 (guideline of technical evaluation of general purpose parallel lathe ) The lathe machine shall comply to the test requirement given in IS :1878 (Part-1)-1993(Reaffirmed 2004) swing over bed up to 800 mm   | - | - |  |
| 9  | Sub-assemblies like head stock: Feed box & apron are built & kept for running on respective running stands for 16 Hrs. Assemblies are inspected as per standard test chart.   | - | - |  |
| 10 | Legs should be scraped. Bed placed on legs, levelled. Bed should be tightened and re-levelled   | - | - |  |
| 11 | Head stock bottom “v” and flat are scraped to give proper seating of 20 to 24 points per 25 x 25 mm square with respect to bed “v” and flat. Alignment is checked with respect to front v” and flat.  | - | - |  |



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|    |  |   |   |  |
|----|--|---|---|--|
| 12 | Tailstock v” and flat is scraped to give proper seating of 20 to 24 points per 25 x 25 mm square with respect to bed “v” and flat. Alignment is checked with tackle & inspection mandrel with respect to head stock. | - | - |  |
| 13 | Mounting face of feed box, apron and end bearing are scraped to give correct alignment checked with respect to bed “v” and flat.   | - | - |  |
| 14 | Lead screw is aligned with two thrust bearings.  | - | - |  |
| 15 | The machine should have been kept sequence for 16 Hrs. to ensure gear noise within 80 dB, temperature rise within 28 deg. and no oil seepage from gear box.  | - | - |  |
| 16 | Thread cutting trials to be carried out for different pitches.   | - | - |  |
| 17 | Chasing dial to be provided.   | - | - |  |
| 18 | <b>Casting grade should be certified by NABL approved Lab.</b>   | - | - |  |
| 19 | Portable Electronic Hardness testing Machine must be provided for checking hardness of bed, guide ways & other at the Pre dispatch inspection  | - | - |  |

Gear train gears: - 1 Material cast iron  
2 Hardness 38to 48 HRC,  
3 Surface finish should be accurately finished



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#### E: SPACE REQUIREMENT FOR INSTALLATION:

#### F: FOUNDATION/INSTALLATION SPECIFICATION:

| S.N | Particular                               |
|-----|--|
| 1   | Anti – vibrant mount - 04 Nos.           |
| 2   | Oil suitable for gearbox & feed box etc. |
|     |  |

#### G: ELECTRIC SUPPLY SPECIFICATION:

| S.N | Particular   |
|-----|--|
| 1   | Complete electrical equipment's suitable for 415V, 3 Phase, 50Hz A.C. supply |
| 2   | Single Phase Preventer   |

#### H: ESTIMATED PRICE AND DELIVERY PERIOD

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|--|--|--|--|

Note:-

- All casting used including Bed, Head stock, tail stock, etc. in machine should be of the highest grade cast Iron from reputed brands maintained the initial accuracy for many years. Material Hardened
- All casting should be of high grade cast iron ( grade F G-250 IS 210)

| S.N | Particulars          | Dimensions |
|-----|----------------------|------------|
| 1   | Overall length in mm | 2500       |
| 2   | Overall Width in mm  | 1200       |
| 3   | Overall Height in mm | 1800       |
| 4   | Net Weight-Kg        | 1600       |
| 5   | Gross Weight-Kg      | 2000       |
| 6   | Other                | -          |

- All body parts, spindle, head stock, beds, guide ways, material should be of high grade and hardened and having hardness value from 55 to 60 HRC
- Thickens of all ribs and walls of casting structure should be minimum 12mm or more than 12mm to have adequate structural rigidity and stability
- The surface finish of spindle and guide ways should be within valve of 2.5 Ra





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#### 62. SHEARING MACHINE (LEVER TYPE) HAND OPERATED COMPLETE WITH 300 MM BLADE LENGTH

##### 62.1 Basic Indicative Diagram



|      |                               |                      |
|------|-------------------------------|----------------------|
| 62.2 | Max Shear Width               | 300mm                |
| 62.3 | Blade Length                  | 300mm                |
| 62.4 | Cutting Capacity (Square) Rod | 10 to 13 mm          |
| 62.5 | Cutting Capacity (Sheet)      | 6 mm                 |
| 62.6 | Cutting Capacity (Flat)       | 70 X 6 mm            |
| 62.7 | Usage/Application             | Sheet Cutting        |
| 62.8 | Automation                    | Manual Hand Operated |

**KEY FEATURES:** - • Angle Iron Cutting Cap: - 25,32,40,50 deg. (thickness Up to 6mm.)

- Last Longer
- Interchangeability
- Tool Steel Hardened

Capacity of blade length: -



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#### Size: 12 inch

- 12 Inch Manual Hand Plate Shear for Sheet Metal, Rebar and Round Stock
- This multi-function 12 inch metal shear cutter is designed to shear carbon steel plates and bars. It is able to cut sheet metal, rebar and round stock as well. Its blade length is 12 inch (304.8 mm) and cutting thickness can reach to 1/4 inch (6 mm) maximum, 3/16 inch (4.75 mm) thickness at full length.

#### Features:

- Cutting blades made with hardened steel, able to shear carbon steel plate
- The metal shear owns an adjustable hold-down clamp inside, this helps to secure material more firmly
- Long handle saves your time and energy. Level arm with compensating spring, easy cutting across the entire length
- Solid steel frame ensures stability while cutting
- Screw holes at the bottom, can be fixed onto workbenches
- Designed to cut different metal forms including sheet metal, rebar and round stock

#### Specification:

- Blade Length: 12" (304.8 mm)
- Capacity:
- Sheet Steel Thickness: 1/4" (6 mm)
- Flat Steel Size: 2-3/4" x 1/4" (70 x 6 mm)
- Rod Steel: 1/2" (13 mm)
- Maximum Thickness at Full Length: 3/16" (4.75 mm)
- Gross weight: 59.9 lb. (27.2 kg)
- Package dimensions (L x W x H): 29.9" x 18.9" x 7.5" (76 x 48 x 19 cm)
- Package Content:
- 1 X 12 Inch Manual Metal Sheet Cutter



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### 63. Universal Milling Machine, Standard and optional accessories and set Of cutters:-

#### 63.1 Basic Indicative Diagram



| S. N                             | Particular   | Range             |                   | Remark |
|----------------------------------|--|-------------------|-------------------|--------|
|                                  |  | From              | To                |        |
| <b>Name of part/Particulars:</b> |  |                   |                   |        |
| <b>MODEL TABLE</b>               |  |                   |                   |        |
| 1                                | Working Surface (mm)Length<br>Working Surface (mm)Width  | 1350 mm<br>300 mm | 1600 mm<br>450 mm |        |
| 2                                | Swivel range of table on both side   | 0°                | 45°               |        |
| 3                                | T-Slot Nos.  | 3                 | -                 |        |
| 4                                | T-Slot Size  | 14 mm             | 18 mm             |        |
| 5                                | T-Slot Centre  | 45 mm             | 65 mm             |        |
| 6                                | Min. distance, centre lower face of Milling head spindle to table to face<br>Max. distance, centre lower face of Milling head spindle to table to face | 0 mm<br>475 mm    | 60mm<br>600 mm    |        |
| 7                                | X-Longitudinal Travel (Max.)   | 800 mm            | 1000 mm           |        |
| 8                                | Y-Cross Travel (Max.)  | 400 mm            | 600 mm            |        |
| 9                                | Z-Vertical Travel (Max.)   | 230 mm            | 450 mm            |        |



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| FEEDS      |                                 |              |           |  |
|------------|---------------------------------|--------------|-----------|--|
| 10         | No. of Feeds                    | 18           | 21        |  |
| 11         | Range of Longitudinal Feed/ min | 16-25        | 800-1000  |  |
| 12         | Range of Cross Feed / min       | 16-25        | 800-1000  |  |
| 13         | Range of Vertical Feed / min    | 4-10         | 200-400   |  |
| 14         | No. of Rapid Feeds              | 1            | -         |  |
| 15         | Longitudinal Rapid Feeds / min  | Min.320<br>0 | -         |  |
| 16         | Cross Rapid Feeds / min         | Min.320<br>0 | -         |  |
| 17         | Vertical Rapid Feeds / min      | Min.800      | -         |  |
| SPINDLE    |                                 |              |           |  |
| 18         | No. of Spindle Speeds           | 18           | 21        |  |
| 19         | Range of Spindle Speeds (RPM)   | 25-45        | 1800-2000 |  |
| 20         | Spindle Taper                   | ISO 40       | -         |  |
| ELECTRICAL |                                 |              |           |  |
| 21         | Main Motor                      | 7.5 H.P.     | 10 H.P.   |  |
| 22         | Feed Motor                      | 2 H.P.       | 3 H.P.    |  |
| 23         | Coolant Motor                   | 0.1 H.P.     | 0.15 H.P. |  |

#### C.STANDARD ACCESSORIES:

| S. N                             | Particular  | Range |    | Remark     |
|----------------------------------|---|-------|----|------------|
|                                  |   | From  | To |            |
| <b>Name of part/Particulars:</b> |   |       |    |            |
| 1                                | Stub arbore size – (Dia. 27mm, Dia.32mm, Dia.40mm)      | -     | -  | 01 no each |
| 2                                | Long arbore size - Ø27mm x500mm long & Ø 1” x500mm long |       |    | 01 no each |
| 3                                | Universal milling head                                  |       |    | 1 No.      |
| 4                                | Universal dividing head                                 |       |    | 1 No.      |
| 5                                | Rotary table size 250mm-300mm                           |       |    | 1 No.      |
| 6                                | Slotting attachment                                     |       |    | 1 No.      |
| 7                                | Rack cutting attachment                                 |       |    | 1 No.      |



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|    |  |   |   |       |
|----|--|---|---|-------|
| 8  | Machine light suitable for 415 V operations with machine lamp.   | - | - | 1 Set |
| 9  | Coolant system with tank   | - | - | 1 Set |
| 10 | 7.5 H.P. - 10 H.P. Electric motor with control gear  | - | - | 1 Set |
| 11 | Auto feed box with 2 H.P. - 3 H.P. Electric motor  | - | - | 1 Set |
| 12 | Set of requisite tools   | - | - | 1 Set |
| 13 | Swivel base type machine vice 160 mm heavy duty  | - | - | 1 No. |
| 14 | Conical type collets $\varnothing$ 5mm to $\varnothing$ 25 mm by 1mm or 2mm with collets chuck                   | - | - | 1 Set |
| 15 | Face milling cutter size $\Phi$ 80mm x 27mm or $\Phi$ 100mm x 32mm bore diameter with index able carbide inserts | - | - | 1 No. |
| 16 | Self-cantering vice  | - | - | 1 No. |
| 17 | Instruction & spare parts manual   | - | - | 1 No. |
| 18 | Free preventive maintenance visit for three years as per our requirement   | - | - | -     |
| 19 | On side training for two days & centralized training for one week about machine to trained our staff.            | - | - | -     |

#### D. OTHER FEATURES:

| S. N                             | Particular  | Range |    | Remark |
|----------------------------------|---|-------|----|--------|
|                                  |   | From  | To |        |
| <b>Name of part/Particulars:</b> |   |       |    |        |
| 1                                | High rigidity of structure and drives.                  | -     | -  |        |
| 2                                | Convenient Design.                                      | -     | -  |        |
| 3                                | Separate Drive for the spindle and the table movements. | -     | -  |        |
| 4                                | Single lever control of feeds & rapid traverse.         | -     | -  |        |



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|    |  |   |   |  |
|----|--|---|---|--|
| 5  | Wide ranges of spindle speeds & feeds with high upper limits.  | - | - |  |
| 6  | Casting is high tensile strength & superior quality. Steel & Chemicals included in casting(NABL approved test lab certificate )  | - | - |  |
| 7  | High rates of rapid table traverse while the spindle is running or at rest.  | - | - |  |
| 8  | Large longitudinal & traverse movements of table.  | - | - |  |
| 9  | Prolong Hardened Gears. ( HRC 55-60 )  | - | - |  |
| 10 | All Parts should Interchangeable.  | - | - |  |
| 11 | Casting grade : FG260 IS210  | - | - |  |
| 12 | <b>LUBRICATION:</b> Central lubrication for guide ways & lead screw. Splash lubrication for speed & feed gearing   | - | - |  |
| 13 | <b>TABLE DRIVE:</b> Lead screw with two nuts for backlash free setting, Feed selection by sliding gear drive Reversal of movement direction through motor reversalHardness & 55 to 60 HRC, Surface finish should be accurately finished & minimum thickness of wedges and walls should be 12mm | - | - |  |
| 14 | <b>HOUSING:</b> The rigid spindle housing, cross ribbed box type column structure & the closed box type knee design ensure optimum chip removal & surface finish. The rigid structure ensures vibration free & smooth machining  | - | - |  |
| 15 | <b>WORK SPINDLE:</b> Optimum spacing of precision taper roller bearing ensure vibration free cutting The bearing preload is adjusted by a common nut.Hardness & 55 to 60 HRC, Surface finish should be accurately finished & minimum thickness of wedges and walls should be 12mm              | - | - |  |
| 16 | <b>GUIDES:</b> Built in hardened & ground guide ways on all three axes helping for retain unwavering accuracy for years  | - | - |  |
| 17 | <b>OTHER :</b> Machine base, column, overarm & knee should be made of high grade cast iron of grade  | - | - |  |



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|    |   |   |   |  |
|----|---|---|---|--|
|    | FG260 IS210.Spindle housing should be rigid & column should be cross ribbed box type to ensure vibration free & smooth machining. The dovetail guide ways are amply dimensioned to resist extreme machine load. The guide ways are protected constantly from the ingress of swarf and coolant.<br>X, Y & Z axes slides ways with anti-friction/vibration material turcite on the sliding surfaces to eliminate stick up & dampen cutting vibration. |   |   |  |
| 18 | <b>The universal milling machine shall comply with the test requirements given in IS 2200 – 1994 ( Test chart for milling machine with table of variable height with horizontal spindle ) For swivel table the requirement given in IS 13993 – 1994 test chart for Universal milling machine with a swivelling table shall be complied</b>  | - | - |  |
| 19 | Spindle run out is within 10 (microns symbol) T. I. R.  | - | - |  |
| 20 | Centralized push button controls for ease of operation.   | - | - |  |
| 21 | Casting grade should be certified by NABL approved Lab.   |   |   |  |

