

**Upgradation of ITIs into Centers of Excellence-Broad guidelines for implementation of the scheme for “Sector Production & Manufacturing”**

These Centres will be providing multiskill training to meet the skill requirement of particular sector of industry with their active involvement in all aspects of training. The training will be provided in three parts as given below:

- ✓ Training in Basic skill areas for a period of one year.
- ✓ Training in Advanced modules for next six months.  
The testing & certification for the Basic skill training during first year & also for advanced training during next six months will be conducted by NCVT.
- ✓ Training in specialized modules mainly in the industry (The course curricula, duration etc will be designed in consultations with the IMC/local industry. The trade testing & certification for this component will be done jointly by the State Government & Industry. Said certificate will be recognized by NCVT

**As per the recommendations of the EFC, Training in the shop floor should constitute at least 25-40% of the curriculum.**

The training programme will have multi-entry and multi-exit provisions:

- ✓ trainee can opt to go to the labour market after completing broad based basic training of one year duration as well as after completing 1½ year of training.
- ✓ trainee can come back after some time to seek admission for advanced/specialised training in another module
- ✓ ITI pass out trainee of the particular trade(s) from the conventional system can seek admission for advanced/specialised training

As per the approved curricula in the Area/Sector of “Production & Manufacturing”, uniform rotation of trainees in six modules each of eight weeks duration as mentioned below is envisaged to be taken up. The trades from where existing infrastructure i.e.

equipment/ instructor etc. could be utilized for the training in ‘**Producton & Manufacturing**’ sector and space requirement of each module is as under

Basic Module	NAME OF THE MODULE	Trade(s) from where existing equipment/instructor could be utilised
<b>PMBT - 01</b>	<b>BASIC Fitting and Measurement</b>	<b>Fitter</b>
<b>PMBT – 02</b>	<b>BASIC Sheet Metal Worker and Welding</b>	Sheet Metal Worker/Welder
<b>PMBT – 03</b>	<b>BASIC Electrical &amp; Electronics and Computer Skill</b>	Electrician/ Electronic Mechanic /COPA
<b>PMBT – 04</b>	<b>BASIC Turning &amp; Grinding (including knowledge of Material &amp; Heat Treatment)</b>	Turner/Machinist (Grinder)
<b>PMBT – 05</b>	Basic Milling and Gear Cutting(including knowledge of Planning , Shaping and slotting)	Machinist
<b>PMBT – 06</b>	Basic CNC Programming & Operation and Hydraulics & Pneumatics	Machinist/Turner/Tool & Die Maker

For each of above module, Trade Practical will be 28 hours /week and Trade theory for 4 hours /week. Apart from above, Generic modules as mentioned below will be taught throughout the year.

**PMBT-07- WORKSHOP CALCULATION & SCIENCE.....2 hrs/week**

**PMBT-08-ENGINEERING DRAWING .....2 hrs/week**

**G-01-ENTERPRENEURSHIP AND COMMUNICATION SKILLS... .....2 hrs/week**

In addition, 4 hours/week have been kept for Library studies & Physical Training

**Vocational Instructors:**

NAME OF THE MODULE	No. of Vocational Instructors (VIs)
<b>PMBT – 01 to 06</b>	Six VIs one each for 6 module of relevant trades
PMBT-07 & PMBT - 08	One VI having Diploma in relevant field
<b>G-01</b>	One contract/part time / guest faculty for Generic module, ENTERPRENEURSHIP AND COMMUNICATION SKILLS –G-01

The eligibility and other criteria will be as follows:

**Eligibility :** 10<sup>th</sup> pass under 10+2 system

**Batch size :** 96 trainees 16 in each module ( 20% supernumeraries be allowed to take care of drop outs as already exist under CTS)

**Admission:**

For basic training, admissions are to be made in August / Feb each year.

**Fee Structure:**

Fee Structure may be decided by States Govt. in consultation with IMCs . It may be desirable to prescribe a uniform tuition fee for a sector in all Centres of Excellence of a state.

**Space:** Since workshop/theory class rooms are envisaged to be accommodated in the existing building of the ITI, therefore, following norms are prescribed only for new infrastructure is to be created .

- (1) Workshop space of 80 Sqm for each basic module (except for ECBT-1 & ECBT – 4 where space required is 80 Sqm)
- (2) Three Theory classrooms of 30 Sqm each  
(some flexibility i.e. from 80-60 Sqm area for workshop and 20-30 Sqm area for class room area is proposed to be provided)

The Theory classrooms should have latest infrastructure including AV aids as per details given below:

1. Suitable Chairs/ tables*	-	As required
2. OHP/Epidiascope	-	1 No.
3. Laptop computer/PC (latest) & LCD projector**	-	1 No.
4. Magnetic white board	-	1 No.
5. White board	-	1 No.
6. Flip chart	-	1 No.
7. Storage Almirah	-	As required

(\* Optimum utilization of space/flexibility may be kept in view)

(\*\*Keeping in view the constraints of funds under the scheme, it is proposed to procure only one set of Laptop computer/PC / LCD projector for CoE. However, States if so desire may procure additional Laptop computer/PC/LCD projector from their funds) While selecting furniture, it should be kept in mind that these are meant

for Centres of Excellence. Criteria like maximum flexibility/utilization of space should be kept in view.

**Office Equipment:**

For each CoE one Scanner, one Photocopy Machine and one PC/printer along with suitable accessories/furniture and internet connection (if not already available in the institute) is proposed to be provided for each CoE, in addition to the equipment prescribed in the syllabus.

**Addition/alteration/Construction:**

For Civil Works, tentative amount of Rs 40.00 lakhs have been proposed per CoE. It is envisaged to have separate block/ wing for the Centres of Excellence in the ITI campus. In case space is available in the existing building of an ITI for taking up new areas as per requirement of the cluster of Industry, the existing space will be renovated as per the need. Alternately, separate block will be built up in the same campus keeping in view the space requirements of the Electrical Sector .

While planning for addition /alteration/Construction of workshop and Class rooms, following may be kept in view:

- ✓ concept of a Centre of Excellence
- ✓ the fact that the requirement of funds for construction /addition /alteration for advanced training will be higher than that of basic training

**Publicity**

Wide publicity & advertisement be given for better response . The role of the local as well as the concerned Industry is very vital for the success of this program.

**States may consider providing additional equipment/ other facilities like separate Library/upgradation of existing Library, Conference Hall/ Committee Room etc. from their own funds.**

# I N D E X

## UPGRADATION OF ITIs INTO CENTERS OF EXCELLENCE

### SECTOR / AREA: PRODUCTION AND MANUFACTURING

#### BROAD BASED BASIC TRAINING ( FIRST YEAR )

BASIC MODULE	NAME OF THE BASIC MODULE	DURATION IN WEEKS	PAGE NO.
PMBT-01	BASIC FITTING and MEASUREMENT	8 weeks	2--6
PMBT-02	BASIC SHEET METAL WORK and WELDING	- do -	7—12
PMBT-03	BASIC ELECTRICAL & ELECTRONICS and COMPUTER SKILLS	- do -	13—18
PMBT-04	BASIC TURNING and GRINDING (INCLUDING KNOWLEDGE OF MATERIALS & HEAT TREATMENT )	- do -	19—23
PMBT- 05	BASIC MILLING and GEAR CUTTING (INCLUDING KNOWLEDGE OF PLANING, SHAPING AND SLOTTING )	- do -	24—27
PMBT-06	BASIC CNC PROGRAMMING & OPERATION and HYDRAULICS & PNEUMATICS	- do -	28—32

GENERIC MODULES			
PMBT-07	ENGINEERING DRAWING	@ 2 hrs / week 48 weeks	33—36
PMBT-08	WORKSHOP CALCULATION & SCIENCE	- do -	37--38
G-01	ENTREPRENEURSHIP AND COMMUNICATION SKILLS (given separately)	- do -	--

**UPGRADATION OF ITIs into CENTERS of EXCELLENCE**  
**(CoE)**

**SECTOR / AREA : PRODUCTION AND MANUFACTURING**

**BROAD BASED BASIC TRAINING**  
**( First Year )**

**BASIC MODULE – PMBT-01 : BASIC FITTING and MEASUREMENT**  
**( Duration - 8 weeks )**

**BROAD BASED BASIC TRAINING  
( First Year )**

**BASIC MODULE – PMBT-01 : BASIC FITTING and MEASUREMENT**

**( Duration - 8 weeks )**

**I) COURSE CONTENT**

a) Measurement - 2 weeks

b) Basic Fitting - 6 weeks

<b>Practical</b>	<b>Theory</b>
Physical introduction to measuring instruments – handling of instruments – exercises in the use of Linear measuring instruments such as Steel rule of different ranges.  Outside calipers, inside calipers for measuring inside, outside parameters.  Vernier calipers - Least count , exercise in outside measurement, inside measurement s, depth gauge.	Introduction to Metrology, Objectives of Metrology – measurements – principles -methods of measurement.  Terminology used in Metrology - Accuracy - Repeatability - Resolution etc.  SI units of measurements – physical quantities under SI system
Measurement of flat rectangular objects , cylindrical objects, hollow components, threaded components  Exercises on external & internal measurements using Micrometers and Height gauges	Selection of measuring instruments, care, use and maintenance of measuring instruments – Handling of precision instruments – Vernier Caliper, Micrometer, Height Gauge, Dial Gauge ( Plunger and bevel type ) with stand ( 0.01 mm Resolution), checking squareness using combination set.
Introduction to safety including fire equipments and their uses.  Familiarize with Fitter's hand tools  Filling a flat surface of Mild steel and cast iron. Check for flatness, straightness and squareness	Manufacturing processes in brief. Out line of various subjects to be covered.  Introduction to hand tools and their safety.  Environmental Factors and Personal Safety
Simple blue print reading  Mark out according to simple blue print  Punching.  Hack sawing to dimension	Marking and punching tools and their uses  Hacksaw – types, specification and their uses.

