CURRICULUM

Pre-Diploma in

Hydropower Engineering-
Plant Operation and Maintenance

(Apprenticeship Programme)

Council for Technical Education & Vocational Training (CTEVT)

Curriculum Development Division

Sanothimi, Bhaktapur

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Introduction:

Nepal's hydropower sector, with over 40,000 MW of viable potential, plays a crucial role in driving national development, strengthening energy security, and facilitating regional power trade. Although the current installed capacity is sufficient, the sector remains underutilized due to a shortage of skilled manpower and the absence of standardized operation and maintenance practices. Bridging this gap requires a well-designed, industry-responsive training program and curriculum to develop capable professionals who can ensure the effective and efficient operation and maintenance of hydropower plants.

In response, the Council for Technical Education and Vocational Training (CTEVT), Nepal's apex TVET body, developed this Curriculum for Pre-Diploma in Hydropower Engineering-Plant Operation and Maintenance to produce entry-level professionals for the renewable energy sector, following an apprenticeship-based Dual VET model. This 24-month program includes 15 weeks of foundational in-house training, 78 weeks of workplace training with one-day weekly classes, and a final 4-week revision period, with an implementation strategy of tripartite agreement among trainees, training institutes, and industries to ensure hands-on skill development in the hydropower plant operational and maintenance.

Rational

Nepal's current installed hydropower capacity stands at 3,511.57 MW, with peak demand slightly above 2,200 MW, yet maximum supply often remains around 2,000 MW due to factors such as water levels, maintenance, transmission constraints, and a shortage of essential regulatory skills. Furthermore, as Nepal seeks to export surplus electricity and improve domestic energy reliability, the role of skilled technicians in maintaining uninterrupted power generation and transmission becomes even more critical. To ensure reliable power generation, a specialized curriculum is needed to equip graduates with professional skills in operation, maintenance, safety, and troubleshooting.

Course Title

Pre-Diploma in Hydropower Engineering-Plant Operation and Maintenance (Apprenticeship Program)

Aim

The aim of this curriculum is to develop a competent workforce capable of efficiently operating and maintaining hydropower plants across Nepal. It seeks to equip learners with the practical skills, theoretical knowledge, and workplace competencies necessary to ensure the safe and effective management of hydropower plants according to established standard practice guidelines.

Objectives

The main objectives of developing this curriculum are to:

- Develop foundational concepts of hydropower principles and plants components.
- Apply safety standards in hydropower projects.
- Utilize appropriate materials and construction techniques in hydropower projects.
- Use instruments and measurement techniques with high precision and accuracy.
- Operate hydropower plants efficiently and safely according to standard procedures.
- Perform effective maintenance and manage resources to ensure plant reliability.
- Interpret technical drawings to clearly understand hydropower plant layouts and systems.

- Develop entrepreneurial skills to support sustainable and innovative practices in the hydropower plant regulations.
- Enhance communication and professionalism for effective workplace performance.

Course Duration

This course will be completed within 24 months after the enrolment in a formal setting. The total hours for the course will be 3880 hours in the 24 months of period. The details of the course duration are as follows:

A. Institute Based Instruction:	**1280 hours (32 Weeks)**
• Pre training course:	15 weeks (600 hours)
• One day/week for 78 weeks:	13 weeks (520 hours)
• Block Release:	4 weeks (160 hours)
B. Industry Based Training (Hands on Practice):	**2600 hours (65 Weeks)**
• Workshop Technology	5 weeks (200 hours)
• Instrumentation and Measurement	10 weeks (400 hours)
• Hydropower Plant Operation	25 weeks (1000 hours)
• Hydropower Plant Maintenance	25 weeks (1000 hours)

Entry Criteria

Individuals with following criteria will be eligible for this program:

- SEE, Grade-10 with any GPA and grade (Since 2072 SLC).
- SLC appeared (Before 2072 SLC).
- Nepali citizen above 16 years of age.
- Pass entrance examination administered by CTEVT/as decided by the Office of the Controller of Examinations, CTEVT.
- Selected candidates should pass the interview conducted jointly by industry and the training institute.
- Mentally & physically fit for the occupation.

Group size

The group size of this program will be 40.

Medium of Instruction

The medium of instruction will be in English and/or Nepali language.

Pattern of Attendance

The students should have 90% attendance in theory classes and 100% in practical/industrial practice to be eligible for internal assessments and final examinations.

Instructors' Qualification

- Instructors should have at least a Bachelor Degree in Electrical/Mechanical Engineering
- Assistant Instructors should have Diploma in Electrica/Mechanical Engineering
- Practical Assistant/Teaching Aide should have minimum of Pre-diploma (TSLC) in Electrical/Mechanical Engineering along with at least three years of relevant experience.
- For in-company/industry trainers, the required qualifications must align with those specified in the apprenticeship training guidelines.