#### E:SPACE REQUIREMENT FOR INSTALLATION:

| S. N | Particulars          | Dimensions |
|------|----------------------|------------|
| 1    | Overall length in mm | 2600       |
| 2    | Overall Width in mm  | 3200       |
| 3    | Overall Height in mm | 2000       |
| 4    | Net Weight-Kg        | 2500       |
| 5    | Gross Weight-Kg      | 3500       |
| 6    | Other                | -          |

#### F: FOUNDATION/INSTALLATION SPECIFICATION:

| S.No. | Particular                              |
|-------|---|
| 1     | Anti – vibrant mount - 04 Nos.          |
| 2     | Oil suitable for gearbox &feed box etc. |



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#### G: ELECTRIC SUPPLY SPECIFICATION:

| S.No. | Particular   |
|-------|--|
| 1     | Complete electrical equipment's suitable for 415V, 3 Phase, 50Hz A.C. supply with Single Phase Preventer |
| 2     | E L C B  |
| 3     | Two Way Reverses forward Switch  |

Note:-

1. All casting used including Bed, Head stock, tail stock, etc. in machine should be of the highest grade cast Iron from reputed brands maintained the initial accuracy for many years. Material Hardened
2. All casting should be of high grade cast iron ( grade F G-250 IS 210)
3. All body parts, spindle, head stock, beds, guide ways, material should be of high grade and hardened and having hardness value from 55 to 60 HRC
4. Thickness of all ribs and walls of casting structure should be minimum 12mm or more than 12mm to have adequate structural rigidity and stability
5. The surface finish of spindle and guide ways should be within value of 2.5 Ra

#### 6. FEATURES

7. 1) LUBRICATION: Central lubrication for guide ways & lead screw. Splash lubrication for speed & feed gearing
8. 2) Table driver: Lead screw with two nuts for backlash free setting, Feed selection by sliding gear drive Reversal of movement direction through motor reversal
9. 3) Housing: The rigid housing, cross ribbed box type column structure & the closed box type knee design ensure optimum chip removal and surface finish. The rigid structure ensure vibration free and smooth machining
10. 4) Work spindle: optimum spacing of precision taper roller bearing ensure vibration free cutting the bearing preload is adjusted by a common nut
11. 5) Guides: Built in hardened & ground gateways on all three axes helping for retain unwavering accuracy for years.
12. 6) Other: Machine base, column, overarm & knee should be made of high grade cast iron of grade FG260 IS210 class G4. Spindle housing should be rigid & column should be cross ribbed box type to ensure vibration free & smooth machining. The dovetail guide ways are amply dimensioned to resist extreme machine load. The guide ways are protected constantly from the ingress of swarf and coolant
13. 7) X, Y & Z axes slides ways with anti-friction/vibration material turcite on the sliding surfaces to eliminate stick up & dampen cutting vibration.
14. Spindle run out is within 10 (microns symbol) T. I. R.





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15. Centralized push button controls for ease of operation.
16. The universal milling machine shall comply with the test requirements given in IS 2200-1994 (Test chart for milling machine with table of variable height with horizontal spindle) For swivel table the requirement given in IS 13993-1994 test chart for Universal milling machine with a swivelling table shall be complied



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### 64. Horizontal and Vertical milling machine Standard and optional accessories and set of cutters each.-

#### 64.1A Horizontal milling machine Basic Indicative Diagram



Table Length x width 1350 x 310 mm having motorized up & down movement along with auto feed arrangement and 150mm Universal vice, Motor Capacity - 7.5KW  
STANDARD ACCESSORIES:

Stub arbore size(27mm, Dia. 32mm. Dia. 40mm) - 1 no. each

Instruction & spare parts manual.

Machine light suitable for 415 V operation with machine lamp 4) Coolant system

4)7.5H.P.-10H.P. Electric motor with control gear

Auto feed box with 2 H.P.-3 H.P. Electric motor, Set of requisite tools

Type collets 5mm to 25 mm by 1mm or 2mm with collets chuck

Swivel base type machine vice 160 mm heavy duty.

Face milling cutter size Dia 80mm x 27mm o dia.100mm x 32mm bare diameter with indexable carbide inserts-1 No.Self-centring vice

#### FEATURES

High rigidity of structure and drives Convenient Design,

Separate Drive for the spindle and the table movements.

Single lever control of feeds & rapid traverse. Wide ranges of spindle speeds & feeds with high upper limits.

Casting is high tensile strength & superior quality, Steel & Chemicals included in casting (NABL approved test lab certificate)

High rates of rapid table traverse while the spindle is running or at rest

Large longitudinal & traverse movements of table Prolong Hardened Gears. (HRC 55-60) All Parts should be interchangeable. Casting grade: FG260 IS210



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**LUBRICATION:** Central lubrication for guide ways & lead screw. Splash lubrication for speed & feed gearing.

**Table Drive:** - Lead screw with two nuts for backlash free setting, Feed selection by sliding gear drive Reversal of movement direction through motor reversal

**Housing:** - the rigid spindle housing cross ribbed box type column structure & the closed box type design ensure optimum chip removal & surface finish.

The rigid structure ensures vibration free & smooth machining.

**Work +spindle:-**Optimum spacing of precision taper roller bearing ensure vibration free cutting The bearing preload is adjusted by a common nut.

**Guides:-**Built in hardened & ground guide ways on all three axes helping for retain unwavering accuracy for years.

Other Machine Base, column overarm& knee should be made of high-grade cast iron of grade FG260 IS210 class G4 Spindle housing should be rigid & column should be cross ribbed box type.

To ensure vibration free & smooth machining. The dovetail guide ways are amply dimensioned to extreme machine load. The guide ways are protected constantly from the ingress of swarf and coolant.

X, Y& Z AXES Slides ways with anti-friction/Vibration material turcite on the sliding Surfaces to eliminate stick up & dampen cutting vibration.

Spindle run out is within 10 (microns symbol) T.I.R.

Centralized push button controls for ease of operation.

#### STANDARD ACCESSORIES

- ELECTRICALS, - SUITABLE ARBOR, - COOLANT EQUIPMENT
- CONTROL PANEL, OPTIONAL ACCESSORIES, - UNIVERSAL MILLING HEAD
- VERTICAL ATTACHMENT, - SLOTTING ATTACHMENT, - DIVIDING HEAD
- RACK CUTTING ATTACHMENT, - MACHINE VICE, - ROTARY MILLING TABLE

| Sr. No | Item Descriptions                           | Specification |
|--------|---|---------------|
| 1      | Table Size                                  | 1200x300mm    |
| 2      | T- Slot                                     | 5-14-61       |
| 3      | Swivel of Table to Both Side                | ----          |
| 4      | Longitudinal Movement                       | 800           |
| 5      | Travel Movement                             | 300           |
| 6      | Vertical Movement                           | 400           |
| 7      | Spindle Taper                               | ISO-40        |
| 8      | Distance From Spindle Axis to Table Surface | 0-400         |
| 9      | No of Spindle Speed                         | 12            |
| 10     | Range of Spindle Speed                      | 58-1800 RPM   |
| 11     | Milling Spindle Motor                       | 7.5 KW        |
| 12     | Feed Motor                                  | 0.55 kw       |



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### 64.1B Vertical milling machine

Basic Indicative Diagram



#### B.BASIC ITEM SPECIFICATION:

| S.No.                            | Particular  | Range   |         | Remark |
|----------------------------------|---|---------|---------|--------|
|                                  |   | From    | To      |        |
| <b>Name of part/Particulars:</b> |   |         |         |        |
| <b>MODEL TABLE</b>               |   |         |         |        |
| 1                                | Working Surface (mm)Length  | 1350 mm | 1600 mm |        |
| 2                                | Working Surface (mm)Width   | 300 mm  | 450 mm  |        |
| 3                                | Swivel range of table on both side  | -       | -       |        |
| 3                                | T-Slot Nos.   | 3       | -       |        |
| 4                                | T-Slot Size   | 14 mm   | 18 mm   |        |
| 5                                | T-Slot Centre   | 45 mm   | 65 mm   |        |
| 6                                | Min. distance, centre lower face of Milling head spindle to table to face | 0 mm    | 60mm    |        |
| 6                                | Max. distance, centre lower face of Milling head spindle to table to face | 475 mm  | 600 mm  |        |
| 7                                | X-Longitudinal Travel (Max.)  | 800 mm  | 1000 mm |        |
| 8                                | Y-Cross Travel (Max.)   | 400 mm  | 600 mm  |        |



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|                   |   |              |           |  |
|-------------------|---|--------------|-----------|--|
| 9                 | Z-Vertical Travel (Max.)                      | 230 mm       | 450 mm    |  |
| <b>FEEDS</b>      |   |              |           |  |
| 10                | No. of Feeds                                  | 18           | 21        |  |
| 11                | Range of Longitudinal Feed/ min               | 16-25        | 800-1000  |  |
| 12                | Range of Cross Feed / min                     | 16-25        | 800-1000  |  |
| 13                | Range of Vertical Feed / min                  | 4-10         | 200-400   |  |
| 14                | No. of Rapid Feeds                            | 1            | -         |  |
| 15                | Longitudinal Rapid Feeds / min                | Min.320<br>0 | -         |  |
| 16                | Cross Rapid Feeds / min                       | Min.320<br>0 | -         |  |
| 17                | Vertical Rapid Feeds / min                    | Min.800      | -         |  |
| <b>SPINDLE</b>    |   |              |           |  |
| 18                | No. of Spindle Speeds                         | 18           | 21        |  |
| 19                | Range of Spindle Speeds (RPM)                 | 25-45        | 1800-2000 |  |
| 20                | Vertical milling head swivelling to both side | 45°          | -         |  |
| 21                | Spindle Taper                                 | ISO 40       | -         |  |
| <b>ELECTRICAL</b> |   |              |           |  |
| 22                | Main Motor                                    | 7.5 H.P.     | 10 H.P.   |  |
| 23                | Feed Motor                                    | 2 H.P.       | 3 H.P.    |  |
| 24                | Coolant Motor                                 | 0.1 H.P.     | 0.15 H.P. |  |

#### C.STANDARD ACCESSORIES:

| S.No.                            | Particular   | Range |    | Remark     |
|----------------------------------|--|-------|----|------------|
|                                  |  | From  | To |            |
| <b>Name of part/Particulars:</b> |  |       |    |            |
| 1                                | Stub arbore size – (Dia. 27mm, Dia.32mm, Dia.40mm)             | -     | -  | 01 no each |
| 2                                | Machine light suitable for 415 V operations with machine lamp. | -     | -  | 1 Set      |
| 3                                | Coolant system with Pump and Tank cap. 20 ltr                  | -     | -  | 1 Set      |
| 4                                | 7.5 H.P. - 10 H.P. Electric motor with control gear            | -     | -  | 1 Set      |
| 5                                | Auto feed box with 2 H.P. - 3 H.P. Electric motor              | -     | -  | 1 Set      |



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|    |  |   |   |       |
|----|--|---|---|-------|
| 6  | Set of requisite tools   | - | - | 1 Set |
| 7  | Swivel base type machine vice 160 mm heavy duty  | - | - | 1 No. |
| 8  | Conical type collets Ø 5mm to Ø 25 mm by 1mm or 2mm with collets chuck                                 | - | - | 1 Set |
| 9  | Face milling cutter size Φ 80mm x 27mm or Φ 100mm x 32mm bore diameter with index able carbide inserts | - | - | 1 No. |
| 10 | Self-centring vice   | - | - | 1 No. |
| 11 | Instruction & spare parts manual   | - | - | 1 No. |
| 12 | Free preventive maintenance visit for three years as per our requirement                               | - | - | -     |
| 13 | On side training for two days & centralized training for one week about machine to trained our staff.  | - | - | -     |

#### D.OTHER FEATURES:

| S.No.                            | Particular  | Range |    | Remark |
|----------------------------------|---|-------|----|--------|
|                                  |   | From  | To |        |
| <b>Name of part/Particulars:</b> |   |       |    |        |
| 1                                | High rigidity of structure and drives.  | -     | -  |        |
| 2                                | Convenient Design.  | -     | -  |        |
| 3                                | Separate Drive for the spindle and the table movements.   | -     | -  |        |
| 4                                | Single lever control of feeds & rapid traverse.   | -     | -  |        |
| 5                                | Wide ranges of spindle speeds & feeds with high upper limits.   | -     | -  |        |
| 6                                | Casting is high tensile strength & superior quality. Steel & Chemicals included in casting(NABL approved test lab certificate ) | -     | -  |        |
| 7                                | High rates of rapid table traverse while the spindle is running or at rest.   | -     | -  |        |
| 8                                | Large longitudinal & traverse movements of table.   | -     | -  |        |
| 9                                | Prolong Hardened Gears. ( HRC 55-60 )   | -     | -  |        |
| 10                               | All Parts should Interchangeable.   | -     | -  |        |



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|----|--|---|---|--|
| 11 | <b>Casting grade : FG260 IS210</b> Hardened and Pressurised  | - | - |  |
| 12 | <b>LUBRICATION:</b> Central lubrication for guide ways & lead screw. Splash lubrication for speed & feed gearing with Gear type Pump & feed presser regulator  | - | - |  |
| 13 | <b>TABLE DRIVE:</b> Lead screw with two nuts for backlash free setting, Feed selection by sliding gear drive Reversal of movement direction through motor reversal   | - | - |  |
| 14 | <b>HOUSING:</b> The rigid spindle housing, cross ribbed box type column structure & the closed box type knee design ensure optimum chip removal & surface finish. The rigid structure ensures vibration free & smooth machining Material Hardness should be 30 to 40 HRC   | - | - |  |
| 15 | <b>WORK SPINDLE:</b> Optimum spacing of precision taper roller bearing ensure vibration free cutting The bearing preload is adjusted by a common nut. Hardness , surface finished  | - | - |  |
| 16 | <b>GUIDES:</b> Built in hardened & ground guide ways on all three axes helping for retain unwavering accuracy for years Material Hardening and heat treatment, surface finish  | - | - |  |
| 17 | <b>OTHER :</b> Machine base, column, overarm & knee should be made of high grade cast iron of grade FG260 IS210. Spindle housing should be rigid & column should be cross ribbed box type to ensure vibration free & smooth machining. The dovetail guide ways are amply dimensioned to resist extreme machine load. The guide ways are protected constantly from the ingress of swarf and coolant. Minimum rib thickness of 12mm at all placement X, Y & Z axes slides ways with anti-friction/vibration material turcite on the sliding surfaces to eliminate stick up & dampen cutting vibration. | - | - |  |
| 18 | The vertical milling machine shall comply with the test requirements given in IS 2201– 1994  | - | - |  |



