

CURRICULUM GUIDE

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**Micro-hydro Technician**

**Short-term**

*(A Modular Curriculum)*



**Council for Technical Education and Vocational Training**  
**Curriculum Development Division**

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## **Introduction**

The competency based and market oriented curriculum guide for **Micro-hydro Technician** is designed to produce employable multi skilled workforce equipped with knowledge, skills, and attitudes related to the occupation. In this curriculum, the trainees will practice skills of installation of micro hydro in the related occupation. Once the trainees acquired competencies they will have ample opportunity for wage employment and self-employment through which they will contribute in the national streamline of poverty reduction in the country.

*The feature of this curriculum is to focus on entrepreneurship development in order to create self-employment opportunity. Applied mathematics, applied English, applied drawing, introductory micro hydro and bench work are focused in this curriculum. It is considered that the basic knowledge and skills included will prepare the trainees to learn the specialized contents so that they can be competent technician needed for the occupation. Another major feature of this curriculum is the incorporation of the drop-out youths who have only the class eight schooling experience. **The curriculum is designed on the basis of modular modality so that it will be successful to meet the needs of individuals, community, and industry.***

## **Aims**

The main aim of this program is to produce employable skilled **Micro-hydro Technician** who could provide services in the micro-hydro industries in the country.

To produce such human resources through institutional training program followed by "On the Job Training (OJT)" is made mandatory. This provision provides the trainees the opportunity for maximum experience & exposure of "The World of Work."

The graduates of this program will be able to be employed or be an entrepreneur.

## **Objectives**

The main objective of this curricular program is to produce skilled workforce of the field of micro-hydro. Moreover, general objectives of the program are:

1. Develop the concept on micro hydro.
2. Learn and apply simple English language for effective communication.
3. Perform simple mathematical problems related to occupation.
4. Perform electrical works.
5. Perform civil works related with micro hydro.
6. Develop concept & interpretation of MH design drawings.
7. Install electro mechanical equipments.
8. Perform welding associated with micro hydro plant.
9. Erect transmission & distribution line.
10. Perform house wiring.
11. Explain the concept of socio-economic aspects of micro hydro.
12. Perform testing & commissioning of micro hydro power plant.
13. Manage micro hydro plant.
14. Develop entrepreneur skills to an entrepreneur.
15. Develop generic skills for adopting in the new situation and technologies.

## **Course Description**

This curriculum guide is based on the job required to be performed by micro hydro technician at micro hydro projects in Nepal. Therefore, this curriculum guide is designed to equip the trainees with skills & knowledge in the micro hydro occupation. This curriculum is designed in modular approach with the prerequisite of basic module. This program consists of seven modules viz, (1) basic module, (2) basic civil works, (3) basic electrical works, (4) electro- mechanical installation works, (5) welding, (6) Power distribution works, (7) testing and commissioning works and, (8) Micro hydro plant management and (9) entrepreneurship development.

Basic module consists of introductory micro hydro, applied English, applied mathematics, applied drawing and bench work.

The provision of On-the- Job Training (OJT) is included to provide the trainees the opportunities to have experience and exposure of "The World of Work" as well as practice the critical competencies.

The duration of particular modules will be as mentioned in the course structure. There will be demonstration by instructors/trainers and the opportunity to practice skills/tasks necessary for this level of technician. Trainees will practice & learn skills using typical tools, equipment, machines, and materials necessary for the program.

### **Course duration**

The total duration of the course extends over 12 months (i.e. 9x130 hours in house training + 3x160 hours OJT=1650). The total duration of in-house training and OJT are 9 months and 3 months respectively. After the completion of all modules, the trainees should undergo OJT for the period as mentioned on the course structure. Trainees will learn and practice the knowledge and skills at the institutional level and apply them during the period of OJT so as to have exposure/ experience of the "world of work." Entrepreneurial skills will be provided at the end of training to make the trainees competent and orient them for self-employment.

### **Target Group**

The target group for this training program will be school leavers having minimum of class eight educations. Priority will be given to the individual of rural, poor, and disadvantaged groups.

### **Target location**

The target location for this training program will be all over Nepal.

### **Group Size**

The group size for this training program will be maximum 30, provided all necessary resources to practice the tasks/ competencies as specified in this curriculum guide.

### **Medium of Instruction**

The medium of instruction for this program will be Nepali or English or both

### **Pattern of Attendance**

The trainees should secure 80% attendance in theory classes and 90% in practical performance to be eligible for final examination.

### **Focus of Curriculum**

This is a competency-based curriculum. This curriculum emphasizes on competency performance. 80% time is allotted for performance and remaining 20% time is for related technical knowledge. So, the main focus will be on performance of the specified competencies in this curriculum. The provision of OJT is made to practice the critical tasks during the stated period.

### **Entry Criteria**

Individuals who meet the following criteria will be allowed to enter this curricular program:

- Minimum of eight class pass
- Nepali citizen
- Minimum of 15 years of age
- Should pass entrance examination

### **Instructional Media and Materials**

The following instructional media and materials are suggested for the effective instruction and demonstration.

- **Printed Media Materials** (Assignment sheets, Case studies, Handouts, Information sheets, Individual training packets, Procedure sheets, Performance Check lists, Textbooks etc.).
- **Non-projected Media Materials** (Display, Models, Flip chart, Poster, Writing board etc.).
- **Projected Media Materials** (Opaque projections, Overhead transparencies, Slides etc.).
- **Audio-Visual Materials** (Audiotapes, Films, Slide-tape programs, Videodiscs, Videotapes etc.).
- **Computer-Based Instructional Materials** (Computer-based training, Interactive video etc.).

### **Teaching Learning Methodologies**

The methods of teachings for this curricular program will be a combination of several approaches. Such as Illustrated Lecture, Group Discussion, Demonstration, Simulation, Guided practice, Practical experiences, Fieldwork and Other Independent learning.

- Theory: Lecture, Discussion, Assignment, Group work.
- Practical: Demonstration, Observation, Guided practice and Self-practice.

### **Follow up Provision**

**First follow up:** Six months after the completion of the program

**Second follow up:** Six months after the completion of the first follow up

**Follow up cycle:** In a cycle of one year after the completion of the second follow up for five years

### **Grading System**

The trainees will be graded as follows based on the marks in percentage secured by them in tests/ evaluations.

- Distinction: Passed with 80% or above
- First Division: passed with 75% or above
- Second Division: passed with 65% or above
- Third Division: passed with 60% or above

### **Students Evaluation Details**

- Continuous evaluation of the trainees' performance is to be done by the related instructor/ trainer to ensure the proficiency over each competency under each area of sub-module.
- Related technical knowledge learnt by trainees will be evaluated through written or oral tests as per the nature in the institutional phase of training.
- Trainees must secure minimum marks of 60% in an average of both theory and practical evaluations.
- There will be three internal evaluations and one final evaluation in each module at institution.
- The ratio between internal and final examination of knowledge test will be 20:80 but for the performance test it will be 80:20.
- The entrance test will be administered by the concerned training institute
- The OJT will be evaluated according to the OJT details stated in the curriculum

### **Trainers' Qualification (Minimum)**

- Diploma in Electrical, Mechanical and/or Civil Engineering
- Good communicative and instructional skills
- Experience in micro hydro

### **Trainer-Trainees Ratio**

- 1:10 for practical classes

- For theory, as per the class room situation

### **Suggestions for Instruction**

- 1. Select objectives**
  - Write objectives of cognitive domain.
  - Write objectives of psychomotor domain.
  - Write objectives of affective domain
- 2. Select Subject matter**
  - Study subject matter in detail.
  - Select content related to cognitive domain.
  - Select content related to psychomotor domain.
  - Select content related to affective domain.
- 3. Select Instructional Methods**
  - Teacher centered methods: like lecture, demonstration, question answers inquiry, induction and deduction methods.
  - Student initiated methods like experimental, field trip/excursion, discovery, exploration, problem solving, and survey methods.
  - Interaction methods like discussion, group/team teaching, microteaching and exhibition.
  - Dramatic methods like role play and dramatization
4. Select Instructional method (s) on the basis of objectives of lesson plans and KAS domains.
5. Select appropriate educational materials and apply at right time and place.
6. Evaluate the trainees applying various tools to correspond the KAS domains.
7. Make plans for classroom / field work / workshop organization and management.
8. Coordinate among objectives, subject matter and instructional methods.
9. Prepare lesson plan for theory and practical classes.
10. Deliver /conduct instruction / program.
11. Evaluate instruction/ program.

### **Special suggestion for the performance evaluation of the trainees**

1. Perform task analysis.
2. Develop a detail task performance checklist.
3. Perform continuous evaluation of the trainees by applying the performance checklist.

### **Suggestion for skill training**

1. Demonstrate task performance in normal speed.
2. Demonstrate slowly with verbal description of each and every step in the sequence of activity of the task performance using question and answer techniques.
3. Repeat 2 for the clarification on trainees demand if necessary.
4. Perform fast demonstration of the task.

### **Provide trainees the opportunities to practice the task performance demonstration**

1. Provide opportunity to trainees to have guided practice.
2. Create environment for practicing the demonstrated task performance.
3. Guide the trainees in each and every step of task performance.
4. Provide trainees to repeat and re-repeat as per the need to be proficient on the given task performance.
5. Switch to another task demonstration if and only trainees developed proficiency in the task performance.

### **Other suggestions**

1. Apply principles of skill training.
2. Allocate 20% time for theory classes and 80% time for task performance while delivering instructions.
3. Apply principles of learning relevant to the learners' age group.
4. Apply principles of intrinsic motivation.
5. Facilitate maximum trainees' involvement in learning and task performance activities.
6. Instruct the trainees on the basis of their existing level of knowledge, skills and attitude.

### **Certificate Requirements**

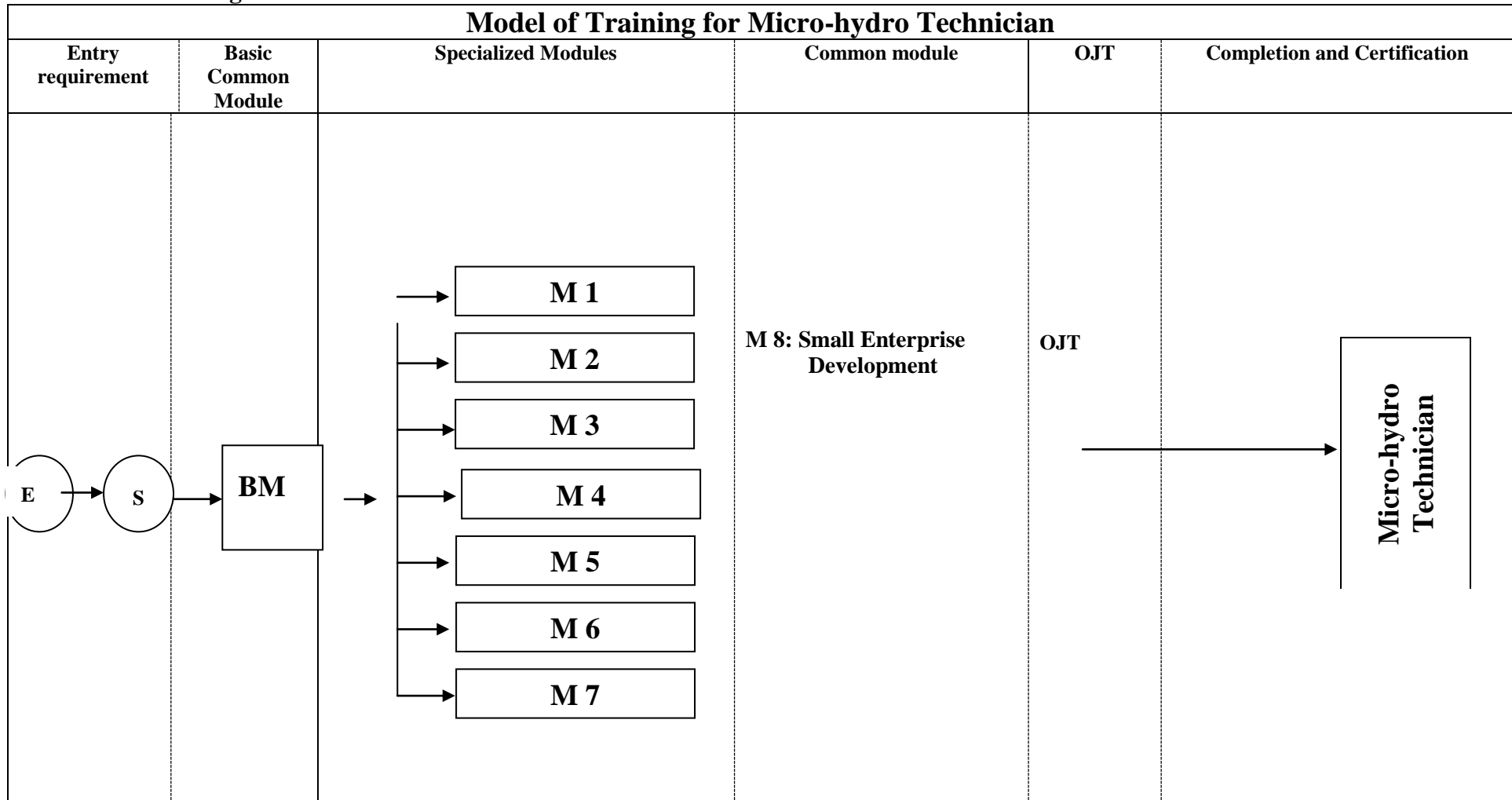
The related training institute will provide the training certificate in "**Micro-hydro Technician**" based on the related OJT completed as per the model of the curriculum. However; individuals who complete Module (s) of the institutional training will receive the certificate of the particular module completed.

### **Skill Testing Provision**

The graduates who have the completion certificate of this program may sit in the skill test of level two. The following competencies will be considered for the development of skill standard of level two.

1. Develop the concept on micro hydro.
2. Perform simple mathematical problems related to occupation.
3. Perform electrical works.
4. Perform civil works related with micro hydro.
5. Develop concept & interpretation of MH design drawings.
6. Install electro mechanical equipments.
7. Perform welding associated with micro hydro plant.
8. Erect transmission & distribution line.
9. Perform house wiring.
10. Explain the concept of socio-economic aspects of micro hydro.
11. Perform testing & commissioning of micro hydro power plant.
12. Manage micro hydro plant.
13. Develop entrepreneur skills essential for micro hydro technician to an entrepreneur
14. Develop generic skills for adopting in the new situation and technologies.

# Model of Training



E = Entry    S = Start    BM = Basic Module



### Course Structure for Micro-hydro Technician

S.N.	Code	Modules	Nature	Total hours	Full marks
1	M 0	Mo: Basic Module	T+P	220	200
2	M1	M1: Basic Civil Works	T+P	50	50
3	M 2	M2: Basic Electrical Works	T+P	200	200
4	M 3	M3: Electro- Mechanical Installation Works	T+P	50	50
5	M4	M4: Arc Welding	T+P	120	100
6	M 5	M5: Power Distribution Works	T+P	240	200
7	M6	M6: Testing and Commissioning Works	T +P	150	100
8	M7	M7: Micro-hydro Plant Management	T+P	70	50
9	M8	M8: Small Enterprise Development	T+P	70	50
<b>Sub total</b>				<b>1170</b>	<b>1000</b>
<b>On-the-Job Training (OJT)</b>			<b>P</b>	<b>480</b>	<b>300</b>
<b>Total</b>				<b>1650</b>	<b>1300</b>

*Note: OJT commences after the completion of the above-mentioned modules*

## Module Code: M0

### Module: Basic Module

#### **Description**

This module is designed to equip trainees with the knowledge and skills on Basic Module as a prerequisite for mastering any specialized module/s. This module intends to provide foundation for modular curriculum in micro hydro technician. This module especially, deals with; introductory contents of micro hydro, applied English, applied mathematics, applied drawing and bench work related to micro-hydro as mentioned in the course structure.

#### **Aim**

This module aims to equip trainees with knowledge and skills to master any specialized module.

#### **Objectives**

After completion of this module the trainees will be able to:

1. Develop the basic concept on micro-hydro operation.
2. Learn and apply simple English language for effective communication.
3. Perform simple mathematical problems related to occupation.
4. Develop concept & interpretation of MH design drawings.
5. Perform bench work related to occupation.

**Prerequisite:** Nil

**Duration:** 220 hours

#### **Module Structure (M 0)**

S.N.	Code	Sub-modules	Nature	Total hours	Full marks
1	SM 0.1	Introductory Micro-hydro	T+P	220	200
2	SM 0.2	Applied English	T		
3	SM 0.3	Applied Mathematics	T		
4	SM 0.4	Applied Drawing	T+P		
5	SM 0.5	Bench work	T+P		
<b>Total</b>				<b>220</b>	<b>200</b>

**Module Code: M 0**  
**Sub module Code: SM 0.1**  
**Sub module: Introductory Micro hydro**

**Description**

This course is designed to help trainees to provide knowledge on Micro Hydro Technology as a sub module for mastering any specialized module/s. This sub module deals with the basic concept of micro hydro, functional division of micro hydro, components of generation, components of distribution and components of consumption.

**Prerequisite:** Nil

**Duration:** 10 hours

**Competencies**

**1. Explain the concept of micro hydro.**

The basic principle of hydropower is that if water can be piped from a certain level to a lower level, then the resulting water pressure can be used to do work. If the water pressure is allowed to move a mechanical component then that movement involves the conversion of the potential energy of the water into mechanical energy. Hydro turbines convert water pressure into mechanical shaft power, which can be used to drive an electricity generator, a grinding mill or some other useful device.

To know the power potential of water in a river it is necessary to know the flow in the river and the available head.

The flow of the river is the amount of water (in m<sup>3</sup> or litres) which passes in a certain amount of time a cross section of the river. Flows are normally given in cubic meters per second (m<sup>3</sup>/s) or in litres per second (l/s).

Head is the vertical difference in level (in meters) the water falls down.

The theoretical power (P) available from a given head of water is in exact proportion to the head H and the flow Q.

$$P=Q \times H \times c \quad c = \text{constant}$$

The constant c is the product of the density of water and the acceleration due to gravity (g).

If P is measured in Watts, Q in m<sup>3</sup>/s and H in meters, the gross power of the flow of water is:

$$P=1000 \times 9.8 \times Q \times H$$

This available power will be converted by the hydro turbine in mechanical power. As a turbine has an efficiency lower than 1, the generated power will be a fraction of the available gross power.

Micro hydro in Nepal is defined as hydropower installations with a power output less than 100 kW

**2. Enlist the functional division of micro hydro.**

- Generation division
- Transmission and Distribution division
- Consumption division

**3. Enlist the component of generation.**

Diversion weir, Intake, Intake gate, Stop logs, Course trash rack, Flood canal, Gravel trap Head race canal, Open canal, Forebay, Spillway, Penstock Contraction and Expansions joint, Saddles, Powerhouse, Machine foundation, Tailrace, Penstock support, Valve (Butterfly and spherical), Turbine (Cross flow, Peltron), Generator (Synchronous and Induction), Control panel, Load controller, Governor.

**4. Enlist the component of distribution.**

Time totalizer, Single phase wire, Three phase wire, Transformer, Switchgear, Moulded-case circuit breaker (MCCB), Lightning, Earthing, Overhead transmission / distribution lines, Underground transmission lines, Service lines, Overhead distribution board connections, Pole.

**5. Enlist the component of consumption.**

Wire, Bulb, Main switch, Meter, and Moulded-case circuit breaker (MCCB).

**Module Code: M0**  
***Sub module Code: SM 0.2***  
**Sub module: Applied English**

**Description**

This course is designed to equip trainees with the skills and knowledge Applied as a sub module for mastering any specialized module/s. This sub module especially, intends to familiarize trainees with the occupation related terminologies, interpretation of order slip, maintenance slip and equipment manual.

**Prerequisite:** Nil

**Duration:** 40 hours

**Competencies**

1. Define micro hydro related terminologies.

**1.1 Terminologies in Civil Component**

River flow, Design Flow, Flow duration curve (FDC), Flood flow, Low flow, Return period, Eleven months Exceedence, Hydrology, Hydrograph, Diversion weir, Intake, Intake gate, Stop logs, Course trash rack, Trapping efficiency, Flood canal, Gravel trap Gross head, Net head, Surge Head, Design head, Head loss, Bed load, Head race canal, Open canal, Water level, Freeboard, High Density Polythene Pipe, Bed slope, Pressure pipes, Flow velocity, Sediment deposition, Grain size, Forebay, Spillway, Stone masonry, Concrete masonry, Hydraulic forces Contraction, Expansions, Friction, Saddles, Self weight, Powerhouse, Machine foundation, Tailrace, Plant size, Plant capacity and Reinforced concrete.

**1.2 Terminologies in Electro Mechanical Component.**

Flushing device, Slide gate, Penstock, Penstock support, Mild steel, Air valves, Vent pipes, Gate valve, Valve (Butterfly and spherical), Expansion joint, Turbine (Cross flow, Peltron), Efficiency, Generator (Synchronous and Induction ), Power drive, Belt (V belt and flat belt), Control panel, Load controller, Governor, Dump load, Ballast, Generated voltage, Frequency, Load current, Ballast voltage or stepped indicators, Time totalizer, Single phase, Three phase, Transformer, Switchgear, Moulded-case circuit breaker (MCCB), Lightning and Earthing.

**1.3 Terminologies Transmission and Distribution Line**

Overhead transmission / distribution lines, Underground transmission lines, Service lines, Overhead distribution board connections, Pole height, Ground clearance, House wiring and Bulb.

2. Interpret order slip and maintenance slip.
3. Interpret equipment manual.
4. Interpret operation manual.

**Module Code: M 0**  
***Sub module Code: SM 0.3***  
**Sub module: Applied Mathematics**

**Description**

This module is designed to equip trainees with the knowledge and skills on Applied Mathematics as a sub module for mastering any specialized module/s. This sub module deals with mathematical skills such as unit conversion, fraction, measurement, simple geometric concept, volume and quantity calculation, cost calculation as well as other calculations related to their occupation.

**Prerequisite:** Nil

**Duration:** 40 hours

**Competencies**

1. Review basic mathematical calculations
2. Convert unit of measurement from one system to another system
3. Measure length, breadth and height of the object /geometrical figure
4. Calculate perimeter of the geometrical figures (triangle, square, rectangle, circle, polygon)
5. Calculate area (rectangle, circle, trapezoid, triangle etc)
6. Measure mass/density/weight/capacity/Volume of solid and liquid
7. State ratio and proportion
8. Calculate the quantity of materials required
9. Measure the quantity of work performed
10. Calculate the total cost of work performed
11. Calculate loss, profit and simple interests
12. Apply simple unitary rule.