Practical	Theory
<p>Filing flat and square to size to an accuracy of <math>\pm 0.1\text{mm}</math></p> <p>Marking and punching of stepped and angular components and finishing the part to the required shape and size to an accuracy of <math>\pm 0.1\text{mm}</math></p> <p>Exercise on angular measurement using combination set &amp; Vernier Bevel protector</p>	<p>Classification and specification of files, shapes, sizes &amp; grades.</p> <p>Bench vice - constructional details</p> <p>Selection criteria of files</p> <p>Vernier Bevel Protector-reading and use.</p> <p>Use of thread gauge &amp; screw thread micrometer.</p>
<p>Center drilling, drilling, reaming, counter sinking, counter boring and tapping for various sizes of mild steel and tapping on various sizes of mild steel material</p>	<p>Drilling machine - Types - Drilling operation - Drill bits.</p> <p>Reamers – types, care and maintenance</p>
<p>Fitting exercises – simple to complex ( Involving drilling, tapping, reaming, counter sinking, counter boring and slide fitting.)</p>	<p>Taps and Dies – Description, care and maintenance</p> <p>Lubrication for tapping</p> <p>Determination of drill size for tapping</p> <p>Selection of Spindle RPM for drilling</p> <p>Tool holding and work holding devices</p> <p>Types of Fasteners</p> <p>Standard size of threads, types</p> <p>Applications of adhesives, Metal, Shellac etc.</p>
<p>Manufacturing of different components individually and assembling with fasteners</p>	<p>Limits and fits according to IS: 919</p>



**II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees**

SI No	Item	Qty
01	Steel rule 30 cm graduated both in English & Metric units	17 Nos.
02	Outside spring caliper 150 mm	17 Nos.
03	Inside spring caliper 150 mm	17 Nos.
04	Hermaphrodite caliper 150 mm	17 Nos.
05	Divider spring 150 mm	17 Nos.
06	Centre punch 100 mm	17 Nos.
07	Hammer B.P. 0.5 kg	17 Nos.
08	Combination plier 150mm	17 Nos.
09	Safety glasses	17 Nos
10	File flat bastard 300mm	17 Nos
11	File flat 2 <sup>nd</sup> cut 250 mm	17 Nos.
12	Engineers screw driver	17 Nos.
13	File flat smooth 200 mm	17 Nos
14	Cold chisel flat 25 x 200 mm	17 Nos.

**Tools, Instruments and General Shop Out fits:**

SI No	Item	Qty
15	Granite Surface plate 1000mm x 630 mm grade 1	4Nos
16	Metal stand Table for surface plate 900 x 900 x 1200mm	4Nos
17	Screw Driver Set (multiheads)	1Set
18	Scribing block universal 300mm	2Nos
19	Vee Block universal 300mm	2Nos
20	Try square 150 mm	2Nos
21	Outside spring caliper 200 mm	2Nos
22	Divider spring 200mm	2Nos
23	Inside spring caliper 200mm	2Nos
24	Straight edge steel 1 metre	1No
25	Straight edge steel 500 mm	1No
26	Steel tape 2 metre in case	1No
27	Spirit level 2V 250, 05 metre	1 No
28	Hammer B.P. 800 gms with handle	6 Nos.
29	Screw driver, heavy duty 300mm with handle	4 Nos.
30	Hammer lead 1 Kg	2 Nos
31	Combination set 300mm	2Nos
32	Spindle blade screw driver 100mm	2 Nos.

33	Allen hexagonal keys 2.5 to 12	2 sets
34	Spanner D.E.C.P. series 2( 7 pcs. each)	6setsof
35	Adjustable spanner 12 Nos	3 Nos.
36	Reduction sleeve MT as required	1Set
37	Angle plate size 200 x 100 x 200mm	2 Nos.
38	Angle plate adjustable 250 x 150 x 175	2 Nos.
39	Solid parallels in pairs ( Different sizes) in Metric	12 pairs
40	Oil can pressure feed 500 mg	6 Nos.
41	Oil stone 150 x 50 x 25 mm	2 Nos.
42	Twist drills 3mm to 13mm (Parallel Shank)	1 set
43	Drill chuck 0 -20 with taper shank	1 No.
44	Centre drill A1 to 5	2 sets
45	Grinding wheel dresser (star type)	1No.
46	Clamps C 100mm	2 Nos.
47	Clamps C 200mm	2 Nos.
48	Tap and die set in box metric pitch	1 set
49	Drill HSS taper shank	1 set
50	File flat 2 <sup>nd</sup> cut 250 mm	4 Nos.
51	File flat smooth 200mm	4 Nos.
52	File H/R 2 <sup>nd</sup> cut 250 mm	4 Nos
53	File triangular smooth 200mm	4 Nos.
54	Needle file set	1 No.
55	File square 2 <sup>nd</sup> cut 250mm	4 Nos.
56	Reamer 6 mm to 13mm by 1 mm	1 set
57	Hacksaw adjustable 250 – 300 mm with blades	8 Nos.
58	Hand vice 50 mm jaw	2 Nos.
59	Magnifying glass 75 mm	2 Nos.

### Measuring Instruments :

SI No	Item	Qty
60	Micrometer outside 0-25 mm	4 Nos.
61	Micrometer outside 25 – 50mm	4 Nos
62	Micrometer outside 50 – 75mm	2 No
63	Micrometer depth gauge 0-150mm	8Nos
64	Direct reading Vernier caliper 0 to 300	4 Nos
65	Vernier height gauge 250 mm	1 No
66	Vernier bevel protractor with least count of 5 minutes	1 No.
67	Dial Gauge	4 Nos
68	Lever Type dial gauge	4 Nos
69	Dial gauge stand	4 Nos
70	Screw pitch gauge for metric pitches ( 0.5 to 7 mm)	2 sets
71	Radius gauge metric set ( 1-6mm)	1 set
72	Feeler gauge	1 No.

**General installation:**

73	Sensitive Drilling machine pillar 12mm capacity with accessories	2 No
74	Radial drill 1200mm motorized with tapping attachment	1 No.
75	Drilling machine pillar 20mm capacity with accessories	1 No
76	Pedestal grinder	1 No
77	Hand Drilling Machine Power (10 mm )	1 no

**Workshop furniture:**

Sl. No.	Workshop furniture	Qty
1	Suitable Work Tables with vices	As required
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf ( glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required

# **UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)**

**SECTOR / AREA : PRODUCTION AND MANUFACTURING**

**BROAD BASED BASIC TRAINING  
( First Year )**

**BASIC MODULE – PMBT-02 : BASIC SHEET METAL WORK and  
WELDING**  
**( Duration - 8 weeks )**

## **BROAD BASED BASIC TRAINING**

( First Year )

### **BASIC MODULE –PMBT-02 : BASIC SHEET METAL WORK and WELDING**

( Duration - 8 weeks )

#### **I) COURSE CONTENT**

a) Sheet Metal Work - 3 weeks

b) Welding - 5 weeks

<b>Practical</b>	<b>Theory</b>
Use of protective safety devices on shop floor Identification of Tools & Equipments Practice in Scribing of straight line, Bisection of straight lines with marking tools. Practice in cutting sheet metal to different shapes using various types of snips Folding/Bending sheet metal to 90° using wooden mallet Practice On hard soldering method (Lead & Tin)	Safety precautions to be observed in the Workshop. Importance of sheet metal work & welding in Industry Safety in Gas welding & manual metal Arc welding Metals and their characteristics Sheet metal – Classification and uses Measuring & Marking Tools – Try square, dividers, trammels, marking block, Scriber, Steel rules, Calipers, SWG etc. Types of Snips, shears and their uses Sheet metal work Tools – Mallet, Nylon Hammers, etc. Bench vice C clamps, Pliers, Bench stokes or sheet formers, Types and uses.
Making holes in sheet metal using punching machine  Making hole in sheet metal with a twist drill Riveting practice using various types of rivet heads  Making a dust pan. Corner and handle riveted	Cutting methods – straight cutting – circle cutting – Louver cutting, Nibbling, Slot cutting, Notching,  Sheet Metal Works – Folding, Bending & Flanging  Solder – Different types of Solder and their uses (Soft & hard solids) Heating appliances Description and uses of guillotine shears and circle cutting machines.  Description and use of hand punching machine Description of Drilling machines, Drill bits, etc..