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|    |   |   |   |  |
|----|---|---|---|--|
| 19 | Spindle run out is within 10 (microns symbol) T. I. R.          | - | - |  |
| 20 | Centralized push button controls for ease of operation.         | - | - |  |
| 21 | Casting grade should be certified by NABL approved Lab.         |   |   |  |
| 22 | Portable hardness testing should be provided at the time of PDI |   |   |  |

#### E: SPACE REQUIREMENT FOR INSTALLATION:

| S.N o. | Particulars          | Dimensions |
|--------|----------------------|------------|
| 1      | Overall length in mm | 2600       |
| 2      | Overall Width in mm  | 2000       |
| 3      | Overall Height in mm | 2000       |
| 4      | Net Weight-Kg        | 2500       |
| 5      | Gross Weight-Kg      | 3500       |
| 6      | Other                | -          |

#### F: FOUNDATION/INSTALLATION SPECIFICATION:

| S.N o. | Particular                               |
|--------|--|
| 1      | Anti – vibrant mount - 04 Nos.           |
| 2      | Oil suitable for gearbox & feed box etc. |

#### G: ELECTRIC SUPPLY SPECIFICATION:

| S.No. | Particular   |
|-------|--|
| 1     | Complete electrical equipment's suitable for 415V, 3 Phase, 50Hz A.C. supply |

Note:-

1. All casting used including Bed, Head stock, tail stock, etc in machine should be of the highest grade cast Iron from reputed brands maintained the initial accuracy for many years. Material Hardened
2. All casting should be of high grade cast iron ( grade F G-250 IS 210)
3. All body parts, spindle, head stock, beds, guide ways, material should be of high grade and hardened and having hardness value from 55 to 60 HRC
4. Thickness of all ribs and walls of casting structure should be minimum 12mm or more than 12mm to have adequate structural rigidity and stability
5. The surface finish of spindle and guide ways should be within value of 2.5 Ra





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### 65. Hydraulic Surface Grinding Machine standard and optional accessories and set Of wheels:-

#### 65.1 Basic Indicative Diagram



#### B.BASIC ITEM SPECIFICATION:

| S.No.                            | Particular                                     | Range              |                    | Remark |
|----------------------------------|--|--------------------|--------------------|--------|
|                                  |  | From               | To                 |        |
| <b>Name of part/Particulars:</b> |  |                    |                    |        |
| 1                                | Grinding Length                                | 400 mm             | 600 mm             |        |
|                                  | Grinding Width                                 | 200 mm             | 300 mm             |        |
| 2                                | Distance between Table & Spindle Centre (Max.) | 400 mm             | 600 mm             |        |
| 3                                | Working Surface off table(Length)              | 410 mm             | 610 mm             |        |
|                                  | Working Surface off table(Width)               | 210 mm             | 310 mm             |        |
| 4                                | Weight carrying capacity of Table              | 180 Kg.<br>approx. | 300 Kg.<br>approx. |        |
| <b>TABLE MOVEMENT</b>            |  |                    |                    |        |
| 5                                | Max.Longitudinal movement                      | 410 mm             | 630 mm             |        |
| 6                                | Max Cross movement                             | 210 mm             | 310 mm             |        |
| 7                                | T-slots No.                                    | 1                  |                    |        |
|                                  | T-slots Width                                  | 14 mm              | 18 mm              |        |



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Regional Office, Pune

|                              |  |                                      |                            |                                 |
|------------------------------|--|--------------------------------------|----------------------------|---------------------------------|
| 8                            | Max vertical movement                  | Min.280 mm                           |                            |                                 |
| <b>LONGITUDINAL MOVEMENT</b> |  |                                      |                            |                                 |
| 9                            | Max. Table Speed                       | 1-5 m/min                            | 18-30m/min                 |                                 |
| <b>CROSS MOVEMENT</b>        |  |                                      |                            |                                 |
| 10                           | Auto cross feed at each Table reversal | 0.20-0.30 mm/stroke                  | 6-8 mm/stroke              |                                 |
| 11                           | Manual Feed rate per turn              | 1 mm                                 |                            |                                 |
| 12                           | Least count of Hand wheel              | 0.01 mm                              |                            |                                 |
| <b>VERTICAL MOVEMENT</b>     |  |                                      |                            |                                 |
| 13                           | Automatic vertical traverse rapid      | 0.15-m/min.                          | 0.3m/min                   |                                 |
| 14                           | Least count of Hand wheel              | 0.002 mm                             | -                          |                                 |
| <b>GRINDING WHEEL</b>        |  |                                      |                            |                                 |
| 15                           | Diameter x Thickness x Bore            | 200 x 20 x 76.2 mm/180x 18x 31.75 mm | -                          |                                 |
| 16                           | Speed                                  | 2440-2800RPM approx.                 | 3000-3300 RPM approx.      |                                 |
| <b>MOTORS</b>                |  |                                      |                            |                                 |
| 17                           | Grinding spindle                       | 2 H.P.                               | 3 H.P.                     | Confirming to ISI specification |
| 18                           | Coolant pump                           | 0.1 H.P.                             | 0.15 H.P.                  | Confirming to ISI specification |
| 19                           | Vertical rapid motor                   | 0.4 H.P                              | 0.5 H.P.                   |                                 |
| <b>HYDRAULIC SYSTEM</b>      |  |                                      |                            |                                 |
| 20                           | Working pressure                       | 10 Kg / C m <sup>2</sup>             | 12 Kg / C m <sup>2</sup> - |                                 |
| 21                           | Power of Hyd. Pump Motor               | 1 HP                                 |                            |                                 |

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|    |                        |        |         |  |
|----|------------------------|--------|---------|--|
| 22 | Tank capacity          | 60Lit. | 75 Lit. |  |
| 23 | Feed presser regulator |        |         |  |

**C.STANDARD ACCESSORIES:**

| S.N                              | Particular  | Range |    | Remark |
|----------------------------------|---|-------|----|--------|
|                                  |   | From  | To |        |
| <b>Name of part/Particulars:</b> |   |       |    |        |
| 1                                | Hardened & Ground Precision Screw less Grinding vice -100mm Jaw Width                                 | -     | -  | 1 No.  |
| 2                                | Permanent magnetic chuck 250 X 120mm  | -     | -  | 1 No.  |
| 3                                | Coolant tank with magnetic filter / Separator   | -     | -  | 1 Set  |
| 4                                | Machine light suitable for 415 V operation with machine lamp  | -     | -  | 1 Set  |
| 5                                | Grinding wheel  | -     | -  | 2 Nos. |
| 6                                | Grinding wheel flange unit ( wheel collet)  | -     | -  | 1 No.  |
| 7                                | Table guard   | -     | -  | 1 No.  |
| 8                                | Set of necessary tool kit   | -     | -  | 1 Set  |
| 9                                | Hydraulic system.   | -     | -  | 1 Set  |
| 10                               | Radius dressing attachment  | -     | -  | 1 No.  |
| 11                               | Micro (Fine) feed for cross slide and vertical movement   | -     | -  | 1 No.  |
| 12                               | Multi-Diamond Dresser with Holder   | -     | -  | 1 No.  |
| 13                               | Instruction & spare parts manual  | -     | -  | 1 No.  |
| 14                               | Free preventive maintenance visit for three years as per our requirement                              | -     | -  | -      |
| 15                               | On side training for two days & centralized training for one week about machine to trained our staff. | -     | -  | -      |

**D.OTHER FEATURES:**

| S.N                              | Particular   | Range |    | Remark |
|----------------------------------|--|-------|----|--------|
|                                  |  | From  | To |        |
| <b>Name of part/Particulars:</b> |  |       |    |        |
| 1                                | The Machine should be of a high precision, latest technology machine desired to grind Flat surfaces and angular surfaces consistently for the entire life of the machine. the spindle bearing should be of RHP super precision bearings P3 grade grease packed for life The spindle should | -     | -  |        |



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|    |   |   |   |  |
|----|---|---|---|--|
|    | be of quill type running in multiple bearings set for rear end float and zero radial play   |   |   |  |
| 2  | Table traverse should both Hydraulic and Manual. The table traverse on V and flat guide way should be lubricated automatically. The table guide ways are to be lined with Antifriction , abrasion resistant TURCITE material  | - | - |  |
| 3  | Fixed bearing should be located in the vicinity of the grinding wheel. Wheel head should moves up and down on a column on V and flat guide ways via lead screw and nut.   | - | - |  |
| 5  | Vertical feed hand wheel should have a least count of 0.002 mm-0.005 MM. Vertical movement of the spindle head set to accuracy of 0.02 mm in entire length. Column should moves back and forth directly on base on V and fiat guide ways via. Lead screw and nut.                           | - | - |  |
| 6  | Cross traverse has to be in feed infinitely variable from 0.20-0.30 to 6-8 mm per stroke and has rapid traverse also Cross Traverse to longitudinal traverse within 2 micron in the entire length. Proximity sensors should control the table movement and stroke must be adjusted by dogs. | - | - |  |
| 7  | The three basic movement of the machine has to be independent, to ensure a perfect zero Deg. between the three axes   | - | - |  |
| 8  | The work-piece ground should be assured of a high degree of accuracy / flatness.  | - | - |  |
| 9  | All casting used in machine should be of the highest grade from reputed brands maintained the initial accuracy for many years. Material Hardened  | - | - |  |
| 10 | The entire switch gear should be from reputed brand like Siemens or standard make Hydraulic of Yuken make & lubrication of Cenlub make or equivalent.   | - | - |  |
| 11 | Critical components like spindle unit, lead screw and nut etc. should be tested Separately.   |   |   |  |
| 12 | The practical and geometrical tests should be taken according to the Test Chart IS-   | - | - |  |



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|    |   |   |   |  |
|----|---|---|---|--|
|    | 2743:1992/ISO1986:1985 reaffirmed in <b>Aug.2002.</b>   |   |   |  |
| 13 | Electrical equipment i.e. Motor and Control gear suitable for operation of 415 V $\pm$ 2% 3 phase, 50 Hz along Ammeter, for overhead protection and single phase protection & ELCB  | - | - |  |
| 14 | <b>MANUAL DOWN FEED:</b><br>It should have mechanism for vertical feed in the range between 2 - 10 microns in the multiples of 5 microns i.e. user can select a down feed of min. 2 micron or multiple of 2 micron up to 10 micron viz 4,6,8,10 and cross traverse has to be in-feed infinitely variable from 0.2-0.3 to 6-8 mm per stroke and should have rapid traverse (Cross feed graduation 0.05 mm and Elevator movement with MICROFEED 0.002 mm) | - | - |  |
| 15 | <b>SPINDLE BEARING:-</b><br>The spindle bearings should be of RHP super precision bearings P3 grade grease packed for life.   | - | - |  |
| 16 | <b>CASTING:-</b><br>All the castings used in machine should be of highest grade (FG 260 IS210) Material Hardened  | - | - |  |
| 17 | <b>COOLANT</b><br>The coolant to be supplied by a tank set up, next to column, the tank is separated from the machine and provides with baffle plates to enable setting of grinding dust and chips  | - | - |  |
| 17 | Machine should be provided with, Hydraulic oil Servo-68 —40 lit.  | - | - |  |
| 18 | Casting grade should be certified by NABL approved Lab.   | - | - |  |
| 19 | Portable Hardness Tester should be Provided at the time of PDI  |   |   |  |

#### E: SPACE REQUIREMENT FOR INSTALLATION:

| S.N | Particulars          | Dimensions |
|-----|----------------------|------------|
| 1   | Overall length in mm | 2000       |
| 2   | Overall Width in mm  | 2000       |
| 3   | Overall Height in mm | 2000       |



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|   |                 |      |
|---|-----------------|------|
| 4 | Net Weight-Kg   | 2000 |
| 5 | Gross Weight-Kg | 2400 |
| 6 | Other           | -    |

#### F: FOUNDATION/INSTALLATION SPECIFICATION:

| S.N | Particular                     |
|-----|--------------------------------|
| 1   | Anti – vibrant mount - 04 Nos. |
| 2   | Hydraulic Oil                  |

#### G: ELECTRIC SUPPLY SPECIFICATION:

| S.N | Particular  |
|-----|---|
| 1   | Complete electrical equipment's suitable for 415V, 3 Phase, 50Hz A.C. supply<br>With single Phase Preventer |
| 2   | ELCB  |
| 3   | Heat controlling  |

Note:-

1. All casting used including Bed, Head stock, tail stock, etc. in machine should be of the highest grade cast Iron from reputed brands maintained the initial accuracy for many years. Material Hardened
2. All casting should be of high grade cast iron ( grade F G-250 IS 210)
3. All body parts, spindle, head stock, beds, guide ways, material should be of high grade and hardened and having hardness value from 55 to 60 HRC
4. Thickness of all ribs and walls of casting structure should be minimum 12mm or more than 12mm to have adequate structural rigidity and stability
5. The surface finish of spindle and guide ways should be within value of 2.5 Ra



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### 66. Universal cylindrical grinding machine, Standard and optional accessories and set of wheels.-

#### 66.1 Basic Indicative Diagram



- 193.2 Max. dia. ground (effective) 250 mm
- 193.3 Max. grinding length 300 mm
- 193.4 Height of center 130 mm
- 193.5 Max. distance between centers 340 mm
- 193.6 With special accessories like face plate, steady, radius and Face dressers, find hand feed attachment etc.