**Module Code: M 0**  
***Sub module Code: SM 0.4***  
**Sub module: Applied Drawing**

**Description**

This module is designed to equip trainees with the skills and knowledge on Applied Drawing as a basic module related to the occupation. This module intends to provide skills on interpreting scale, symbols and sign convention, different lines and views. It also focuses on interpreting different views such as plan, elevation, section, isometric, orthographic and photographic.

**Prerequisite:** Nil

**Duration:** 50 hours (13 hours theory and 37 hours practical)

**Competencies**

1. State the concept of drawing.
2. Read / Interpret scale.
3. Apply/interpret different symbols and sign conventions (hatching) in the drawing.
4. Draw different types of lines.
5. Draw free hand sketches.
6. Draw lay-out diagram.
7. Draw wiring diagram.
8. Draw schematic drawing.
9. Draw connection diagram.
10. Interpret plan, elevation & section view.
11. Interpret isometric view.
12. Interpret 3 view drawing (front, side and top).
13. Interpret photographic view.

**Module Code: M 0**  
***Sub module Code: SM 0.5***  
**Sub module: Bench Work**

**Description**

This module is designed to equip trainees with the knowledge and skills on Bench Work as a sub module for mastering any specialized module/s. This sub module especially, intends to provide skills and knowledge on mechanical and electrical bench work related to the occupation.

**Prerequisite:** Nil

**Duration:** 80 hours (16 hours theory and 64 hours practical)

**Competencies**

1. Orient with safety rules
2. Measure/mark/file/saw work piece
3. Drill a hole
4. Measure the dimension using Vernier Caliper
5. Measure angular surface using Bevel Protractor
6. Countersink on hole
7. Bend flat steel
8. Grind center punch
9. Grind flat chisel
10. Perform internal threads using hand taps
11. Perform external threads using threading dies
12. Perform cable/wire joint straight (straight, T- joint, married, brittania )
13. Make wire/cable eyelet.
14. Manufacture a C – clamp (*Project work*).



## Task Analysis

### Task No. 1 Orient with safety rules.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
1. Define safety. 2. Enlist importance of safety precaution. 3. Enlist workshop hazards. 4. Enlist personal safety rules and regulations. 5. Enlist workshop safety rules and regulations.	<p><b><u>Condition (Given):</u></b></p> Class room OHP, transparency, white board and marker, handouts and safety poster.	<ul style="list-style-type: none"> <li>➤ Definition of safety</li> <li>➤ Importance of safety rules</li> <li>➤ Workshop hazards</li> <li>➤ Personal and workshop safety rules and regulations</li> </ul>
	<p><b><u>Task (What):</u></b></p> Orient with safety rules.	
	<p><b><u>Standard (How well):</u></b></p> Various safety rules and regulation oriented.	

**Tools/equipment:**

**Safety:**

## Task Analysis

**Task No: 2 Measure/mark/file/saw work piece.**

Performance Steps	Terminal Performance Objectives	Related Technical Knowledge
<p><b>1 Measurement:</b> 1.1 Measure the dimension. (Inch/centimeter, millimeter, meter)</p> <p><b>2. Marking:</b> 2.1 Measure the dimension as per drawing. 2.2 Mark the point by using scribe or pencil.</p> <p><b>3. Filing</b> 3.1 Read drawing 3.2 Measure the work piece by using scale. 3.3 clamp work piece on the vice. 3.4 File the work piece using appropriate file. 3.5 Check filing surface level and perpendicular using by back square. 3.6 Measure the final dimension. 3.7 Clean work place.</p> <p><b>4. Sawing:</b> 4.1 Mark on the work piece as per drawing. 4.2 Clamp the work piece on the bench vice. 4.3 Collect and fix hacksaw blade on hacksaw. 4.4 Saw on the work piece. 4.5 Apply coolant.</p>	<p><b><u>Condition (Given):</u></b></p> <p>Measuring tape, marking scribe, file, hammer, work piece.</p> <p><b><u>Task (What):</u></b></p> <p>Measure/mark/file/saw work piece</p> <p><b><u>Standard (How well):</u></b></p> <p>Work piece measured. Work piece filed. Right angle maintained. Straight sawn</p>	<ul style="list-style-type: none"> <li>➤ Measurement system</li> <li>➤ Conversion of units</li> <li>➤ Marking system</li> <li>➤ Method of filing</li> <li>➤ Method of sawing</li> <li>➤ Identification of tools</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

**Tools/equipment:**

Marking scribe/Measuring tape/File/Hack saw frame/, Steel scale/Bench vice

**Safety:**

- Fix the saw blade properly
- Clamp the work piece properly.
- Apply coolant while sawing.
- Reduced pressure on saw just before the separation.

## Task Analysis

### Task No: 3 Drill a hole.

Performance Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain drawing.</li> <li>2. Obtain required tools and equipment.</li> <li>3. Obtain finished work piece.</li> <li>4. Mark layout line on the work piece.</li> <li>5. Punch the center.</li> <li>6. Clamp the work piece on the machine vice.</li> <li>7. Mount the required drill bit on drill chuck.</li> <li>8. Set up R.P.M. as per drill bit size.</li> <li>9. Set coolant-housing pipe.</li> <li>10. Start the machine &amp; give hand feed.</li> <li>11. Drill until obtaining required depth.</li> <li>12. Stop the machine.</li> <li>13. Remove the work piece from vice &amp; clean it.</li> <li>14. Measure the center &amp; the hole size according to the drawing.</li> <li>15. Remove the drill bit &amp; clean tools &amp; working place.</li> </ol>	<p><b><u>Condition (Given):</u></b> Well equipped workshop, drill machine, drill bit set, refinished work piece, steel rule, scribe, center punch, hammer, safety goggles coolant.</p> <p><b><u>Task (What):</u></b> Drill a hole.</p> <p><b><u>Standard (How Well):</u></b> Work piece clamping checked. Drill bit mounting checked. Selection of R.P.M. checked. Accuracy &amp; finishing of dimension checked.</p>	<ul style="list-style-type: none"> <li>➤ Importance of drill machine</li> <li>➤ Types of drill machine.</li> <li>➤ Drill bits &amp; its types.</li> <li>➤ Importance of speed feed R.P.M.</li> <li>➤ Calculation of R.P.M.</li> <li>➤ Procedure</li> <li>➤ Safety precautions</li> </ul>

#### Tools/equipment:

#### Safety:

- Tighten the work piece perfectly.
- Check drill bit cutting edge before drilling
- Use safety goggles.
- Never use very loose cloth, tie, chain etc.
- Use clan brush to clean the chips.
- Follow general safety rules.

## Task Analysis

### Task No: 4 Measure the dimension using vernier caliper.

Performance Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain pre machined W/P.</li> <li>2. Obtain vernier caliper.</li> <li>3. Clean the caliper &amp; check that the caliper reads correctly.</li> <li>4. Clean the work pieces &amp; remove burrs.</li> <li>5. Measure outside dimension.</li> <li>6. Set the outside measuring jaw to a dimension larger than that to be measured.</li> <li>7. Place the work piece between the two jaws.</li> <li>8. Move the sliding jaw so that the caliper grips the W/P.</li> <li>9. Make sure that the jaws are in full contact with W/P.</li> <li>10. Read the number of millimeters on the main scale, which show in front of the zero of the vernier scale.</li> <li>11. Read the tenths of mm (0.1) or twentieths (0.05) on the vernier scale.</li> <li>12. Add together both reading</li> <li>13. Measure inside dimension.</li> <li>14. Set the inside measuring jaws of the caliper to a dimension smaller than the dimension be measured.</li> <li>15. Place the jaws against the W/P.</li> <li>16. Move the sliding jaw so that the caliper grafts the work piece.</li> <li>17. Read the measurement as the outside dimension.</li> </ol>	<p><b><u>Condition (Given):</u></b> Vernier caliper work piece with well-equipped fitter shop.</p> <p><b><u>Task (What):</u></b> Measure the dimension using vernier caliper.</p> <p><b><u>Standard (How Well):</u></b> Outside &amp; inside dimensions measured.</p>	<ul style="list-style-type: none"> <li>➤ Introduction &amp; Features of vernier caliper.</li> <li>➤ Reading scale &amp; uses of vernier caliper.</li> <li>➤ Least count &amp; care of vernier caliper</li> <li>➤ Procedure</li> <li>➤ Safety precautions</li> </ul>

#### Tools/equipment

#### Safety:

- Clean the W/P & vernier caliper before use.
- Use vernier caliper only for measuring.
- Clean the vernier caliper after use & store it safely.

## Task Analysis

### Task 5: Measure angular surface using bevel protractor.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain pre-machined work-piece material.</li> <li>2. Obtain Bevel protractor.</li> <li>3. Set the angle that has to be measure.</li> <li>3. Hold the work-piece in one hand and place the bevel of the protractor against the adjacent surface.</li> <li>4. Slide the bevel down the vertical surface until the protractor blade touches the angular surface.</li> <li>5. Position the work so that a bright light, such as a window or an electric light, is behind the work-piece.</li> <li>6. Look at between work-piece and protractor to see if any light shows between the blade and the work-piece. If no light can be seen, the surfaces of the work-piece are at required angle.</li> <li>8. Wipe the Bevel protractor clean and put it in its storing place.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Bevel protractor with fully equipped mechanical workshop.</p> <p><b><u>Tasks (What):</u></b></p> <p>Measure angular surface using bevel protractor.</p> <p><b><u>Standards(How well):</u></b></p> <p>Work-piece rechecked. Angle on Bevel protractor set.</p>	<ul style="list-style-type: none"> <li>➤ Introduction of bevel protractor</li> <li>➤ Types of protractor</li> <li>➤ Uses of bevel protractor</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

#### Safety:

- Clean the W/P & bevel protractor before use.
- Use bevel protractor only for measuring.
- Clean the bevel protractor after use & store it safely.

## Task Analysis

### Task 6: Countersink on hole.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain workshop drawing.</li> <li>2. Obtain previously drilled work-piece material</li> <li>3. Obtain countersink as per required size.</li> <li>4. Mount the same size of twist drill on drill spindle or drill chuck.</li> <li>5. Clamp the work-piece in drill vice or hold by hand placing at the machine table.</li> <li>6. Align the center of machine spindle with the drilled hole to cut uniform angle.</li> <li>7. Change countersink on machine spindle.</li> <li>8. Set up RPM.</li> <li>9. Start the machine.</li> <li>10. Check the alignment giving feed by hand.</li> <li>11. Re-align if necessary.</li> <li>12. Give feed as per depth required.</li> <li>13. Stop the machine.</li> <li>14. Remove work-piece</li> <li>15. Chamfer if necessary.</li> <li>16. Check the final measurement.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Drill machine with fully equipped workshop.</p> <p><b><u>Tasks (What):</u></b></p> <p>Countersunk a hole.</p> <p><b><u>Standards(How well):</u></b></p> <p>Work-piece clamped. RPM setting checked. Uniform angle of countersink checked</p>	<ul style="list-style-type: none"> <li>➤ Introduction to Countersink</li> <li>➤ Uses of countersink</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

#### Safety:

- Avoid cleaning chips by blowing or bare hand.
- Check the countersink that it is blunt or not.
- Use Drift to remove taper shank from drill spindle.
- Refer also the safety precautions of Task Drill a hole.

## Task Analysis

### Task: 7 Bend flat steel.

Performance Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the required drawing.</li> <li>2. Study the drawing carefully.</li> <li>3. Obtain the required tools.</li> <li>4. Obtain the required work piece (PVC/metal pipe).</li> <li>5. Mark centre and bending area according to the drawing.</li> <li>6. Clamp pipe on near centre on pipe vices firmly.</li> <li>7. Hold the pipe vices handle in correct position.</li> <li>8. Bend pipe slowly on the according bending degree.</li> <li>9. Restore the tools/materials.</li> <li>10. Clean the work area.</li> </ol>	<p><b><u>Condition (Given):-</u></b></p> <p>Workshop Work piece Drawing</p> <p><b><u>Task (What):-</u></b></p> <p>Bend flat steel.</p> <p><b><u>Standard (How well):-</u></b></p> <p>Pipe bended on right degree Measurement Performed Performed Centre of bending performed.</p>	<ul style="list-style-type: none"> <li>➤ Introduction to bending and bending types</li> <li>➤ Procedure</li> <li>➤ Safety precautions</li> </ul>

**Tools /Equipment:**

Steel scale, scribe, pipe vice, divider.

**Safety:**

- Don't apply too much pressure while bending, do slowly.

## Task Analysis

### Task 8 : Grind center punch.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain Bench or Pedestrian grinding machine.</li> <li>2. Obtain blunt center punch.</li> <li>3. Obtain Safety goggles, Bevel protractor or grinding gauge.</li> <li>4. Check the grinding wheel abrasive type, trueness of wheel and cracks.</li> <li>5. Dress the wheel, if necessary.</li> <li>6. Check the tool-rest, set up if necessary.</li> <li>7. Hold center punch left hand side pointing the tip towards wheel.</li> <li>8. Wear safety goggles</li> <li>9. Run the machine.</li> <li>10. Touch the angular part of tip on face of wheel, holding left hand side so that it can be turn freely by right hand side.</li> <li>11. Give feeding slightly rotating the punch.</li> <li>12. Check the angle with gauge or Bevel protractor.</li> <li>13. Repeat the grinding until desired angle and sharpened tip obtained.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Bench or Pedestrian grinding machine, with fully equipped workshop.</p> <p><b><u>Tasks (What):</u></b></p> <p>Grind center punch.</p> <p><b><u>Standards(How well):</u></b></p> <p>Punch holding checked            Wheel dressing checked.            Grinding process checked.            Tip angle checked.</p>	<ul style="list-style-type: none"> <li>➤ Introduction of center punch</li> <li>➤ Uses of center punch.</li> <li>➤ Procedure</li> <li>➤ Safety precautions</li> </ul>

#### Safety:

- Make sure the grinding wheel guards are in place.
- Always wear safety goggles.
- Avoid working on grinding wheels which are loaded or glazed.
- It is dangerous to working cracked or improperly balanced wheels.
- Adjust the tool-rest as close to the wheels as possible. The maximum recommended gap is 2mm.
- Small jobs should be held with pliers or other suitable tools.
- Never holds jobs with cotton waste or similar materials.
- Use gloves while grinding heavy jobs.



## Task Analysis

### Task 9 : Grind flat chisel.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain Bench or Pedestrian grinding machine.</li> <li>2. Obtain blunt Flat chisel.</li> <li>3. Obtain Safety goggles, Bevel protractor or grinding gauge.</li> <li>4. Check the grinding wheel abrasive type, trueness of wheel and cracks.</li> <li>5. Dress the wheel, if necessary.</li> <li>6. Set up tool-rest if necessary.</li> <li>7. Hold Flat chisel by both hand pointing the tip towards wheel.</li> <li>8. Wear safety goggles</li> <li>9. Run the machine.</li> <li>10. Position the angular part of tip up ward on face of wheel, fronting left hand side so that it can be move freely by right hand side.</li> <li>11. Give feeding slightly moving across the full face.</li> <li>12. Check the angle with gauge or Bevel protractor.</li> <li>13. Repeat the grinding until desired angle and sharpened tip obtained.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Bench or Pedestrian grinding machine, with fully equipped workshop.</p> <p><b><u>Tasks (What):</u></b></p> <p>Grind flat chisel.</p> <p><b><u>Standards(How well):</u></b></p> <p>Chisel holding checked</p> <p>Grinding process checked.</p> <p>Tip angle checked.</p>	<ul style="list-style-type: none"> <li>➤ Introduction of chisels</li> <li>➤ Uses of chisels</li> <li>➤ Procedure</li> <li>➤ Safety precautions</li> </ul>

#### Safety:

- Move the work across the full face of the wheel to prevent uneven wearing off of the grinding wheel.
- Refer the same safety precautions of the task grind center punch.

## Task Analysis

### Task 10: Perform internal threads using hand taps.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain workshop drawing.</li> <li>2. Obtain pre-machined work material.</li> <li>3. Obtain drill size for internal thread.</li> <li>4. Obtain sets of taps and tap handle.</li> <li>5. Mark the piece using height gauge.</li> <li>6. Punch on center to drill hole.</li> <li>7. Clamp the work-piece on drill vice.</li> <li>8. Drill a hole as for internal thread.</li> <li>9. Chamfer a hole.</li> <li>10. Remove &amp; re-clamp the work-piece on Bench vice in horizontal position, slightly above the vice jaws.</li> <li>12. Fix the first tap in the tap handle.</li> <li>13. Position in the chamfered hole.</li> <li>14. Hold tap handle close to the center.</li> <li>15. Exert steady downward pressure &amp; turn the tap handle slowly in a clock wise direction to start the thread.</li> <li>16. Ensure the thread start, check the tap alignment removing tap handle.</li> <li>17. Check the alignment placing Back square in 2 position 90° to each other.</li> <li>18. Make correction if necessary, exerting slightly more pressure on the opposite side of the tap inclination.</li> <li>19. Fit the tap handle, without disturbing the tap alignment.</li> <li>20. Make 1-2 turn &amp; check the alignment.</li> <li>21. Turn the tap handle lightly without exerting any downward pressure.</li> <li>22. Turn backward about quarter turn.</li> <li>23. Cut continue, turning backward frequently about every quarter turn.</li> <li>24. Cut the thread until the tap is fully inside the hole being threaded.</li> <li>25. Finish &amp; clean up with intermediate &amp; plug tap following the step 21 to 25.</li> <li>26. Remove the chips from the thread</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Drill machine, Working Bench, Bench vice with fully equipped workshop.</p> <p><b><u>Tasks (What):</u></b></p> <p>Perform internal thread using hand taps.</p> <p><b><u>Standards (How well):</u></b></p> <p>Tap alignment checked. Tap turn backward after every quarter turn checked.</p>	<ul style="list-style-type: none"> <li>➤ Introduction of taps</li> <li>➤ Types of taps</li> <li>➤ Procedure</li> <li>➤ Safety precautions</li> </ul>

**Safety:**

- Use a cutting fluid while cutting the thread.
- Avoid apply side pressure without giving a turning motion to the tap.
- The tap alignment should be corrected within the first few turns. Afterwards this cannot be done for the threads will break.

## Task Analysis

### Task 11: Perform external thread using threading dies.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain workshop drawing.</li> <li>2. Obtain workshop material.</li> <li>3. Obtain sets of Sets of files</li> <li>4. Obtain Hole gauge, Caliper, Threading die and Die handle and Check nut.</li> <li>5. Mark square at the end face as per thread diameter.</li> <li>6. File out rough, following the same steps of Filing square block.</li> <li>7. File round bar for blank size, following the steps of file external radius.</li> <li>8. Check the blank size with hole gauge.</li> <li>9. Re-file if necessary until the blank diameter obtain.</li> <li>10. Chamfer at the end of the blank 45°.</li> <li>11. Fix the Die in the Die handle.</li> <li>12. Re-clamp the work-piece on vice projecting the blank above the vice just the required thread length.</li> <li>13. Place the leading side of the die on the chamfer of the work-piece.</li> <li>14. Make sure that the die is fully open by tightening the center screw.</li> <li>15. Hold die handle close to the center.</li> <li>16. Apply pressure on dia handle evenly &amp; turn in a clockwise direction to advance the die on the bolt blank</li> <li>17. Ensure the thread start, reverse frequently about every quarter turn.</li> <li>18. Cut the thread until the die is fully down the length to be threaded.</li> <li>19. Increase the depth of cut gradually by adjusting the outer screws.</li> <li>20. Check the thread with check nut.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Sets of thread cutting dies, Die stock, working bench and Bench vice with fully equipped workshop.</p> <p><b><u>Tasks (What):</u></b></p> <p>Perform external thread using threading dies.</p> <p><b><u>Standards(How well):</u></b></p> <p>Blank size checked.</p> <p>Chamfer made at the end of the rod checked.</p> <p>Selection of the die and die handle checked.</p> <p>Die on die handle set.</p> <p>Die reversed after every quarter turn checked.</p>	<ul style="list-style-type: none"> <li>➤ Introduction of threading dies and die handle</li> <li>➤ Identification of blank size</li> <li>➤ Procedure</li> <li>➤ Safety precautions</li> </ul>

#### Safety:

- Screws on the die handle should be checked before starting to cut thread.
- Too much depth of cut at one time will spoil the threads. It can also spoil the die.
- Clean the die frequently to prevent the chips from clogging and spoiling the thread.
- Keep the die handle in right angle with the blank size.

## Task Analysis

**Task: 12 Perform cable/wire Joint (straight, T- joint, married, brittania ).**

Performance Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the required drawing.</li> <li>2. Study the drawing.</li> <li>3. Obtain the required tools.</li> <li>4. Obtain the required wire/cable piece.</li> <li>5. Measure and mark the wire/cable piece according to the drawing.</li> <li>6. Cut the insulation of wire/cable by electrification knife/cutting pliers/wire stripper.</li> <li>7. Remove the insulation of wire/cable by pliers/wire stripper.</li> <li>8. Over lap the stripping parts of wire/cable each other.</li> <li>9. Twist the wire/cable each other slowly and carefully by pliers.</li> <li>10. Restore the tools/material.</li> <li>11. Clean the work place.</li> </ol>	<p><b><u>Condition (Given):-</u></b></p> <p>Workshop Drawing Wire/cable</p> <p><b><u>Task (What):-</u></b></p> <p>Perform cable/wire Joint (straight, T- Joint, married, brittania).</p> <p><b><u>Standard (How well):-</u></b></p> <p>Cable jointed Measurement performed.</p>	<ul style="list-style-type: none"> <li>➤ Introduction to wire/cable joint</li> <li>➤ Types of joint</li> <li>➤ Measured of joint</li> <li>➤ Technique of insulation remove from wire/cable</li> <li>➤ Safety precautions</li> </ul>

**Tools /Equipment:**

**Safety:**

- Don't scratch on wire

## Task Analysis

### Task: 13 Make wire/cable eyelet.

Performance Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the required drawing.</li> <li>2. Study the drawing carefully.</li> <li>3. Obtain the required tools.</li> <li>4. Obtain the required work piece wire/cable.</li> <li>5. Mark the wire/cable piece according to the drawing measurement.</li> <li>6. Cut the insulation of mark wire/cable by knife/cutting pliers/wire stripper.</li> <li>7. Remove the insulation of wire/cable by pliers/wire stripper.</li> <li>8. Twist the stripping parts of wire/cable by long nose pliers carefully.</li> <li>9. Check the eyelet hole inserting screw.</li> <li>10. Restore the tools/material.</li> <li>11. Clean the work place.</li> </ol>	<p><b><u>Condition (Given):-</u></b></p> <p>Workshop Work piece (wire/cable) Drawing</p> <p><b><u>Task (What):-</u></b></p> <p>Make wire/cable eyelet.</p> <p><b><u>Standard (How well):-</u></b></p> <p>Wire/cable eyelet made.</p>	<ul style="list-style-type: none"> <li>➤ Introduction to eyelet and it's uses</li> <li>➤ Method of twisting</li> <li>➤ Safety precautions</li> </ul>

**Tools /Equipment:**

**Safety:**

- Don't scathe on wire, do slowly.