PRACTICAL	THEORY
<p>Practice on removing dents of spherical and hemi – spherical articles.</p> <p>Practice on cutting cylinder obliquely. To make 90° L piece of equal diameter and join them at right angle.</p> <p>Practice on pipe bending by hand</p> <p>Making 60° off set “T” piece (round)</p>	<p>Methods of laying out pattern</p> <p>Parallel line method</p> <p>Radius line method</p> <p>Triangular line method</p> <p>Fastening of sheet metal, various types of fastening devices</p> <p>Introducing to tube and pipe</p> <p>Bending of pipes</p> <p>Laying out pattern of cylinder cut obliquely</p> <p>Description of roll forming machine types and operators principle</p>
<p>Setting up of gas welding plant</p> <p>Opening and closing procedure of gas welding plant.</p> <p>Lighting and adjustment of flame</p> <p>Setting up of beading practices</p> <p>Setting of Arc welding plant</p> <p>Striking an Arc</p> <p>Beading practices</p>	<p>Safety in welding work</p> <p>Types of welding processes and application</p> <p>Nomenclature of welding joints &amp; Edge preparation</p> <p>Terms applied to welding</p> <p>Welding symbols – Description and uses</p> <p>Distortion and its control</p> <p>Different process of metal joints – Bolting – Riveting – Soldering – Brazing, &amp; Welding</p> <p>Simple Electrical terms – uses of Electricity and applied to welding</p>
<p>Brazing, soldering &amp; silver soldering by oxy- Ace. Process.</p> <p>Fusion run with / without filler rods</p> <p>Square butt joint on M S plate</p> <p>Oxy acetylene, hand cutting on M S plate</p> <p>Pipe Butt joint on M S pipe</p> <p>Production jobs as per drawing such as Furniture items, Windows, Grills.</p>	<p>Gas welding hand tools – uses</p> <p>Oxy-acetylene welding – Principles and applications.</p> <p>Common gases used for welding</p> <p>Types of Oxy-acetylene flames – their uses</p> <p>Flame Temperature – chemistry and structure of oxy-acetylene flame</p> <p>Oxygen cylinder, DA Cylinder description</p> <p>Regulator – Types - Construction</p> <p>Care &amp; maintenance of blow pipes and cutting torches.</p> <p>Filler rods used in Gas welding</p> <p>Welding flux</p> <p>Faults in gas welding – Causes - Corrections</p>
<p>Straight bend on M S plate</p> <p>Horizontal bead on M S plate</p> <p>Fillet Tee joint on M S plate, open corner joint on MS plate</p> <p>Square butt joint on M S</p>	<p>Principles of Arc welding, tools &amp; accessories</p> <p>Types of welding machine AC/DC and applications</p> <p>Care &amp; maintenance of welding</p>

Single V Butt joint	<p>machine</p> <p>Welding position – Flat, Horizontal, Vertical and O.H.</p> <p>Electrodes – Types, Functions of flux loading</p> <p>Criteria for choice of electrodes</p> <p>Welding defects, Causes and remedy.</p>
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**II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees**

SI No	Item	Qty
1	Steel Rule 300 mm	17
2	Wing Divider 200 mm	17
3	Centre Punch 100 mm	17
4	Spring Dividers 150 mm	17
5	Ordinary Wooden Mallet 50 mm	17
6	Cross Peen Hammer 0.25 Kg with handle	17
7	Protractor with blade 150 mm	17
8	Steel Tape 2 meters	17
9	Ballpane Hammer 0.5 Kg with handle	17
10	Scriber 150mm x 3 mm (Engineers)	17

**SHOP OUT FIT**

SI No	Item	Qty
11	Steel Square 450mm x 600 mm	4 Nos.
12	Sheet Metal Gauge	2Nos.
13	Stake Round and Bottom	4 Nos.
14	Half Moon Stake	4 Nos.
15	Funnel Stake	4 Nos.
16	Anvil Face Stake	4 Nos.
17	Bick Iron stake	4 Nos.
18	Tinmans Horse	2 Nos.
19	Hammer Peaning with handle	4 Nos.
20	Hammer Creasing with handle	4 Nos.
21	Hammer Planishing with handle	4 Nos.
22	Hammer Block with handle	2 Nos.
23	Sher Tinmans 300 mm	8 Nos.
24	Snips straight 250 mm	8 Nos.
25	Right cut snips 250 mm	4 Nos.
26	Left cut Snips 250 mm	4 Nos.
27	Hand Shear Universal 250 mm	4 Nos.

28	Punch Round 3 mm , 4mm & 6mm Dia	4 Nos
29	Punch Round 4 mm Dia	4 Nos
30	Punch Round 6 mm Dia	4 Nos
31	Rivet sets snap and Dolly combined 3 mm ,4 mm, 6mm	4 Nos each
32	Chisel cold flat 25 mm x 250 mm	4 Nos
33	Punch Letter 4mm and Punch Number 4 mm	1 set each
34	File flat 250 mm second cut and smooth	2 Nos each
35	File flat 250 mm smooth	2 Nos.
36	File flat 300 mm bastard	2 Nos.
37	File half round 300mm smooth	2 Nos
38	Hacksaw frame 300 mm adjustable ( tubular)	4 Nos.
39	Hand Groover 3 mm, 4mm, 5mm	4 Nos.
40	Plier Combination 150 mm	2 Nos
41	Grip Wrench 200mm	2 Nos
42	Ladle 150 mm Dia	2 Nos
43	Blow Lamp 1 litre	2 Nos
44	H.S.S. Twist Drill 3 mm, 4mm & 6 mm (Parallel Shank)	3 Nos each
45	Hand Drill 0 to 6 mm, 8mm, 10mm & 12mm	2 Nos. each
46	Soldering Copper Hatchet type 500 gms	8 Nos
47	Pneumatic rivet gun	2 Nos.
48	Trammel Point ( with beam 600 mm)	1 No.
49	Vernier caliper ( 0mm – 150mm)	1 No.
50	Micrometer outside (0 to 25mm)	1 No.
51	Raspcut file 250 mm	4 Nos.
52	D.E.Spanner G.P ( 6 mm to 32 mm) ( Set of 12 spanner)	2 set
53	Bessing Mallet	4 Nos
54	Endfaked Mallet	4 Nos
55	Soft Hammer ( Brass, Copper, Lead, Rubber and Rawhide heads with handle)	4 Nos
56	Steel Rule 600mm	4 Nos
57	Oil Can Pressure feed 500 ml	2 Nos
58	Raising Hammer with handle	4 Nos
59	Rawl Punch holder and bits ( No.8,10, 12,14)	2 sets
60	Hollowing Hammber with handle	4 Nos
61	Tripaning tool 70mm	1 No.
62	Safety Glasses	4 pairs
63	Handvice 50mm	16 Nos.
64	Steel wire Brush 50mm x 150mm	16 Nos.
65	Gloves for Welding (Leather and Asbestos)	16 Nos.
66	Leather Apron	16 Nos.
67	Tongs, Close mouth and pick up ( 1 each)	4 pairs
68	Portable Electric drill ( Single phase)	2 Nos.
69	Crow bar 910 x 25mm	2Nos.
70	Trowel Medium	1 No.
71	Trowel small	1No.



72	Poprivet gun	2 Nos.
73	Lazy Tong	2 Nos.
74	Screw Driver 250mm	2 Nos.
75	Round File 2 <sup>nd</sup> Cut 250mm	4 Nos.
76	Triangular File Smooth 250mm	4 Nos.
77	Square File 2 <sup>nd</sup> Cut 250mm	4 Nos.
78	'C' Clamp 150mm	6 Nos

## GENERAL INSTALLATION

SI No	Item	Qty
79	Light General purpose portable forge	2 Nos.
80	Liquified Petroleum Gas ( LPG ) Cylinder, Regulator and Torch with Burner	2 Nos.
81	Bench lever shears 250mm Blade x 3 mm Capacity	1 No.
82	Air Compressor ( Pressure and displacement of air)	1 No.
83	Spray Gun ( Painting) 500 ml	1 No.
84	Guillotine Shearing Machine foot operated ( 1 mt x 18G Capacity)	1 No.
85	Welding plant Oxy-Acetylene complete ( high pressure)	2 Nos
86	Circle Cutting Machine 300 mm Dia	1 No
87	Pillar type drilling machine 12mm	1 No.
88	Slip roll former 1.6mm x 1000 mm	1 No.
89	D.E. Grinder Pedestal motorized 200 mm	1 No.
90	Anvil 50 Kgs with Stand	1 No.
91	Bench vice 120mm, 150mm	2 each
92	Fly press/Ball press No.4 single body	1 No.
93	Buffing and Polishing Machine	1 No.
94	Nibbling Machine	1 No.
95	Spinning Lathe	1 No.
96	Seaming Machine	1 No
97	Black Board with Easel	1 No
98	Wooden Rule 450 mm	1 No.
99	Portable Nibbler	2 Nos.
100	Portable Pneumatic Shear	2 Nos.
101	Pipe Bending Machine ( Hydraulic type) 12mm to 30mm	1 No.
102	Hand Press Brake Capacity ( 0.8mm)	1 No.
103	Beading Machine with 380mm throat clearance ( with crimping rollers)	1 No
104	Welding Transformer ( 200 to 400 Amps)	2 No.
105	Gas Welding Table 1220 mm x 760 mm	2 Nos
106	Spot Welding Machine	1 No.
107	Tin smiths bench folder 600 x 1.6mm	1 No.