#### B.BASIC ITEM SPECIFICATION:

| S.N                              | Particular  | Range  |        | Remark |
|----------------------------------|---|--------|--------|--------|
|                                  |   | From   | To     |        |
| <b>Name of part/Particulars:</b> |   |        |        |        |
| <b>CAPACITY</b>                  |   |        |        |        |
| 1                                | Max. grinding length                                  | 300mm  | 390mm  |        |
| 2                                | Centre height   | 125mm  | 130 mm |        |
| 3                                | Max.distance between centres                          | 340mm  | 390mm  |        |
| 4                                | Max.distance between centres(with extended tailstock) | 590mm  | 640 mm |        |
| 5                                | Open steady rest accommodates diameters               | 5 mm   | 80 mm  |        |
| 6                                | Wax. work piece weight without rest                   | 60 kg  | 70 kg  |        |
| 7                                | Max.work piece weight with rest                       | 75 kg  | 85 kg  |        |
| <b>TABLE</b>                     |   |        |        |        |
| 8                                | Max.travel  | 310 mm | 350 mm |        |



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|                       |  |  |             |  |
|-----------------------|--|--|-------------|--|
| 9                     | Min. travel (automatic)                | 2 mm   | -           |  |
| 10                    | Max.swivel (included angle)            | 14 degree  | 20 degree   |  |
| 11                    | Rate of traverse                       | 0.03-0.1 m/min.  | 4–6 m/min.  |  |
| 12                    | Dwell at table reversal                | 0 Sec.   | 20 Sec.     |  |
| <b>GRINDING WHEEL</b> |  |  |             |  |
| 13                    | Standard Wheel Size (OD. xWidth xBore) | 300x40x127 mm  | -           |  |
| 14                    | Wheel speed                            | 1700 rpm   | 2200 rpm    |  |
| 15                    | Grinding wheel Head Bearing            | Precision Angular Contact Bearing (Hydrodynamic White Metal Bearing) | -           |  |
| <b>GR. WHEEL HEAD</b> |  |  |             |  |
| 16                    | Swivel                                 | Max. swivel 60° towards work and 45° Towards tailstock               | -           |  |
| 17                    | Rapid movement                         | 45 mm  | 50 mm       |  |
| 18                    | One revolution of Hand wheel           | 0.5 mm   | -           |  |
| 19                    | Automatic In feed (at table travel)    | 0.00125  | 0.0125 mm   |  |
| <b>WORK HEAD</b>      |  |  |             |  |
| 20                    | No. of speeds                          | 8 Nos.   | -           |  |
| 21                    | Speed range                            | 40-60 rpm  | 600-650 rpm |  |
| 22                    | Swivel                                 | ±90 Deg. Towards wheel and 30°Away from wheel                        | -           |  |





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|                          |                                  |   |         |  |
|--------------------------|----------------------------------|---|---------|--|
| 23                       | Spindle nose taper               | MT-3  | -       |  |
| <b>INTERNAL GRINDING</b> |                                  |   |         |  |
| 24                       | Spindle                          | 60 x 250 mm                                       | -       |  |
| 25                       | Grinding diameters (Min. & Max.) | 15 mm   | 100 mm  |  |
| 26                       | Max. depth of grinding           | 80 mm   | 90 mm   |  |
| 27                       | Spindle speed                    | (Max. speed<br>18,000 rpm,<br>min. 10,000<br>rpm) |         |  |
| <b>POWER</b>             |                                  |   |         |  |
| 28                       | Wheel Head                       | 4 KW  | 5 KW    |  |
| 29                       | Work Head                        | 0.35KW  | 0.75 KW |  |
| 30                       | Hydraulic Power Pack             | 1.1 KW  | 1.5 KW  |  |
| 31                       | Coolant pump                     | 0.25 KW   | 0.37 KW |  |

#### C.STANDARD ACCESSORIES:

| S.No.                            | Particular  | Range |    | Remark     |
|----------------------------------|---|-------|----|------------|
|                                  |   | From  | To |            |
| <b>Name of part/Particulars:</b> |   |       |    |            |
| 1                                | Electrical equipment suitable for 3 phase, 415 volts, 50 Hz ,AC supply                | -     | -  | 1 Set      |
| 2                                | Complete hydraulic equipment including motor, pump and tank                           | -     | -  | 1 Set      |
| 3                                | Complete coolant equipment including motor, pump and tank                             | -     | -  | 1 Set      |
| 4                                | Grinding wheel for external grinding with standard wheel flange and balancing blocks. | -     | -  | 1 Set      |
| 5                                | Extracting nut for grinding wheel.  | -     | -  | 1 No.      |
| 6                                | Balancing mandrel with suitable stand.  | -     | -  | 1 No.      |
| 7                                | Two 60° carbide tipped centre's with MT3 shank.                                       | -     | -  | 1 No. each |
| 8                                | Hinged driving dog with a driving pin.  | -     | -  | 1 No.      |
| 9                                | Set of two V-belts for wheel drive.   | -     | -  | 1 Set      |
| 10                               | Set of service tools.   | -     | -  | 1 Set      |
| 11                               | Wheel dresser mounted on tailstock without diamond.                                   | -     | -  | 1 No.      |
| 12                               | Swivel back wheel dresser on table without diamond.                                   | -     | -  | 1 No.      |
| 13                               | Open steady rest  | -     | -  | 1 No.      |
| 14                               | Draw bar for collets  | -     | -  | 1 No.      |



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|    |   |   |   |       |
|----|---|---|---|-------|
| 15 | Adaptor for centres.  | - | - | 1 No. |
| 16 | Adaptor with flange for face plate or chuck.  | - | - | 1 No. |
| 17 | Internal grinding spindle with one pulley mounted on spindle.   | - | - | 1 No. |
| 18 | Three quills for internal grinding spindle.   | - | - | 1 Set |
| 19 | One additional pulley for internal grinding spindles.   | - | - | 1 Set |
| 20 | Set of service tools for internal grinding spindles including extractor for pulley.                   | - | - | 1 Set |
| 21 | Set of flat belt for internal grinding spindle.   | - | - | 1 Set |
| 22 | Belt guard for internal grinding belt.  | - | - | 1 No. |
| 23 | Splash guard for chuck.   | - | - | 1 No. |
| 24 | Protection cap for wheel spindle.   | - | - | 1 No. |
| 25 | Three jaw self-centring chuck 150 mm with chuck key, adaptor & suitable flange                        | - | - | 1 Set |
| 26 | Face plate 180mm – 01 No.   | - | - | 1 No. |
| 27 | Instruction & spare parts manual  | - | - | 1 No. |
| 28 | Free preventive maintenance visit for three years as per our requirement                              | - | - | -     |
| 29 | On side training for two days & centralized training for one week about machine to trained our staff. | - | - | -     |

#### D. OTHER FEATURES:

| S.No.                            | Particular   | Range |    | Remark |
|----------------------------------|--|-------|----|--------|
|                                  |  | From  | To |        |
| <b>Name of part/Particulars:</b> |  |       |    |        |
| 1                                | Machine bed should be made of one piece close grained, graded Cast Iron Box structure design with optimum ribbing provides high static and dynamic rigidity to the machine. Hardness & 55 to 60 HRC, Surface finish should be accurately finished & minimum thickness of wedges and walls should be 12mm | -     | -  |        |
| 2                                | Precision hand scraped V flat guide ways with continuous automatic lubrication.  | -     | -  |        |
| 3                                | Linear slide way material "TURCITE-B" coated on main table as well as grinding wheel head table for:-<br>No stick slip effect  | -     | -  |        |



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|    |  |   |   |  |
|----|--|---|---|--|
|    | Ensures low frictional movements by avoiding direct metal to metal contact<br>Excellent vibration damping<br>High respective positioning accuracy<br>Provides excellent dimensional stability and should be compatible with coolant system<br>Highly resistant to corrosion & Fungus |   |   |  |
| 5  | Main table movement should have hydraulically as well as manually  | - | - |  |
| 6  | Machine should be rigid Universal Work head. Work head spindle made of alloy steel, must be specially heat treated, ground and lapped to achieve very high dimensional stability, accuracy & long life.  | - | - |  |
| 7  | Hi-speed grinding wheel head spindle suitable for max. 45 m/s cutting speed  | - | - |  |
| 8  | High powered 4KW-5KW grinding wheel head with V belts for efficient power transmission.  | - | - |  |
| 9  | Cartridge type grinding wheel spindle with precision angular contact bearing duly packed with grease and suitable for 45 m/s cutting speed   | - | - |  |
| 10 | Tail stock should be of single piece construction to provide maximum rigidity and stability Facility should be provided for adjusting Tailstock quill clearance Hardness & 55 to 60 HRC, Surface finish should be accurately finished  | - | - |  |
| 11 | The Feed screw of In feed system should be through hardened and OD ground having double nut for backlash error adjustment. Automatic in feed at table reversal   | - | - |  |
| 12 | Hydraulically operated rapid approach /retraction of wheel head slide  | - | - |  |
| 13 | Grinding spindle (Quills) should be provided.  | - | - |  |
| 14 | Electrical unit/control should be housed outside the machine in separate control cabinet, making it moisture proof and provide easy maintenance.   | - | - |  |
| 15 | Electronic dwelling arrangement for effective End grinding operation Separate timers for left and right ends.  | - | - |  |



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|    |   |   |   |  |
|----|---|---|---|--|
| 16 | Machine should have Centralized lubrication system  | - | - |  |
| 17 | It should have separate coolant tank fitted with Magnetic coolant separator   | - | - |  |
| 18 | Electrical equipment i.e. Motor and Control gear suitable for operation of 415 V $\pm$ 2% 3 phase,50 Hz along Ammeter for overhead protection and single phase protection.                                    | - | - |  |
| 19 | The practical and geometrical tests should be taken according to the Test Chart IS-2368:1993/ISO2433:1984 reaffirmed in Feb. 2003.  | - | - |  |
| 20 | The Rack and Pinion arrangement for table movement should be Hardened & Ground  | - | - |  |
| 21 | Machine should be provided with, Hydraulic oil Servo-68 —60 lit.  | - | - |  |
| 22 | The base on which table is mounted must have adequate size coolant gutter in the casting of the base itself which runs through all four sided for easy flow of coolant on the drain valve fitted at one side. | - | - |  |
| 23 | Large capacity coolant tank and hydraulic power pack of modular design with DC solenoid valves should separate from machine, minimizing the thermal effect on the structure.                                  | - | - |  |
| 24 | <b>Casting grade : FG260 IS210</b>  | - | - |  |
| 25 | <b>Casting grade should be certified by NABL approved Lab.</b>  | - | - |  |

#### E: SPACE REQUIREMENT FOR INSTALLATION:

| S.N o. | Particulars          | Dimensions |
|--------|----------------------|------------|
| 1      | Overall length in mm | 3500       |
| 2      | Overall Width in mm  | 2000       |
| 3      | Overall Height in mm | 2000       |
| 4      | Net Weight-Kg        | 2500       |
| 5      | Gross Weight-Kg      | 2700       |



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#### F: FOUNDATION/INSTALLATION SPECIFICATION:

| S.No. | Particular                     |
|-------|--------------------------------|
| 1     | Anti – vibrant mount - 04 Nos. |
| 2     | Hydraulic Oil for Power Pack   |

#### G: ELECTRIC SUPPLY SPECIFICATION:

| S.No. | Particular   |
|-------|--|
| 1     | Complete electrical equipment's suitable for 415V, 3 Phase, 50Hz A.C. supply |



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### 67. CNC turn Centre [specification as per Annex-A (I)]:-

Basic Indicative Diagram



#### B. BASIC ITEM SPECIFICATION:

|   |
|---|
| Features  |
| CNC slant bed turning centre with 8 station programmable indexing turret, with Industrial FANUC OI Mate TC control system.  |
| The machine base/structure should be built with grey cast iron grade (FG300 - IS210 class G4) with all sub modules stress relieved. Certificate should be provided from manufacturer. |
| Sub modules of Machines should be of high standard & reputed make like THK, RHP, FANUC, HIWIN or equivalent, Certificate should be provided from manufacturer.                        |
| The machine should be built on T.P.M. concept. All wearable parts should be visible externally for easy maintenance.  |
| The machine should be laser calibrated & Laser calibration certificate should be provided by manufacturer.  |
| The spindle should be dynamically balanced with work holding device. Balancing certificate should be provided from Manufacturer.  |



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| Full Machine Guards with aesthetic look. |     |   |         |                                 |      |                |
|--|-----|---|---------|---------------------------------|------|----------------|
| Sr. No.                                  |     | Particular  | Unit    | Range                           |      | Re<br>ma<br>rk |
|  |     |   |         | From                            | To   |                |
| 1.<br>Capacity                           | 1.1 | Swing over bed, dia.  | mm      | 300                             |      |                |
|  | 1.2 | Admit between centres   | mm      | 500                             |      |                |
|  | 1.3 | Maximum turning length with chuck   | mm      | 350                             |      |                |
|  | 1.4 | Maximum turning diameter  | mm      | 150                             |      |                |
|  | 1.5 | 3 Jaw hydraulic operated solid cylinder Chuck size, dia. With one Hard jaw set & two soft jaw sets. | mm      | 165                             |      |                |
| 2.<br>Travers                            | 2.1 | Cross travel (X Axis)   | mm      | 150                             |      |                |
|  | 2.2 | Longitudinal travel (Z Axis)  | mm      | 500                             |      |                |
| 3.<br>Spindle                            | 3.1 | Spindle nose  | type    | A 2-5                           |      |                |
|  | 3.2 | Hole through spindle, dia.  | mm      | 38                              |      |                |
|  | 3.3 | Spindle speed range   | rpm     | 45                              | 3000 |                |
|  | 3.4 | Spindle front bearing Dia.  | mm      | 60                              |      |                |
|  | 3.5 | AC Servo Spindle motor power, - Cont. FANUC (No Induction or other motor)                           | KW      | 3.7/5.5                         |      |                |
| 4.<br>feed<br>system                     | 4.1 | Rapid traverse rate - X Axis  | mm /min | 10000                           |      |                |
|  | 4.2 | Rapid traverse rate –Z Axis   | mm /min | 10000                           |      |                |
|  | 4.3 | Feedback elements   | type    | Rotary Optical absolute Encoder |      |                |
|  | 4.4 | Guide ways - X & Z axis   | type    | Linear Motion Bearing           |      |                |
|  | 4.5 | Ball Lead Screw for X& Z axis   | Type    | C class                         |      |                |
| 5. Turret - BTP 63 / Equivalent          | 5.1 | Actuation   | type    | Hydraulic / Electro mechanic    |      |                |
|  | 5.2 | Turret clamp  | type    | Hydraulic                       |      |                |
|  | 5.3 | No. of stations   | Nos.    | 8                               |      |                |
|  | 5.4 | Tool shank size   | mm      | 25 X 25                         |      |                |



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(NSQF LEVEL- 4)