## Task Analysis

### Task 14 Manufacture a C – Clamp (*Project work*)

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain workshop drawing</li> <li>2. Obtain work piece material</li> <li>3. Check rough dimension and file out one side (marrow) plane as a reference plane</li> <li>4. Mark a layout for necessary dimension to saw</li> <li>5. Punch dots on marking lines</li> <li>6. Drill holes to get internal radius R7mm</li> <li>7. Drill chain holes to cut out unnecessary metal</li> <li>8. Remove stock material by chiseling the webs</li> <li>9. Maintain the thickness of 15mm with correct flatness and square ness in geometrical tolerances</li> <li>10. Drill a hole Ø8,5mm for M10 thread</li> <li>11. Make diamond surface on the drill surface</li> <li>12. Make radius of R12 and R7.5 on two corners as per given drawing</li> <li>13. Chamfer and finish the work piece</li> <li>14. Check final measurements</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Venire caliper with fully equipped mechanical workshop.</p> <p><b><u>Tasks (What):</u></b></p> <p>Manufacture a C - clamp</p> <p><b><u>Standards(How well):</u></b></p> <p>Marking layout line checked            Chain drilling checked            Flatness and square ness checked            Straightness of M10 thread checked            Dimensions in tolerances checked</p>	<ul style="list-style-type: none"> <li>➤ Introduction to C-clamp</li> <li>➤ Manufacturing procedure</li> <li>➤ Safety precaution</li> </ul>

**Safety:**

- Refer the tasks drilling, sawing, thread cutting.

## **Module Code: M1**

# **Module: Basic Civil Works**

### **Description**

This module is designed to equip trainees with the knowledge and skills on various civil works and components of micro hydro technology as a specialized module. This course especially, deals with preparing cement mixture, lay plaster, build masonry wall, fill gabion box and joining of different pipes.

### **Aim**

This module aims to equip trainees with knowledge and skills on various civil works related with micro hydro and its technology.

### **Objectives**

After completion of this module the trainees will be able to:

1. Prepare cement mixture.
2. Lay plaster.
3. Build masonry wall.
4. Align/fill gabion box.
5. Join HDPE pipes.

**Prerequisite:** Basic module completed

**Duration:** 50 hours (10 hours theory and 40 hours practical)

### **Competencies**

- ❖ Prepare cement mortar.
- ❖ Prepare cement concrete.
- ❖ Lay/Apply concrete or plaster.
- ❖ Build stone masonry wall.
- ❖ Fill/ align gabion box.
- ❖ Join HDPE pipes.

## Task Analysis

### Task No: 1 Prepare cement mortar.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools and equipment.</li> <li>3. Collect cement, sand and water</li> <li>4. Finalize mixing ratio</li> <li>5. Choose appropriate weighing equipments</li> <li>6. Mix proportionately in a watertight platform</li> <li>7. Apply cement mortar in specified purposes.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At site</b></p> <p>Cement, sand and water  Mixer, Weighing machine, watertight platform</p> <p><b><u>Task (What):</u></b></p> <p>Prepare cement mortar.</p> <p><b><u>Standard (How Well):</u></b></p> <p>Mixing ratio for maintained  1:4 cement mortars maintained for all masonry works in contact with flowing water.  1:6 cement mortars maintained for all masonry works not in contact with flowing water.  Neutral water maintained.  Sand particle size of 4 mm maintained.</p>	<ul style="list-style-type: none"> <li>➤ Importance of cement mortar</li> <li>➤ Definition of cement mortar</li> <li>➤ Water cement ratio</li> <li>➤ Calculation of mixing ratio</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>



## Task Analysis

### Task No: 2 Prepare cement concrete.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools and equipment.</li> <li>3. Collect cement, sand, aggregate and water</li> <li>4. Determine the proportion of fine and coarse aggregate, sand, cement and water.</li> <li>5. Choose appropriate weighing equipments</li> <li>6. Determine the quantities of fine and coarse aggregates and sand by weight</li> <li>7. Measure the water quantity accurately after giving proper allowance for surface water present in the aggregates</li> <li>8. Use mechanical mixer (if possible) for mixing.</li> <li>9. Use watertight platform, if hand mixing is used</li> <li>10. Do not pour water into the drum of the mixture until all the cement and aggregates are mixed for at least one minute</li> <li>11. Continue mixing until there is uniformity in color and consistency.</li> <li>12. Clean mixer or platform thoroughly when the next mixing commences.</li> <li>13. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At site</b>            Cement, sand, aggregate and water, Mixer, Water tight plate form, Weighing machine</p> <p><b><u>Task (What):</u></b>            Prepare cement concrete.</p> <p><b><u>Standard (How Well):</u></b>            Mixing ratio well maintained            Concrete mixture for structural concrete (C20 to C25) of 1:2:3, i.e., 1part cement, 2parts sand (&lt;5mm grain size) and 3parts of gravel (&lt;40mm grain size).            Maintained            Concrete mixture for other works of 1:3:5 or better with up to 40% plums (stones &lt;300mm diameter or 1/3 of least dimension to be concreted).</p>	<ul style="list-style-type: none"> <li>➤ Importance of cement concrete</li> <li>➤ Definition of cement concrete</li> <li>➤ Water cement ratio</li> <li>➤ Calculation of mixing ratio</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

**TaskNo: 3 Lay/apply concrete.**

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools and equipment.</li> <li>3. Place concrete as nearly as possible in its final position.</li> <li>4. Avoid segregation of the concrete and displacement of the reinforcement, other embedded items or formwork.</li> <li>5. Remove all shavings, dirt and water that are collected at the bottom before concrete is placed</li> <li>6. Start placing at the lower end of the surface to avoid decompaction of concrete on a horizontal surface.</li> <li>7. Do not place concrete during rain</li> <li>8. Do not disturb the surface, after the concrete has been placed.</li> <li>9. Compact (if possible by vibrator) the surface to a maximum subsidence without segregation.</li> <li>10. Cure all concrete for 7 days immediately after placement or until covered by further concrete whichever is shorter.</li> <li>11. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p><b>At site</b> Cement, sand, aggregate and water Mixer, Weighing machine, Watertight platform</p> <p><b><u>Task (What):</u></b></p> <p>Lay/Apply concrete.</p> <p><b><u>Standard (How Well):</u></b></p> <p>Mixing ratio well maintained concrete mixture for Structural concrete (C20 to C25) shall be 1:2:3, i.e., 1part cement, 2parts sand (&lt;5mm grain size) and 3parts of gravel (&lt;40mm grain size). Maintained.</p> <p>Concrete mixture for other works shall be 1:3:5 or better with up to 40% plums (stones &lt;300mm diameter or 1/3 of least dimension to be concreted).</p> <p>Compressive strength maintained.</p>	<ul style="list-style-type: none"> <li>➤ Importance of concrete laying</li> <li>➤ Process of handling technique</li> <li>➤ Calculation of mixing ratio</li> <li>➤ Strength of concrete</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 4 Build stone masonry wall.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools and equipment.</li> <li>3. Collect clean, hard, unweathered stone</li> <li>4. Prepare foundation-surface by laying large selected stones with bound stones with their largest dimension in the horizontal plane</li> <li>5. Fill spaces between large stones with spalls.</li> <li>6. Prepare cement mortar as mentioned in earlier section</li> <li>7. Chisel and hammer the bond stones</li> <li>8. Clean exposed stones on faces by wire brushing</li> <li>9. Flush point the mortar</li> <li>10. Provide weep holes as per drawing to drive moisture/water form the back filling.</li> <li>11. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At site</b>            Cement, sand, aggregate and water Mixer, Weighing machine, Watertight platform, Stones, Hammer, Chisel</p> <p><b><u>Task (What):</u></b>            Build stone masonry.</p> <p><b><u>Standard (How Well):</u></b>            length of any stone not exceeded three times its height and breadth not exceed 150mm of greater than three ¾ th of thickness of the wall. Crushing strength of stones maintained. Permissible tensile and shear stresses maintained.</p>	<ul style="list-style-type: none"> <li>➤ Importance of stone masonry</li> <li>➤ Types of stone masonry</li> <li>➤ Requirement of good stones</li> <li>➤ Process of handling technique</li> <li>➤ Calculation of mixing ratio</li> <li>➤ Concept of tensile and shear strength</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 5 Fill/ align gabion box.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools and equipment.</li> <li>3. Collect clean, hard, sound, unweathered stones and angular rock fragments or boulders</li> <li>4. Place the crates, stretch to their full dimension and securely peg to the ground or wired to adjacent gabions before filling</li> <li>5. Anchor gabions at one end or side and stretch from the opposite end or side by inserting temporary bars and levering them forward,</li> <li>6. Stretch the top and bottom by tensioning with tie wires attached to an anchorage.</li> <li>7. Place individual stones into the gabion by hand in courses in such a manner that the stones are bedded on each other and bonded as in dry random rubble masonry.</li> <li>8. Fill all 1m deep gabions three equal layers and 0.5m deep gabions in two equal layers.</li> <li>9. Space bracing wires horizontally along and across the gabions.</li> <li>10. Fix the ties to the bottom of the units prior to filling.</li> <li>11. Over filled the gabion boxes and mattress compartments by 50mm above their tops to allow for subsequent settlement.</li> <li>12. Stretch the lids to fit the sides exactly by means of a suitable tool</li> <li>13. Secure corners temporarily.</li> <li>14. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At site</b>            Cement, sand, aggregate and water Mixer, Weighing machine, Watertight platform, Stones, Hammer, Chisel</p> <p><b><u>Task (What):</u></b>            Fill/align gabion box</p> <p><b><u>Standard (How Well):</u></b>            Length of any stone not exceeded three times its height and breadth not exceeded 150mm of greater than three <math>\frac{3}{4}</math> th of thickness of the wall            The specialized gravity of the stone not less than 2.50 and the stones not absorbed water more than 5 percent when tested as per IS:1124.            The vertical corners kept square and to full dimension by inserting a steel bar of at least 20 mm diameter at each vertical corner, maintained it in the correct final position throughout the filling process, and removing it when the crate is full.            Bracing wires spaced horizontally along and across the gabions at distances not greater than 0.33m            The gabion wire tested for mass, uniformity and adhesion of zinc coating and tensile strength of the wire itself</p>	<ul style="list-style-type: none"> <li>➤ Importance of gabion filling</li> <li>➤ Process of filling technique</li> <li>➤ Calculation of quantity of stone to be filled</li> <li>➤ Idea of gravitational force</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 6 Join HDPE pipes.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction</li> <li>2. Collect materials</li> <li>3. Heat hot plate with burner or use electrical heating plate.</li> <li>4. Cover hot plate with Teflon paper.</li> <li>5. Mark with thermo chalk to know the heating temperature</li> <li>6. Put the pipes to be joined in two sides of the hot plate</li> <li>7. Join the pipe as per the instruction.</li> <li>8. Check if any leakage.</li> </ol>	<p><b><u>Condition(Given):</u></b> Hot plate, Burner, Teflon paper, Thermo chalk Layout drawings, Excavation tool, Hammer, Chisel, Field</p> <p><b><u>Task (What):</u></b> Join HDPE pipes</p> <p><b><u>Standard (How Well):</u></b> Pipes are joint with minimum burr and no leakage from joints.</p>	<ul style="list-style-type: none"> <li>➤ Importance of pipe joints</li> <li>➤ Concepts on joining Techniques</li> <li>➤ Safety precaution</li> <li>➤ Concept on cutting techniques.</li> <li>➤ Concept on Safety precautions</li> </ul>

## Module Code: M 2

# Module: Basic Electrical Works

### Description

This module is designed to equip trainees with the knowledge and skills on various electrical works and components of micro hydro technology as a specialized module. This course especially, deals with concept of electricity, designing of house wiring, installation and designing of single phase and three phase wiring and installation of earthing system.

### Aim

This module aims to equip trainees with knowledge and skills on various electrical works related with micro hydro and its technology.

### Objectives

After completion of this module the trainees will be able to:

1. Interpretation concept of electricity
2. Design house wiring
3. Installation single phase & three phase wiring
4. Perform earthing

**Prerequisite:** Basic module completed

**Duration:** 200 hours

### Module Structure (M 2)

S.N.	Code	Sub-modules	Nature	Total hours	Full marks
1	SM 2.1	Concept of Electricity	T+P	200	200
2	SM 2.2	House Wiring System	T+P		
3	SM 2.3	Single-phase Wiring	T+P		
4	SM 2.4	Three-phase Wiring	T+P		
5	SM2.5	Earthing System	T+P		
<b>Total</b>				<b>200</b>	<b>200</b>

**Module Code: M2**  
***Sub module Code: SM2.1***  
**Sub module: Concept of Electricity**

**Description**

This course is designed to help trainees to provide Concept of Electricity on as a sub module. This sub module especially intends to provide knowledge on basic concept of electricity and provides knowledge and skills on operation of various electrical meters and identification of sign and symbols used in electrical system.

**Prerequisite:** Basic module completed

**Duration:** 40 hours (8 hours theory and 32 hours practical)

**Competencies**

- ❖ Explain basic concepts of electricity
- ❖ Operate Multi meter/ Voltmeter/Ammeter/Frequency meter/Wattmeter/PF meter / Energy meters.
- ❖ Identify symbols used in electrical system

## Task Analysis

### Task No: 1 Explain basic concept of Electricity.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Define electricity.</li> <li>2. Enlist importance of electricity.</li> <li>3. Enlist sources of electricity.</li> <li>4. Describe all the basic quantities.</li> <li>5. Derive the related units and equations</li> <li>6. Solve the numerical problems with the related units.</li> <li>7. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Books, handouts with some numerical with unit conversions and power equations.</p> <p><b><u>Task (What):</u></b> Explain resistance, voltage, current, frequency and power</p> <p><b><u>Standard (How Well):</u></b> The units are identified and well defined, numerical associated with the topics are solved.</p>	<ul style="list-style-type: none"> <li>➤ Definition of electricity</li> <li>➤ Importance of electricity</li> <li>➤ Principle of AC /DC, Single phase, three phase</li> <li>➤ Principle of ohms law and power and energy equations.</li> <li>➤ Definition of series and parallel resistance</li> <li>➤ Definition of Resistance, inductance, capacitance, voltage, Current, Frequency, and Power and energy</li> <li>➤ Concept of electrical units and notations.</li> </ul>



## Task Analysis

**Task No: 2 Operate Multi meter/  
Voltmeter/Ammeter/Frequency meter/Wattmeter/PF meter /  
Energy meters.**

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Study instruments catalogue carefully.</li> <li>3. Obtain required tools, equipment and materials.</li> <li>4. Connect to the load.</li> <li>5. Measure the electrical quantities.</li> <li>6. Record the readings with appropriate meters.</li> <li>7. Repeat the readings with different inputs.</li> <li>8. Recheck each reading with multimeters.</li> <li>9. Analyze the readings.</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Ammeters, Voltmeters, Frequency meters, Wattmeter, Energy meter, Multimeters, Catalogues and instruction manual, Practical Lab</p> <p><b><u>Task (What):</u></b> Operate Multi meter/ Voltmeter/ Ammeter/ Frequency meter/Wattmeter/PF meter Energy meters</p> <p>Measure resistance, voltage, current, frequency, power, power factors</p> <p><b><u>Standard (How Well):</u></b> All the meters identified. All the meters operated. The resistance, voltage, current, frequency, power, power factors are measured as per norms.</p>	<ul style="list-style-type: none"> <li>➤ Introduction of units and meter</li> <li>➤ Importance of meter</li> <li>➤ Calibration of setting</li> <li>➤ Handling precaution</li> <li>➤ Reading the output displayed by the specified meter</li> <li>➤ Analysis of reading</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 3 Interpret/sketch symbols used in electrical systems.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Study the symbols carefully.</li> <li>3. Obtain electrical template.</li> <li>4. Trace them into the drawings as per given instructions.</li> <li>5. Align if required.</li> <li>6. Decorate the symbol in front of the classroom.</li> <li>7. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Standardized drawings, drawings kits, drawing papers, Classroom.</p> <p><b><u>Task (What):</u></b> Interpret and sketch electrical symbols.</p> <p><b><u>Standard (How Well):</u></b> Standard electrical symbols interpreted and sketched.</p>	<ul style="list-style-type: none"> <li>➤ Concept of (AC and DC, types of system, and associated electronic components capacitor, inductor diode etc)</li> <li>➤ Importance of electrical systems</li> <li>➤ Symbols of accessories and fittings</li> <li>➤ Drawing interpretation</li> </ul>

**Module Code: M2**  
***Sub module Code: SM2.2***  
**Sub module: House Wiring System**

**Description**

This course is designed to help trainees to provide knowledge and skills on House Wiring System as a sub module. This sub module especially, intends to provide knowledge and skills on laying out dimension, estimating wiring materials and performing wiring.

**Prerequisite:** Basic module completed

**Duration:** 50 hours (10 hours theory and 40 hours practical)

**Competencies**

- ❖ Layout the dimension
- ❖ Estimate wiring material
- ❖ Perform wiring

## Task Analysis

### Task No: 1 Layout the dimension.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain drawing paper</li> <li>3. Fix into the drawing board</li> <li>4. Margin the drawing paper</li> <li>5. Align if required</li> <li>6. Trace the design as per instruction.</li> <li>7. Prepare the drawings with standard symbols and appropriate scales.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Drawing paper, drawing board, tape, scale, eraser, lid pencil, template, Class room,</p> <p><b><u>Task (What):</u></b> Layout the dimension</p> <p><b><u>Standard (How well):</u></b> The dimension laid out and drawing prepared with standard symbols and appropriate scales.</p>	<ul style="list-style-type: none"> <li>➤ Concept of various types of wirings</li> <li>➤ Types of diagram</li> <li>➤ Introduction of design and feature of drawings</li> <li>➤ Importance of drawings and scale</li> <li>➤ Definitions of technical terminology associated house wiring design</li> <li>➤ Interpretation of electrical wiring diagrams and symbols</li> </ul>

## Task Analysis

### Task No: 2 Estimate wiring materials.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools and equipment.</li> <li>3. Obtain required materials.</li> <li>4. Identify the items for wiring materials.</li> <li>5. Refer catalogue and depending upon the types of the wiring, select the appropriate wiring materials.</li> <li>6. Follow the layout design.</li> <li>7. Estimate the quantity of items from design.</li> <li>8. Prepare the bill of quantities and estimate the cost.</li> <li>9. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> P.V.C cables, switches, holders, MCB, wiring accessories etc, Catalogues, Class room</p> <p><b><u>Task (What):</u></b> Estimate of wiring materials</p> <p><b><u>Standard (How well):</u></b> Wiring materials selected of standard quality and appropriate ratings and bill of quantities is prepared.</p>	<ul style="list-style-type: none"> <li>➤ Technical specializations of cables, switch, bulbs, holders, MCB, fuses</li> <li>➤ Working principles, functions and types available standard ratings of wiring materials.</li> <li>➤ Calculation of current and power.</li> <li>➤ Familiarization with the market price</li> </ul>

## Task Analysis

### Task No: 3 Perform wiring on wooden board.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Draw the wiring.</li> <li>4. Mark on the board.</li> <li>5. Fix the items through the screws.</li> <li>6. Wires insert in respective position</li> <li>7. Insulate the connection.</li> <li>8. Verify the circuits.</li> <li>9. Supply electricity in the circuit.</li> <li>10. Test the performance.</li> <li>11. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Wooden ply board, wire, MCB, switch, bulb holder connection, screws, wiring electrical tools, insulation tape, junction box, listy Class room</p> <p><b><u>Task (What):</u></b> Perform wiring on wood board.</p> <p><b><u>Standard (How Well):</u></b> Wiring on wooden ply board performed and desired performance tested.</p>	<ul style="list-style-type: none"> <li>➤ Electrical wiring diagram and symbol</li> <li>➤ Technical terms associate the wiring</li> <li>➤ Working principles, functions and types of wiring</li> <li>➤ Methods of testing wire/bulb</li> <li>➤ Concept of electrical circuit testing procedure</li> <li>➤ Trouble shooting techniques</li> <li>➤ Safety precautions</li> </ul>

**Module Code: M2**  
***Sub module Code: SM2.3***  
**Sub module: Single-phase Wiring**

**Description**

This course is designed to help trainees to provide knowledge and skills on Single- phase Wiring as a sub module. This sub module especially, intends to provide knowledge and skills on the installation of main switch, junction box, one way two way switch, sockets and meter box as well as connection of wiring accessories.

**Prerequisite:** Basic module completed

**Duration:** 70 hours (14 hours theory and 56 hours practical)

**Competencies**

- ❖ Install main switch.
- ❖ Install junction box.
- ❖ Install one way, two-way switch.
- ❖ Install five pin /three pin/two pin socket.
- ❖ Connect electrical/ accessories.
- ❖ Install meter box (energy meters).