**Workshop furniture :**

<b>Sl.No.</b>	<b>Workshop furniture</b>	<b>Qty</b>
1	Suitable Work Tables with vices	As required.
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf ( glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required

# **UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)**

**SECTOR / AREA : PRODUCTION AND MANUFACTURING**

**BROAD BASED BASIC TRAINING  
( First Year )**

**BASIC MODULE – PMBT-03 : BASIC ELECTRICAL &  
ELECTRONICS and  
COMPUTER SKILLS**

**( Duration - 8 weeks )**

## **BROAD BASED BASIC TRAINING**

**( First Year )**

### **BASIC MODULE – PMBT-03 : BASIC ELECTRICAL & ELECTRONICS and COMPUTER SKILLS**

**( Duration - 8 weeks )**

#### **I) COURSE CONTENT**

a) Electrical & Electronics - 4 weeks

b) Computer Skills - 4 weeks

<b>Practical</b>	<b>Theory</b>
Demonstration of use of Safety equipments and artificial respiration. Use of hand tools. Joining Practice with single and multi-strand conductors of different wires. Joining practice of bare conductors - Soldering Practice on Printed circuit boards - Demonstration & practice on soldering the Aluminum conductor, cable joints. Use of Aluminum flux and Alca 'P' solder. Demonstration and practice of crimping of various wires	Importance of Safety- Description, specification, general care & maintenance of common hand tools Wires & cables - conductors, Insulators & semiconductors - their shapes, sizes with respect to low, medium & high voltage Soldering Printed circuit boards & its uses - Different fluxes for different purposes on metals- Crimping equipment - Joining of conductors by soldering Importance of Preventive Maintenance and routine tests Earthing and its importance.
Making of a simple circuit with a lamp and battery Study and use of Multimeters - measurement of current, voltage, resistance in DC/AC circuits Demonstration & verification of ohm's law - Series circuits - Parallel circuits Demonstration & Practice on connecting & replacement of common electrical accessories in circuits – Use of tong tester	Resistance, Voltage, Current, open circuit and short circuits- Ohm's law - Voltage drop - series & parallel circuits - Power & energy relations - Electrical measuring Instruments – Multi-meters Common electrical accessories used in Industries - Bus-bars, Relays, Contactors, Circuit Breakers, etc.. Fuses and its ratings – materials used

Practical	Theory
<p>Demonstration of use of Safety equipments and artificial respiration.</p> <p>Use of hand tools. Joining Practice with single and multi-stand conductors of different wires.</p> <p>Joining practice of bare conductors - Soldering Practice on Printed circuit boards - Demonstration &amp; practice on soldering the Aluminum conductor, cable joints. Use of Aluminum flux and Alca 'P' solder. Demonstration and practice of crimping of various wires</p>	<p>Importance of Safety- Description, specification, general care &amp; maintenance of common hand tools</p> <p>Wires &amp; cables - conductors, Insulators &amp; semiconductors - their shapes, sizes with respect to low, medium &amp; high voltage</p> <p>Soldering Printed circuit boards &amp; its uses - Different fluxes for different purposes on metals- Crimping equipment</p> <p>- Joining of conductors by soldering</p> <p>Importance of Preventive Maintenance and routine tests</p> <p>Earthing and its importance.</p>
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<p>Simple wiring practice with distribution boards, Junction Boxes, Main Switches two way and intermediate Switches.</p> <p>Identification of different parts of DC generators- testing and measuring the field and Armature resistances</p> <p>Identification of different parts of AC Motors - Testing and measurement on Induction motors - Demonstration on Alternators .</p> <p>Identification and testing of transformers.</p> <p>Grouping &amp; testing of cells for a specified voltage &amp; current - Preparation of battery charging .</p>	<p>Induction principles - Electro-magnetism - Faraday's Laws</p> <p>Single phase &amp; Poly phase system 3 phase star-delta connections, Impedance &amp; power factor –</p> <p>Principles &amp; Applications of DC Motors , Series, Shunt &amp; compound motor – AC Motors</p> <p>Transformers &amp; its applications</p> <p>Chemical effect of electric current - Rechargeable batteries - Care &amp; maintenance of cells</p> <p>AC Motor starting with DOL Starter and Star - Delta Starter</p>
<p>Identification of different type of capacitors - Testing of capacitors - Identification and Testing of assorted diodes, PNP/NPN Transistors - Uni - junction Transistor, Field effect Transistor &amp; Silicon Controlled Rectifier ICs etc. - Demonstration on Rectifiers - Identification of ICs</p>	<p>Static Electricity - Capacitors &amp; its applications</p> <p>Fundamentals of a electron theory - semiconductor devices - Symbols - specifications - Diodes, Transistors, Uni-junction Transistor, Field effect Transistor Silicon Controlled Rectifier &amp; ICs.</p> <p>Half wave, full wave &amp; Bridge rectifier with filters, DC Power supply</p>
<p>Booting The Computer , Opening Windows Menus, using the mouse, refresh computer desktop using right click of the</p>	<p>Introduction To Computer Fundamentals And Its Parts, Familiarising With Disk Drives, Booting Of A Computer System,</p>

<p>mouse, create a directory in xp and linux, format a floppy, create a file using notepad, save the file in Floppy, copy the file into hard disk, copy a file from hard disk to floppy, create a directory in floppy, create a directory in hard disk, use my documents, use start menu for opening an application, to open a document recently written, change control panel settings for display, change the volume name of the hard disks using system properties., Familiarise with Keyboard and Keys.</p>	<p>Using The Mouse, Right Click, Left Click And Use Of Operating Systems Like Windows XP, Linux , Menu System, Tool Bars, File Structures, Directories, Moving And Copying A File From Floppy To Hard Disk, Hard Disk To Floppy Disk, Creating Directories. Formatting Floppy Disk.</p>
<p>Techniques of Changing desktop wall paper, changing Desktop Screen properties, Control Panel , User Accounts, customizing icons, writing a sample text using Notepad, Using Paint for drawing figures to get accustomed with mouse. Saving a file. Using Windows Explorer, Install a software, Remove a Software, Add new hardware to the system (like a Printer, Change the system date and Time, changing the Regional Settings of the system like country, Currency , Date Format , Using Start Menu, Creating Desktop Short Cuts</p>	<p>Use of desktop , control panel settings, Explorer, regional settings, creating shortcuts, Use of Simple applications like Paint, Notepad.</p>
<p>Open internet explorer,change the settings in IE, customize Internet Explorer for default applications, enable cookies, change the security settings, setup an internet connection, user ID and password saving in the computer for future usage, setup outlook express for an e-mail account, setup server authentication settings, receive and send emails from the account. Search using Yahoo and Google for certain topics, download a file from the internet, save the downloaded file. Set up the netmeeting using MSN or Yahoo Messenger.</p>	<p>Study of Internet Explorer, Modem, Settings in the IE and Modem, Dial Up and Broadband connections, Outlook Express, Viewing Email from the web site and Outlook Express, Creating email Accounts, using search engines, Video conferencing, MS Chat.</p>
<p>Open MS WORD, Create a new file, Save a file, open an existing file, Save as a text file, type a paragraph , Set for left and right margins, change the letters from upper to lower case, vice versa, cut a paragraph, copy a paragraph, setup tab positions, set hanging indents, draw a simple table,</p>	<p>Creating sample documents using MS WORD. Text wrapping, Text Formatting, Changing Letters to different case, drawing table, Mail Merging, Page formatting, Using different Font Types, Printing a document</p>

<p>insert rows, insert columns, erase rows, erase columns, search the document for spelling corrections, print the letter in a printer attached, in portrait and landscape. Open Excel, and workout the following to understand the theory commands:</p> <p>Prepare a salary bill for ABC organization with Column A for names, column B for Basic Salary, Column C for DA, Column D for addition of B &amp; C to get the full salary. Add the Column D into a new cell as TOTAL amount.</p> <p>Copy the sheet into sheet 2. Sort the sheet1 as per names. Sort the sheet2 as per Total salary.</p> <p>Insert two rows in sheet1. Merge these rows. Enter heading as Salary Bill. Use border and shading for the entire used column.</p> <p>Print the sheet using set print area with margins, and use scale factor for reduction and enlargement. Use portrait and Landscape.</p>	<p>Using Excel as spread Sheet, Familiarising with Cells, Formulae, Text, Numbers, and date, Using shortcuts for entering date and Numbers in Progressive cells, Copying Formulae, Text and Numbers, Using borders, Merging Cells, Unmerging, Changing Cell width, Row height, Printing an area of the sheet, Options of Printing like fit to paper, shrinking, etc, Using different Sheets in a work book, changing Colour of cells, fonts, text.</p>
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## II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

SI No	Item	Qty
1	Combination Pliers 200mm insulated	16Nos
2	Screw Driver 100mm200mm	16 Nos. each
3	Neon Tester 500V Pencil bit type	16Nos
4	Electrician Knife	16Nos
5	Hammer ball pein 0.25 kg	16Nos
6	File round 150mm	16Nos
7	Pliers side cutting 200mm	4Nos
8	Pliers round nose 200mm	4Nos
9	Pliers flat nose 150mm	4Nos
10	Pliers long nose 200mm	4Nos
11	Firmer chisel 25mm	4Nos
12	Hammer ball pein 1.0kg	1No.
13	Wall jumper octagonal 37mmX 450mm	1No.
14	Center punch 100mm	1No.
15	Steel measuring tape 20mts	1No.
16	Allen Keys	1Set
17	Spanner double ended set of 6	2 Sets
18	Adjustable spanner	1No.