Regional Office, Pune

|                               |      |  |        |                            |             |
|-------------------------------|------|--|--------|----------------------------|-------------|
|                               | 5.5  | Maximum boring bar diameter  | mm     | 32                         |             |
|                               | 5.6  | Indexing system  | type   | Bi directional             |             |
| 6. Tailstock                  | 6.1  | Hydraulically operated   |        |                            |             |
|                               | 6.2  | Quill dia.   | mm     | 50                         |             |
|                               | 6.3  | Quill stroke   | mm     | 75                         |             |
|                               | 6.4  | Quill taper  | type   | MT- 4                      |             |
| 7. Lubrication                | 7.1  | Automatic centralized Lubrication system with low level indication - tank capacity | litres | 2.5                        |             |
|                               | 7.2  | Spindle bearings   | type   | Grease packed              |             |
| 8. Coolant                    | 8.1  | Coolant tank capacity  | litres | 100                        |             |
|                               | 8.2  | Coolant pump motor   | KW     | 0.5                        |             |
|                               | 8.3  | Hydraulic tank capacity  | litres | 30                         |             |
|                               | 8.4  | Hydraulic oil ( Encl 68)   | litres | 25                         |             |
| 9. Power source               | 9.1  | Electrical power supply - Voltage  | Volts  | 3Phase.AC 415 ± 10 % 50 Hz |             |
|                               | 9.2  | Voltage Stabilizer   | KVA    | 15                         |             |
|                               | 9.3  | Copper Cable Four core 6 sq. mm.   | meter  | 5                          |             |
| 10. Machine size              | 10.1 | Machine Front(L) x Side(B) x height(H)   | mm     | 2250 x1550 x 2000          | approximate |
|                               | 10.2 | Machine weight, excluding accessories  | kg     | 2500                       | approximate |
| 11. Accuracy                  | 11.1 | Positioning accuracy – X axis  | mm     | 0.015                      |             |
|                               | 11.2 | Positioning accuracy – Z axis  | mm     | 0.02                       |             |
|                               | 11.3 | Repeatability - X / Z axis   | mm     | ± 0.005                    |             |
| 12. Standard items & Fittings | 12.1 | Coolant system,  |        |                            |             |
|                               | 12.2 | Graphic simulation display   |        |                            |             |
|                               | 12.3 | Machine work lamp  | No.    | 01                         |             |
|                               | 12.4 | Process completion lamp ( 3 tier)  | No.    | 01                         |             |
|                               | 12.5 | Built-in AC  |        |                            |             |
|                               | 12.6 | Foot switch for chucking & Tailstock   | No.    | 01                         |             |
|                               | 12.7 | Manual Pulse generator (MPG Wheel)   | No.    | 01                         |             |
|                               | 12.8 | Absolute encoder   |        |                            |             |
| 1.                            | 1.1  | Control  |        | FANUC Oi Mate              |             |
|                               | 1.2  | Number of controlled axes  |        | Two ( X & Z)               |             |





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|--------------------------|-----|---|------|---|--|
| CNC control system       | 1.3 | Simultaneously controllable axes              |      | Two   |  |
|                          | 1.4 | Incremental input & output                    |      | Minimum :<br>0.001mm  |  |
| 2. Feed Function         | 2.1 | Rapid traverse rate                           |      | X : 5 m / min ;<br>Z : 5 m / min  |  |
|                          | 2.2 | Cutting feed rate for. 1. X axis<br>2. Z axis |      | 0 -10000 mm / min<br>0 -10000 mm / min  |  |
|                          | 2.3 | Rapid traverse override                       |      | 0 – 120%  |  |
|                          | 2.4 | Cutting feed rate override                    |      | 1 – 120%  |  |
|                          | 2.5 | Manual jog feed rate                          |      | 0 to 1000 mm/min<br>in 10 steps   |  |
|                          | 2.6 | Manual handle feed (Variable)                 |      | In steps of 0.001,<br>0.01, 0.1 & 1mm   |  |
|                          | 2.7 | Backlash compensation                         |      | Compensation of<br>mechanical play<br>separately<br>settable for each<br>axis.  |  |
|                          | 2.8 | Stored pitch error compensation               |      | Correction of ball<br>screw pitch error<br>separately<br>settable each<br>axes. |  |
|                          | 2.9 | Dwell time                                    | Sec. | By G04 : 0 to<br>99999.999 sec  |  |
| 3.Spindle Function       | 3.1 | Spindle speed command                         |      | S - 4 digit direct  |  |
| 4.Tool Function          | 4.1 | Tool Nose radius compensation activation      |      | G40, G41 & G42  |  |
| 5. Programming Function. | 5.1 | Part program storage - Battery back up        |      | 256 KB 640 meters.  |  |
|                          | 5.2 | No. of programs register able                 |      | 300   |  |
|                          | 5.3 | Sub program                                   |      | Sub program call<br>by M98xxxx: Sub<br>program number                           |  |



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|                                    |      |                                   |  |   |  |
|------------------------------------|------|-----------------------------------|--|---|--|
|                                    |      |                                   |  | is xxxx. Nesting depth : 4  |  |
|                                    | 5.4  | Inch / Metric selection           |  | G20 : Inch input<br>G21 : Metric input  |  |
|                                    | 5.5  | Absolute / Incremental selection  |  | X, Z : Absolute input   |  |
|                                    | 5.6  | Miscellaneous functions           |  | 2 digit M code  |  |
|                                    | 5.7  | Fixed cycles                      |  | Simplified commands for machining operations - Standard cycles for facing, turning, boring, grooving & threading etc. |  |
| 6.<br>Operationa<br>l<br>Function. | 6.1  | Dry run                           |  |   |  |
|                                    | 6.2  | Machine lock                      |  |   |  |
|                                    | 6.3  | Single block execution            |  |   |  |
|                                    | 6.4  | Feed hold                         |  |   |  |
|                                    | 6.5  | Block skip function               |  |   |  |
|                                    | 6.6  | Block search                      |  |   |  |
|                                    | 6.7  | Program number search             |  |   |  |
|                                    | 6.8  | Sequence number search            |  |   |  |
|                                    | 6.9  | Coordinate system setting         |  |   |  |
|                                    | 6.10 | Self-diagnosis                    |  |   |  |
|                                    | 6.11 | Soft over travel                  |  |   |  |
|                                    | 6.12 | Decimal point input               |  |   |  |
|                                    | 6.13 | Radius/ Diameter programming      |  |   |  |
|                                    | 6.14 | Extended part program editing     |  |   |  |
|                                    | 6.15 | Radius designation on arc         |  |   |  |
|                                    | 6.16 | Manual reference point return     |  |   |  |
|                                    | 6.17 | Background editing                |  |   |  |
|                                    | 6.18 | Thread cutting retract            |  |   |  |
|                                    | 6.19 | Continuous thread cutting         |  |   |  |
|                                    | 6.20 | Parity check                      |  |   |  |
|                                    | 6.21 | Custom macro                      |  |   |  |
|                                    | 6.22 | Program input of offset data G10  |  |   |  |
|                                    | 6.23 | Work co-ordinate system G54 - G59 |  |   |  |



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|                |      |  |  |                                     |  |
|----------------|------|--|--|-------------------------------------|--|
|                | 6.24 | Run time & parts count display                       |  |                                     |  |
|                | 6.25 | Direct drawing dimension programming                 |  |                                     |  |
|                | 6.26 | Program protect                                      |  |                                     |  |
|                | 6.27 | Program restart                                      |  |                                     |  |
|                | 6.28 | Menu programming                                     |  |                                     |  |
|                | 6.29 | Polar coordinate Interpolation                       |  |                                     |  |
|                | 6.30 | Spindle orientation                                  |  |                                     |  |
|                | 6.31 | Emergency stop                                       |  |                                     |  |
|                | 6.32 | Canned cycles - G70 to G76                           |  |                                     |  |
|                | 6.33 | Automatic acceleration and deceleration              |  |                                     |  |
|                | 6.34 | Absolute/incremental programming                     |  |                                     |  |
|                | 6.35 | Tool nose radius compensation                        |  |                                     |  |
|                | 6.36 | Spindle speed binary/Analog output/Speed Clamp (G92) |  |                                     |  |
|                | 6.37 | Reader/Puncher interface                             |  |                                     |  |
|                | 6.38 | HRV control  |  |                                     |  |
|                | 6.39 | Inch/metric conversion                               |  |                                     |  |
|                | 6.40 | Spindle speed override                               |  |                                     |  |
|                | 6.41 | Rigid tapping  |  |                                     |  |
|                | 6.42 | Battery backup for part program                      |  |                                     |  |
| 7.<br>Function | 7.1  | Display screen                                       |  | Colour LCD / TFT with MDI keyboard  |  |
|                | 7.2  | Selection  |  | Menu switch                         |  |
|                | 7.3  | Manual data input                                    |  | Alphanumeric key board              |  |
|                | 7.4  | Manual pulse generator (MPG Wheel)                   |  | For manual movement of axes         |  |
|                | 7.5  | Display of messages                                  |  | Operator / Alarm messages on screen |  |
|                | 7.6  | Fault diagnosis                                      |  | Using ladder diagram                |  |
|                | 7.7  | Peripheral interface.(Reader/puncher )               |  | RS 232C with 3 meter cable          |  |
|                | 7.8  | External program execution                           |  | Through DNC mode                    |  |



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#### B. Standard accessories.

| Sr. No.      | Particular | Unit   | Range  |    | Remark |
|--------------|------------|--|--------|----|--------|
|              |            |  | From   | To |        |
| Accessories. | a.         | Voltage Stabilizer -Input voltage 300V to 460V AC  | 15 KVA |    |        |
|              | b.         | A.C. Unit for Electrical Cabinet   | 01     |    |        |
|              | c.         | Flash card reader with MMC card  | GB     | 2  |        |
|              | d.         | Pen drive slot with pen drive  | GB     | 4  |        |
|              | e.         | Ethernet Slot with Ethernet cable  | meter  | 2  |        |
|              | f.         | R.s 232 port with cable  | meter  | 3  |        |
|              |            |  |        |    |        |
| Manuals      | a          | Programming & operating Manual   | 01     |    |        |
|              | b          | Alarm & diagnosis Manual   | 01     |    |        |
|              | c          | Service& Maintenance Manual include Maintenance Chart / spare parts details description, drawings & photographs                                      | 01     |    |        |
|              | d          | Electrical circuit diagram Manual drawings & photographs   | 01     |    |        |
|              | e          | Instruction manual consist of all type of Procedure of installation & commissioning, working instructions, operational safety measures do's & don't, | 01     |    |        |
|              | F          | Machine Operation Manual – Turret ,  | 01     |    |        |
|              | G          | Air conditioners Manual.   | 01     |    |        |
|              | H          | Stabilizer Manual.   | 01     |    |        |
|              | i.         | Hydraulic Power Pack.  | 01     |    |        |



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|                       |   |
|-----------------------|---|
| Training Requirement. | a) Introduction & training regarding machine operation at site for 2 persons of each consignee.   |
|                       | b) Programming, & preventive maintenance, servicing, basic adjustment and set-up of the machine (including system maintenance and mechanical maintenance) |
|                       | c) No. of sample job to be perform on machine with various type of operations & programming for trial.  |

### C. OTHER FEATURES:

|                     | Particular  | Range |    | Remark  |
|---------------------|---|-------|----|---|
|                     |   | From  | To |   |
| Special Accessories | 1.1 Requisite Maintenance tools - Allen Key set 1.5 to 10mm                                 | set   | 01 |  |
|                     | 1.2 Double Ended standard spanner set 6 to 32 mm  | set   | 01 |  |
|                     | 1.3 Suitable antivibration mounting pad   | Set   | 01 |  |
|                     | 1.4 Tool Kit box consisting require spanner, Allen keys, Screw driver, pressure grease gun. | set   | 01 |   |



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|   |     |   |     |    |   |
|---|-----|---|-----|----|---|
|   | 1.5 | Material for trial -Aluminium size Dia. 40 x120mm length. | No. | 10 |  |
| TOOLING DETAILS - Following one tool holder with require Allen key set & five insert each |     |   |     |    |   |

|               | Description of tool |                                  | Insert type  | Tool Holder   |
|---------------|---------------------|----------------------------------|--|---|
| Cutting Tools | 1.1                 | PCLNL 25 X 25                    | CNMG 120408     |   |
|               | 1.2                 | PDJNL 25 X 25                    | DNMG 150408   |  |
|               | 1.3                 | SVVBN 25 X 25                    | VBMT 160408   |  |
|               | 1.4                 | MTJNL 25 X 25                    | TNMG 160408   |  |
|               | 1.5                 | FACE GROOVING 25 X 25            | 3 mm width    |  |
|               | 1.6                 | OD GROOVING 25 X 25              | 3 mm width    |  |
|               | 1.7                 | ID GROOVING 25 X 25              | 3 mm width    |  |
|               | 1.8                 | OD THREADING TOOL (CEL 2525-M16) | 16EL 1.5 ISO  |  |



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|      |  |  |   |
|------|--|--|---|
| 1.9  | ID THREADING TOOL Shank<br>Dia.16mm (SNL 0010-K-11 )                                       | 11NL 1.5ISO   |    |
| 1.20 | S25PCLNL   | CNMG 120408   |    |
| 1.21 | S08 SCLCL 06   | CCMT 060304   |    |
| 1.22 | S12 SCLCL 09   | CCMT 090304   |    |
| 1.23 | S16SCLCL 09  | CCMT 090304  |   |
| 1.24 | Boring block holder Internal<br>Dia.32mm   | 04 No.   |  |
| 1.25 | Facing block (C-Type) holder   | 02 No.   |  |
| 1.26 | Boring sleeve varies from<br>ID*OD - 6*32, 8*32, 10*32,<br>12*32,16*32,20*32 &<br>25*32mm. | each one no.   |  |
| 1.27 | Revolving Centre MT-4 Long<br>Nose   | 01 No.   |  |
| 1.28 | Key less Drill chuck sleeve<br>hook spanner  | 01 No.   |  |
| 1.29 | Taper bore sleeve of OD 32<br>mm with – MT1, MT2, MT3,<br>MT-4                             | one no. each   |  |
| 1.30 | Centre drill A4  | 05 Nos.  |  |



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|  |      |  |            |   |
|--|------|--|------------|---|
|  | 1.31 | HSS Straight shank Drill in step of 0.5 mm | 3 to 12 mm |  |
|--|------|--|------------|---|

#### E. Space requirement for Installation:

|              | Sr. No. | Particular     | Unit | Dimension | Remark |
|--------------|---------|----------------|------|-----------|--------|
| Machine Size | 1.1     | Overall length | mm   | 3000      |        |
|              | 1.2     | Overall Width  | mm   | 2000      |        |
|              | 1.3     | Overall Height | mm   | 3000      |        |
|              | 1.4     | Net Weight     | Kg.  | 2500      |        |
|              | 1.5     | Gross Weight   | Kg   | 2750      |        |

#### F. Foundation/ Installation Specification:

| Sr.No. | Particular   | Dimension | Quantity    | Remark |
|--------|--|-----------|-------------|--------|
| 1.     | Suitable anti-vibration mounting pad capacity 2000 Kg. | Set       | 1 (04 Nos.) |        |
| 2.     | Space Required   | Sq.mtr.   | 5           |        |