## Task Analysis

### Task No: 1 Install main switch.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Choose for ease access</li> <li>4. Install at well ventilated room and at dry place</li> <li>5. Erect at 1.25m above the floor level</li> <li>6. Connect to the incoming and outgoing conductor</li> <li>7. Outer casing be weather proof</li> <li>8. Give the supply, check for operation</li> <li>9. Clear identification of phase and neutral wire</li> <li>10. Incorporate danger notice plate for safety precaution.</li> <li>11. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Main switch, wiring layout drawings, wiring performing location.</p> <p><b><u>Task (What):</u></b> Test and install main switch</p> <p><b><u>Standard (How Well):</u></b> Main switch tested and installed as per requirements.</p>	<ul style="list-style-type: none"> <li>➤ Interpretation of service manuals</li> <li>➤ Technical specialization of main switch.</li> <li>➤ Operating principles, functions and types of main switch</li> <li>➤ Main switch testing process</li> <li>➤ Trouble shooting techniques</li> <li>➤ Safety precaution.</li> </ul>

## Task Analysis

### Task No: 2 Install one way switch/two way switch/ fuse indicator.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools and equipment.</li> <li>3. Obtain the materials as per appropriate ratings and size as specified in the design-drawing layout.</li> <li>4. Measure the dimension at place where it has to be fixed.</li> <li>5. Facilitate the casing capping listic</li> <li>6. Install fuse in the live line.</li> <li>7. Install indicator lamp.</li> <li>8. Connect bulb wired from switch and neutral.</li> </ol> <p><b><u>For two way switch</u></b></p> <ol style="list-style-type: none"> <li>9. Connect live wire in mid position of two way switch.</li> <li>10. Place the upper and lower point of both switch is in respective points.</li> <li>11. Connect the wire from mid position of two way switch to the bulb.</li> <li>12. Check the insulation and verify connections.</li> <li>13. Perform test.</li> <li>14. Record data.</li> </ol>	<p><b><u>Condition ( Given):</u></b> One way switch/two way switch/ fuse indicator, wiring layout diagram, Wiring location (field)</p> <p><b><u>Task (What):</u></b> Install ant test one way/ two way switch with fuse indicator</p> <p><b><u>Standard (How well):</u></b> The one way/ two way switch with fuse and indicators installed at appropriate place as required and tested.</p>	<ul style="list-style-type: none"> <li>➤ Importance and functions of switches</li> <li>➤ Properties and types of switches and fuses</li> <li>➤ Calculations of ratings.</li> <li>➤ Familiarization with electrical wiring diagram and symbols</li> <li>➤ Trouble shooting techniques</li> <li>➤ Safety precaution</li> </ul>



## Task Analysis

### Task No: 3 Install junction box.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools and equipment.</li> <li>3. Obtain the junction box.</li> <li>4. Read the layout drawing.</li> <li>5. Erect the junction box at appropriate position.</li> <li>6. Arrange distinctly the phase loop and neutral loop.</li> <li>7. Make earthing of the junction box if it is of metal.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Wires distribute through junction box, wiring layout, location for wiring</p> <p><b><u>Task (What):</u></b> Install junction box.</p> <p><b><u>Standard (How Well):</u></b> Junction box installed and common connection taken from junction box.</p>	<ul style="list-style-type: none"> <li>➤ Importance of Junction box</li> <li>➤ Familiarization with electrical wiring diagram and symbols</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 4 Install two pin/three pin /five pin socket.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Read the wiring layout and control diagram.</li> <li>4. Choose for ease access.</li> <li>5. Arrange the materials.</li> <li>6. Install at dry places.</li> <li>7. Connect the phase, neutral and earthed in specified point.</li> <li>8. Give the supply, check for operation.</li> <li>9. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Five pin /three pin/two pin sockets with accessories, wiring layout drawing, wiring location.</p> <p><b><u>Task(What):</u></b> Install two pin/three pin /five pin socket.</p> <p><b><u>Standard(How Well):</u></b> The various sockets are installed and connected in proper position as required.</p>	<ul style="list-style-type: none"> <li>➤ Importance and functions of five pin/three pin and two pin power sockets.</li> <li>➤ Ratings of various switches.</li> <li>➤ Identification of phase, neutral, earth and testing of connection</li> <li>➤ Familiarization with electrical wiring diagram and symbol</li> <li>➤ Trouble shooting techniques</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 5 Connect electrical/ accessories.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Arrange the required materials for connection.</li> <li>4. Screw the box, switch plate box.</li> <li>5. Use of drill machine for ease.</li> <li>6. Insulate the connection through insulation tape.</li> <li>7. Solder the connection.</li> <li>8. Adopt the standard practice.</li> <li>9. Test the connection to be assured.</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> MCB, Fuses and accessories, wiring layout, wiring location</p> <p><b><u>Task (What):</u></b> Connect the electrical/wiring accessories</p> <p><b><u>Standard (How Well):</u></b> The accessories are well connected as per standard practice.</p>	<ul style="list-style-type: none"> <li>➤ Importance and functions of MCB, fuses and various accessories.</li> <li>➤ Importance of users load demand</li> <li>➤ Ratings of various accessories.</li> <li>➤ Familiarization with electrical wiring diagram and symbol</li> <li>➤ Trouble shooting techniques</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 6 Install single phase energy meters.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Arrange the required materials for connection.</li> <li>4. Screw the box, switch plate box.</li> <li>5. Use of drill machine for ease.</li> <li>6. Insulate the connection through insulation tape.</li> <li>7. Solder the connection.</li> <li>8. Adopt the standard practice.</li> <li>9. Test the connection to be assured.</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Single-phase energy meters, wiring layout, wiring location.</p> <p><b><u>Task (What):</u></b> Install single phase energy meter</p> <p><b><u>Standard (How Well):</u></b> Single phase energy meter installed and tested.</p>	<ul style="list-style-type: none"> <li>➤ Operational principle of energy meters</li> <li>➤ Types and ratings of energy meters.</li> <li>➤ Familiarization with electrical wiring diagram and symbol</li> <li>➤ Trouble shooting techniques</li> <li>➤ Safety precaution</li> </ul>

**Module Code: M2**  
***Sub module Code: SM2.4***  
**Sub module: Three-phase Wiring**

**Description**

This course is designed to help trainees to provide knowledge and skills on Three-phase Wiring as a sub module. This sub module especially, intends to provide knowledge and skills on designing of three-phase wiring and installation of three phase wiring.

**Prerequisite:** Basic module completed

**Duration:** 20 hours (4 hours theory and 16 hours practical)

**Competencies**

- ❖ Design three-phase wiring.
- ❖ Install/control three phase wiring with control panel as per designed.

## Task Analysis

### Task No: 1 Design three-phase wiring.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Refer catalogue of different products of different company.</li> <li>4. Prepare layout drawing (Line/Control).</li> <li>5. Choose the proper specializations of the wiring materials.</li> <li>6. Estimate the wiring materials.</li> <li>7. Prepare bill of quantities and costing.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Drawing paper, standard manual, cable catalogues, wiring accessories catalogues, scale, pencil, eraser, calculator, template, class room</p> <p><b><u>Task (What):</u></b> Design three phase wiring.</p> <p><b><u>Standard (How):</u></b>  Three phase wiring designed, the layout drawing prepared.</p>	<ul style="list-style-type: none"> <li>➤ Concept of three phase wirings</li> <li>➤ Importance of color codes.</li> <li>➤ Concept of power cables, types and ratings</li> <li>➤ Calculation associated with three-phase power, current and power factor.</li> <li>➤ Importance of marking and layout</li> <li>➤ Concepts of types of customers and nature of load demand, cost benefit analysis,</li> <li>➤ Concepts of motor, DOL, forward, reverse, star/delta configuration</li> <li>➤ Definitions of Technical terms associated three phase system</li> <li>➤ Testing procedure of power circuit.</li> <li>➤ Trouble shooting techniques.</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 2 Install/control three phase wiring with control panel.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Fabricate/make panel board ready</li> <li>4. Read the design layout and the control diagram.</li> <li>5. Fix the listic /pipe as per ease</li> <li>6. Layout the cables of appropriate size and connect them accordingly as per design.</li> <li>7. Recheck the electrical system to conform.</li> <li>8. Check operation with supply.</li> <li>9. Switch on the switches to check the operation.</li> <li>10. Fix MCCB for safety.</li> <li>11. Perform earthing as per standard.</li> <li>12. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Workshop, 3 phase supply, panel board, associated equipments, cables, meters, wiring design layout, standard earthing, soldering items, screw drivers, crimp tools, clamp meters.</p> <p><b><u>Task (What):</u></b> Install/control three phase wiring with control panel.</p> <p><b><u>Standard (How well):</u></b> Three phase wiring performed as per design and drawing and performance tested.</p>	<ul style="list-style-type: none"> <li>➤ Electrical wiring diagram and symbols</li> <li>➤ Importance &amp; introduction of types and accessories associated with three phase electrical system and wiring</li> <li>➤ Description of technical terms associated with electrical systems</li> <li>➤ Electrical circuit testing procedure</li> <li>➤ Operating principles and functions of panel board, three phase energy meters, watt meters, soft starters</li> <li>➤ Calculation of power, current and power factor.</li> <li>➤ Safety precautions</li> </ul>

**Module Code: M2**  
***Sub module Code: SM2.5***  
**Sub module: Earthing System**

**Description**

This course is designed to help trainees to provide knowledge and skills on Earthing System as a sub module. This sub module especially, intends to provide knowledge and skills on performing of body earthing of the plant and equipments and appliances and performing system earthing.

**Prerequisite:** Basic module completed

**Duration:** 20 hours (4 hours theory and 16 hours practical)

**Competencies**

- ❖ Perform body earthing of the plant equipments and appliances.
- ❖ Perform system earthing (Neutral earthing).

## Task Analysis

### Task No: 1 Perform body earthing of the plant equipments and appliances.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Arrange the required materials</li> <li>4. Choose appropriate location for earthing</li> <li>5. Excavate the ground.</li> <li>6. Follow earthing procedure and standard.</li> <li>7. Connect to the earth wire to the plate with brass nut bolt.</li> <li>8. Lay the GI pipe for drain salt water.</li> <li>9. Measure the earth resistance.</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b> Metal enclosure, transformer, generator, panel board, earth electrode and wire, black coal, salt and copper plate, earthing location</p> <p><b><u>Task(What):</u></b> Perform body earthing of the plant equipments and appliances.</p> <p><b><u>Standard (How Well):</u></b> The metallic part of the equipment earthed properly and resistance measured ( resistance should be below 10 ohms)</p>	<ul style="list-style-type: none"> <li>➤ Definition of earthing.</li> <li>➤ Concepts on types of earthing</li> <li>➤ Concept on earthing procedure and earthing standards.</li> <li>➤ Measurement of earth resistance.</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 2 Perform systems earthing (Neutral earthing).

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Arrange the required materials</li> <li>4. Choose appropriate location for earthing.</li> <li>5. Excavate the ground.</li> <li>6. Follow earthing procedure and standard for neutral earthing.</li> <li>7. Connect to the earth wire to the plate with brass nut bolt.</li> <li>8. Lay the GI pipe for drain salt water.</li> <li>9. Measure the earth resistance.</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b> Transformer, generator, earth electrode and wire, black coal, salt and, earthing location</p> <p><b><u>Task(What):</u></b> Perform system earthing (Neutral earthing)</p> <p><b><u>Standard (How Well):</u></b> System earthing (Neutral earthing) performed as per requirements.</p>	<ul style="list-style-type: none"> <li>➤ Definition of earthing</li> <li>➤ Importance of system earthing</li> <li>➤ Types of earthing</li> <li>➤ Earthing procedure and earthing standards</li> <li>➤ Measurement of earth resistance</li> <li>➤ Concept of safety precautions</li> </ul>

## **Module Code: M3**

# **Module: Electro Mechanical Installation Works**

### **Description**

This module is designed to equip trainees with the knowledge and skills on Electro Mechanical Installation as a specialized module. This module intends to provide skill and knowledge on alignment and erection of base frame, installation of turbine & generators, alignment of pulley, belts & couplings, installation of ELC control panel and erection of ballast tank and heater.

### **Aim**

This module aims to equip trainees with knowledge and skills micro hydro necessary to be a micro hydro technician.

### **Objectives**

After completion of this module the trainees will be able to:

1. Align and erect base frame
2. Install turbine and generator
3. Align pulley, belts and couplings
4. Install ELC control panel
5. Erect ballast tank and ballast heater

**Prerequisite:** Basic module completed

**Duration:** 50 hours (10 hours theory and 40 hours practical)

### **Competencies**

- ❖ Align base frame
- ❖ Install turbine & generator
- ❖ Align pulley & belts
- ❖ Align couplings
- ❖ Install ELC control panel
- ❖ Erect ballast tank



## Task Analysis

### Task No: 1 Align and erect base frame.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Select the penstock route via fore bay.</li> <li>4. Excavate the ground for machine foundation.</li> <li>5. Place the wooden frame for foundations under the base frame</li> <li>6. Erect anchor rod as per given instructions</li> <li>7. Place the base frame in level</li> <li>8. Fill the concrete mixture</li> <li>9. Cure the structure for gaining strength.</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Base frame, spirit level, level pipe, thread, Power house detail layout drawings, measuring tape, wooden frame, anchor rod, Concrete mixture</p> <p><b><u>Task (What):</u></b> Align and erect base frame</p> <p><b><u>Standard (How Well):</u></b> Base frame erected properly as per given layout drawing</p>	<ul style="list-style-type: none"> <li>➤ Importance and purpose of base frame</li> <li>➤ Levelling of the base frame.</li> <li>➤ Measurement with spirit level, level pipes.</li> <li>➤ Interpretation of layout drawings</li> </ul>

## Task Analysis

### Task No: 2 Install turbines & generator.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Obtain the design drawing</li> <li>4. Layout the dimension as per drawing</li> <li>5. Assemble the turbine housing and its components</li> <li>6. Place the Generator on the base frame</li> <li>7. Fix it in the base frame as per given instruction</li> <li>8. Fix other accessories</li> <li>9. Check the alignment</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Founded Base frame, spirit level, level pipe, thread, measuring tape, wooden frame, Design layout of Turbine Generator set</p> <p><b><u>Task (What):</u></b> Install turbine &amp; generator</p> <p><b><u>Standard (How Well):</u></b> The turbine &amp; generator installed accurately.</p>	<ul style="list-style-type: none"> <li>➤ Importance and purpose of installing turbine &amp; generator</li> <li>➤ Familiarization with turbine and generator parts</li> <li>➤ Concept of drawing dimensions and angles</li> <li>➤ Assembling of turbine housing and various components</li> <li>➤ Concept of nut and bolt fixing</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 3 Align pulley and belts.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction.</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Insert pulley into the shaft of associated equipments and fix it as per given instruction.</li> <li>4. Observe the pulley through the key.</li> <li>5. Fit belts on the pulley</li> <li>6. Adjust belt tensioning</li> <li>7. Check the alignment and belt tension</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Pulleys, Belts, File (round &amp; flat), spirit level, level pipe, thread, measuring tape</p> <p><b><u>Task (What):</u></b> Align pulley and belts</p> <p><b><u>Standard (How Well):</u></b> Pulley and belts aligned properly. The tension in the belt shall be not more than 2%. Mechanical power from turbine to generator transformed by using pulley and belt.</p>	<ul style="list-style-type: none"> <li>➤ Importance and purpose of alignment of pulley and belts</li> <li>➤ Types of drive system</li> <li>➤ Properties and application of various types of belts</li> <li>➤ Concept of pulley alignment, belt fixing and tensioning</li> <li>➤ Speed checking procedure</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 4 Align couplings.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Obtain the layout drawing</li> <li>4. Insert coupling into the shaft of associated equipments</li> <li>5. Align them as per given instructions.</li> <li>6. Check for the angular and positional misalignment.</li> <li>7. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Coupling, dial gauge, spirit level, shaft for fitting, lab or test field, coupling catalogue, layout drawing</p> <p><b><u>Task (What):</u></b> Align coupling</p> <p><b><u>Standard (How Well):</u></b> Couplings are aligned properly. The allowable angular misalignment is <math>0.5^{\circ}</math> and positional misalignment is 0.25 mm for flexible coupling.</p>	<ul style="list-style-type: none"> <li>➤ Importance and purpose of coupling</li> <li>➤ Concept of angular and positional misalignment</li> <li>➤ Introduction of various types of coupling and their features.</li> <li>➤ Measurement with dial gauge</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 5 Install ELC control panel.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Place the ELC panel in proper location with sufficient space for ventilation.</li> <li>4. Install the ELC closer to the generator</li> <li>5. Insulate the armored cables</li> <li>6. Trim the armored cables</li> <li>7. Join the cable shoes</li> <li>8. Connect the cable to both control panel and generator and ballast tank</li> <li>9. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> ELC control panel, wiring diagram, Armored cable, body earthing, cable shoes</p> <p><b><u>Task (What):</u></b> Install ELC panel</p> <p><b><u>Standard (How Well):</u></b> ELC panel board installed properly.</p>	<ul style="list-style-type: none"> <li>➤ Introduction of ELC</li> <li>➤ Purpose and functions of installing ELC</li> <li>➤ Concept of wiring diagram</li> <li>➤ Concept of insulating &amp; trimming armored cable</li> <li>➤ Concept of joining cable shoes</li> <li>➤ Concept of connecting the cables in both control panel and generator</li> <li>➤ Concept on MH reference standard.</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 6 Erect ballast tank and ballast heater.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Make certain height base level</li> <li>4. Fit the heaters into the tank</li> <li>5. Tighten through the wrench</li> <li>6. Join the armoured cables through cable shoes</li> <li>7. Set earthing of ballast tank.</li> <li>8. Balance the phases equally</li> <li>9. Fit Inlet and outlet pipe</li> <li>10. Fill the water into the tank</li> <li>11. Insert water level indicator to avoid short circuit or heater burnout.</li> <li>12. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Ballast heaters, Ballast tank, Heaters Wrench, Cable shoes, multimeter</p> <p><b><u>Task (What):</u></b> Erect ballast tank &amp; ballast heater</p> <p><b><u>Standard (How Well):</u></b> Ballast tank &amp; ballast heater erected properly.</p>	<ul style="list-style-type: none"> <li>➤ Concept and purpose of the ballast tank and ballast heaters</li> <li>➤ Concept of heater fixing</li> <li>➤ Acquaintance of earthing</li> <li>➤ Concept of measuring heater resistance</li> <li>➤ Concept of inserting water level indicator</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

## **Module Code: M4**

# **Module: Arc Welding**

### **Description**

This module is designed to equip trainees with the skills and knowledge on Shielded Metal Arc Welding (SMAW) as a specialized module related to the occupation. This module intends to provide knowledge and skills on welding machine, striking, surface welding, edge joints, butt joint, and corner joint in various positions such as flat position, horizontal position, vertical position and overhead position.

### **Aim**

This module aims to equip trainees with knowledge and skills on arc welding to be a micro hydro technician.

### **Objectives**

After completion of this module the trainees will be able to:

1. Perform arc welding on various positions and methods.
2. Repair and maintain ferrous components of the MH plant.

**Prerequisite:** Basic module completed

**Duration:** 120 hours (24 hours theory and 96 hours practical)

### **Competencies**

1. Familiarize with of welding machine.
2. Perform striking/ maintaining arc.
3. Perform surface welding in flat position.
4. Weld edge joint in flat position.
5. Weld lap joint in flat position.
6. Weld 'T' joint in flat position.
7. Weld square butt in flat position.
8. Perform surface welding in horizontal position.
9. Weld square butt in horizontal position.
10. Perform surface welding in vertical position.
11. Perform fillet lap joint in vertical position.
12. Perform surface welding in overhead position.
13. Weld square butt joint in overhead position.

## Task Analysis

### Task 1: Familiarize with welding machine.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Observe the types of welding machine.</li> <li>2. Enlist function of welding machine.</li> <li>3. Identify welding machine and accessories</li> <li>4. Identify positive and negative pole (Earthing &amp; holder)</li> <li>5. Describe polarity change</li> <li>6. Set ampere.</li> <li>7. Identify electric supply set.</li> <li>8. Define voltage and ampere.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding machine and accessories.</p> <p><b><u>Task (What):</u></b></p> <p>Familiarize with welding machine.</p> <p><b><u>Standard (How well):</u></b></p> <p>Arc welding machine familiarized.</p>	<ul style="list-style-type: none"> <li>➤ Definition of arc welding</li> <li>➤ Importance of arc welding.</li> <li>➤ Use of arc welding machine</li> <li>➤ Function of welding machine</li> <li>➤ Types of welding machine</li> </ul>

## Task Analysis

### Task 2: Perform striking/ maintaining arc.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the required tools and material.</li> <li>2. Connect the power supply for welding generator.</li> <li>3. Set the earthing supply.</li> <li>4. Set the angle of electrode.</li> <li>5. Weld straight striking and maintaining the arc on working plate.</li> <li>6. Check the work piece.</li> <li>7. Re-store the tools.</li> <li>8. Clean the working area.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Perform striking and maintaining arc.</p> <p><b><u>Standard (How well):</u></b></p> <p>Striking/ maintaining the arc performed as per drawing/ instruction</p>	<ul style="list-style-type: none"> <li>➤ Concept of striking and maintaining arc</li> <li>➤ Striking type and method.</li> <li>➤ Identification of tools, materials &amp; equipment.</li> <li>➤ Selection of ampere according to type and size of electrode &amp; base metal.</li> <li>➤ Selection of electrode.</li> <li>➤ Welding positions.</li> <li>➤ Welding procedure</li> <li>➤ Electrode pre- heating.</li> <li>➤ Type and size of electrode.</li> <li>➤ Types of arc length.</li> <li>➤ Types of welding machine. (A/c, D/c, Rectifier).</li> </ul>

#### Safety precaution:

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the ear thing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.

## Task Analysis

### Task 3: Perform surface welding in flat position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the required drawing/ instruction.</li> <li>2. Obtain the required tools and material.</li> <li>3. Study the drawing carefully.</li> <li>4. Prepare the work piece in flat position.</li> <li>5. Check the level of work piece.</li> <li>6. Weld straight on working plate.</li> <li>7. Clean the slag from the work piece.</li> <li>8. Check the work piece.</li> <li>9. Put the number on work piece.</li> <li>10. Re-store the tools.</li> <li>11. Clean the working area.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Perform surface welding in flat position.</p> <p><b><u>Standard (How well):</u></b></p> <p>Surface welding performed in flat position as per drawing/instruction</p> <p>Size of welding and maintained.</p> <p>Accurate movement of weld bead maintained.</p>	<ul style="list-style-type: none"> <li>➤ Welding position.</li> <li>➤ Identification of level.</li> <li>➤ Selection of electrode ( Type and size)</li> <li>➤ Welding procedure</li> <li>➤ Procedure of handling wire brush and chipping hammer.</li> <li>➤ Electrode pre- heating.</li> <li>➤ Defects of welding.</li> </ul>

#### Safety precaution:

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touches open wire when machine is on.
- Do not keep flammable materials around the working area.

## Task Analysis

### Task 4: Weld edge joint in flat position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the required drawing/ instruction.</li> <li>2. Obtain the required tools and material.</li> <li>3. Prepare the work piece for edge joint.</li> <li>4. Fix the work piece in position.</li> <li>5. Hold the electrode and weld it on the work piece.</li> <li>6. Check the penetration back side of the edge joint in flat position.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Weld edge joint in flat position.</p> <p><b><u>Standard (How well) :</u></b></p> <p>Edge joint welded in flat position as per drawing/instruction</p> <p>Welding size maintained</p>	<ul style="list-style-type: none"> <li>➤ Welding method.</li> <li>➤ Concept of tack welding.</li> <li>➤ Welding procedure.</li> <li>➤ Defects of welding.</li> <li>➤ Edge preparation.</li> <li>➤ Ampere selection.</li> <li>➤ Method of minimizing distortion.</li> <li>➤ Method of electrode travel.</li> <li>➤ Maintain arc length.</li> <li>➤ Heat affected zone.</li> </ul>

#### Safety precaution:

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.



## Task Analysis

### Task 5: Weld lap joint in flat position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the required drawing/ instruction.</li> <li>2. Obtain the required tools and material.</li> <li>3. Fix the work piece in position with tack welding in lap joint.</li> <li>4. Weld the straight lap joint in flat position.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Weld lap joint in flat position.</p> <p><b><u>Standard (How well):</u></b></p> <p>Lap joint welded in flat position as per drawing/instruction</p> <p>Welding size maintained.</p>	<ul style="list-style-type: none"> <li>➤ Concept of lap welding</li> <li>➤ Paralleled gap and penetration method.</li> <li>➤ Welding positions.</li> <li>➤ Welding size and bead performance.</li> <li>➤ Welding procedure</li> <li>➤ Defects of welding.</li> <li>➤ Method of minimizing distortion.</li> <li>➤ Heat affected zone (HAZ).</li> </ul>

#### Safety precaution

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.