19	Steel rule 300mm	4Nos.
20	Electric soldering iron 35W	4Nos.
21	Electric soldering iron 125W	2Nos.
22	Rubber gloves 5000V	2pairs
23	Multimeter 0-5,100,200,500 mill amperes 0-100-1000,10000 ohms 0-150,300,600V AC/DC	2Nos
24	Bar magnet	1No.
25	Horse shoe magnet	1No.
26	Electric Drill Machine 6mm capacity universal type 250 V	1No.
27	D.C. shunt motor 1 H.P. 250V (Laboratory type)	2No.
28	Universal motor 750W AC/DC 250V	2No.
29	Squirrel cage induction motor 1 H.P,230V with DOL starter	1No.
30	Transformer single phase 500 ma./ 250 /12V	4Nos.
31	L.F oscilloscope with Attenuation probes	1No.
32	Star Delta starter (contact type 8 points)	1No.
33	Tong Tester	1 No.
34	Meggar	1 No;
35	DC Power Supply 0v – 110 v / 5A	1 No.
36	Auto – transformer – variac 230 v	1 No.
37	Tweezers	16 Nos.
38	Crimping tools	1 set
39	PENTIUM IV COMPUTER or latest WITH 512 MB RAM WITH FOLLOWING ACCESSORIES DVD COMBO DRIVE WITH THE LATEST X VERSION, HARD DISK WITH 80 GB OR ABOVE, 17" MONITOR , AGP GRAPHICS CARD WITH 64 MB, 10/100 ETHERNET CARD, MODEM	9 NO
40	CENTRALISED UPS WITH 5KVA CAPACITY	1 NO
41	LASER PRINTER	1 NO
42	DOT MATRIX PRINTER	1 NO
43	WINDOWS XP OPERATING SYSTEM	09 NO
44	MS – OFFICE 2000	09 NO

#### Workshop furniture:

Sl.No.	Workshop furniture	Qty
1	Suitable Work Tables	As required
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf ( glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required



**Furniture-Computer Lab:**

<b>Sl.No.</b>	<b>Furniture-Computer Lab</b>	<b>Qty</b>
1	Suitable Computer Tables	As required
2	Computer Chairs	17 Nos
3	Tool Cabinet	2 Nos
4	Trainees locker	2 Nos
5	Book shelf ( glass panel)	1 No.
6	Shoe Rack	As required
7	Vacuum cleaner	1 No.

# **UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)**

**SECTOR / AREA : PRODUCTION AND MANUFACTURING**

**BROAD BASED BASIC TRAINING  
( First Year )**

**BASIC MODULE – PMBT-04 : BASIC TURNING and GRINDING  
( INCLUDING KNOWLEDGE OF MATERIALS & HEAT  
TREATMENT )**

**( Duration - 8 weeks )**

## **BROAD BASED BASIC TRAINING**

**( First Year )**

### **BASIC MODULE – PMBT-04: BASIC TURNING and GRINDING**

**( INCLUDING KNOWLEDGE OF MATERIALS & HEAT TREATMENT )**

**( Duration - 8 weeks )**

#### **I) COURSE CONTENT**

**a) Turning - 4 weeks**

**b) Grinding - 4 weeks**

<b>Practical</b>	<b>Theory</b>
Manufacturing process and their importance in Industries Introduction to an Engine Lathe, identification of different parts of engine lathe, holding the job in 3 jaw chuck, Perform facing and plain turning operation to an accuracy of $\pm 0.1\text{mm}$ Use of Measuring instruments required for turning	Manufacturing processes in brief- Outline of various subject to be covered – Disciplinary rules of the Institute, Training and other facilities available. Introduction to Lathe, description, Lathe types – construction – parts and functions Specification of a centre lathe, lathe operations
Hold round job on independent chuck and perform the following operations. Facing Plain turning Step turning Taper turning	Work holding devices – Mounting and dismounting procedure and their safety. Lathe tools, their angles for roughing and finishing operation Classification of steels, alloy steels and effect of alloying elements.
Turn an angular surface – By compound slide method. Set a grooving tool & perform an undercutting operation for threading Perform Chamfering operation Set a threading tool to cut 'V' thread and cut 'V' thread	Taper – types and uses Calculation on taper Different methods of producing a taper on a lathe, their merits and demerits Types of threads, forms of thread and its depth calculation.
Perform knurling operation Perform center drilling and drilling Perform boring operation. Cut "V" thread on through bore. Perform parting off operation Demo on parallel turning between centers	Calculation of spindle speeds, feeds & depth of cut for different lathe operations. Method of producing a thread on a lathe. Cutting tool materials Types of coolants and their applications Heat treatment process – uses and types

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Practical	Theory
<p>Safety precautions followed in grinding</p> <p>Re-sharpen of plain turning tool on pedestal grinding to an accuracy of one degree.</p> <p>Check the tool angle using bevel protractor.</p> <p>Familiarize with controls of surface grinding machine</p>	<p>Grinding - Principle, types of grinding machine and their uses.</p> <p>Safety in grinding operation and principles of 5S.</p> <p>Surface grinding machine parts – function and operations.</p> <p>Method of grinding, taper surface by surface grinding</p> <p>Annealing of work material (Steel, CI &amp; Aluminum )</p>
<p>Use of work holding devices on grinding machine</p> <p>Grind parallel surface and stepped surfaces to a dimensional accuracy of <math>\pm 0.05</math> mm on surface grinder</p> <p>Demonstration of taper grinding</p>	<p>Grinding wheels – specification and classification</p> <p>Types of grinding wheels</p> <p>Selection Criteria of grinding wheels, wheel balancing, wheel truing</p> <p>Work holding devices such as magnetic vice, chucks etc.</p> <p>Demagnetisation of jobs</p> <p>Normalizing of Forging, Casting &amp; Machined jobs.</p>
<p>Grind cylindrical external, step surfaces on a cylindrical grinder to a dimensional accuracy of <math>\pm 0.05</math> mm</p> <p>Balancing and truing of grinding wheel</p>	<p>Cylindrical grinding machine parts – function and operation</p> <p>Methods of producing external and internal cylindrical surfaces of plain taper and stepped surfaces</p> <p>Basic idea of hardness testing, Hardness testing m/c different types.</p> <p>Hardening &amp; Tempering of chisels ( water hardening ) cutting tools ( oil hardening ) &amp; H S S ( Air Hardening )</p>
<p>Grind cylindrical internal surfaces on a cylindrical grinder to an accuracy of <math>\pm 0.05</math> mm</p> <p>Mounting and dressing of grinding wheel</p>	<p>Grinding defects, causes and remedy</p> <p>Work holding devices for internal grinding</p> <p>Balancing, truing and dressing of grinding wheel</p> <p>Importance of case hardening &amp; stress relieving</p>

**II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees****TRAINEES TOOL KIT :**

<b>SI No</b>	<b>Item</b>	<b>Qty</b>
1	Steel rule 30 cm graduated both in English & Metric units	17 Nos
2	Outside spring caliper 150 mm	17 Nos.
3	Inside spring caliper 150 mm	17 Nos
4	Hermaphrodite caliper 150 mm	17 Nos.
5	Divider spring 150 mm	17 Nos.
6	Centre punch 100 mm	17 Nos.
7	Hammer B P 0.5 Kg	17 Nos
8	Combination plier 150 mm	17 Nos
9	Safety goggle	17 Nos
10	File Flat smooth 200 mm	17 Nos