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#### G. Electric supply specification:

| Sr.No. | Particular                      | Dimension                         | Quantity | Remark |
|--------|---------------------------------|-----------------------------------|----------|--------|
| 1.     | Power Supply                    | 415V $\pm$ 2%,<br>50Hz,3<br>phase |          |        |
| 2.     | Copper Cable Four core 6 sq.mm. | Meter.                            | 05       |        |
| 3.     | Copper strip Earthing.          | Meter.                            | 10       |        |
| 4.     | MCB                             | AMP                               | 35       |        |
| 5.     | Total Connected Load            | KW                                | 7to 10   |        |



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### 68. CNC Vertical Machining Centre:-

#### 68.1 Basic Indicative Diagram



Detailed specification for CNC Vertical Machining Centre:

#### B. BASIC ITEM SPECIFICATION:

| Features   |
|--|
| Sub modules of Machines should be reputed make like THK, FANUC or equivalent. Manufacturer's certificate should be provided.   |
| The machine bed, base/structure should be built with grey cast iron grade (FG300 - IS210 class G4) with all sub modules stress relieved. Certificate should be provided from manufacturer.   |
| CNC VERTICAL MACHINING CENTER with FANUC Oi Mate controller. Soft Servo CNC with closed loop servo motor control fitted with Industrial Control Panel & linking with Robot, CAD/CAM and FMS. |
| The machine should be laser calibrated & Laser calibration certificate should be provided by manufacturer.   |
| The spindle should be dynamically balanced with work holding device. Balancing certificate should be provided by Manufacturer.   |
| Full Machine Guards with aesthetic look.   |



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| Sr.No.           |     | Particular  | Unit             | Range        |       |
|------------------|-----|---|------------------|--------------|-------|
|                  |     |   |                  | Min          | Max   |
| 1.Traverses      | 1.1 | X-axis stroke   | Mm               | 425          |       |
|                  | 1.2 | Y-axis stroke   | Mm               | 325          |       |
|                  | 1.3 | Z-axis stroke   | Mm               | 350          |       |
| 2. Table         | 2.1 | Clamping / working area   | mm x mm          | 600 x 300    |       |
|                  | 2.2 | T-slots : No. of slot /Width/CD   | No./mm/mm        | 3 x 14 x 100 |       |
|                  | 2.3 | Distance from spindle face to table   | Mm               | 100          | 500   |
|                  | 2.4 | Max. safe load on table   | Kg               | 200          |       |
| 3.Spindle        | 3.1 | Spindle Speed   | Rpm              | 0            | 6000  |
|                  | 3.2 | A.C. Servo motor for spindle continuous rating - FANUC  | Kw               | 3.7/5.5      |       |
|                  | 3.3 | Spindle nose taper  | BT               | 40           |       |
|                  | 3.4 | Instant Tool Clamping by disc springs and de clamping by pneumatic cylinder/ Advanced Electro-Mechanical System |                  |              |       |
|                  | 3.5 | Hydraulic / Pneumatic counter balance for Z axis  |                  |              |       |
| 4.Control System | 4.1 | Controller  | Fanuc Oi Mate MD |              |       |
|                  | 4.2 | PCMCIA memory card (Flash card) with card reader for saving & restoring data Graphics.                          | GB               | 2            |       |
|                  | 4.3 | RS232C – Communication cable with interfacing software  | Meters           | 3            |       |
|                  | 4.4 | USB slot with pen drive   | GB               | 4            |       |
|                  | 4.5 | Ethernet slot with suitable data cable  | Meters           | 2            |       |
|                  | 4.6 | Graphic simulation with standard pocket cycle & standard canned cycle   |                  |              |       |
|                  | 4.7 | Machine data back up on CD  |                  |              |       |
|                  | 4.8 | MPG wheel   |                  |              |       |
| 5.Feed Drives    | 5.1 | Programmable cutting feed rates   | mm/min           | 0            | 10000 |
|                  | 5.2 | Rapid feed rates X/Y/Z axes   | m/min            | 32/32/20     |       |



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|  |      |  |          |                       |  |
|--|------|--|----------|-----------------------|--|
|  | 5.3  | A.C. Servo drives in all three axes.                           |          | FANUC                 |  |
|  | 5.4  | Hardened & Ground Ball Lead Screws in all 3 axes               | Class    | C5                    |  |
|  | 5.5  | Hardened & Ground Linear Motion Guide ways in all 3 axes       |          |                       |  |
| <b>6.Axis</b>                                    | 6.1  | X Axis Motor   | FANUC    |                       |  |
|  | 6.2  | Y Axis Motor   | FANUC    |                       |  |
|  | 6.3  | Z Axis Motor   | FANUC    |                       |  |
| <b>7.Accuracy</b>                                | 7.1  | Positioning  | Mm       | ±0.005                |  |
|  | 7.2  | Repeatability  | Mm       | ±0.003                |  |
| <b>8.Coolant System</b>                          | 8.1  | Chips Disposal   | Type     | Front / Rear          |  |
|  | 8.2  | Coolant Pump Flow  | LPM      | 50                    |  |
|  | 8.3  | Coolant tank & Chip tray                                       | Ltr.     | 150                   |  |
| <b>9.Lubrication System</b>                      | 9.1  | Automatic Centralized lubrication system                       | Ltr      | Tank capacity 2.5 Ltr |  |
| <b>10.Automatic Tool Changer / Tool Magazine</b> | 10.1 | Type of magazine   | Arm Type |                       |  |
|  | 10.2 | No. of Tools   | No.      | 10 to 20              |  |
|  | 10.3 | Max tool dia. (all tools)                                      | Mm       | 80                    |  |
|  | 10.4 | Max tool dia. (with adj. Pocket empty)                         | Mm       | 125                   |  |
|  | 10.5 | Max tool length  | Mm       | 200                   |  |
|  | 10.6 | Max tool weight  | Kg       | 7                     |  |
|  | 10.7 | Tool selection method  |          | Random                |  |
|  | 10.8 | Tool change time ( T-T )                                       | Sec.     | 3                     |  |
| <b>11. Material Block</b>                        | 11.1 | Material block for trial – Aluminium size 100mm X 100mm X 60mm | No.      | 1                     |  |



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|                          |      |   |   |      |  |
|--------------------------|------|---|---|------|--|
| 12. Power Failure Safety | 12.1 | Tapping Restoration After Power Failure     | Single switch Easy.                             |      |  |
|                          | 12.2 | Tool Change Restoration After Power Failure | Single switch Easy.                             |      |  |
| 13. Cutting capability   | 13.1 | Tapping Time Reduction                      | During Tap Retraction Speed/Feed can be doubled |      |  |
| 14. Machine Size         | 14.1 | Overall length                              | Mm  | 2000 |  |
|                          | 14.2 | Overall Width                               | Mm  | 2500 |  |
|                          | 14.3 | Overall Height                              | Mm  | 2700 |  |
|                          | 14.4 | Net Weight                                  | Kg.   | 2500 |  |
|                          | 14.5 | Gross Weight                                | Kg.   | 3000 |  |

### C. STANDARD ACCESSORIES.

| Sr. No.             | Particular   | Range   |    |
|---------------------|--|---------|----|
|                     |  | From    | To |
| Machine Accessories | a. Machine Lamp  | 9 Watt  |    |
|                     | b. Process completion lamp (3 tier)  | 01 No.  |    |
|                     | c. Voltage Stabilizer -Input voltage 300V to 460V AC   | 15 Kva  |    |
|                     | d. Suitable air Compressor (Minimum 100 Litre tank Capacity) with FRL unit & require attachments & Air Gun with hose pipe. | CFM 1.4 |    |
|                     | e. A.C. Unit for Electrical Cabinet  |         |    |
|                     | f. Coolant Gun with hose pipe & fittings.  |         |    |
|                     | g. A.C. Unit for Electrical Cabinet  |         |    |
|                     | h. LED Display of 72" for class room utility with separate   |         |    |



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**(NSQF LEVEL- 4)**

**Regional Office, Pune**

|                |    |  |     |    |
|----------------|----|--|-----|----|
|                |    | mounting. i.e. Stands & wall mounting. Interface with CNC controller with required accessories.  |     |    |
|                | i. | Hydraulic oil (Enclo 68 ) - 30 Ltr.  | Ltr | 30 |
| <b>Manuals</b> | a. | Programming & operating Manual   | 01  |    |
|                | b. | Alarm & diagnosis Manual   | 01  |    |
|                | c. | Service & Maintenance Manual include Maintenance Chart /schedule   | 01  |    |
|                | d. | Electrical circuit diagram Manual  | 01  |    |
|                | e. | instructions with spare parts details description, drawings & photographs  | 01  |    |
|                | f. | Instruction manual consist of all type of Procedure of installation & commissioning, working Instructions, operational safety measures do's & don't, | 01  |    |
|                | g. | Machine Operation Manual – Turret , ATC etc.   | 01  |    |
|                | h. | Air conditioners Manual  | 01  |    |
|                | i. | Stabilizer Manual  | 01  |    |
|                | j. | Hydraulic & Pneumatic / Power pack manual  | 01  |    |

|                              |  |
|------------------------------|--|
| <b>Training Requirement.</b> | a) Introduction & training regarding machine operation at site for 2 persons of each consignee.  |
|                              | b) Programming, & preventive maintenance, servicing, basic adjustment and set-up of the machine (including system maintenance and mechanical maintenance ) |
|                              | c) No. of sample job to be perform on machine with various type of operations & programming for trial.   |

### D. OTHER FEATURES:

| Special |  | Particular | Range |    | Remark |
|---------|--|------------|-------|----|--------|
|         |  |            | From  | To |        |
|         |  |            |       |    |        |



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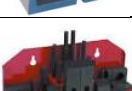






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|                          |  |  |     |   |   |
|--------------------------|--|--|-----|---|---|
| <b>Accessories</b>       | 1.1  | Requisite Maintenance tools - Allen Key set 1.5 to 10mm  | Set | 01  |    |
|                          | 1.2  | Double Ended standard spanner set 6 to 32 mm   | Set | 01  |    |
|                          | 1.3  | Machine vice with swivel base 150 mm opening should be 100 mm with suitable T bolt & stud  | No  | 01  |    |
|                          | 1.4  | Self-Centring Vice Dia.10 to 80mm bar caring capacity with suitable T bolt & stud  | No  | 01  |    |
|                          | 1.5  | Clamping set with carry case consist of 52 Nos. various type of T bolt & stud, etc.  | Set | 01  |    |
|                          | 1.6  | Suitable anti vibration mounting pad   | Set | 01  |   |
|                          | 1.7  | Material block for trial - Aluminium size 100mm X100mmX 40mm   | No. | 02  |  |
| <b>11. Cutting Tools</b> | <b>Drilling operation</b>  |  |     |   |   |
|                          | a  | HSS Straight shank Drill in step of 1mm  | Set | 4 to 12mm   |  |
|                          | b  | Centre drill A4 X10  | No. | 05  |  |
|                          | <b>Tapping Operation</b>   |  |     |   |   |
|                          | a  | CNC tap collets for M6,M8,M10& M12 with require HSS straight shank drill size 4.8,6.8,8.5,10.2mm& machine Tap size of 6,8,10 & 12mm. | No. | Each One  |  |
| b.                       | BT – 40 floating tap tool holder with tapping collet & pull stud | No.  | 01  |  |   |



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|    | <b>End Mill cutters</b>   |                        |          |   |
|----|---|------------------------|----------|---|
| a. | HSS End mill cutter dia. 4,6,8,10,12,16&20 mm   | No.                    | Each one |    |
| b. | HSS slot drill dia. 6,8,10,12& 16 mm  | No.                    | Each one |    |
| c. | BT - 40 collet adaptor chuck with pull stud   | No                     | 04       |    |
| d. | Set of suitable collets of sizes ER-25 in step of 1mm   | 3-16mm in steps of 1mm | 01 set   |   |
| e. | BT- 40 FACE MILL ARBOR with pull stud<br>FMB22-45 (For holding the face milling Cutter Dia.50,63mm with 10nos. inserts) | Set                    | 01       |  |
| f. | BT- 40 Collet Adapter vice with hook spanner type 'E'   | No.                    | 01 each  |  |
| g. | BT- 40 standard Pull Stud   | No.                    | 05       |  |
| h. | BT- 40 key less drill chuck with pull stud  | Nos.                   | 12       |  |
| i. | Edge finder- 3/8"shank x 0.2" head (For setting work coordinate on machine.)  | NO.                    | 01       |  |

### E. SPACE REQUIREMENT FOR INSTALLATION:





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| Sr.No. | Particular     | Unit | Dimension | Remark |
|--------|----------------|------|-----------|--------|
| 1.1    | Overall length | mm   | 3000      |        |
| 1.2    | Overall Width  | mm   | 3000      |        |
| 1.3    | Overall Height | mm   | 4000      |        |

#### F. FOUNDATION / INSTALLATION SPECIFICATION

| Sr.No. | Particular  | Dimension | Quantity    | Remark |
|--------|---|-----------|-------------|--------|
| 1.     | Suitable antivibration mounting pad capacity 3000 Kg. | Set       | 1 (04 Nos.) |        |
| 2.     | Space Required  | Sq.mtr.   | 10          |        |

#### G. ELECTRIC SUPPLY SPECIFICATION:

| Sr.No. | Particular                      | Dimension                          | Quantity | Remark |
|--------|---------------------------------|------------------------------------|----------|--------|
| 1.     | <b>Power Supply</b>             | 415V $\pm$ 2%,<br>50Hz, 3<br>Phase |          |        |
| 2.     | Copper Cable Four core 6 sq.mm. | Meters                             | 05       |        |
| 3.     | Copper strip Earthing.          | Meters                             | 10       |        |
| 4.     | MCB                             | AMP                                | 35       |        |
| 5.     | Total Connected Load            | KW                                 | 10       |        |

#### WARRANTY AND ANNUAL MAINTENANCE CONTRACT :

1. Warranty for successful operation of equipment for the period of 1 year for mechanical & 2 years for electrical, electronics & Control System etc. from the date of installation & commissioning of the equipment.

2) The supplier shall provide & ensure servicing facility throughout the warranty period. Supplier must be binded to attend for any type of fault occurred in equipment during the



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warranty period & must attend at least 3 preventive maintenance calls in a year as per requirement of consignee.

3) After expiry of warranty, Compressive AMC for span of 3 years to be provided, for which cost should be quoted separately.

ALL Test reports i.e. Physical & Chemical test reports should be from authorized agency & NABL approved laboratory.