## Task Analysis

### Task 6: Weld 'T' joint in flat position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the required drawing/ instruction.</li> <li>2. Obtain the required tools and material.</li> <li>3. Fix the work piece in 'T' position with tack welding (angle 90°).</li> <li>4. Apply fixer/jigs</li> <li>5. Weld the straight 'T' joint in flat position.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b>Task (What):</b></p> <p>Weld 'T' joint in flat position.</p> <p><b><u>Standard (How well):</u></b></p> <p>'T' joint welded in flat position as per drawing/instruction</p> <p>Weld bead and reinforcement size maintained.</p>	<ul style="list-style-type: none"> <li>➤ Concept of 'T' joint</li> <li>➤ Welding position.</li> <li>➤ welding bead and reinforcement.</li> <li>➤ Paralleled gap and penetration method.</li> <li>➤ Welding procedure</li> <li>➤ Method of minimizing distortion.</li> <li>➤ Heat affected zone (HAZ).</li> <li>➤ Ampere setting.</li> </ul>

#### Safety precaution

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.

## Task Analysis

### Task 7: Weld square butt in flat position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the required drawing/ instruction.</li> <li>2. Obtain the required tools and material.</li> <li>3. Fix the work piece in square butt welding position with tack welding</li> <li>4. Weld the straight square butt weld in flat position.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Weld square butt in flat position.</p> <p><b><u>Standard (How well):</u></b></p> <p>Square butt-welded in flat position as per drawing / instruction.</p> <p>Weld bead and reinforcement size maintained.</p>	<ul style="list-style-type: none"> <li>➤ Concept of square butt welding</li> <li>➤ Welding position</li> <li>➤ Welding procedure</li> <li>➤ Welding bead and reinforcement.</li> <li>➤ Method of minimizing distortion.</li> <li>➤ Heat affected zone (HAZ).</li> <li>➤ Ampere setting.</li> <li>➤ Type and size pf welding machine and Electrode.</li> <li>➤ Handling technique of welding gauge</li> </ul>

#### Safety precaution

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.

## Task Analysis

### Task 8 : Perform surface welding in horizontal position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing/ instruction.</li> <li>2. Obtain required tools and material.</li> <li>3. Fix work piece in horizontal welding position with tack welding.</li> <li>4. Weld straight surface weld in horizontal position.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Perform surface weld in horizontal position.</p> <p><b><u>Standard (How well):</u></b></p> <p>Surface weld performed in horizontal position as per drawing/instruction</p> <p>Weld bead and reinforcement size maintained.</p>	<ul style="list-style-type: none"> <li>➤ Horizontal welding position.</li> <li>➤ Selection of electrode.</li> <li>➤ Penetration method.</li> <li>➤ Welding procedure</li> <li>➤ Arc length.</li> <li>➤ Angle of electrode and travel procedure.</li> <li>➤ Defects of welding.</li> <li>➤ Ampere setting.</li> </ul>

#### Safety precaution

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.

## Task Analysis

### Task 9: Weld square butt in horizontal position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing/ instruction.</li> <li>2. Obtain required tools and material.</li> <li>3. Fix work piece in square butt-welding position with tack welding.</li> <li>4. Weld straight square butt weld in horizontal position.</li> <li>5. Check welding               <ul style="list-style-type: none"> <li>- The root should be well filled.</li> <li>- The top of the weld should be slightly fix.</li> </ul> </li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Weld square but in flat position.</p> <p><b><u>Standard (How well):</u></b></p> <p>Square but welded in flat position as per drawing/instruction</p> <p>Weld bead and reinforcement size maintained.</p>	<ul style="list-style-type: none"> <li>➤ Square butt-welding in horizontal position.</li> <li>➤ penetration method.</li> <li>➤ Selection of electrode.</li> <li>➤ Welding procedure</li> <li>➤ Arc length.</li> <li>➤ Angle of electrode and travel procedure.</li> <li>➤ Defects of welding.</li> <li>➤ Ampere setting.</li> </ul>

#### Safety precaution

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.

## Task Analysis

### Task 10: Perform surface welding in vertical position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing/ instruction.</li> <li>2. Obtain required tools and material.</li> <li>3. Fix work piece in vertical welding position with tack welding.</li> <li>4. Start welding at the top of the work piece along first scribed line.</li> <li>5. Weld straight surface welding in vertical position.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Perform surface welding in vertical position.</p> <p><b><u>Standard (How well):</u></b></p> <p>Surface welding performed in vertical as per drawing/instruction</p> <p>Weld bead and reinforcement size maintained.</p>	<ul style="list-style-type: none"> <li>➤ Vertical welding position.</li> <li>➤ penetration method.</li> <li>➤ Selection of electrode.</li> <li>➤ Ampere setting.</li> <li>➤ Arc length.</li> <li>➤ Vertical ascending and descending welding techniques.</li> <li>➤ Electrode traveling angle and speed.</li> <li>➤ Welding procedure</li> </ul>

#### Safety precaution

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.

## Task Analysis

### Task 11: Perform fillet lap joint in vertical position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing/ instruction.</li> <li>2. Obtain required tools and material.</li> <li>3. Scribe line.</li> <li>4. Tack weld.</li> <li>5. Chip off slag from the tack welding.</li> <li>6. Perform fillet lap joint in vertical position.</li> <li>7. Check welding quality.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Perform fillet lap joint in vertical position.</p> <p><b><u>Standard (How well):</u></b></p> <p>Fillet lap joint performed in vertical position as per drawing/instruction</p> <p>Weld bead and reinforcement size maintained.</p>	<ul style="list-style-type: none"> <li>➤ Fillet lap joint.</li> <li>➤ penetration method.</li> <li>➤ Selection of electrode.</li> <li>➤ Welding procedure</li> <li>➤ Ampere setting.</li> <li>➤ Defects of welding.</li> <li>➤ pre-heating and post heating.</li> <li>➤ welding distortion.</li> <li>➤ Electrode traveling method.</li> <li>➤ Angle and traveling speed of electrode.</li> </ul>

#### Safety precaution

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.

## Task Analysis

### Task 12: Perform surface welding in overhead position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing/ instruction.</li> <li>2. Obtain required tools and material.</li> <li>3. Prepare clamping device to hold the work piece for overhead welding.</li> <li>4. Fix welding materials in position.</li> <li>5. Fix work piece in overhead position.</li> <li>6. Weld straight surface in overhead position.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Perform surface weld in overhead position.</p> <p><b><u>Standard (How well):</u></b></p> <p>Surface welding performed in overhead position as per drawing/instruction</p> <p>Weld bead and reinforcement size maintained.</p>	<ul style="list-style-type: none"> <li>➤ Clamping device.</li> <li>➤ Overhead position.</li> <li>➤ Penetration method.</li> <li>➤ Selection of electrode.</li> <li>➤ Techniques of electrode traveling.</li> <li>➤ Welding distortion.</li> <li>➤ Electrode traveling method.</li> <li>➤ Angle and traveling speed of electrode.</li> <li>➤ Ampere setting.</li> <li>➤ Arc length.</li> </ul>

#### Safety precaution

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.



## Task Analysis

### Task 13: Weld square butt joint in overhead position.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing/instruction.</li> <li>2. Obtain required tools and material.</li> <li>3. Tack weld two plates and tack them to an overhead support.</li> <li>4. Stand directly under the weld in line with it or slightly to one side.</li> <li>5. Mount the plates for welding in overhead position.</li> <li>6. Fix welding materials in position.</li> <li>7. Weld straight square butt joint in overhead position.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Workshop &amp; Site, welding tools, equipment and materials</p> <p><b><u>Task (What):</u></b></p> <p>Perform square butt joint in overhead position.</p> <p><b><u>Standard (How well):</u></b></p> <p>Square butt joint performed in overhead position as per drawing/instruction</p> <p>Weld bead and reinforcement size maintained.</p>	<ul style="list-style-type: none"> <li>➤ Ampere setting.</li> <li>➤ Electrode angle and traveling method.</li> <li>➤ Penetration types and methods.</li> <li>➤ Defects of welding.</li> <li>➤ Selection of machine and electrode.</li> <li>➤ Welding procedure</li> <li>➤ Arc length</li> <li>➤ Distortion minimizing technique</li> </ul>

#### Safety precaution

- Wear goggles, apron, welding seal, Leather glove and shoes.
- Check the power connection.
- Check the earthing connection.
- Do not touch open wire when machine is on.
- Do not keep flammable materials around the working area.

## Module Code: M5

# Module: Power Distribution Works

### Description

This module is designed to equip trainees with the knowledge and skills on Power Distribution Works as a specialized module. This module intends to provide skill and knowledge on performing overhead and underground transmission distribution line erection, install service mains and install protection system in transmission distribution line as the sub modules.

### Aim

This module aims to equip trainees with knowledge and skills on perform knowledge on power distribution works.

### Objectives

After completion of this module the trainees will be able to:

1. Perform overhead and underground transmission and distribution line erection.
2. Install service mains.
3. Install protection system in transmission and distribution line.

**Prerequisite:** Basic module completed

**Duration:** 240 hours

### Module Structure (M5)

S.N.	Code	Sub-modules	Nature	Total hours	Full marks
1	SM5.1	Overhead Transmission and Distribution Line Erection	T+P	240	200
2	SM5.2	Underground Distribution Line Erection	T+P		
3	SM5.3	Service mains and Load limit Switch	T+P		
4	SM5.4	Protection System in Transmission and Distribution Line	T+P		
<i>Total</i>				<b>240</b>	<b>200</b>

**Module Code: M5**  
**Sub module Code: SM5.1**

**Sub module: Overhead Transmission and Distribution line  
Erection**

**Description**

This course is designed to help trainees to provide knowledge and skills on Overhead Transmission and Distribution line Erection as a sub module. This sub module especially, intends to provide knowledge and skills on selection of pole, erection of pole, installation of pole stay cable, conductor selection, insulator selection, calculation of conductor size, calculation of sag, and clearance maintenance.

**Prerequisite:** Basic module completed

**Duration:** 90 hours (18 hours theory and 72 hours practical)

**Competencies**

- ❖ Choose size/type of pole.
- ❖ Erect poles.
- ❖ Install pole stay cable.
- ❖ Perform conductor selection.
- ❖ Perform insulator selection and fittings.
- ❖ Calculate conductor size.
- ❖ Erect conductor and joint conductor.
- ❖ Calculate sag of conductor.
- ❖ Maintain clearance (Wire to structure).
- ❖ Maintain clearance (Ground to wire).
- ❖ Maintain clearance (Between wires).

## Task Analysis

### Task No: 1 Choose size / type of pole.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain catalogue/ standard or guideline.</li> <li>3. Analyze the local site condition.</li> <li>4. Analyze the availability and quality of local wood.</li> <li>5. Analyze the option with concrete pole or metallic pole with transportation cost in consideration.</li> <li>6. Consider transmission/ distribution voltage level.</li> <li>7. Determine the size and type of pole.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Transmission/distribution pole standard size catalogue/ standard or guideline.</p> <p><b><u>Task (What):</u></b> Choose a transmission pole with appropriate dimension.</p> <p><b><u>Standard (How well):</u></b> Type and size of the pole selected as per MH standard/ MH guideline.</p>	<ul style="list-style-type: none"> <li>➤ Purpose and importance of pole</li> <li>➤ Types of poles</li> <li>➤ Handling of pole</li> <li>➤ Treatment of pole</li> <li>➤ Calculate the load applied to the pole</li> <li>➤ MH standards for pole size</li> </ul>

## Task Analysis

### Task No: 2 Erect poles.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Choose the appropriate pole types.</li> <li>4. Drill the hole in the top portioning the internal of respective phases and neutral.</li> <li>5. Align the poles in straight lines to minimize the stay sets.</li> <li>6. Ground 1/6<sup>th</sup> part of total pole length.</li> <li>7. Clamp the D-iron and adjust insulator.</li> <li>8. Coat the bitumen paint in the grounded portion and 1 m above the pole.</li> <li>9. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Transmission/ Distribution pole, field.</p> <p><b><u>Task (What):</u></b> Erect pole.</p> <p><b><u>Standard (How Well):</u></b> Pole are erected and upright and straight aligned.</p>	<ul style="list-style-type: none"> <li>➤ Purpose and importance of pole</li> <li>➤ Comparison on cost analysis between overhead and under ground</li> <li>➤ Concept of ease pole erection.</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 3 Install pole stay cable.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Lay the pole to the ground.</li> <li>4. Determine the pole that needs stay supports (dead end poles, first poles, branch poles and pole which have conductors bend angle more than <math>15^{\circ}</math>).</li> <li>5. Incorporate stay accessories.</li> <li>6. Clamp stay wire by the vice puller.</li> <li>7. Tension wire by vice puller as instructed.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Vice puller, stay cable, stay insulator, turn buckle, stay rod, stay plate, transmission pole, line erection field.</p> <p><b><u>Task (What):</u></b> Install stay cable between pole and to the ground</p> <p><b><u>Standard (How well):</u></b> Pole stay cable set installed as per design and drawing and well tensioned.</p>	<ul style="list-style-type: none"> <li>➤ Principle of stay set</li> <li>➤ Importance and purpose of stay cable</li> <li>➤ Concept of temporary and permanent stay used during pole erection.</li> <li>➤ Technical terms associated with stay set</li> </ul>

## Task Analysis

### Task No: 4 Perform insulator selections and fittings.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain required tools, equipment and materials.</li> <li>3. Observe the available insulators</li> <li>4. Check insulators.</li> <li>5. Study the configuration.</li> <li>6. Fasten it to the pole with its accessories.</li> <li>7. Bind the ACSR conductor on it.</li> <li>8. Avoid metal contacts.</li> <li>9. Perform insulation test.</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Insulators, pole, line erection field</p> <p><b><u>Task (What):</u></b> Perform insulator selection and fittings</p> <p><b><u>Standard (How Well):</u></b> Insulators selected and fitted as per norms.</p>	<ul style="list-style-type: none"> <li>➤ Importance of insulator</li> <li>➤ Concepts on types of insulators and its use</li> <li>➤ Functions of insulators</li> <li>➤ Concepts on Holdings and fastening insulator on poles.</li> <li>➤ Concept on insulation test using megger.</li> </ul>

## Task Analysis

### Task No: 5 Calculate Conductor size.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain catalogue of cables, calculator, and load demand chart.</li> <li>3. Obtain PVC and ACSR.</li> <li>4. Check the specializations and ratings of cables.</li> <li>5. Determine the conductor size to transfer the design current.</li> <li>6. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Catalogue of cables, calculator, load demand chart</p> <p><b><u>Task (What):</u></b> Calculate cable size</p> <p><b><u>Standard (How Well):</u></b> Required cable size is selected for designed current. The current rating of the cable selected shall be 50% overrated than that of design current rating. The selection for conductor for distribution line shall be such that the voltage drop at far receiving end does not exceed 10%.</p>	<ul style="list-style-type: none"> <li>➤ Concept of cables and uses in the electrical field</li> <li>➤ Properties of various types conductors( ACSR , ABC cables)</li> <li>➤ Importance of conductor</li> <li>➤ Measurement of cables continuity</li> <li>➤ Calculation of required conductor rating</li> </ul>

## Task Analysis

### Task No: 6 Perform conductor selections.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain catalogue of cables, calculator, and load demand chart.</li> <li>3. Obtain PVC and ACSR, Armored and Unarmored cables.</li> <li>4. Check the specializations rated in cables and conditions for laying conductors.</li> <li>5. Determine the standards.</li> <li>6. Connect the conductor as marked by the apparatus.</li> <li>7. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b></p> <p>Catalogue of cables, calculator, load demand chart</p> <p><b><u>Task (What):</u></b></p> <p>Perform conductor selection.</p> <p><b><u>Standard (How Well):</u></b></p> <p>Conductor selection performed as per norms.</p> <p>Required cable size is selected for designed current.</p> <p>The current rating of the cable selected shall be 50% overrated than that of design current rating.</p> <p>The selection for Conductor for distribution line shall be such that the voltage drop at far receiving end does not exceed 10%.</p>	<ul style="list-style-type: none"> <li>➤ Concept of electrical and mechanical properties of conductor</li> <li>➤ Concept of conductor in the electrical engineering</li> <li>➤ conductor selection criteria</li> <li>➤ Importance of conductor in the transmission and distribution line</li> <li>➤ Measurement of conductor size.</li> </ul>

## Task Analysis

### Task No: 7 Erect conductor and joint conductor.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the instruction.</li> <li>2. Embed the poles</li> <li>3. Compact the poles with stone and mud</li> <li>4. Lay the conductor to the pole</li> <li>5. Tension the wire through the puller</li> <li>6. Join the conductors with splice joints or with grips.</li> </ol>	<p><b><u>Condition (Given):</u></b> ACSR conductor, Overhead pullers, poles, helmet and safety belts, gloves,</p> <p><b><u>Task (What):</u></b> Erect conductor and joint conductor</p> <p><b><u>Standard (How Well):</u></b> ACSR conductor erected well and joined properly.</p>	<ul style="list-style-type: none"> <li>➤ Concept of electrical and mechanical properties of conductor</li> <li>➤ Importance of conductor in the transmission and distribution line</li> <li>➤ Concept of conductors laying</li> <li>➤ Concept of using Overhead pullers</li> <li>➤ Safety Requirements while giving tension in the conductor.</li> </ul>

## Task Analysis

### Task No: 8 Calculate sag of conductor.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain catalogue.</li> <li>3. Strike the conductor.</li> <li>4. Measure the wave velocity through the watch.</li> <li>5. Calculate the sag on the conductor.</li> <li>6. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Books, handouts, catalogue, classroom, field, stop watch, paper, vice puller</p> <p><b><u>Task (What):</u></b> Calculate sag of conductor.</p> <p><b><u>Standard (How Well):</u></b> The sag in transmission line calculated and tested.</p>	<ul style="list-style-type: none"> <li>➤ Definition of sag</li> <li>➤ Importance of sag in transmission line</li> <li>➤ Calculation of sag in transmission line at erecting time</li> <li>➤ Measurement of sag in the transmission line</li> </ul>



## Task Analysis

### Task No: 9 Maintain clearances (wire to structure).

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Follow the transmission route in straight.</li> <li>4. Transmit the line close to the structure apart at least 1.50m.</li> <li>5. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b> Transmission line, structure(stone, trees, houses)</p> <p><b><u>Task (What):</u></b> Maintain clearance (wire to structure)</p> <p><b><u>Standard(How Well):</u></b>  Wire to structure clearances maintained as per guidelines as prescribed by MHP</p>	<ul style="list-style-type: none"> <li>➤ Definition of transmission line</li> <li>➤ Importance and purposes of transmission line</li> <li>➤ Procedure</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 10 Maintain clearances (Ground to wire).

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Follow the transmission route in straight</li> <li>4. Avoid to pass over the big stone closer to the line</li> <li>5. Trim the trees and bushes closer to the line</li> <li>6. Embed the poles</li> <li>7. Measure the ground clearance</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Handouts, guide lines of MHP, Transmission line, ground</p> <p><b><u>Task (What):</u></b> Maintain clearance (Ground to wire).</p> <p><b><u>Standard(How Well):</u></b> Ground to wire clearances maintained as per guidelines as prescribed by MHP.</p>	<ul style="list-style-type: none"> <li>➤ Definition of transmission line</li> <li>➤ Importance and purposes of transmission line</li> <li>➤ Procedure</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 11 Maintain clearances (between wires).

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Follow the transmission route in straight.</li> <li>4. Avoid passing over the big stone closer to the line.</li> <li>5. Trim the trees and bushes closer to the line.</li> <li>6. Drill the hole to suspend the conductor at least 30 cm in 3 phase, 4 wire system whereas in single phase is 45 cm respectively.</li> <li>7. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Handouts, guide lines of MHP, Transmission line, D-iron clamp</p> <p><b><u>Task (What):</u></b> Maintain clearance (between wires).</p> <p><b><u>Standard(How Well):</u></b> Wire to wire clearances maintained as per guidelines as prescribed by MHP.</p>	<ul style="list-style-type: none"> <li>➤ Definition of transmission line</li> <li>➤ Importance and purposes of transmission line</li> <li>➤ Procedure</li> <li>➤ Safety precautions</li> </ul>

**Module Code: M5**  
***Sub module Code: SM5.2***

**Sub module: Underground Distribution line Erection**

**Description**

This course is designed to help trainees to provide knowledge and skills on Underground Distribution line Erection as a sub module. This sub module especially, intends to provide knowledge and skills on cable size calculation, cable selection, cable shoe selection and laying and joining cable.

**Prerequisite:** Basic module completed

**Duration:** 40 hours (8 hours theory and 32 hours practical)

**Competencies**

- ❖ Calculate cable size.
- ❖ Perform cable selection.
- ❖ Perform cable shoe selection & fittings.
- ❖ Lay down cable and join cable.

## Task Analysis

### Task No: 1 Calculate cable size.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Obtain Armored and Unarmored cable catalogues.</li> <li>4. Check the specializations and ratings of cables.</li> <li>5. Determine the cable size to transfer the design current in given specified condition.</li> <li>6. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Catalogue of cables, Calculator, load demand, classroom</p> <p><b><u>Task (What):</u></b> Calculate Conductor size</p> <p><b><u>Standard (How Well):</u></b> Required cable size selected for designed current.</p> <p>The current rating of the cable selected shall be 50% over rated than that of design current rating.</p>	<ul style="list-style-type: none"> <li>➤ Concept of cables</li> <li>➤ Uses in the electrical field</li> <li>➤ Properties of various types cables ( Al or Cu cables)</li> <li>➤ Importance of Al or Cu cables</li> <li>➤ Calculation of required cable rating</li> </ul>

## Task Analysis

### Task No: 2 Perform cable selections.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain catalogue of cables, calculator, and load demand chart.</li> <li>3. Obtain PVC and ACSR, Armored and Unarmored cables.</li> <li>4. Check the specializations rated in cables and conditions for laying conductors.</li> <li>5. Choose the cables as per the standards.</li> <li>6. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Catalogue of cables, calculator, load demand chart</p> <p><b><u>Task (What):</u></b> Perform cable selection</p> <p><b><u>Standard (How Well):</u></b> Required cable size selected for designed current. The current rating of the cable selected shall be 50% overrated than that of design current rating.</p>	<ul style="list-style-type: none"> <li>➤ Importance of cables in the electrical engineering</li> <li>➤ Importance of cables in the transmission and distribution line</li> <li>➤ Cable selection criteria</li> <li>➤ Calculation of conductor size</li> <li>➤ Measurement of cables size.</li> <li>➤ Concept of MH reference standards</li> </ul>

## Task Analysis

### Task No: 3 Perform cable shoe selection & fittings.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Identify the materials.</li> <li>4. Insert conductor to the required cable shoes.</li> <li>5. Crimp the conductor in to the cable shoes.</li> <li>6. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Cable shoes, conductor, crimping tools</p> <p><b><u>Task (What):</u></b> Select cable shoes</p> <p><b><u>Standard (How Well):</u></b> Appropriate types of cable shoes fittings selected as per the conductor types and size.</p>	<ul style="list-style-type: none"> <li>➤ Importance and functions cable shoe</li> <li>➤ Calculation of the appropriate size and fittings</li> <li>➤ Selection criteria</li> </ul>

**Safety:** Avoid the loose connection.

## Task Analysis

### Task No: 4 Lay down cables /join cable.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Trim the insulator of the conductor</li> <li>4. Twist the both conductor</li> <li>5. Insert cable shoes of appropriate size in the cables and crimp it.</li> <li>6. Lay down the cables on either cable trench or under ground in earth as per the given instruction for the laying.</li> </ol>	<p><b><u>Condition (Given):</u></b> Cables, pliers, cable shoes, crimping tools, single line diagram, joint box, field,</p> <p><b><u>Task (What):</u></b> Lay down and Join the cable</p> <p><b><u>Standard (How Well):</u></b> Cable laid properly underground and or in trench. The cable shoes properly tied and connected as per line diagram provided.</p>	<ul style="list-style-type: none"> <li>➤ Types of underground cables</li> <li>➤ Importance of cable joint</li> <li>➤ Concept on single line diagram.</li> <li>➤ Using crimping tools</li> <li>➤ Cable laying techniques.</li> <li>➤ Safety precaution</li> </ul>

**Module Code: M5**  
***Sub module Code: SM5.3***

**Sub module: Service mains and Load limit Switch**

**Description**

This course is designed to help trainees to provide knowledge and skills on Service mains and Load limit Switch as a sub module. This sub module especially intends to provide knowledge and skills on service main installation and connection of police switch.