**Tools, Instruments and General Shop Out fits**

<b>SI No</b>	<b>Item</b>	<b>Qty</b>
11	Surface plate 900 x 900 x 1200 mm with Table	1 No.
12	Marking off table 1200 x 1200 x 900mm high	1 No.
13	Scribing block universal 300 mm	2 Nos.
14	" V " block 100/7-80-A	2 Nos.
15	Try Square 150 mm	2 Nos.
16	Outside spring caliper 200 mm	2 Nos.
17	Divider spring 200 mm	2 Nos.
18	Steel rule 60 cm graduated both in English and Metric units	2 Nos.
19	Spirit level 2V 250, 05 metre	1 No.
20	Hammer B P 800 gms with handle	12 Nos.
21	Screw Driver, heavy duty 300 mm with handle	4 Nos.
22	Combination set 300 mm	1 No.
23	Reduction sleeve MT ( to suit the machine)	1 set
24	Angle plate size 200 x 100 x 200 mm	2 Nos.
25	Solid parallels in pairs ( Different sizes ) in Metric	4 pairs
26	Oil can pressure feed 500 mg	6 Nos.
27	Oil stone 150 x 50 x 25 mm	2 Nos.
28	Twist Drill Taper shank set 12 to 20 mm in step of 1 mm	2 sets
29	Twist drills& Drill chucks including keyless drill chuck	1 set
30	Grinding wheel dresser (diamond)	1 No.
31	C-Clamps as required	2 Nos.
32	Clamps C 200 mm	1 set.
33	Assorted carbide lathe tools with holder different shapes and sizes	As Reqd.
34	Hacksaw frame adjustable 250 - 300mm with blades	2 Nos.
35	Universal table angle plate	1 No.
36	Plier cutting 200 mm	2 Nos.
37	Magnifying glass 75 mm	2 Nos.
38	Hand hammer 1 Kg with handle	2 Nos.
39	Centre drill 2,3,& 4	4 Sets

## MEASURING INSTRUMENTS

SI No	Item	Qty
40	Micrometer outside 0-25 mm	4 Nos.
41	Micrometer outside 25 - 50 mm	2 Nos.
42	Micrometer depth gauge 0 – 200 mm	1 No.
43	Direct reading Vernier caliper B 300 (direct reading with dial)	1 No.
44	Vernier height gauge 300 mm	1 No.
45	Vernier bevel protractor with 150 mm blade	1 No.
46	Bevel gauge 200 mm	1 No.
47	Telescopic gauge 13 mm to 300 mm	1 set
48	Compound dial gauge with stand ( Metric )	1 No.
49	Dial test indicator with magnetic gauge type 1 grade A with magnetic base	1 No.
50	Screw pitch gauge for metric pitches ( 0.5 to 6mm)	2 sets
51	Radius gauge metric set ( 1- 6 mm )	1 set
52	Taper gauge M T No. 1,2,3,4, & 5	1 set
53	3 pin micrometer 10 – 25 mm	2 Nos.

## GENERAL INSTALLATION :

SI No	Item	Qty
54	Lathe General purpose all geared ( gap bed ), height of centres 150 mm, bed length 1500 mm with 3 jaw & 4 jaw chuck, face plate, taper turning attachment steadies etc., and set of lathe tool holders.	4 Nos.
55	Pedestal grinder, double ended with 170mm wheels ( one fine and one rough)	2 No.
56	Surface grinding machine wheel dia 180 mm (or near) reciprocating table, longitudinal table traverse 200 mm (or near) fitted with adjustable traverse stop, magnetic chuck 250 mm x 120 mm. With set of grinding wheels, diamond tool holders for dressing & set of spanner etc.,	2 No.
57	Cylindrical grinder with internal grinding attachment, center height – 130mm with standard accessories including 3 Jaw self centering chuck, 4 Jaw independent chuck with set of grinding wheels, balancing equipments, mandrels, centers, tailstock etc.,	2 Nos.
58	Lip grinder, drill grinder, fly press, arbor press	1 each

**Workshop furniture :**

<b>SL. No.</b>	<b>Workshop furniture</b>	<b>Qty</b>
1	Suitable Work Tables with vices	As required
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf ( glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required



## **BROAD BASED BASIC TRAINING**

**( First Year )**

### **BAISC MODULE – PMBT-05 : BASIC MILLING and GEAR CUTTING** **( INCLUDING KNOWLEDGE OF PLANING, SHAPING AND SLOTTING )**

**( Duration - 8 weeks )**

#### **I) COURSE CONTENT**

a) Milling - 4 weeks

b) Gear Cutting - 4 weeks

<b>Practical</b>	<b>Theory</b>
Manufacturing processes and their importance in industries. Safety precautions followed on shop floor Horizontal milling machine - Identifying different parts, importance of each part - work holding devices - tool holding devices - hand tools Mill a plain surface using plain milling cutter / slab milling cutter Checking the flatness with tri-square. Mill six faces of a cuboidal block to an accuracy of $\pm 0.1\text{mm}$ . Checking the squareness with tri-square and the size with vernier caliper.	Outline of various subjects to be covered. Disciplinary rules of the Institute Training and other facilities available Manufacturing processes in brief. Milling machine - description - construction - types - specifications and applications. Merits and demerits of different types of milling machine Work holding devices and cutter holding devices. Processes of milling – upmilling, down milling, face milling and end milling.
Step mill using side and face milling cutter. Angular mill using angular milling cutter checking with bevel protractor. Slot mill using slot milling cutter / slitting saw.	Classification of different types of milling cutters and their uses. Nomenclature of milling cutters.
Vertical milling machine Face mill using face milling cutter Step mill using end mill. Slot mill using a slot drill Milling angular surface by tilting the spindle head and universal vice	Selection of cutting speed feed and depth of cut for different milling Operations Method of producing angular surface using vertical and horizontal milling machines. Milling of formed surfaces – concave and convex.
Mill a hexagon / square on a round rod using direct indexing. Mill a tung and groove - match the same	Dividing head – types, parts, function and uses. Calculation of direct indexing to mill a polygon.

<b>Practical</b>	<b>Theory</b>
Cut Spur gear on horizontal milling machine by using indexing head Check gear tooth using gear tooth vernier caliper	Universal indexing head – parts and function Types of Gear trains and calculations Methods of indexing and their calculation Nomenclature of spur gear, their proportion and calculation
Mill a rack by linear indexing method Checking the gear tooth using gear tooth vernier caliper	Racks – types, nomenclature and calculation Methods of producing racks on milling machine
Cut RH helical gear on universal milling machine Checking the gear tooth using flange micrometer. Exercise using rotary table	Helical gear tooth proportion and calculation Calculation for milling helical gear on an universal Milling machine
Cutting LH helical gear and match with right hand helical gear.	Shaping, slotting and planning machines - description, construction, types, parts, functions and uses

**II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees****Trainees Tool Kit:**

<b>SI No</b>	<b>Item</b>	<b>Qty</b>
1	Steel Rule 30 cm graduated both in English & Metric units	17
2	Outside spring caliper 150 mm	17
3	Inside spring caliper 150 mm	17
4	Hermaphrodite caliper n150 mm	17
5	Divider spring 150 mm	17
6	Centre punch 100 mm	17
7	Hammer B.P. 0.5 kg.	17
8	Combination plier 150 mm	17
9	Safety glasses	17
10	File flat bastard 300 mm	17
11	File flat 2 <sup>nd</sup> cut 250 mm	17
12	Engineers screw driver	17
13	File flat smooth 200 mm	17

**GENERAL SHOP OUT FIT :**

<b>SI No</b>	<b>Item</b>	<b>Qty</b>
14	Surface plate 400 mm x 400 mm grade	1
15	Table for surface plate 900x 900 x 1200 mm	1
16	Marking off table 1200 x 1200 x 900 mm	1
17	Scribing block universal 300 mm	2
18	Vee block 100/7-80-A	2
19	Try square 300 mm	2
20	Outside spring caliper 200 mm	2
21	Divider spring 200 mm	2
22	Inside spring caliper 200 mmm	2
23	Straight edge steel 500 mm	1
24	Steel tape 2 metre in case	1
25	Steel rule 60 cm graduate both in English and Metric units	2
26	Spirit level 2V 250, 05 metre	
27	Hammer B.P. 800 gms, with handle	12
28	Screw driver, heavy duty 300 mm with handle	4
29	Hammer lead 1 kg	2
30	Combination set 300 mm	1
31	Spindle blade screw driver 100 mm	4
32	Allen hexagonal keys 2.5 to 12	2
33	Spanner D.E.G.P. series 2 ( 7 pcs. Each )	6 sets
34	Adjustable spanner 300 mm	3
35	Angle plate size 200x100x200 mm	2
36	Angle plate adjustable 250 x 150 x 175	2
37	Solid parallels in pairs (different sizes)	12 pairs
38	Milling cutters of different sizes, shapes etc. including end mills and drills	1 set

39	Ivolute milling cutter 2 module	1 set
40	Oil can pressure feed 500 ml.	6
41	Oil stone 150 x 50 x 25 mm	2
42	File square 2 <sup>nd</sup> cut 250 mm	4
43	Hacksaw frame adjustable 250-300 mm with blades	2
44	Hand vice 50 mm jaw	2
45	Universal table angle plate	1

#### MEASURING INSTRUMENTS :

SI No	Item	Qty
46	Micrometer outside 0-25 mm	4
47	Micrometer 25-50 mm	2
48	Micrometer outside 50-75 mm	1
49	Micrometer depth gauge 0-200 mm	1
50	Direct reading vernier caliper B300 ( Direct reading with dial )	1
51	Vernier height gauge 250 mm	1
52	Vernier gear tooth caliper	1
53	Vernier bevel protractor with 150 mm blade	1
54	Bevel gauge 200 mm	1
55	Sine bar 200 mm	1
56	Compound dial gauge with stand (metric)	1
57	Dial test indicator with magnetic gauge type 1 grade A with magnetic base	1
58	Centre gauge 60	1
59	Slip gauge set (normal set) Metric	1 set
60	Flange micrometer size 0-25 mm	1 no.
61	Flange micrometer size 25-50 mm	1
62	Limit plug gauges 5 mm to 25 mm by 2.5 mm range	1 set