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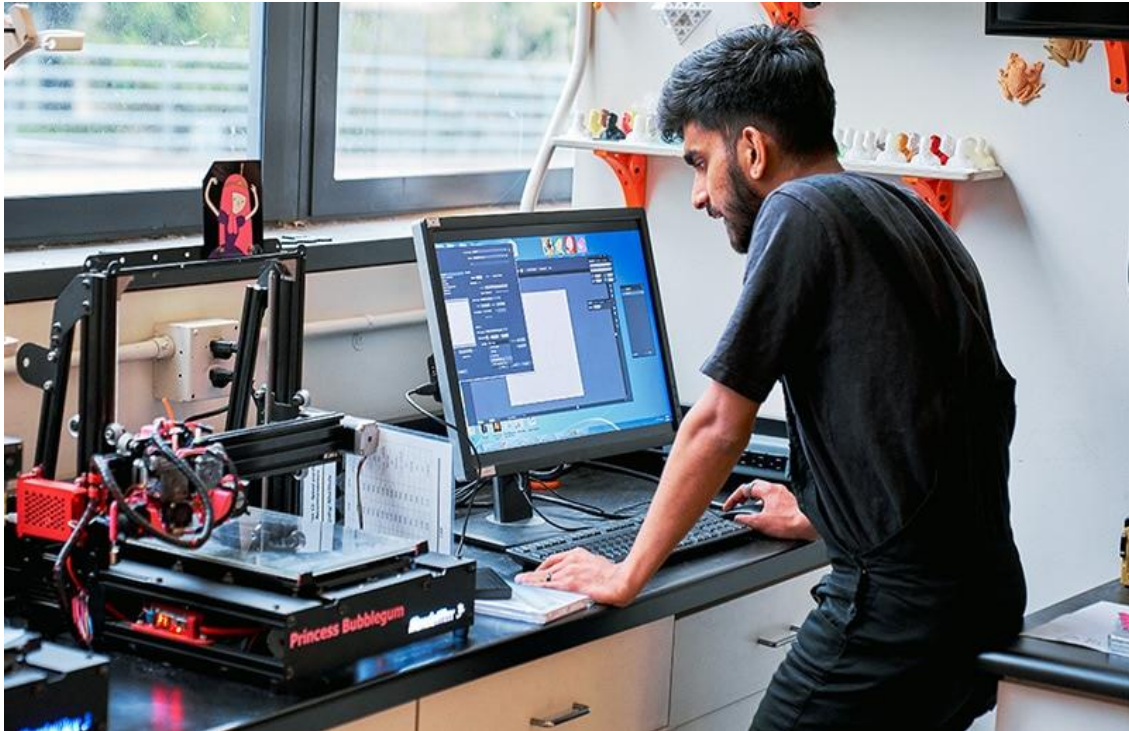
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### 69. Drafting /AutoCAD software LATEST VERSION



#### System requirements for AutoCAD 2021 including Specialized Toolsets (Windows)

|                           |  |
|---------------------------|--|
| <b>Operating System</b>   | 64-bit Microsoft® Windows® 10 and Windows 11.  |
| <b>Processor</b>          | <b>Basic:</b> 2.5–2.9 GHz processor<br><b>Recommended:</b> 3+ GHz processor<br>Multiple processors: Supported by the application |
| <b>Memory</b>             | <b>Basic:</b> 8 GB<br><b>Recommended:</b> 16 GB  |
| <b>Display Resolution</b> | <b>Conventional Displays:</b><br>1920 x 1080 with True Colour<br><br><b>High Resolution &amp; 4K Displays:</b>                   |



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#### System requirements for AutoCAD 2021 including Specialized Toolsets (Windows)

|                        |  |
|------------------------|--|
|                        | Resolutions up to 3840 x 2160 supported on Windows 10, 64-bit systems (with capable display card)  |
| <b>Display Card</b>    | <b>Basic:</b> 1 GB GPU with 29 GB/s Bandwidth and DirectX 11 compliant<br><b>Recommended:</b> 4 GB GPU with 106 GB/s Bandwidth and DirectX 11 compliant  |
| <b>Disk Space</b>      | 7.0 GB   |
| <b>Network</b>         | <p>Deployment via Deployment Wizard.</p> <p>The license server and all workstations that will run applications dependent on network licensing must run TCP/IP protocol.</p> <p>Either Microsoft® or Novell TCP/IP protocol stacks are acceptable. Primary login on workstations may be Netware or Windows.</p> <p>In addition to operating systems supported for the application, the license server will run on Windows® Server 2012 R2, Windows Server 2016, and Windows Server 2019 editions.</p> |
| <b>Pointing Device</b> | MS-Mouse compliant   |
| <b>.NET Framework</b>  | .NET Framework version 4.8 or later  |

|                 |   |
|-----------------|---|
| <b>CPU Type</b> | 64-bit Intel CPU<br><b>Recommended:</b> Intel Core i7 or higher |
| <b>Memory</b>   | <b>Basic:</b> 4GB<br><b>Recommended:</b> 8GB or higher          |



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|                           |   |
|---------------------------|---|
| <b>Display Resolution</b> | <b>Basic:</b> 1280 x 800 display<br><b>High Resolution:</b> 2880 x 1800 with Retina Display |
| <b>Disk Space</b>         | 3 GB free disk space for download and installation  |
| <b>Pointing Device</b>    | Apple-compliant Mouse, Apple-compliant Track pad, Microsoft-compliant mouse                 |
| <b>Display Card</b>       | <b>Recommended:</b> Mac native installed graphics cards                                     |
| <b>Disk Format</b>        | APFS, APFS(Encrypted), Mac OS Extended (Journaled), Mac OS Extended (Journaled, Encrypted)  |

| Additional Requirements for large datasets, point clouds, and 3D modelling |   |
|--|---|
| <b>Memory</b>  | 8 GB RAM or more  |
| <b>Disk Space</b>  | 6 GB free hard disk available, not including installation requirements  |
| <b>Display Card</b>  | 1920 x 1080 or greater True Colour video display adapter; 128 MB VRAM or greater; Pixel Shader 3.0 or greater; Direct3D®-capable workstation class graphics card. |

AutoCAD® is computer-aided design (CAD) software that architects, engineers, and construction professionals rely on to create precise 2D and 3D drawings.

- Draft, annotate, and design 2D geometry and 3D models with solids, surfaces, and mesh objects
- Automate tasks such as comparing drawings, counting, adding blocks, creating schedules, and more
- Customize with add-on apps and APIs



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### 2D drafting, drawing, and annotation

- **Text settings**

Create single or multiline text (m-text) as a single text object. Format the text, columns, and boundaries.

### Dimensions

Create dimensions automatically. Pass the cursor over selected objects to get a preview before you create it

### Leaders

Create leaders with a variety of content, including text or blocks. Easily format leader lines and define styles

### Centrelines and centre marks

Create and edit centrelines and centre marks that automatically move when you move the associated objects

### Tables

Create tables with data and symbols in rows and columns, apply formulas, and link to a Microsoft Excel spreadsheet

### Revision clouds

Draw revision clouds around new changes in a drawing to quickly identify your updates.

### Views

Save views by name to easily return to a specific view for quick reference or for applying to layout viewports.



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### Layouts

Specify the size of your drawing sheet, add a title block, and display multiple views of your model

### Fields

Use fields in text objects to display text that can be updated automatically as the field value changes

### Data linking

Enable simultaneous updates by creating a live link between a Microsoft Excel spreadsheet and a table in your drawing

### Data extraction

Extract information from objects, blocks, and attributes, including drawing information.

### Dynamic blocks

Add flexibility and intelligence to your block references, including changing the shape, size, or configuration.

### Arrays

Create and modify objects in circular or rectangular patterns, or along a path.

### Parametric constraints

Apply geometric and dimensional constraints to maintain relationships between drawing geometry.



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### Purge

Remove multiple unneeded objects at once with easy selection and object preview

### 3D modeling and visualization

- **Solid, surface, and mesh modelling**

Create realistic 3D models of your design using a combination of solid, surface, and mesh modelling tools.

- **3D navigation (orbit, View Cube, wheel)**

Use 3D viewing and navigation tools to orbit, swivel, walk, and fly around a 3D model to showcase your design.

- **Visual styles**

Apply visual styles to control the display of edges, lighting, and shading of your 3D model.

- **Section planes**

Create section planes to display cross-sectional views through solids, surfaces, meshes, or regions.

- **Rendering**

Apply lighting and materials to give your 3D models a realistic appearance and to help communicate your designs.

- **Cloud rendering**

Render 3D models online without consuming processing power or disk space on your local computer.

- **Point clouds**

Attach point cloud files acquired by 3D laser scanners or other technologies to use as a starting point for your designs.

- **Model documentation**

Generate 2D drawings including base, projected, section, and detail views from 3D models.

### Collaboration

- **PDF files**

Share and reuse data from PDF files by importing, exporting, or attaching them as underlays.

- **DGN Files**

Share and reuse data from DGN files by importing, exporting, or attaching them as underlays.

- **DWG compare**





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Compare two versions of a drawing without leaving your current window.

- **Sheet sets**

View, access, manage, and plot multiple drawings as sheet sets.

- **Model references and import**

Attach Navisworks models as underlays to your drawings, and import models from other applications.

- **Geographic location and online maps**

Insert geographic location information into a drawing, and display a map in the drawing from an online map service.

#### Installation and customization

- **Simplified installer**

Reduce the amount of time you spend setting up AutoCAD with faster and customizable installations.

- **Start tab**

The new AutoCAD Start tab lets you easily access files and other helpful content directly from the home screen.

- **TrustedDWG technology**

TrustedDWG™ technology alerts you to a possible incompatibility when a file was not last saved by Autodesk software.

- **CUI customization**

Customize the user interface to improve accessibility and reduce the number of steps for frequent tasks.

- **Secure load**

Specify security restrictions for running executable in AutoCAD to help protect against malicious executable code.

- **Action recorder**

Record commands and input values that can be played back as an action macro.

- **System variable monitor**

Monitor current system variables against a preferred list of values. Notification balloons alert you to deviations.

#### Learn more

- **CAD standards checker**

Define and monitor CAD standards to maintain consistent styles for layers, linetypes, text, and dimensions.

- **Application Programming Interface (API)**

Control drawings and databases with ActiveX, VBS, AutoLisp, Visual LISP, ObjectARX, JavaScript, and .NET.



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### Autodesk App Store

#### INCLUDES:

- Access to the Autodesk App Store
- AutoCAD web app
- AutoCAD mobile app
- Access specialized toolsets for architecture, mechanical design, electrical design, and more

#### WHAT IT DOES:

- Create and edit 2D geometry
- Create and edit 3D models with solids, surfaces, and mesh objects
- Annotate drawings with text, dimensions, leaders, and tables
- Customize with add-on apps and APIs
- Customize the ribbon and tool palettes
- Extract object data to tables
- Attach and import data from PDF files
- Share and use data from DGN files, Navisworks, and Bing Maps
- Apply and monitor CAD standards



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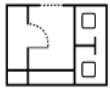
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### Save time with the specialized toolsets

Across seven studies, the average productivity gain was 63% for tasks completed using a specialized toolset in AutoCAD.\*



Architecture toolset



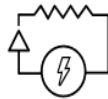
Mechanical toolset



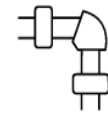
Map 3D toolset



MEP toolset



Electrical toolset



Plant 3D toolset



Raster Design toolset



See all included toolsets



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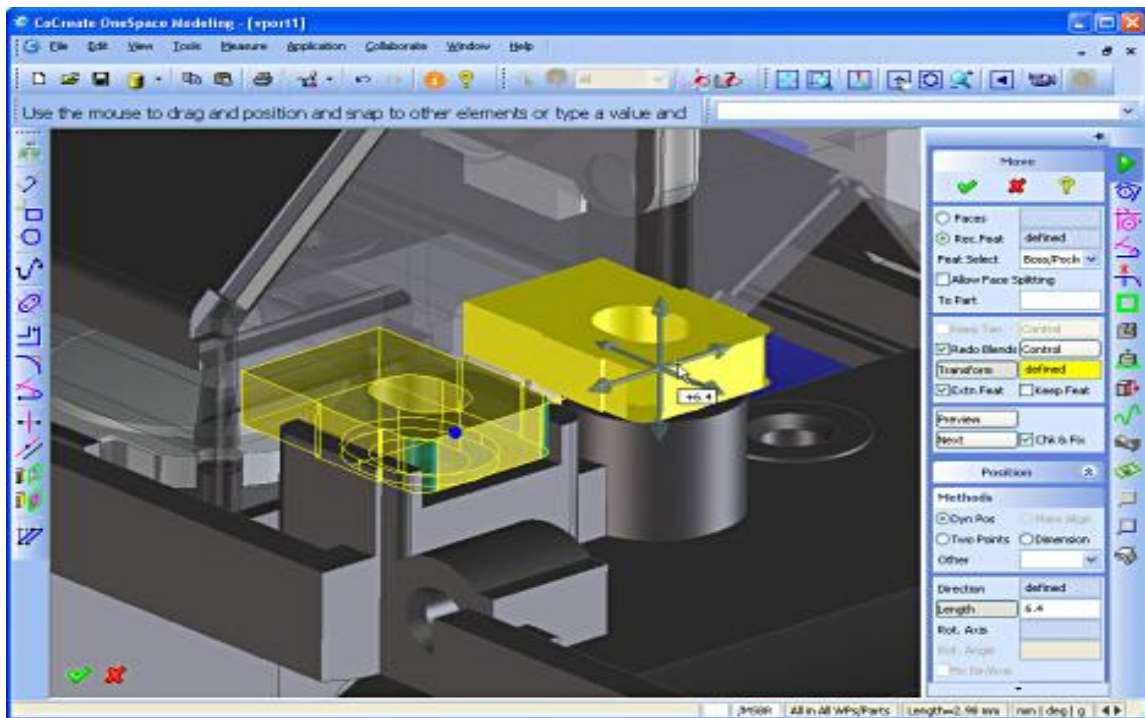
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### 70. Creo (Pro-E) SOFTWARE Latest Version



As per required

CAD software – Pro-e Creo latest version

CADD software – Drafting & designing

For drafting design & Manufacturing of Presstools,Jigs & fixtures,Dies,Mould inbuilt all Library

With all module & 3D animation



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### Pro/ENGINEER CAD

#### Styling and Surfacing Products

Style Counts...But style is only relevant if it can exist in a reasonably manufactured product. From digital brainstorming to reverse engineering, from aesthetic and technical surfacing to photo-realistic rendering, [Pro/ENGINEER](#) Creo CAD 3D and 2D Design Software allows product designers to see the product before it becomes reality – while making sure the product can become reality.