**Prerequisite:** Basic module completed

**Duration:** 20 hours (4 hours theory and 16 hours practical)

**Competencies**

- ❖ Install service mains
- ❖ Connect police switch (limit switch)

## Task Analysis

### Task No: 1 Connect service wire.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Identify the phase and neutral wire.</li> <li>4. Trim the certain span connects to the transmission line.</li> <li>5. Connect to the Energy meter and D.P switch in the entry of house.</li> <li>6. Check the continuity of house wiring.</li> <li>7. Apply of long service wire may cause excessive voltage drop.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Service wire, energy meter, DP switch, lab room house</p> <p><b><u>Task (What):</u></b> Connect Service Wire</p> <p><b><u>Standard (How Well):</u></b> Service wire between transmission line and households energy meter connected. D.P Switch Phase and Neutral wire identified clearly before connection.</p>	<ul style="list-style-type: none"> <li>➤ Definition of the service wire</li> <li>➤ Importance and purpose of it</li> <li>➤ Measurement of continuity</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 2 Connect police switch (limit switch).

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Select the limit switch</li> <li>4. Connect Incoming and outgoing lines through it</li> <li>5. Kept it in metallic enclosures with key locked.</li> <li>6. Complete the circuit as per design layout</li> <li>7. Test the circuit and observe the trip with overload.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b> Limit switch, unarmored cables, enclosures box, field</p> <p><b><u>Task (What):</u></b> Connect police switch</p> <p><b><u>Standard (How Well)</u></b> Police switch connected as per norms and performance of the limit switch tested.</p>	<ul style="list-style-type: none"> <li>➤ Definition of the police switch</li> <li>➤ Importance and purpose of it</li> <li>➤ Calculation of required rating</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

**Safety:** Avoid the failure of whole system.

**Module Code: M5**  
***Sub module Code: SM5.4***  
**Sub module: Protection System in Transmission and  
Distribution Line**

**Description**

This course is designed to help trainees to provide knowledge and skills on Protection System in Transmission and Distribution Line as a sub module. This sub module especially intends to provide knowledge and skills on protection system installation and regulation under the transmission and distribution line.

**Prerequisite:** Basic module completed

**Duration:** 90 hours (18 hours theory and 72 hours practical)

**Competencies**

- ❖ Perform protective device selection
- ❖ Perform protective device connection
- ❖ Install circuit breaker
- ❖ Install lightning arrestor
- ❖ Perform Star-Delta connections.
- ❖ Record /balance load.
- ❖ Regulate voltages.
- ❖ Measure/Maintain power factor.
- ❖ Measure/ Maintain earth resistance.



## Task Analysis

### Task No: 1 Perform protective device selection.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Choose the appropriate protective devices as per line drawing.</li> <li>4. Obtain the devices of required ratings.</li> <li>5. Prepare the lists of the protective devices.</li> <li>6. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Handouts, books, calculator, catalogue</p> <p><b><u>Task (What):</u></b> Perform protective device selection</p> <p><b><u>Standard (How Well):</u></b> Protection device with appropriate size and ratings selected to protect from over/under voltage, over current, short circuit. The tripping range for voltage relay setting maintained to <math>180\text{ v} &lt; V &lt; 250\text{ v}</math> The current protection breakers shall be 1.25 times of the rated design current.</p>	<ol style="list-style-type: none"> <li>1. Definition of the respective protective devices</li> <li>2. Concept on protective systems (OV, UV, OF, UF, OC and SC)</li> <li>3. Importance and purpose of these protections</li> <li>4. Operating principles and functions of protective devices</li> <li>5. Concept of MH reference standards</li> </ol> <ul style="list-style-type: none"> <li>➤ Concepts on troubleshooting</li> <li>➤ Safety precautions</li> </ul>

**Safety:** Avoid over voltage, over current, short circuit.

## Task Analysis

### Task No: 2 Perform protective device connection.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Study the line diagram.</li> <li>4. Observe the connecting point.</li> <li>5. Connect as per the instruction provided</li> <li>6. Check the connection and performance.</li> <li>7. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Protective device, P.V.C cables, screw driver, wire stripper, layout drawings, panel board</p> <p><b><u>Task (What):</u></b> Perform protective device connection</p> <p><b><u>Standard (How Well):</u></b>  Protective devices connected in specialized point The operation tested.</p>	<ul style="list-style-type: none"> <li>➤ Define the respective protective device</li> <li>➤ Importance and purpose of it</li> <li>➤ Operating principles and functions</li> <li>➤ Measurement of the performance</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 3 Install circuit breaker.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools and equipment.</li> <li>3. Obtain the circuit breaker</li> <li>4. Observe the configuration</li> <li>5. Connect respective line as marked in it</li> <li>6. Give the supply</li> <li>7. Check the operation &amp; performance</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Circuit Breaker, handouts, catalogue, lecture, lab</p> <p><b><u>Task (What):</u></b> Test and install circuit breaker</p> <p><b><u>Standard (How Well):</u></b>  Circuit breaker installed as per norms</p> <p>the operation checked through the supply Installation before the load</p>	<ul style="list-style-type: none"> <li>➤ Definition of the circuit breaker</li> <li>➤ Importance and its purpose</li> <li>➤ Calculation of required rating</li> <li>➤ Interpretation of Circuit breaker</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 4 Install lightning arrestor.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Arrange the materials.</li> <li>4. Excavate the ground.</li> <li>5. Install lightning arrestor in phase.</li> <li>6. Facilitate the neutral.</li> <li>7. Take neutral to the ground.</li> <li>8. Take Cu-wire.</li> <li>9. Joint to the Copper Plate.</li> <li>10. Solder the connection.</li> <li>11. Pass wire through GI pipe.</li> <li>12. Recommend brass nut bolt for connection.</li> <li>13. Test with the help of Meager.</li> <li>14. Facilitate single phase and 3 phase system accordingly.</li> <li>15. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b> Lightning arrestors, bracing along its clamp, copper wire, measuring instruments, salt, coal, cu.plate, pvc pipe</p> <p><b><u>Task(What):</u></b> Install lightning arrestor</p> <p><b><u>Standard (How Well):</u></b> Lightning arrestor installed to discharge the high voltage and lightning.</p>	<ul style="list-style-type: none"> <li>➤ Definition of lightning and allied arrestor</li> <li>➤ Scope in the L.T and H.T transmission line</li> <li>➤ Importance, purpose and functions of lightning arrestor</li> <li>➤ Earthing testing procedure</li> <li>➤ Identification and types of earthing</li> <li>➤ Trouble shooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 5 Perform Star-Delta connections.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Study the internal configuration of generator, transformer and induction motor.</li> <li>4. Measure the resistance between phases and phase-to –neutral.</li> <li>5. Connect to the wire from control panel.</li> <li>6. Operate at synchronous speed.</li> <li>7. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Symbols chart, generator, transformer, lab room, powerhouse.</p> <p><b><u>Task (What):</u></b> Perform star-delta connection.</p> <p><b><u>Standard (How Well):</u></b> Star-delta connection performed as per norms</p>	<ul style="list-style-type: none"> <li>➤ Importance of Star – Delta connection</li> <li>➤ Interpretation of drawings</li> <li>➤ Operating principles of star-delta configuration</li> <li>➤ Purpose of transmit the power</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 6 Record /balance load.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Divide the households</li> <li>4. Connect the house alternate the phase equally</li> <li>5. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Log book, phase balance sheet, design guidelines, drawing paper, meters (voltage, current, frequency)</p> <p><b><u>Task(What):</u></b> Balance the load</p> <p><b><u>Standard (How Well):</u></b> Load recorded and balanced as per norms</p>	<ul style="list-style-type: none"> <li>➤ Concept of balance load</li> <li>➤ Importance and purpose of balance load</li> <li>➤ Procedure</li> <li>➤ Safety precaution</li> </ul>

## Task Analysis

### Task No: 7 Regulate voltages.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain the voltage regulation equipments.</li> <li>3. Connect proper connection.</li> <li>4. Record the data.</li> <li>5. Fill in the table.</li> <li>6. Ensure the handling equipments easily.</li> <li>7. Observe the performance.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Voltage stabilizer, AVR, Measuring instruments, lab room</p> <p><b><u>Task(What):</u></b> Regulate voltage</p> <p><b><u>Standard (How Well):</u></b> Voltage regulated.</p> <p>The permissible voltage at consumer premises ensured.</p>	<ul style="list-style-type: none"> <li>➤ Define voltage regulation</li> <li>➤ Importance and purpose of it</li> <li>➤ Operating principles</li> <li>➤ Safety precautions</li> <li>➤ Troubleshooting</li> </ul>

## Task Analysis

### Task No: 8 Measure/Maintain power factor.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Arrange the required apparatus</li> <li>4. Connect proper connection.</li> <li>5. Series capacitors are connect in transmission line.</li> <li>6. Record the data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Power factor meter, Clamp meter, data book, catalogue, panel board</p> <p><b><u>Task(What):</u></b> Maintain the power factor</p> <p><b><u>Standard (How Well):</u></b> the output system designed and ensured The necessary backup protection avoided.</p>	<ul style="list-style-type: none"> <li>➤ Importance and purpose of power factor</li> <li>➤ Measurement of the power factor</li> <li>➤ Calculation of the required capacitor to neutralize the lagging current</li> <li>➤ Safety precautions</li> <li>➤ Troubleshooting</li> </ul>

**Safety:** Avoid necessary backup protection.

## Task Analysis

### Task No: 9 Measure/ maintain earth resistance.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools, equipment and materials.</li> <li>3. Measure earth resistance.</li> <li>4. Maintain earth resistance.</li> <li>5. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Earth Electrode, Earthing plate, Megger</p> <p><b><u>Task (What):</u></b> Measure/ Maintain Earth resistance</p> <p><b><u>Standard (How Well):</u></b>  Earth resistance measured and maintain as per norms.</p>	<ul style="list-style-type: none"> <li>➤ Definition of earth resistance</li> <li>➤ Importance and purposes of earth resistance</li> <li>➤ Calculation of the required resistance</li> <li>➤ Procedure</li> <li>➤ Safety6 precaution</li> </ul>

## Module Code: M6

# Module: Testing & Commissioning Works

### Description

This module is designed to equip trainees with the knowledge and skills on Testing and Commissioning Works as a specialized module. This module intends to provide skill and knowledge on measure flow and head, measure insulation resistance for generator, transformer, domestic wiring and house wiring, operate ELC and IGC, measure current, measure/maintain voltage and frequency, and perform static test, dynamic test and power output test.

### Aim

This module aims to equip trainees with knowledge and skills on testing commissioning works necessary to be a micro hydro technician.

### Objectives

After completion of this module the trainees will be able to:

1. Measure flow and head.
2. Measure insulation resistance for generator, transformer, domestic wiring and house wiring.
3. Operate ELC and IGC.
4. Measure current.
5. Measure/maintain voltage and frequency.
6. Perform static test, dynamic test and power output test.

**Prerequisite:** Basic module completed.

**Duration:** 150 hours (30 hours theory and 120 hours practical)

### Competencies

- ❖ Measure flow
- ❖ Measure head
- ❖ Measure insulation resistance for generator
- ❖ Measure insulation resistance for transformer
- ❖ Measure insulation resistance for domestic wiring
- ❖ Measure insulation resistance for industrial wiring
- ❖ Operate ELC (Electronic Load Controller)
- ❖ Operate IGC (Induction Generator Controller)
- ❖ Measure current
- ❖ Measure/ maintain voltage
- ❖ Measure / maintain frequency
- ❖ Perform installations checking at Static Condition
- ❖ Perform installations checking at Dynamic Condition
- ❖ Perform Power Output Testing.

## Task Analysis

### Task No: 1 Measure flow.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Measure the flow with each method.</li> <li>4. Stir the salt in a bucket as per the instruction</li> <li>5. Drop the salt into the river</li> <li>6. Read the data from conductivity meter</li> <li>7. Compute the data and determine the flow</li> <li>8. Install the weir in appropriate location</li> <li>9. Calculate the flow</li> <li>10. Throw the floating matter in river</li> <li>11. Calculate the x-section</li> <li>12. Record the time taken by stop watch</li> <li>13. Calculate the flow.</li> <li>14. Compare the flow obtain by the various methods.</li> <li>15. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Salt, weighing machine, measuring tape, stop watch conductivity meter, weir, gauged and un-gauged river</p> <p><b><u>Task (What):</u></b> Measure the flow using various methods</p> <p><b><u>Standard (How Well):</u></b> Flow measured with various methods.</p>	<ul style="list-style-type: none"> <li>➤ Various methods of flow measurements (Area Velocity, Salt dilution, weir)</li> <li>➤ Importance and purpose of the flow measurement.</li> <li>➤ Calculation of flow with various methods</li> <li>➤ Accuracy and limitation of the various flow measurement methods.</li> <li>➤ Concept on MH reference standard and MH design guidelines.</li> </ul>

## Task Analysis

### Task No: 2 Measure head.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Survey the MH plant installed site.</li> <li>4. Fill the data in standardized format</li> <li>5. Compile the data</li> <li>6. Calculate the gross head.</li> <li>7. Measure static head from pressure gauge reading.</li> <li>8. Compare this reading with calculated gross head.</li> <li>9. Run the turbine at design discharge and measure dynamic head (Net head).</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Long measuring tape, Abney level, GPS, Auto Level, staff, ranging rod, record book, chopping weapons, pressure gauge</p> <p><b><u>Task (What):</u></b> Measure head</p> <p><b><u>Standard (How Well):</u></b> Head measured both with survey equipment and with pressure gauge reading accurately.</p>	<ul style="list-style-type: none"> <li>➤ Importance and purpose of head</li> <li>➤ Concept on using Abney level, auto level.</li> <li>➤ Calculation of the height through survey.</li> <li>➤ Measurement of head with pressure gauge</li> </ul>

## Task Analysis

### Task No: 3 Measure insulation resistances for generator.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Disconnect the supply to the panel board</li> <li>4. Open all phases</li> <li>5. Join the phase through jack</li> <li>6. Move the meager</li> <li>7. Test between Phases and Phase-Neutral</li> <li>8. Fill the data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Megger, Digital Multimeter, , generator catalogue, lab</p> <p><b><u>Task (What):</u></b> Measure insulation resistance for generator</p> <p><b><u>Standard (How Well):</u></b> Insulation resistance measured for generator Insulation resistance maintained above 2-mega ohm or as prescribed by the manufacturer catalogue.</p>	<ul style="list-style-type: none"> <li>➤ Definition of the insulation</li> <li>➤ Calculation of the required insulation</li> <li>➤ Measurement of the resistance insulation</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>



## Task Analysis

### Task No: 4 Measure insulation resistances for transformer.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Disconnect the supply to the panel board</li> <li>4. Open all phases</li> <li>5. Join the phase through jack</li> <li>6. Move the meager</li> <li>7. Test between Phases and Phase-Neutral</li> <li>8. Test the Earth-phases and neutral – earth.</li> <li>9. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Digital Multimeter, Transformer, Megger, catalogue, lab</p> <p><b><u>Task (What):</u></b> Measure insulation resistances for transformer.</p> <p><b><u>Standard (How Well):</u></b> Insulation resistances measured for transformer as insulation resistance specified by manufactures.</p>	<ul style="list-style-type: none"> <li>➤ Definition of the resistance insulation</li> <li>➤ Calculation of the required resistance</li> <li>➤ Measurement of the insulation capacity by meter</li> <li>➤ Troubleshooting</li> <li>➤ Safety Precautions</li> </ul>

## Task Analysis

### Task No: 5 Measure insulation resistances for domestic wiring.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Disconnect the supply to the panel board</li> <li>4. Take out main switch. All other fuses are in position</li> <li>5. Position all switches.</li> <li>6. Position all the lamps or the holders (short-circuited).</li> <li>7. Short line and neutral terminals on the installation side.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Digital Multimeter, Megger, House, catalogue of conductor</p> <p><b><u>Task (What):</u></b> Measure insulation resistance for domestic wiring</p> <p><b><u>Standard (How Well):</u></b> Recommended value be examined Insulation resistance maintained 12.5M OHM/no. of outlets</p>	<ul style="list-style-type: none"> <li>➤ Definition of the resistance</li> <li>➤ Calculation of the outlets and load</li> <li>➤ Measurement the insulation</li> <li>➤ Troubleshooting</li> <li>➤ Safety Precautions</li> </ul>

## Task Analysis

### Task No: 6 Measure insulation resistances for industrial wiring.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Disconnect the supply to the panel board</li> <li>4. Take out main switch.</li> <li>5. Position all the fuses.</li> <li>6. Position all the switches.</li> <li>7. Position all the lamps or the holders (short-circuited).</li> <li>8. Short line and neutral terminals on the installation side.</li> <li>9. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Digital Multimeter, Megger, Industry, catalogue of conductor, contactor, relay</p> <p><b><u>Task (What):</u></b> Measure insulation resistance for industrial wiring</p> <p><b><u>Standard (How Well):</u></b> Recommended value examined.</p>	<ul style="list-style-type: none"> <li>➤ Definition of the resistance</li> <li>➤ Calculation of the outlets and inductive, resistive, capacitive load</li> <li>➤ Measurement of the insulation</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No:7 Operate ELC (Electronic Load Controller).

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Collect the materials</li> <li>4. Install at Powerhouse</li> <li>5. Connect between generator and panel board</li> <li>6. Open the valve</li> <li>7. Observe the movement of turbine and generator</li> <li>8. Observe the reading of mains voltmeter in the panel board</li> <li>9. Set the proper position of voltage.</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b> Turbine, AC Synchronous Generator, ELC, control panel, ballast heaters, turbine assembly</p> <p><b><u>Task (What):</u></b> Operate ELC</p> <p><b><u>Standard (How Well):</u></b> Frequency variations controlled.</p>	<ul style="list-style-type: none"> <li>➤ Definition of ELC</li> <li>➤ Calculate required capacity for any MHP</li> <li>➤ Importance, purpose and functions of ELC</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 8 Operate IGC (Induction Governor Controller).

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Install at Powerhouse</li> <li>4. Connect between generator and panel board</li> <li>5. Open the valve</li> <li>6. Observe the movement of turbine and generator</li> <li>7. Observe the reading of mains voltmeter in the panel board</li> <li>8. Set the proper position of output voltage</li> <li>9. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Turbine, Induction Generator, IGC, control panel, ballast heaters, turbine assembly</p> <p><b><u>Task (What):</u></b> Operate IGC</p> <p><b><u>Standard (How Well):</u></b> Voltage variations controlled</p>	<ul style="list-style-type: none"> <li>➤ Definition of IGC</li> <li>➤ Calculation of required capacity for any MHP</li> <li>➤ Importance, purpose and functions of IGC</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 9 Measure current.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Move the turbine and generator by prime mover</li> <li>4. Install ammeter in series with load</li> <li>5. Load coils insert through CT</li> <li>6. Total the load</li> <li>7. Switch on</li> <li>8. Record the current.</li> </ol>	<p><b><u>Condition(Given):</u></b> Ammeter, clamp meter, load(resistive, inductive, capacitive ), CT, panel board</p> <p><b><u>Task (What):</u></b> Measure current</p> <p><b><u>Standard (How Well):</u></b> Current drawn load.</p>	<ul style="list-style-type: none"> <li>➤ Definition of current</li> <li>➤ Importance and purpose of ammeter</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 10 Measure and maintain voltage.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Move the generator by prime mover</li> <li>4. Read the voltmeter scale</li> <li>5. Adjust the voltage by moving motherboard pot</li> <li>6. Move either anticlockwise or clockwise as up to desired voltage</li> <li>7. Set voltage from trip circuit as well</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> ELC motherboard, voltmeter, digital meter, tester, panel board, voltage trip circuit</p> <p><b><u>Task (What):</u></b> Measure and maintain voltage</p> <p><b><u>Standard (How Well):</u></b> National recommendations voltage set</p>	<ul style="list-style-type: none"> <li>➤ Definition of voltage</li> <li>➤ Importance, functions and purpose of voltage</li> <li>➤ Calculation of the required voltage to operation</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

### Task No: 11 Measure and maintain frequency.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive the necessary instruction</li> <li>2. Collect the required tools, equipment and materials.</li> <li>3. Connect to the respective connections</li> <li>4. Move the generator</li> <li>5. Attend to see frequency meter</li> <li>6. Rotate frequency tab in motherboard</li> <li>7. Set as a permissible range.</li> <li>8. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> ELC motherboard, frequency meter, generator, digital meter, tester, panel board</p> <p><b><u>Task (What):</u></b> Measure and maintain frequency</p> <p><b><u>Standard (How Well):</u></b> Frequency within acceptable limits measured.</p>	<ul style="list-style-type: none"> <li>➤ Definition of frequency</li> <li>➤ Importance and purpose of frequency</li> <li>➤ Measurement of the frequency</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> </ul>

## Task Analysis

**Task No: 12 Perform installations checking at Static Condition.**

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive necessary instructions.</li> <li>2. Perform check with flow control mechanism</li> <li>3. Check the free board sufficiency</li> <li>4. Check headrace for if any minor or major leakages</li> <li>5. Check Penstock for if any minor or major leakages</li> <li>6. Check penstock lining for sagging or any cracks in piers or anchors.</li> <li>7. Record data.</li> </ol>	<p><b><u>Condition (Given):</u></b> Nozzles valves are closed, required amount of water taken into canal, at site</p> <p><b><u>Task (What):</u></b> Perform installations checking at Static Condition</p> <p><b><u>Standard (How Well):</u></b> All the parameters are tested as per the MH reference standard</p>	<ul style="list-style-type: none"> <li>➤ Concept of free board</li> <li>➤ Concept on flow control mechanism</li> <li>➤ Pressure gauge reading</li> <li>➤ Concept of static and dynamic head</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> <li>➤ MH reference standards.</li> </ul>

## Task Analysis

**Task No: 13 Perform installations checking at Dynamic Condition.**

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive necessary instructions.</li> <li>2. Perform various test as per the instruction</li> <li>3. Record data</li> </ol>	<p><b><u>Condition (Given):</u></b> Running power plants, Clam on RMS meters,</p> <p><b><u>Task (What):</u></b> Perform installations checking at Dynamic Condition.</p> <p><b><u>Standard (How Well):</u></b> All the parameters are tested as per the MH reference standard</p>	<ul style="list-style-type: none"> <li>➤ Concept of vibration, noise, bearing temperatures and body temperatures.</li> <li>➤ Concept on procedure of under voltage, over voltage, under/ over frequency test.</li> <li>➤ Concept on Load acceptance, Load resection test.</li> <li>➤ Pressure gauge reading</li> <li>➤ Concept of static and dynamic head</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> <li>➤ MH reference standards.</li> </ul>

## Task Analysis

### Task No: 14 Perform Power Output Testing.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
1. Receive necessary instructions. 2. Perform power test at various flow conditions with village load and with ballast loads. 3. Record data	<p><b><u>Condition (Given):</u></b>            RMS power meter, running powerhouse, dump load for load varying</p> <p><b><u>Task (What):</u></b>            Perform Power Output Testing.</p> <p><b><u>Standard (How Well):</u></b>            All the parameters are tested as per the MH reference standard</p>	<ul style="list-style-type: none"> <li>➤ Concept of static and dynamic head</li> <li>➤ Concept on flow measurement</li> <li>➤ Measurement of power, current, Voltage and PF with RMS meters</li> <li>➤ Power measurement techniques</li> <li>➤ Troubleshooting</li> <li>➤ Safety precautions</li> <li>➤ MH reference standards.</li> </ul>

## **Module Code: M7**

# **Module: Micro-hydro Plant Management**

### **Description**

This module is designed to equip trainees with the knowledge and skills on Micro-hydro Plant management as a specialized module. This module intends to provide skills and knowledge on micro hydro plant management activities and social mobilization activities related to the occupation.