#### GENERAL MACHINERY INSTALLATION :

SI No	Item	Qty
63	Milling machine universal, machine size No.1 with standard accessories and the following attachments: i. Universal dividing head with set of change gears - 1 No ii. Long arbors dia 16, 22, 27 and 32 mm - 1 each iii. Machine vice swivel base 150mm - 1 No	2 sets
64	Milling machine plain type – horizontal, machine size No.1 with standard accessories and the following attachments: i. Machine vice swivel base 150 mm - 1No ii. Long arbor dia 16, 22, 27 and 32 mm - 1 each	2 sets.
65	Milling machine vertical, machine size No.1 with standard accessories and the following attachments: i. Machine vice plain 150 mm - 1No ii. Collet adaptor and collets (standard size) - 1set	2 sets.

	iii. Stub arbor, style 'C' dia 22, 27 and 32 mm - 1each iv. Rotary table 300mm with indexing arrangement - 1No v. Boring head - 1 No.	
66	Pedestal grinding machine double ended with 170 mm wheels ( one fine and one rough )	2 Nos
67	Arbor press , fly press	1 each

**Workshop furniture :**

<b>SL.No.</b>	<b>Workshop furniture</b>	<b>Qty</b>
1	Suitable Work Tables with vices	As required
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf ( glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required

# **UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)**

**SECTOR / AREA : PRODUCTION AND MANUFACTURING**

**BROAD BASED BASIC TRAINING  
( First Year )**

**BASIC MODULE – PMBT- 06 : BASIC CNC PROGRAMMING & OPERATION  
and HYDRAULICS & PNEUMATICS  
( Duration - 8 weeks )**

**BROAD BASED BASIC TRAINING**  
( First Year )

**BASIC MODULE – PMBT-06 : BASIC CNC PROGRAMMING & OPERATION**  
**and HYDRAULICS & PNEUMATICS**

( Duration - 8 weeks )

**I) COURSE CONTENT :**

- a) CNC - 5 weeks                      b) Hydraulics & Pneumatics - 3 weeks

<b>Practical</b>	<b>Theory</b>
<p>Study of CNC Trainer machines, CNC Turning / Milling with SINUMERIC and FANUC CONTROLS, key boards &amp; specifications.</p> <p>Machine starting &amp; operating in Reference Point, JOG, Incremental Modes on Trainer machines .Co-ordinate system points, in Turning – Milling. - assignments and simulations on basic simulation software.</p> <p>Absolute and incremental programming assignments and simulations.</p> <p>Identification of machine elements-over travel limits and emergency stop.</p> <p>Work and tool setting .</p>	<p>Safety in Handling, Safe handling of tools and equipments</p> <p>Introduction to NC / CNC machines, Conventional &amp; CNC machining, types of NC / CNC machines, advantages &amp; limitations of CNC and CNC applications.</p> <p>Concept of Co-ordinate systems and Points.</p> <p>CNC Machines – Turning - Milling,- Types , Machine axis.</p>
<p>Linear interpolation, assignments and simulations.</p> <p>Circular interpolation, assignment and simulations. Tools for Lathe and Milling Trainer machines</p> <p>Tool offset measurement and entry.</p> <p>Work off set measurement and entry.</p> <p>Simulation software Program entry and editing.</p>	<p>CNC Control Hardware and operating Software</p> <p>NC verses CNC Systems</p> <p>CNC M/C, Control, CNC Software - Specifications &amp; Selection criteria.</p> <p>Input Media and tape formats ISO/DIN.</p> <p>Information Processing of the CNC System</p> <p>Feed Drives and spindle drives on Trainer machines .</p> <p>Feedback devices for CNC control..</p> <p>Zero off sets and tool off sets in FANUC turning / Milling / SIEMENS CNC turning / milling Trainer machines.</p>

Practical	Theory
<p>Linear interpolation, Circular interpolation and simulation.</p> <p>Chuck, work ,Tools removal and mounting on CNC Lathe / Milling Trainer machines.</p> <p>Tool change in CNC turning / milling &amp; MPG mode operation on Trainer machines.</p> <p>Manual Data Input (MDI) mode operations and checking of zero offsets and tool offsets.</p> <p>Preparation of simple turning and facing program for CNC Machines.</p> <p>Automatic mode operation.</p> <p>CNC Trainer Machine Practice Exercises.</p> <p>Turning Exercises -</p> <p>Plain turning, Facing ,Step Turning, Turning Radius/Chamfer with TNRC, Blue Print programming contours with TNRC and Stock removal cycle O</p> <p>Milling Exercises -</p> <p>Face Milling, Chamfering and end milling with CRC, End Milling with polar co-ordinates and Simple drilling-G 81.</p>	<p>Cutting tool materials for CNC .</p> <p>ISO codes for carbide indexable inserts and tool holders for turning / Milling.</p> <p>Tooling systems for CNC Machining Centers.</p> <p>Tool Nose Radius Compensation (TNRC).</p> <p>Cutting parameters selection and process planning.</p> <p>Component Materials (Al, Cast Iron )</p> <p>Preparation of part programmes and simulation on the simulation software for the respective Turning / Milling exercises</p>
<p>Face milling and End milling on CNC milling machines.</p> <p>Simple step turning and facing on CNC turning.</p> <p>Geometry and wear offset correction.</p> <p>CNC Turning with radius/ chamfer and tool nose radius compensation program.</p> <p>Stock removal cycle in CNC turning for OD operation.</p> <p>Chamfering operation on CNC milling.</p> <p>CNC Machine Exercises - Turning Exercises -</p> <p>Drilling / boring cycles OD, Stock removal cycle ID, Grooving and thread cutting OD and Grooving and thread cutting ID</p> <p>Milling Exercises -</p> <p>Chamfer and counter-sink drilling, Deep hole drilling G 83, Boring cycles G-85 - G 89, Circular and rectangular pockets machining.</p>	<p>Planning for CNC Trainer machine operations.</p> <p>Part Features identification and process selection.</p> <p>Processes sequencing .</p> <p>Tool path planning.</p> <p>ISO / DIN G and M codes.</p> <p>CNC. Tool Nose Radius Compensation in turning.(TNRC)</p> <p>Machining parameters for milling for face milling and end milling.</p> <p>Cutter radius compensation in CNC milling.</p> <p>Tooling system for turning and tooling strategies for CNC turning machines.</p> <p>Work locating principle and locating devices for CNC milling.</p> <p>Drilling / Boring cycles in CNC Turning / Milling Trainer machines.</p> <p>Preparation of part programmes and simulation on the simulation software for the respective Turning / Milling exercises</p>



Practical	Theory
<p>Execution of part programs for thread cutting / thread milling for CNC turning / milling Trainer machines.</p> <p>Machining of rectangular / circular pockets on CNC milling.</p> <p>Threading cycle OD / milling - Threading Milling and tapping for simple project on Trainer machines</p>	<p>Grooving / Threading Tools, Processes and Tool selection</p> <p>Programming for Grooving / Threading on OD / ID in CNC Turning / Milling</p> <p>Helical Interpolation and Thread Milling on Trainer machines.</p>
<p>Identification of Pneumatic valves, Components, parts of Air compressor and to draw the symbols.</p> <p>Construction of circuits using single acting cylinder, Double acting cylinder and direction control valve.</p> <p>Construction of circuits for pneumatic power press, pneumatic hammer using double acting cylinder, directional control valve and flow control valve.</p>	<p>Introduction to Pneumatics, Pneumatic Symbol, block diagrams, Compressed Air Theory, Production, Purification and Distribution</p> <p>Construction and applications of directional control valve, pressure control valve and flow control valve with accessories</p>
<p>Familiarisation with basic Hydraulic elements, their graphic symbol and their application.</p> <p>Measurement of viscosity with saybolt universal viscometer</p> <p>Constructing simple logic hydraulic circuits using hydraulic trainer kit</p> <p>Dismantling and assembling of hydraulic pumps, gear pump</p>	<p>Principles of Hydraulics, Definition- Force, Pressure, Flow Rate and their units, Pascal's Law, block diagrams, Hydraulic symbols, Hydraulics Intensifiers.</p> <p>Hydraulic Fluids – Types, properties and its various units.</p> <p>Construction and functions of – Single acting, Double acting Cylinders, Hydraulic Pumps and Hydraulic motors.</p>
<p>Dismantling and assembling of 4 / 3 directional control valve</p> <p>Dismantling and assembling of flow control valve</p> <p>Dismantling and assembling of Single acting cylinder, Double acting cylinder</p> <p>Dismantling and Assembling of Pressure Control valve</p> <p>Tracing and drawing the hydraulic circuits for the following machines</p> <p>Hydraulic Shaping machine</p> <p>Hydraulic Surface Grinder</p> <p>CNC Machine</p>	<p>Direction control valves – types, construction and functions</p> <p>Pressure Control valves - types, construction and functions</p> <p>Flow control valves- types, construction and functions</p> <p>Construction of circuits using single acting cylinders, double acting cylinders with direction control valves and flow control valve on the trainer kit</p>