#### [Pro/ENGINEER Interactive Surface Design](#)

Can quickly and easily create highly precise and distinctly aesthetic product designs.

#### [Pro/CONCEPT](#)

Combined 2D and 3D digital sketchbook.

#### [Pro/ENGINEER Advanced Rendering](#)

Can quickly create stunningly realistic product images.

#### [Pro/ENGINEER Reverse Engineering](#)

Allows the transformation of existing physical products into digital models.

#### Design Products

Design to win...Not all AutoCAD software solutions are equal. Since the 3D CAD design impacts so many of the activities of product development, it represents an incredibly valuable asset. Therefore, it must yield quick, but complete and reliable results. With industry-leading performance and legendary modelling robustness, Pro/ENGINEER CAD design software solutions help determine product success.

#### [Pro/ENGINEER Advanced Assembly](#)

Enhances the productivity of distributed teams.



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#### Pro/ENGINEER Foundation XE

Critical CAD capabilities necessary to bring high quality products to market.

#### Electrical Systems

We see more and more products every day that have an electrical systems component. To enable these products to be designed accurately, cost effectively, and on schedule, Pro/ENGINEER provides a complete suite of solutions for electrical system design.

#### Pro/ENGINEER Routed Systems Designer

Complete solution for documenting both electrical and mechanical systems.

#### Pro/ENGINEER Cabling Design

The ability to extract logical information from schematics greatly automates 3D cable routing.

#### Mechanical Systems

Machinery and industrial equipment generally entails vast arrays of weldments, structural steel, and piping. To ensure that these products are brought to life most effectively – given their inevitably high-levels of assembly and routing sophistication —Pro/ENGINEER provides a complete suite of solutions for mechanical system design.

#### Pro/ENGINEER Piping Design

Its ability to extract logic from schematics automates 3D pipe routing.

#### Pro/ENGINEER Expert Framework

Tailored for machine designers and equipment manufacturers to simplify and speed structure



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|                       |  |
|-----------------------|--|
| Socket                | AM4  |
| CPU (Max Support)     | RYZEN  |
| Chipset               | AMD<sup> </sup> A320 Chipset                   |
| DDR4Memory            | 1866/ 2133/ 2400/ 2667/ 2933(OC)/ 3200(OC) MHz |
| Memory Channel        | Dual   |
| DIMMSlots             | 2  |
| Max Memory (GB)       | 32   |
| PCI-E x16             | 1  |
| PCI-EGen              | Gen3   |
| PCI-E x1              | 2  |
| SATAIII               | 4  |
| RAID                  | 0/1/10   |
| TPM(header)           | 1  |
| LAN                   | 10/100/1000*1                                  |
| USB 3.1 ports (Front) | 2(Gen1, Type A)                                |
| USB 3.1 ports (Rear)  | 4(Gen1, Type A)                                |
| USB 2.0 ports (Front) | 4  |
| USB 2.0 ports (Rear)  | 2  |
| Serialports(Front)    | 1  |
| Audio ports (Rear)    | Realtek<sup> </sup> ALC887 Codec               |
| DVI-D                 | 1  |
| VGA                   | 1  |
| DirectX               | 12   |
| FormFactor            | m-ATX  |
| Operating System      | Support for Windows<sup> </sup> 10 64-bit      |



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Support for Windows <sup> 7 64-bit

AMD Pinnac



## 71. SIMULATOR CNC:

|        |   |
|--------|---|
| 7.1    | <b>Multimedia CNC Simulator Software should contain following specifications</b>  |
| 71.1.1 | The software should enable teaching of CNC milling and turning technology aligned with CTS syllabus prescribed by DGET in a highly effective manner through multimedia such as videos, animations, sound, pictures and text. Software must use video clips from actual machines, cutting tools and machining situations in industry, to enable the student to interactively learn and understand how CNC machines are used in industry and establish a link between theory and practice. The software should contain simulation and machining capability of 2 axis lathe 3 axis milling and 4&5 Multiaxis milling provision inbuilt |





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|         |  |
|---------|--|
|         | Real time 3D machine simulation depicting job cutting, tool movement, coolant flow, chips generation etc. with controller for FANUC, Siemens (SINUMERIK), Mitsubishi, FAGOR, HAAS, HNC, HEIDENHAIN, DASEN, MAZAK and many more Panel styles to operate for both CNC Turning Center & CNC Vertical & Horizontal Machining Center. |
| 71.1.2  | 3D Modeling based OPENGL, Dual Monitor Display.  |
| 71.1.3  | Dynamic rotation, zoom, move, full screen, switch views, etc.  |
| 71.1.4  | 100% replica of the actual CNC system & it emulate CNC controllers like Fanuc, Siemens, Fagor, Mitsubishi, HAAS etc.   |
| 71.1.5  | G Code parser & Debugger Support ISO-1056 prepare function code (G code), assistant function code (M code) and other instruction code.   |
| 71.1.6  | Supports macro variables & parameter programming   |
| 71.1.7  | Validation of NC program code & shows error such as incorrect G code format, Incorrect NC program  |
| 71.1.8  | 3D Validation of collision detection such as collision between tool & fixtures & collision between tool holder, tool shank & work piece.   |
| 71.1.9  | 5 axis Milling Simulation.   |
| 71.1.10 | G codes debug Tool with back plotting.   |
| 71.1.11 | Custom code and cycles in different NC system are supported.   |
| 71.1.12 | Simulate post processed file produced by UG, Pro-E, MasterCam  |
| 71.1.13 | Operation process (AVI) recording and replay.  |
| 71.1.14 | Lathe work piece include bar & tube raw & milling work piece have box & cylinder raw. Work piece setting and mounting.   |
| 71.1.15 | Automatically change tool machine, 4,8,12 Position Turret  |
| 71.1.16 | Vertical and horizontal change tool system   |
| 71.1.17 | Tool preset by using benchmark method and manual method.   |
| 71.1.18 | Machining with coolant, sound and iron fragment effect.  |
| 71.1.19 | Measure tools : edge finder, feeler gauge, micrometer, calipers etc.   |
| 71.1.20 | Management tool and performance parameters adopt database technology.  |



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### Directorate of Vocational Education and Training, Maharashtra State

#### SPECIFICATION FOR TRADE – TECHNICIAN MECHATRONICS

(NSQF LEVEL- 4)

Regional Office, Pune

|                |  |
|----------------|--|
| 71.1.21        | Embedded all kind of tools like external internal turning, drilling, grooving, threading etc. Supporting customize tool.   |
| 71.1.22        | Three-dimensional size measure of work piece after it is machined.   |
| 71.1.23        | Roughness measure-based tool cutting parameters.   |
| 71.1.24        | Import work piece from CAD file.   |
| 71.1.25        | <b>User Management:</b> Teachers register their username and password through server, student may login into the network version in any PC using local area network, Teacher can centralize the management and monitor students over local area network.   |
| 71.1.26        | <b>Exercise Management:</b> Teacher may add and edit exercises in server. Teacher can transmit the exercises with pictures included to clients (students). Then students write the answers and transmit back to the teacher. Server builds up an easier and more convenient way for teacher and students to communicate with each other.                       |
| 71.1.27        | <b>Network Monitor:</b> Server records students' operation information according to their registration information. It can control and inquire students' login and logoff and machining operation information. At the same time, the teacher can also broadcast his screen to students. The Teacher can assist students via Remote View and Control Client PC. |
| 71.1.28        | <b>Examination Subsystem:</b> This system Includes question bank management, test paper management, the test process management as well as the automatic examination marking process.  |
| 71.1.39        | <b>Administrator Subsystem:</b> This Includes test data management, exam permit management, and test result management.  |
| <b>71.1.40</b> | <b>CNC Simulator training module should contain and cove the following points</b>  |
| 71.1.40.a      | Introduction of CNC Simulator  |
| 71.1.40.b      | Introduction to different control panel i.e.Fanuc Siemens, Haas, fagor etc   |
| 71.1.40.c      | Preparing work area<br>Emergency Button, Unlock Key, Homing Position   |
| 71.1.40.d      | Engineering Drawing  |
| 71.1.40.e      | Basics of NC programming   |
| 71.1.40.f      | Inserting program into CNC   |



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|           |  |
|-----------|--|
| 71.1.40.g | Introduction to different modes  |
|           | manual, jog, MDI etc   |
| 71.1.40.h | Syntax checking and debugging  |
| 71.1.40.i | Stock/Material selection for work piece                                  |
| 71.1.40.j | Tool Management  |
| 71.1.40.k | Taking Offset  |
| 71.1.40.l | 2D/3D Metal cutting view   |
| 71.1.40.m | Functioning of CNC   |
| 71.1.40.n | Work safety precautions  |
| 71.1.40.o | Job specifications, Job measurement using measuring tool.                |
| 71.1.40.p | 70-80 % Turning and Milling Operations practice on CNC Machine Simulator |
| 71.1.40.q | CNC Monitoring System  |
| 71.1.40.r | User Management  |
| 71.1.40.s | Exercise management  |
| 71.1.40.t | Examination subsystem  |
| 71.1.40.u | Test administration subsystem  |



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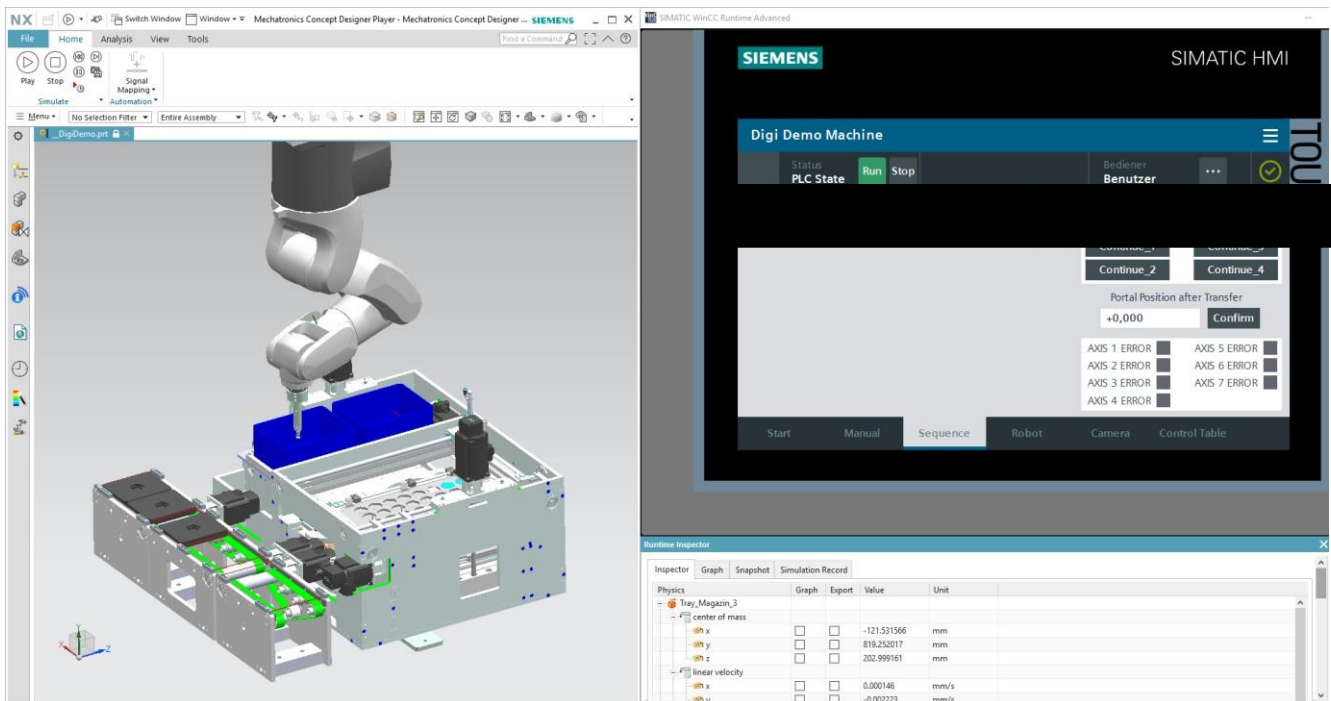
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## 71.1 Simulator Software – Mechatronics Concept Designer

Indicative Picture:



**Mechatronics Design and Simulation Software should be able Integration with PLC Necessary**

**Features required in a software:**

### 1. System engineering Leverage an intelligent function-based architecture

Define mechatronic modularization Improve the configurability

Trace and manage requirements Expand re-use of existing designs Organize and manage complexity

### 2. Concept design Create and validate mechatronic concepts

Define operating sequences Evaluate timing

Bring motion into computer-aided design (CAD) designs Generate a list of sensors and actuators

Logically link events with signals Identify and specify critical details

### 3. Detailed design Initiate detailed engineering Replace conceptual geometry by detailed design

Install motors based on electrical part numbers



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Compare changes in MCAD and ECAD and update them Export to commissioning tools

#### 4. Integrate detailed design

Identify devices and assemblies in electronic computer-aided design (ECAD) and mechanical computer-aided design (MCAD)

Cross-reference sensors and actuators with electrical devices and assemblies Exchange functional structures beyond the boundaries of ECAD and MCAD

#### 5. Virtual commissioning Virtual startup without a physical prototype

Simulate the real machine behavior, including programmable logic controller (PLC), computer numerical control (CNC), actors and sensors

Re-use your 3D concept model for visualization and CNC program simulation Validate your production parameters and test your PLC program

#### Necessary Requirements in a software:

1. The software should provide 3D modeling and simulation of concepts with multibody physics and automation-related behavior found in mechatronics products.
2. Simulate the real machine behavior including programmable logic controller (PLC), Computer Numerical Control (CNC), actuators and sensors.
3. Re-use 3D concept model for visualization and CNC program simulation.
4. Validate production parameters and test PLC program.
5. Integrated detail design in ECAD and MCAD.
6. Bring motion into computer aided designs.

#### D. FOUNDATION/ INSTALLATION SPECIFICATION:

| S.N. | Particular  |
|------|---|
|      | <p>1. Software should be capable of working on Standalone PCs/LAN network</p> <p>2. Software must be protected by a network USB dongles against piracy.</p> <p>3. PC: QuadcoreIntel/Core I5, 2GBRAM,250 Gb space,1024x768 VGA with OpenGL.</p> <p>4. Compatible to Windows 10 OS and latest/upgradable.</p> <p>5. Software Vendor should provide full technical support for Installation and configuration.</p> |