### **Aim**

This module aims to equip trainees with knowledge and skills on micro hydro plant management necessary to be a micro hydro technician.

### **Objectives**

After completion of this module the trainees will be able to:

1. Manage micro hydro plant
2. Explain the concept of socio-economic aspects of micro hydro.

**Prerequisite:** Basic module completed

**Duration:** 70 hours (20 hours theory and 50 hours practical)

### **Competencies**

- ❖ Supervise sub-ordinate.
- ❖ Keep A/C system.
- ❖ Maintain log book.
- ❖ Maintain inventory.
- ❖ Conduct meetings with customers/villagers.
- ❖ Write minutes.
- ❖ Write progress / case study report.
- ❖ Collect customer feedback.
- ❖ Form user committee.
- ❖ Mobilize group.
- ❖ Perform periodic maintenance.

## Task Analysis

### Task No: 1 Supervise sub ordinate

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Define roles and responsibility</li> <li>3. State the issue.</li> <li>4. Conduct discussion on the issue for 5-10 minutes.</li> <li>5. Note the pros and cons of the issue raised in the discussion.</li> <li>6. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At office</b>            Roles and responsibilities</p> <p><b><u>Task (What):</u></b>            Supervise sub ordinate.</p> <p><b><u>Standard (How Well):</u></b>            Supervision made based on professional ethics</p>	<ul style="list-style-type: none"> <li>➤ Concept of job responsibilities</li> <li>➤ Situations and circumstances for effective supervision</li> <li>➤ Advantages and disadvantages of supervision</li> <li>➤ Process for supervision</li> </ul>

## Task Analysis

### Task No: 2 Keep A/C system.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Maintain daily account to show daily expenditure and income status</li> <li>3. Maintain electricity sell account</li> <li>4. Maintain cash account</li> <li>5. Maintain purchase account</li> <li>6. Maintain bank account</li> <li>7. Maintain stock account</li> <li>8. Maintain fixed asset account</li> <li>9. Maintain profit and loss account</li> <li>10. Maintain balance sheet.</li> <li>11. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At office</b>            Ledger, Boucher, Check book, pass book</p> <p><b><u>Task (What):</u></b>            Keep A/C system.</p> <p><b><u>Standard (How Well):</u></b>            Account maintained.              The task steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Definition of account book</li> <li>➤ Importance for maintaining account</li> <li>➤ Process for maintaining account</li> <li>➤ Format for different account</li> <li>➤ Main components of account system</li> </ul>



## Task Analysis

### Task No: 3 Maintain logbook.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Record machine's status</li> <li>3. Record machine's temperature</li> <li>4. Record machine's noise</li> <li>5. Record current</li> <li>6. Record voltage</li> <li>7. Record frequency</li> <li>8. Record the date on which periodic maintenance was done</li> <li>9. Record any other problems not mentioned above.</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At office</b>            White board, blackboard, overhead, slide projector, class room, sample log book</p> <p><b><u>Task (What):</u></b>            Maintain logbook.</p> <p><b><u>Standard (How Well):</u></b>            Logbook maintained.</p> <p>The task steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Definition of log book</li> <li>➤ Reasons/importance for maintaining log book</li> <li>➤ Process for filling log book</li> <li>➤ Format for logbook</li> <li>➤ Main components of log book</li> </ul>

## Task Analysis

### Task No: 4 Maintain inventory.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Collect list of different tools and equipments.</li> <li>3. Register purchase quantity, issued quantity, damage, wear and tear quantity etc.</li> <li>4. Calculate remaining quantity of different materials.</li> <li>5. Verify the quantity with the stock quantity in the store.</li> <li>6. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At site</b>            List of different materials (Purchase quantity, issued quantity, damage, wear and tear quantity etc)</p> <p><b><u>Task (What):</u></b>            Maintain inventory.</p> <p><b><u>Standard (How Well):</u></b>            All the steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Concept of inventory</li> <li>➤ Process for keeping inventory</li> <li>➤ Inventory forms and formats</li> </ul>

## Task Analysis

### Task No: 5 Conduct meetings with customers/villagers.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Get everyone's attention</li> <li>3. Manage the time properly</li> <li>4. Focus on important issue to be discussed.</li> <li>5. Proceed as per the subject matters in agenda.</li> <li>6. Avoid unwanted discussion</li> <li>7. Manage one idea at one time.</li> <li>8. Respect the others view.</li> <li>9. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b> At office Roles and responsibilities</p> <p><b><u>Task (What):</u></b> Conduct meeting s with customer.</p> <p><b><u>Standard (How Well):</u></b>  All the steps followed in sequence</p>	<ul style="list-style-type: none"> <li>➤ Concept of meeting</li> <li>➤ Situations and circumstances for effective meeting conduction</li> <li>➤ Advantages and disadvantages of meeting</li> <li>➤ Process for conduction of meeting</li> </ul>

## Task Analysis

### Task No: 6 Write minutes.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Select one situation which requires minute.</li> <li>3. Take minute copy.</li> <li>4. Write minute (make sure that all components of a minute i.e attendance, agenda, chairperson, meeting date and decisions are clearly written)</li> <li>5. Make sure that all those who are present in the meeting make signature</li> <li>6. Circulate the decisions to the concerned person/body.</li> <li>7. Keep the minute book safely.</li> </ol>	<p><b><u>Condition(Given):</u></b> At office Different simulation situations which requires minute</p> <p><b><u>Task (What):</u></b> Write minute.</p> <p><b><u>Standard (How Well):</u></b>  Minute written.  The task steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Concept of minute</li> <li>➤ Reasons for minute writing</li> <li>➤ Different conditions for minute writing</li> <li>➤ Format for minute</li> <li>➤ Main components of minute</li> </ul>

## Task Analysis

### Task No: 7 Write progress/case studies report.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Select one situation which requires progress/case study writing.</li> <li>3. Take A4 size paper .</li> <li>4. Write progress report (make sure that all progress made during specified time period is included)</li> <li>5. Submit the report to the concerned person/body.</li> <li>6. Keep one copy for self record.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At office</b>            Different simulation situations which requires progress/case reporting</p> <p><b><u>Task (What):</u></b>            Write progress/ case study report.</p> <p><b><u>Standard (How Well):</u></b>            Progress report written.              The task steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Concept of progress report and case study</li> <li>➤ Importance of progress report</li> <li>➤ Different conditions for progress/case study reporting</li> <li>➤ Format for progress and case study report</li> <li>➤ Main components of progress and case study</li> </ul>

## Task Analysis

### Task No: 8 Collect consumer feedback.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Develop checklists.</li> <li>3. Question the community member about his/her understanding of micro-hydro.</li> <li>4. Inform the community member about micro-hydro especially about the need for end use enterprises to make micro-hydro financially viable</li> <li>5. Collect the feedback from them</li> <li>6. Answer the queries of the community member.</li> <li>7. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At meeting</b>            Checklists, formats, consumers</p> <p><b><u>Task (What):</u></b>            collect consumer feedback</p> <p><b><u>Standard (How Well):</u></b>            The task steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Definition of feedback</li> <li>➤ Importance of taking feedback</li> <li>➤ Feedback collection technique</li> </ul>

## Task Analysis

### Task No: 9 Form users' committee.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Build relationships, inform people about meeting, and collect information about best practices of traditional organizations in the area</li> <li>3. Present detailed study report and awareness creation on group formation</li> <li>4. Select representatives for Management Committee</li> <li>5. Determine rules/regulations, and roles and responsibilities of individual members and the Management Committee</li> <li>6. Inform VDC, NGOs, and other groups about formation of user group</li> <li>7. Legalize and register users' group in District Water Resource Committee/ CDO office</li> <li>8. Assess commitment and organizational capacity of users.</li> <li>9. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>Roles and responsibilities of users' committee</p> <p><b><u>Task (What):</u></b> Form users' committee</p> <p><b><u>Standard (How Well):</u></b></p> <p>Users' committee formed.</p> <p>The task steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Definition of users' committee</li> <li>➤ Importance of users' committee</li> <li>➤ Roles and responsibilities</li> <li>➤ Process of committee formation</li> </ul>

## Task Analysis

### Task No: 10 Mobilize group.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools and equipment.</li> <li>3. Select manufacturer/installer</li> <li>4. Conduct meeting for construction management</li> <li>5. Collect local materials (sand, stone, poles etc)</li> <li>6. Facilitate for civil construction (catchments, canal, foundations etc)</li> <li>7. Transport electro-mechanical equipment &amp; materials</li> <li>8. Facilitate installation, testing and commissioning</li> <li>9. Assess commitment and organizational capacity of users.</li> <li>10. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At village</b>            Roles and responsibilities of users' committee</p> <p><b><u>Task (What):</u></b>            Mobilize group .</p> <p><b><u>Standard (How Well):</u></b>            Mobilized group properly.</p> <p>The task steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Definition of group</li> <li>➤ Importance of group mobilization</li> <li>➤ Objectives of group mobilization</li> <li>➤ Process of group mobilization</li> </ul>

## Task Analysis

### Task No: 11 Perform periodic maintenance.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Obtain tools and equipment.</li> <li>3. Maintain stocks of frequently damaged equipments like bearing, belt, thyrister, panel meter, fuse wire ,MCB, insulator, lighting arrestor, nut bolts, screws, etc</li> <li>4. Maintain stocks of frequently needed materials like kerosene, grease, Mobil, insulation tape, connectors etc</li> <li>5. Store enough tools at appropriate place and means for regular repair and maintenance like axe, shovel, scrapper for civil works, wire cutter, nose pliers, minus plus screw driver, shouldering iron, multi meter, clamp meter, line tester, safety belt, wire puller, knife for electrical works and hammer, hack saw spanner, wrench, steel ruler, grease gun, oil can, spirit level, wire brush, khagsi etc for mechanical works.</li> <li>6. Perform maintenance on daily, weakly, monthly, quarterly, half yearly and annual basis to operate the project smoothly.</li> <li>7. Record data.</li> </ol>	<p><b><u>Condition(Given):</u></b>  <b>At site and office</b>            White board,            blackboard, overhead,            slide projector, class room,            A video for documentary display</p> <p><b><u>Task (What):</u></b>            Perform periodic maintenance.</p> <p><b><u>Standard (How Well):</u></b>            Periodic maintenance performed.              The task steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Concept of periodic maintenance</li> <li>➤ Importance of daily, weakly, monthly, quarterly, half yearly and annual maintenance</li> <li>➤ Handling of all tools and equipments for periodic maintenance.</li> </ul>

## Module Code: M8

# Module: Small Enterprise Development

### Description

This module is designed to equip trainees with the knowledge and skills on Small Enterprise Development as a common module. This course intends to provide skills and knowledge on generic skill and entrepreneurship development. The generic skill and entrepreneurship development included here is to make trainees competent for promoting wage and self employment opportunities.

### Aim

This module aims to equip trainees with knowledge and skills on Small Enterprise Development necessary to be a micro hydro technician.

### Objectives

After completion of this module the trainees will be able to:

1. Develop generic skill on related occupation.
2. Acquire entrepreneurship skill to be an entrepreneur.

**Prerequisite:** Basic and specialized modules completed.

**Duration:** 70 hours

### Module Structure (M8)

S.N.	Code	Sub-modules	Nature	Total hours	Full marks
1	SM 8.1	Generic Skill	T+P	40	50
2	SM 8.2	Entrepreneurship Development	T+P	30	
<b>Total</b>				<b>70</b>	<b>50</b>

**Module Code: M8**  
***Sub module Code: SM 8.1***  
**Sub module: Generic Skills**

**Description**

This module is designed to equip trainees with the knowledge and skills on Generic Skills as a prerequisite course for mastering any specialized module/s. The course deals with the life skills needed to survive and adopt any change situation. Similarly, the trainees can cope with the existing environment and technology related to their occupation. *The focus of this package is to develop trainees to maintain personal hygiene, develop personality, enrich with marketing skills, and orient towards self-employment. Similarly, the trainees are to be prepared and educated for about worker traits and occupational code of conducts.*

**Prerequisite:** Core and specialized modules completed

**Duration:** 40 hours (15 hours theory and 25 hours practical)

**Competencies**

1. Explain the importance of self awareness.
2. Orient with personal safety precaution/ hygiene
3. Write application for leave, visa, citizenship etc.
4. Read, notice, vacancy advertisement etc.
5. Keep records of materials, inventory.
6. Study prevailing rules, regulation, bye laws work ethics.
7. Develop bio-data.
8. Develop interpersonal skill with family, friends and members of organization
9. Make effective decision.
10. Solve simple problems.
11. Explain the process of airport proceedings.



## Task Analysis

### Task No: 1 Explain the importance of self awareness.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Define self awareness.</li> <li>3. Discuss importance of self awareness.</li> <li>4. Enlist zest of discussion.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>Reading materials</p> <p><b><u>Task (What):</u></b></p> <p>Explain the importance of self awareness.</p> <p><b><u>Standard (How Well):</u></b></p> <p>Importance of self awareness explained.</p>	<ul style="list-style-type: none"> <li>➤ Definition of awareness</li> <li>➤ Importance self awareness</li> </ul>

## Task Analysis

### Task No: 2 Orient with personal safety precaution/hygiene.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Define safety precaution/personal hygiene.</li> <li>3. Enlist importance of safety precaution/personal hygiene.</li> <li>4. Enlist the things that should be considered while following of safety precaution/personal hygiene.</li> <li>5. Collect information on hazards that may occur in their working condition.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>People Working in workshop</p> <p><b><u>Task (What):</u></b></p> <p>Orient with personal safety precaution/hygiene.</p> <p><b><u>Standard (How Well):</u></b></p> <p>All the Performance steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Definition of Personal hygiene and safety precaution</li> <li>➤ Importance of safety precaution and personal hygiene</li> <li>➤ Thing that we should consider during the personal hygiene and safety precautions</li> </ul>

## Task Analysis

### Task No: 3 Write applications for leave, visa, citizenship etc.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select one situation which requires application.</li> <li>2. Take A4 size paper.</li> <li>3. write application (make sure all components of an application are considered)</li> <li>4. Make sure that main body agrees with the given situation.</li> <li>5. Submit to the concerned body.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>Different simulation situations which requires application</p> <p><b><u>Task (What):</u></b></p> <p>Write application for leave, visa, citizenship etc.</p> <p><b><u>Standard (How Well):</u></b></p> <p>Application is in A4 format written.</p> <p>The task Performance steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Definition of application</li> <li>➤ Reasons for writing application</li> <li>➤ Different conditions for writing application (for visa, citizenship, leave etc)</li> <li>➤ Format for application</li> <li>➤ Main components of application</li> </ul>

## Task Analysis

### Task No: 4 Read notice, vacancy advertisement.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect different types of news paper.</li> <li>2. Select general notice and vacancy advertisement.</li> <li>3. Read notice and vacancy advertisement.</li> <li>4. Explain the general contents of notice and vacancy advertisement.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>Tender documents, notices, vacancy advertisements and different newspapers.</p> <p><b><u>Task (What):</u></b></p> <p>Read notice, vacancy advertisement etc.</p> <p><b><u>Standard (How Well):</u></b></p> <p>Notice and vacancy advertisement read and interpreted.</p>	<ul style="list-style-type: none"> <li>➤ Definition of tender document, notice, advertisement</li> <li>➤ Importance of tender documents, notice and vacancy advertisement</li> </ul>

## Task Analysis

### Task No: 5 Keep records of materials, inventory.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect list of different materials.</li> <li>2. Register purchase quantity, issued quantity, damage, wear and tear quantity etc.</li> <li>3. Calculate remaining quantity of different materials.</li> <li>4. Verify the quantity with the stock quantity in the store.</li> <li>5. Keep records.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>List of different materials (Purchase quantity, issued quantity, damage, wear and tear quantity etc)</p> <p><b><u>Task (What):</u></b></p> <p>Keep records of materials, inventory.</p> <p><b><u>Standard (How Well):</u></b></p> <p>All the Performance steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Definition of Inventory</li> <li>➤ Process for keeping inventory</li> <li>➤ Inventory forms and formats</li> </ul>

## Task Analysis

### Task No: 6 Study prevailing rules, regulation, bye laws, work ethics.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect bye laws, rules regulation documents, code of conduct etc.</li> <li>2. Study the documents.</li> <li>3. List the main rules and regulation.</li> <li>4. Keep records.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>Prevailing rules, regulations, bye laws, code of conduct</p> <p><b><u>Task (What):</u></b></p> <p>Study prevailing rules, regulation, by laws work ethics</p> <p><b><u>Standard (How Well):</u></b></p> <p>Important points of rules and regulations, bye laws listed out.</p>	<ul style="list-style-type: none"> <li>➤ Definition of laws, rules and regulations, bye laws, code of conduct and work ethics</li> <li>➤ Importance of bye laws, code of conduct and work ethics</li> </ul>

## Task Analysis

### Task No: 7 Develop bio-data.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect detail information of the person.</li> <li>2. Keep the information into different headings.</li> <li>3. Develop bio-data in A4 size paper.</li> <li>4. Make sure no information is missed.</li> <li>5. Sign the bio-data</li> <li>6. Keep records.</li> </ol>	<p><b><u>Condition(Given):</u></b> Detail information of the person</p> <p><b><u>Task (What):</u></b> Develop bio-data.</p> <p><b><u>Standard (How Well):</u></b> Bio-data is in A4 format with following contents</p> <ul style="list-style-type: none"> <li>• Full Name</li> <li>• Permanent Address</li> <li>• Date of birth</li> <li>• Educational Qualification</li> <li>• Experience</li> <li>• Language</li> <li>• Signature developed.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Definition Bio-data</li> <li>➤ Points, that should be considered in bio-data</li> <li>➤ Advantages of bio data</li> <li>➤ Procedure for reorganizing information in bio-data</li> </ul>

## Task Analysis

### Task No: 8 Develop interpersonal skill with family, friends and members of organization.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Select the people with different behavior.</li> <li>3. Provide role for each person.</li> <li>4. Discuss on the given topic.</li> <li>5. Note down the words used for developing good relationships between them</li> <li>6. End the discussion.</li> <li>7. Enlist the interpersonal relationship of each person.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>Different people with different behavior</p> <p><b><u>Task (What):</u></b></p> <p>Develop interpersonal skill with family, friends and members of organization.</p> <p><b><u>Standard (How Well):</u></b></p> <p>Interpersonal skill with family, friends and members of organization developed.</p>	<ul style="list-style-type: none"> <li>➤ Definition of good relationship</li> <li>➤ Relationship with your family, friends and members of your organization</li> <li>➤ Advantages of Good relationship</li> <li>➤ Tips for making good relationship</li> </ul>

## Task Analysis

### Task No: 9 Make effective decision.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. State the issue.</li> <li>3. Conduct discussion on the issue for 5-10 minutes.</li> <li>4. Note the pros and cons of the issue raised in the discussion.</li> <li>5. Make decision using win win strategy</li> <li>6. Disseminate the decisions.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>Simulated debatable issues</p> <p><b><u>Task (What):</u></b></p> <p>Make effective decision.</p> <p><b><u>Standard (How Well):</u></b></p> <p>Decision made on the win/win strategy.</p>	<ul style="list-style-type: none"> <li>➤ Definition of decision</li> <li>➤ Situations and circumstances for effective decision</li> <li>➤ Advantages of effective decision</li> <li>➤ Process for making decision</li> </ul>

## Task Analysis

### Task No: 10 Solve simple problem.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive instruction.</li> <li>2. Select the person with simple problem.</li> <li>3. Orient with the problem.</li> <li>4. Find different alternatives of solutions.</li> <li>5. List merits and demerits of each solution.</li> <li>6. Select the best solution.</li> <li>7. Implement the solution.</li> <li>8. Receive the feedback.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>Person with a simple problem related to the life</p> <p><b><u>Task (What):</u></b></p> <p>Solve simple problem.</p> <p><b><u>Standard (How Well):</u></b></p> <p>Alternatives of solutions identified.</p> <p>Person satisfied with the solutions.</p>	<ul style="list-style-type: none"> <li>➤ Definition of problem</li> <li>➤ Types of problem</li> <li>➤ Problem solving process</li> <li>➤ Different types of solutions</li> <li>➤ Merits and demerits of each alternative solutions</li> <li>➤ Win/win strategy</li> <li>➤ Principles of persuasion</li> </ul>

## Task Analysis

### Task No: 11 Explain the process of airport proceedings.

Performance steps	Terminal Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Prepare for departure/arrival.</li> <li>2. Make sure the carries required documents (passport and ticket)</li> <li>3. Check the baggage for security.</li> <li>4. Confirm the departure time looking at the information board or TV.</li> <li>5. Pay the airport tax.</li> <li>6. Register the ticket and baggage</li> <li>7. Collect the tags of the baggage.</li> <li>8. Collect boarding pass.</li> <li>9. Pass through security check.</li> <li>10. Proceed to the plane.</li> <li>11. Register name on the immigration of destination country.</li> <li>12. Arrange the transport to reach work station.</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>Simulated situation for departure / arrival</p> <p><b><u>Task (What):</u></b></p> <p>Explain the process of airport proceedings.</p> <p><b><u>Standard (How Well):</u></b></p> <p>All the Performance steps followed in sequence.</p>	<ul style="list-style-type: none"> <li>➤ Airport for visiting different countries</li> <li>➤ Arrival and departure</li> <li>➤ Procedure for departure and arrival</li> <li>➤ Registration</li> <li>➤ Airport tax</li> <li>➤ Boarding pass</li> <li>➤ Lost and findings</li> <li>➤ Baggage collection</li> <li>➤ Immigration</li> <li>➤ Security check</li> </ul>

**Tools/equipment:**

**Safety:** Always receives passport from the points where it could be checked.

**Module Code: M8**  
***Sub Module Code: SM8.2***  
**Sub module: Entrepreneurship Development**

**Description**

This course is designed to equip the trainees with knowledge and skills on Entrepreneurship Development. The course deals with various entrepreneur competencies, project identification, enterprise management, marketing skills, promotional activities, and business scheme preparation and communication skills needed for their occupation.