**II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees**

<b>SI No</b>	<b>Item</b>	<b>Qty</b>
1	CNC Trainer Lathe with Siemens Sinumerik 802D / Latest version, FANUC 0i / Latest version CNC system , Servo stabilizer and with necessary Turning cutting tools & Tooling package Installation and commissioning	1 No each
2	CNC Trainer Mill with Siemens Sinumerik 802D - M / Latest version, Fanuc 0i – MB / Latest version CNC system, Servo stabilizer and with necessary Milling cutters & Tooling Package Installation and commissioning	1 No each
3	CNC part program – Simulation soft wares for Siemens Sinumerik 802 D / FANUC - 0i MB Turning module - 2 axes - 8 Licenses & Milling Modules - 3 axes - 8 Licenses	1 set
4	Desk Top Personnel Computers – Intel Pentium IV – CPU, 17” CRT Monitor, Multimedia key board, 1.44 Floppy drive, 52 x CD Rom drive and windows x P Professional operating system	8 Nos
5	Uninterrupted power supply UPS - 600 VA	8 Nos
6	Air Compressor-stationary, compression load 8 bar, Suction Capacity 200 liters/min, reservoir 200 liters	1No
7	Pneumatic Trainer kit – consisting of Cylinders, Different types of Direction control valves, pressure dependant valve and flow control valves with accessories for construction and application of different type of pneumatic circuits.	2 Nos
8	Hydraulic Trainer kit with Power pack– consisting of Cylinders, Different types of Direction control valves, Pressure control valves and flow control valves with accessories for construction and application of different type of Hydraulic circuits.	2 Nos

**Workshop furniture :**

<b>Workshop furniture</b>		<b>Qty</b>
1	Suitable Work Tables with vices	As required
2	Stools	17 Nos
3	Discussion Table	1 No
4	Tool Cabinet	2 Nos
5	Trainees locker	2 Nos
6	Fire fighting equipment, first aid box etc	As required
7	Book shelf ( glass panel)	1 No.
8	Storage Rack	As required
9	Storage shelf	As required

**SECTOR / AREA : PRODUCTION AND MANUFACTURING**

**BROAD BASED BASIC TRAINING  
( First Year )**

**GENERIC MODULES**

**PMBT 07 : ENGINEERING DRAWING - 2 hours / week - 48 weeks**

**AND**

**PMBT 08: WORKSHOP CALCULATION & SCIENCE - 2 hours / week - 48 weeks**

## **BROAD BASED BASIC TRAINING**

**( First year )**

### **GENERIC MODULE**

#### **PMBT 07: ENGINEERING DRAWING - 2 hours / week - 48 weeks**

#### **I) COURSE CONTENT :**

##### **Engineering Drawing**

- Familiarisation with the Institute
- Introduction to Engineering Drawing and its importance. Different types of standards used in engineering drawing.
- Drawing instruments and their uses-Drawing board, 'T' square, set squares, protractor, Drawing sheets, Drawing Pencils - Grade and selection, eraser.
- Practice : Layout of drawing sheet
- Types of lines – Thickness, shade of lines and its General applications. Practice : Draw type of lines as per IS-70714 – 1983
- Draw figures involving horizontal, vertical and inclined lines
- Type of Angle, Triangles and their types.
- Practical : Construct Scalene triangles, right angle triangles, Isosceles triangles and equilateral triangles
- Lettering styles- Single stroke letters, Gothic letters as per IS standard.
- Practice : Lettering practice
- Dimensioning- Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement and indication of dimensions.
- Practice : Place dimensions in the drawing by aligned system and unidirectional system, Give dimension to the given drawing by following dimensioning principles as per BIS
- Method of dimension common features

- Geometrical construction using drawing instruments-Lines, Angles, patterns, Circle, Arc, Tangents, Triangles, Quadrilaterals, Regular Polygons. Different type of Tapers, Related Exercise on this topic.
- Practice : Construct square, rectangle, parallelogram, rhombus, trapezium and quadrilateral
- Practice : Draw a regular pentagon by circum scribing & inscribing
- Practice : Draw a regular hexagon by arc method
- Practice : Draw a regular pentagon, octagon and various types of tapers
- Free hand sketching of straight lines, rectangular, circles, squares, Polygons, ellipse.
- Practice : Prepare proportionate free hand sketches of plane figures
- Practice : Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand
- Orthographic projection I and III angle – Simple machine elements, Procedure for preparing a scale drawing.
- Practice : Draw a plan, elevation and side view of prism and cylinder
- Practice : Draw a plan, elevation and side view of cone and pyramids
- Practice : Draw a plan, elevation and side view of frustum of cone and pyramids
- Practice : Draw 1<sup>st</sup> angle and 3<sup>rd</sup> angle projection (i) Front View (ii) Top view and (iii) side view of object having stepped blocks with curved surfaces – simple machine elements.
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Top view and (iii) side view of object having stepped blocks with curved surfaces – simple machine elements.

- Drawing Isometric views out of orthographic views- Simple Machine Elements
- Practice : Construct an isometric scales to a given length
- Practice : Draw the isometric projection of cube, hexagonal prism
- Practice : Draw the isometric projection of a cylinder and cone
- Practice : Draw the isometric view of the objects/blocks with curved surfaces
- Practice : Draw the isometric view of the objects/blocks with curved surfaces
- Missing lines and views.
- Practice : Visualize the shape of the object from the given two views and add the third views – simple machine elements
- Practice : Identify the lines missed in multi views and supply them. Identify atleast five shapes satisfying a given view .
- Identify the third view for the given two views of similar in shapes and size.
- Development of regular objects bounded by plane surfaces-cube, prisms, cylinder and cones.
- Practice : Draw the development of surfaces of a cube and prism
- Practice : Draw the development of surfaces of a cylinder and cones
- Explanations of full – sectional view, half-sectional view , aligned sections.
- Practice : Draw full and half sectional view of simple machine elements
- Conventions and symbols used in drawing, Abbreviations used in engineering drawing, surface finish symbols, Welding symbols and Annotations.
- Practice : Draw surface finish symbols, Welding symbols and Annotations.
- Classification of engineering Drawings, Difference between Assembly drawing and Working drawing.

- Blue print reading of various Engineering drawing and Machine drawing.
- Practice : Blue print reading of Engineering Drawings and Machine drawing.
- Introduction to free hand sketching of machine parts. Tracing and printing of drawing. Introduction to Auto CAD, 3D modeling concept.
- Practice : Draw the elevation, plan and the side view of bench vice and lathe tail stock

## **WORKSHOP CALCULATION & SCIENCE - 2 hours / week - 48 weeks :**

### **Workshop Calculation & Science**

- Familiarisation with the Institute
- Units & Measurements – Systems of units, Fundamentals and derived units
- Conversion of units and applied problems. FPS, CGS, MKS and SI units
- Fraction & decimals – Addition, Subtraction, multiplication and division
- Fraction & decimals – Addition, Subtraction, multiplication and division
- Mass weight, volume and Density and their units.
- Problems on density and volume of Steel, Aluminum and copper.
- Simplification of Fraction and Decimals
- Definition -Force, Pressure, and their units
- Definition- Stress, Strain and Modulus of Elasticity
- Square & Square roots
- Plotting and reading of simple graph.
- Heat, Temperature and conversion of scales Fahrenheit, Centigrade & Kelvin.
- Thermometer, Thermocouple and Pyrometer and its application
- Transmission of heat and co-efficient of Thermal expansion of solid and related problems.
- Ratio and proportion
- Ratio proportion – Direct – Indirect and mixed proportions
- Simple machines – Mechanical advantage, velocity ratio and efficiency
- Simple problems on simple machines
- Mensuration – area of circle, triangle and polygons
- Mensuration – Surface area, Volume of cube and Sphere
- Mensuration – Surface area and volume of Cone and prism



- Mensuration – Surface area & volume of Cylinder and Hollow cylinder
- Use of Logarithm and anti logarithm tables
- Multiplication and Division – use logarithms
- Simplification of Fraction and decimals – use logarithms
- Friction, kinds of friction - Advantage & disadvantage
- Percentage problems – Metal removal by machining
- Percentage problems – Metal added by welding
- Estimation and cost of finished products.
- Classification of Ferrous and Non –Ferrous Metals and Alloys.
- Physical and mechanical properties of metal
- Simple algebraic addition and subtraction
- Simple algebraic multiplication and division
- Algebraic - Simplification problem
- Algebraic – Simultaneous Equation
- Meaning of H P, IHP, BHP and FHP
- Efficiency, problems on Horse Power
- Trigonometrically Ratios and simple formulae
- Calculate the area of triangle by using trigonometry, Application of Pythagoras theorem.
- Calculate height and distance by using trigonometry
- Heat treatment – process of Annealing, Normalizing, Hardening, and tempering
- Case-Hardening process -Carburizing & Nitriding - application & uses.
- Basic principles of electricity. Ohms law – series and parallel circuits.
- Uses of switch, Fuse, Conductor, Insulator and Semi-conductor
- Magnetism – Natural & Artificial and application.