**Prerequisite:** Core and specialized modules completed

**Duration:** 30 hours (10 periods theory and 20 periods practical)

**Competencies**

1. Explain entrepreneurial competencies.
2. Select / identify a project.
3. Prepare a business scheme.
4. Conduct promotional activities.
5. Prepare cost effective production scheme.









## Task Analysis

### Task No: 4 Conduct promotional activities.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select promotion mix as advertising according to               <ul style="list-style-type: none"> <li>- promotion objectives.</li> <li>- nature of the product.</li> <li>- nature of the target market.</li> <li>- stage of product life cycle.</li> <li>- size of the promotion budget.</li> <li>- promotion strategy.</li> </ul> </li> <li>2. Identify target audience.</li> <li>3. Select objective regarding               <ul style="list-style-type: none"> <li>- informative.</li> <li>- persuasive.</li> <li>- reminding.</li> <li>- reinforcing.</li> </ul> </li> <li>4. Make decision for the budget.</li> <li>5. Choose the message.</li> <li>6. Liaison with the advertising agency.</li> <li>7. Supervise advertising and marketing research.</li> <li>8. Select the media               <ul style="list-style-type: none"> <li>- print media.</li> <li>- visual media.</li> <li>- audio media.</li> <li>- audio visual media.</li> </ul> </li> <li>9. Keep in touch with representatives of important media.</li> <li>10. Cooperate with the sales and other departments.</li> <li>11. Distribute advertising material.</li> <li>12. Administration.</li> <li>13. Evaluate impact</li> </ol>	<p><b><u>Condition(Given):</u></b></p> <p>Workshop or site</p> <p><b><u>Task (What):</u></b></p> <p>Conduct promotional activities.</p> <p><b><u>Standard (How Well):</u></b></p> <p>According to the features of advertising.</p>	<ul style="list-style-type: none"> <li>➤ Concept of promotion</li> <li>➤ Communication model</li> <li>➤ Concept of advertisement</li> <li>➤ Purpose of advertising</li> <li>➤ Advertising media</li> <li>➤ Features of advertising</li> </ul>

## Task Analysis

### Task No: 5 Prepare cost effective production.

Performance steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Receive verbal/ written instruction.</li> <li>2. Selects appropriate tools and equipment.</li> <li>3. Prepare work plan.</li> <li>4. Prepare manpower plan.</li> <li>5. Determine stage of supervision.</li> <li>6. Calculate the cost like: material, labor, tools and equipments,</li> <li>7. Calculate per unit cost for fabrication.</li> <li>8. Sum up total price.</li> <li>9. Review production.</li> </ol>	<p><b><u>Condition(Given):</u></b> Class room, calculator, specification, price list and accessories.</p> <p><b><u>Task (What):</u></b> Prepare cost effective production.</p> <p><b><u>Standard (How Well):</u></b> Cost effective production prepared for cost reduction.</p>	<ul style="list-style-type: none"> <li>➤ Concept of cost effective production.</li> <li>➤ Importance of cost effective production.</li> <li>➤ Technique of preparing cost effective production.</li> </ul>

## OJT for Micro hydro Technician

### Overview of OJT

On-the-Job Training is an individual training approach designed to train the learner to perform certain task while working in the job. It creates appropriate working environment for the teaching learning activities. Training is relevant as the learner is being trained in a real work setting. The aim of the On the Job Training (OJT) is to provide the learner the maximum experience & exposure of "The World of Work".

*In one occupational set up, it is not possible to expose the trainees for all required competencies that they have to master to perform their future job. Moreover, trainers and institution management should take precaution while planning for the OJT placement. Therefore, it is suggested to plan the OJT placement on rotating modality so that the trainees will have enough opportunity to practice the skills enlisted for OJT exposure.*

### Objectives of OJT

After completion of OJT the trainees will be able to:

1. To practice/ apply the skills/ knowledge developed by the trainees through institutional training in the real world of the related occupation
2. To practice the skills gained through institutional training that the trainees have not got enough opportunity to practice and apply them due to the institutional constraints and or limitation
3. To gain world of work experiences
4. To acquire skills and knowledge developed in the related field of occupation
5. To make trainees familiar with the future occupation/ job they are going to hold
6. To provide trainees with supporting skills and knowledge necessary for the related occupation
7. To make trainees familiar with the day to day administrative / management activities applicable in their related occupation.

### OJT placement

The related training institute needs to perform the followings for OJT placement of the trainees.

Make list of the employer agencies:

1. Make list of the Employer agencies:
  - (a) Micro hydro projects run by the government / Private agencies
  - (b) Micro hydro projects run by NGOS / INGOS
  - (c) Others
2. Select the employer agencies / related industries:
  - (a) Obtain the curriculum
  - (b) Match the skills specified in the curriculum with the occupational activities being conducted by industries.
  - (c) Select the employer agency for OJT which: -
    - Is well equipped and can provide maximum opportunity to practice /develop / apply the skills and knowledge included in the curriculum
    - Can provide recently developed knowledge / skills in the related occupation
    - Has the possibility to offer job for the trainees having satisfactory job performance after the completion of OJT.
    - Can offer facilities to the trainees during OJT.
3. Contact employer agency for OJT
4. Make agreement with employer agency regarding OJT.

5. Orient the employer regarding supervision & evaluation of the trainees on OJT.
6. Assign the trainees who have passed institutional training to the selected employer agencies
7. Orient the trainees for OJT (Objectives, curriculum, activities in which they have to be involved, recording, supervision & evaluation etc.)
8. Send Trainees with official letter for OJT.
9. Manage / provide salary (at least to cover the living cost) to the trainees.
10. Have initial supervision to help socialize and guide the trainees sent for the OJT.
11. Have periodic supervision and evaluation of the trainees at least three times at an interval of two months during the period of OJT.
12. Collect feedback as inputs for the revision of the curriculum for future.
13. Keep records.

### **Orientation to the Trainees for OJT**

The trainees who are placed on OJT are to be oriented by the related institute about the followings:

1. OJT Activities
2. OJT Evaluation
3. OJT curriculum

### **Suggestion for Trainees for OJT**

1. Receive orientation for OJT provided / delivered by the related Training institute
2. Obtain curriculum
3. Obtain official letter for Joining OJT
4. Contact the assigned organization
5. Maintain attendance
6. Manage Accommodation
7. Obtain Job description
8. Visit / observe the activities related
9. Study critically the related units of industry
10. Obtain curriculum
11. Match the tasks specified in the curriculum with the actual tasks / activities being carried in the industry.
12. Make lists of tasks:
  - (a) You need to practice for confidence building
  - (b) You need to practice the skills that are not covered in the institutional Training
  - (c) You need to practice the skills that are not included in the curriculum but need to perform in the real world of the occupation for successful OJT performance.
  - (d) Recently developed skills through research applicable to your level of job after OJT.
13. Finalize the Task list consulting with:
  - (a) Your supervisor &
  - (b) Instructor
14. Practice / perform / develop as many related skills as possible related to your level of job.
15. Perform related administrative functions.
16. Perform / develop skills on cue the duties and tasks specified in the job description provided by the employer during OJT.
17. Get help form the senior (s) / supervisor (s) to perform the tasks \develop skills as maximum as possible.
18. Develop daily diary / Log book
19. Fill the daily diary / Log book

20. Get signed by your supervisor regularly
21. Seek & follow suggestion from seniors
22. Show excellent job performance to influence your senior (s) / supervisor so that they could will recommend to the employer to offer you the job after OJT.
23. Develop professionalism.

### **OJT Evaluation**

The OJT will be evaluated by:

- a. Related supervisor of organization
- b. Related instructor/supervisor of the training institute
- c. CTEVT (representative or assigned expert if needed)

The marks distribution for the OJT evaluation of the trainees will be as follows:

S.N.	Evaluators	Marks Distribution	
		Full Marks	Percentage
1.	Related Supervisor of the industries / Organization	<b>200</b>	<b>50%</b>
2.	Related supervisor / instructor of the training institute	<b>100</b>	<b>25%</b>
3.	External expert	<b>100</b>	<b>25%</b>
<b>Total</b>		<b>300</b>	<b>100%</b>

### **Competencies to be performed during OJT**

The trainees are suggested to practice all the critical competencies falling under each module repeatedly during the period of OJT.



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# **DACUM (Job Analysis) of Micro-hydro Technician**

**October, 2006**



**Training for Employment Project**  
Pulchowk, Lalitpur

## DUTIES & TASKS for Micro-hydro Technician

### A Perform Bench Works

A1. Measure/ mark work piece	A2. Cut/file work piece	A3. Drill work piece	A4. Thread work piece	A5. Grind work piece	A6. Apply venire caliper	A7. Tighten /open nuts/bolts
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### B Perform Welding

B1. Perform surface welding in flat position.	B2. Weld edge joint in flat position.	B3. Weld lap joint in flat position.	B4. Weld 'T' joint in flat position.	B5. Weld square butt in flat position.	B6. Weld single 'V' butt in flat position.	B7. Weld double 'V' butt in flat position. B6.
B8. Weld corner joint in flat position.	B7. Weld square butt in horizontal position.	B8. Perform surface welding in vertical position.	B9. Weld single 'V' butt joint in vertical position	B10. Perform fillet lap joint in vertical position.	B11. Perform surface weld in overhead position.	B14. Weld square butt joint in overhead position.

### C Sketch Drawings

C1. Read / Interpret scale	C2. Draw Lines	C3. Draw free hand sketches	C4. Draw lay- out Diagram	C5. Draw wiring diagram	C6. Interpret plan, elevation & section	C7. Interpret Isometric view
C8. Interpret orthographi c view	C9. Interpret photographic view	C10. Interpret manual	C11. Draw schematic drawing			

### D Basic Civil Works

D1. Prepare cement & motor	D2. Prepare concrete	D3. Lay plaster/ concrete	D4. Build masonry wall	D5. Fill/ align gabion box	D6. Join HDPE pipe	D7. Make/HDP E fittings
D8. Join HDPE & GI Pipe	D9. Join GI pipes	D10. Thread pipes				

### E Perform Electrical Works

E1. Interpret electrical symbols	E2. Design house wiring system	E3. Install / Control single phase wiring	E4. Install three phase wiring	E5. Design three wiring system	E6. Install main switch	E7. Install one- way/two way switch/fuse indicator
E8. Install junction box	E9. Install five pin/ three pin/ two pin socket	E10. Connection accessories	E11. Perform equipmen t earthing	E12. Perform system earthing		

### F Generate Power

F1. Measure flow	F2. Calculate canal cross section	F3. Maintain fore bay	F4. Measure head	F5. Calculate/ power measure	F6. Maintain intake/ head	F7. Maintain penstock pipe
F8. Operate gate valve	F9. Measure pressure	F10. Regulate flow control valve	F11. Align turbine bearing/ runner	F12. Maintain tack ballast	F13. Measure/ monitor bearing temperatu re	F14. Measure insulation resistance for generator

F15. Measure insulation resistance for transformer	F16. Measure insulation resistance for domestic wiring	F17. Measure insulation resistance for industrial wiring	F18. Operate ELC ( Electronic Load Control)	F19. Operate IGC (Injection Generator Control)	F20. Calculate/measure energy	F21. Measure current
F22. Measure / maintain voltage	F23. Measure/maintain frequency	F24. Align for belt pulley system	F25. Align turbine/ generator shaft for direct coupling system	F26. Install / operate emergency cut out system	F27. Install ballast siren	F28. Synchronize generator
F29. Excite generator	F30. Adjust belt tensioning	F31. Ensure canal condition (leakage, fill up)				

### G Perform Power Distribution Works

G1. Choose size / type of pole	G2. Install pole stay cable	G3. Erect pole	G4. Perform insulator selection	G5. Calculate cable size	G6. Perform cable selection	G7. Calculate sag
G8. String cable	G9. Operate circuit breaker	G10. Install lightning arrester	G11. Maintain clearance ( wire to structure)	G12. Maintain clearance (ground to wire)	G13. Maintain clearance ( between wire)	G14. Perform protective device selection
G15. Perform protective device connection	G16. Connect service wire	G17. Connect police switch (limit switch)	G18. Perform Star-delta connection	G19. Record/ balance load	G20. Regulate voltage	G21. Measure/ maintain power factor
G22. Measure / maintain earth resistance	G23. Join cable	G24. Perform cable shoe selection & fittings	G25. Calculate electrical energy loss			

### H M/H Plant Management

H1. Read meter	H2. Keep A/C system	H3. Prepare bills	H4. Maintain log book	H5. Supervize sub-ordinate	H6. Maintain inventory	H7. Conduct meetings with customer
H8. Progress write/ case study	H9. Write minutes	H10. Prepare checklist for preventive maintenance	H11. Perform periodic maintenance			

### I Mobilize Societies

I1. Collect customer feedback	I2. Conduct villager meeting	I3. Form user committee	I4. Assist in developing constitution	I5. Mobilize user group		
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### J Repair / Maintain M/H Plant

J1 Repair belt	J2 Pull/ grease bearing	J3 Replace turbine bearing	J4 Repair expansion joint	J5 Repair / replace butterfly valve	J6 Repair / replace gate valve	J7 Repair thyristor HRC fuse
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J8	Replace transformer	J9	Replace ampere meter	J10	Replace volt meter	J11	Replace frequency meter	J12	Replace air/ water heater	J13	Replace turbine runner	J14	Replace flow regulating valve
J15	Replace ELC/ IGC	J16	Replace carbon brush	J17	Change slip ring	J18	Repair / Replace Contractor / circuit breaker	J19	Replace fuses	J20	Replace AC/ DC relay	J21	Replace MCCB
J22	Replace parts of emergency cut out system	J23	Refill distilled water in battery	J24	Repair / replace sluice gate								

### **K Communicate with Other**

K1.	Communicate with senior technician	K2.	Communicate with junior technician	K3.	Communicate with villager	K4.	Communicate with customer	K5.	Communicate with client	K6.	Communicate with colleagues	K7.	Communicate with fabricator
K8.	Communicate with supervisor	K9.	Receive phone calls										

### **L Develop Professionalism**

L 1	Seek training places	L 2	Attend training	L 3	Read books / journals	L 4	Browse WWW sites	L 5	Watch AV media	L 6	Visit parts fabricator	L 7	Visit Shops / equipped places
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### Additional Information for Micro-hydro Technician

Worker Traits		Entry Requirements	Career Paths	Future Concerns
Neat & tidy Punctual Friendly Eager to learn Polite Disciplined Service oriented Honest Hard working	Interested towards work Patience Intelligent Cooperative Curious Alert Ethical	Minimum age 16 yrs. Eight class pass Physically fit (eyes and hands in good condition)	Senior technician Instructor	Competitive Bright future
		<b>Duration of training</b> 12 months		
Related Technical Knowledge			Tools & Equipment	
Introduction of micro-hydro, Activities in micro-hydro (generation, distribution, components, function), Concept of electricity, Definition of flow, flow measurement methods, concept of head, type of canal section, calculation of area of canal section, concept of power, calculation of power, concept of energy, concept of current, concept of voltage, concept of frequency, concept of resistance, methods of measuring (current, voltage, resistance and frequency, belt alignment, belt tensioning technique, concept of pressure, relation between pressure and head, working principle of ELC/IGC concept of fore bay, concept of intake, expansion joints, installation of penstock pipe, working principle of expansion joint, types of valves, types of insulators, function of ballast tank, concept of bearing temperature, concept of insulation resistance, working principle, type and technique of turbine alignment/ generator alignment, concept of emergency cutout system, function and types of bearing, function of ballast siren, concept of synchronization and exciting generator, concept of load balancing, voltage regulation, concept of sagging and clearance of conductor, concept and maintaining of power factor, concept of earthing and its type, star-delta connection, cable selection criteria, function and selection criteria of protective devices, concept and working principle of current limiting devices, distribution lines hardware methods of installation, method of cable jointing, types of cable shoe and fittings, types and selection of service wires, working principle and types of circuit breaker, methods of energy loss calculation, working principle of lighting arrester, identification of electrical symbols, methods of wiring, 3 phase industrial wiring, identification and handling technique of tools and equipment, types of fuse, function of fuse, type of belt, types and selection of lubricant, instrumentation, metering measurement and protection, way of finding bearing damage, bearing pulling fitting technique, working principle of transformer, working principle of turbine, working principle of generator, concept of ballast heater			Digital multimeter Clampmeter Insulation tape Soldering iron Disordering pump Slide wrench 8” Screw driver sets Line tester Cutting pliers Nose pliers Side cutters Socket wrench Measuring tape Hammer Wire steeper Brush, Knife Power clamp/multimeter Wire puller with wire grip	Spanner sets Chisel Ellen key Wire steeper Line tester Grease gun Side cutter Control panel Digital clamp meter Combination pliers Nose pliers Cutting pliers Thyristor Belt one set Ammeter, Tester HRC fuse one set each Penstock and other equipment Flat file Round file Rough file Volt meter Frequency meter

## List of Tools and Equipment

1. Adjustable wrench
2. Ammeter, Tester
3. Arc – Carbon holder
4. Arc welding table
5. Back square
6. Belt one set
7. Bench vice
8. Bevel Protector
9. Brush, Knife
10. Centre punch
11. Chipping hammer
12. Chisel
13. Clampmenter
14. Cleaning brush
15. Combination pliers
16. Control panel
17. Counter boar
18. Counter sink
19. Cutting pliers
20. Digital clamp meter
21. Digital multimeter
22. Disordersing pump
23. Divider (inside / out side)
24. Drill bit (metal)
25. Drill M/C
26. Ellen key
27. Flat file
28. Frequency meter
29. Grease gun
30. Hack saw frame
31. Hammer
32. Heating nozzle
33. Hose pipe
34. HRC fuse one set each
35. Insulation tape
36. Line tester
37. Mason hammer
38. Measuring tape
39. Nose pliers
40. Number punch
41. Penstock and other equipment
42. Pipe vice
43. Chain vice
44. Power clamp/multimeter
45. Radius gauge
46. Reamer
47. Rough file
48. Round file
49. Scissor
50. Screw driver sets
51. Scriber
52. Side cutters
53. Slide wrench set
54. Socket wrench
55. Soldering iron
56. Spanner sets
57. Spark lighter
58. Steel hammer
59. Tapping dies
60. Threading dies
61. Thyristor
62. Tongs
63. Vice gripe
64. Volt meter
65. Welding blow torch
66. Welding gauge
67. Welding goggles
68. Welding nozzle
69. Welding shield
70. Welding socket and plug
71. Wire puller with wire grip
72. Wire steeper

## References

### AEPC/ESAP Publications

1. Existing Micro hydro and Pico hydro Standards of Nepal
2. Guidelines for pre- feasibility studies of Micro-hydro projects
3. Guidelines for detailed feasibility studies of Micro-hydro projects
4. Social Mobilization for Micro-hydro Schemes, A Reference Guideline

## **Experts involved**

### **Stage 1: Job Analysis**

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## Glossary used in the technical and vocational curricula

**Competency:** A performance capability needed by workers in a specialized area.

**Curriculum guide:** A curriculum guide is a detail resource for teachers to conduct training programs effectively. The guide intends to add the teacher in developing lesson plan, handouts, training manuals, and evaluation criteria etc, which are basic elements in the teaching learning process.

**Curriculum:** A plan for providing sets of learning opportunity to achieve broad goal and related specialized objectives for an identifiable population serves by a single school center.

**DACUM:** Developing A Curriculum. DACUM is a technique that uses a group consultative process to identify the competencies relevant to a particular occupation. These competencies are then built on to form a vocational curriculum.

**Duty:** is an arbitrary clustering of related tasks in to broad functional area or general area of responsibility.

**Enabling Objective:** The Objectives are defined as to set for guiding the teacher and students to attain the end result of the particular unit of work or lesson.

**Instructional Guide:** is a well-planned and structured document for the instructor to deliver effective instruction so that trainees can attain learning is objectives as per training standards.

**Module:** A module is defined as a specialized learning material. Modules are essentially self-contained. Self-instructional packages, with learning paced by each learner according to his/her individual ability and needs. A module covers either a single element of subject matter content or a group of content elements forming a discrete unit of subject matter or area of skills.

**Occupational Analysis:** is a process used to identify the duties and tasks that are important to workers in any given occupation. A number of alternative and acceptable approaches to occupational analysis are available.

**Program guide:** A program guide is a comprehensive resource for teachers, planners, and top-level management for planning and implementation of any training programs.

**Program Objectives:** The objectives are set in a broad way to target to achieve mastery learning of the complete occupation.

**Related Technical Knowledge:** Knowledge essential to perform a task/ step in complete, accurate and safe manner.

**Skill:** The ability to perform on occupational task with the degree of proficiency required for a given occupation

**Step:** The smallest discrete or observable aspect of a task.

**Task Analysis:** Task analysis is the process of identifying and writing down the specialized skills, knowledge and attitudes that distinguish someone who performs a task competently from someone who cannot perform the task at all.

**Task:** A unit of work complete in itself that forms a logical part of an occupation. It can be broken down into discrete steps.

**Terminal Performance Objective:** The objectives set to attain at the end of the training completion. It includes condition, unit of work and standard of teaching and learning.