- All instructors and trainers should have completed recognized Instructional Skills (IS) Training or Training of Trainers (ToT).

Teacher and Student Ratio

- Overall ratio of teacher and student must be 1:40 (at the institution level).
- Teacher and student's ratio for theory class should be as per nature of classroom
- Teacher and student ratio for practical should be 1:10
- Minimum 75% of the teachers must be fulltime.

Instructional Media and Materials

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

- Printed Media Materials: Assignment sheets, Handouts, Information sheets, Individual training packets, Procedure sheets, Performance Check lists, Textbooks, etc.
- Non-projected Media Materials: Display, Photographs, Flip chart, Poster, Writing board, etc.
- Projected Media Materials: Multimedia, Overhead transparencies, Slides, etc.
- Computer-Based Instructional Materials: Computer-based training, Interactive video, etc.

Teaching Learning Methodologies

The methods of teaching for this curricular program will be a combination of several approaches such as:

- Theory: Lecture, group discussion, Assignment, Group work.
- Practical: Demonstration, Observation and Self-practice, guided practice, tutorial.
- Industrial Practice: Real practice under the supervision of Industrial Supervisor.

Evaluation Details

- The distribution of marks for theory and practical tests will be as per the marks given in the course structure of this curriculum for each subject. Ratio of internal and final evaluation is as follows:

S.N.	Particulars	Internal Assessment	Final Exam	Pass %
1	Theory	50%	50%	40%
2	Practical	50%	50%	60%
3	Industrial Practice	50%	50%	60%

- There will be three internal assessments conducted by institute, followed by the Pre-Industry Exam**ination** for each subject at the end of the initial institute-based training phase. This exam serves as a mandatory for entry into the industry-based training phase. Moreover, the mode of assessment and examination includes both theory and practical or as per the nature of instruction as mentioned in the course structure.
- Continuous evaluation of the students' performance is to be done by the related instructor/ trainer/industrial supervisor to ensure the proficiency over each competency under each area of a subject specified in the curriculum. Upon completion of the industry-based training phase, a **Final Industrial Competency Test** shall be conducted through practical performance tests/assessments, supported by viva and/or objective test items to evaluate the corresponding theoretical knowledge across all subject areas.

- Performance evaluation of industrial practice should be done by the related In-company Trainer (Industrial Supervisor).
- Every student must pass every internal assessment to appear in the Pre-Industry Examination and the final Industrial Competency Test.

Provision for Back Paper

Apprentices may appear in back paper examinations; however, all subjects must be passed within three years from the date of enrolment. Chance examinations shall be conducted as per prevailing CTEVT rules and provisions.

Grading System

The grading system will be as follows:

Grading	**Overall marks**
Distinction	80% or above
First division	75% to below 80%
Second division	65% to below 75%
Third division	Pass aggregate to below 65%

Certificate Awarded

The council for technical education and vocational training will award certificate of "**Pre-Diploma in Hydropower Engineering-Plant Operation and Maintenance (Apprenticeship)"** to those students who have successfully completed the requirements as prescribed by the curriculum. This certificate is considered equivalent to the previous qualification level, Technical School Leaving Certificate (TSLC).

Career Path

The graduate will be eligible for positions equivalent to Non-Gazetted Second Class/Level 4 (Technical) within government-related organizations, as determined by the Public Service Commission of Nepal or other relevant authorities and professional bodies of the Federal Democratic Republic of Nepal.

Course Structure

A. Institute-Based Training: Weeks 1 to 15 (15 weeks @ 40 hours per week)

S. N	Subjects	Teaching Scheme				Examination Scheme						Total Marks	Remarks
		Mode		Hours/ Week	Credit Hours	Theory			Practical				
						Assmt. Marks	Final		Assmt. Marks	Final			
		T	P				Marks	Time (hrs.)		Marks	Time (hrs.)		
1	Fundamentals of Hydropower Engineering	3	2	5	4	20	80	3	25	-	-	125	
2	Workshop Technology	2	6	8	5	10	40	1.5	60	40	4	150	
3	Instrumentation and Measurement	3	4	7	5	20	80	3	30	20	3	150	
4	Hydropower Plant Operation	4	2	6	5	20	80	3	25	-	-	125	
5	Hydropower Plant Maintenance	2	2	4	3	10	40	1.5	25	-	-	75	
6	Engineering Drawing	1	3	4	3	25	-	-	30	20	3	75	
7	Entrepreneurship Development	2	1	3	3	10	40	1.5	25	-	-	75	
8	Applied Communication & Professionalism	3	0	3	3	20	80	3	-	-	-	100	
	Total	**20**	**20**	**40**	**31**	**135**	**440**		**220**	**80**		**875**	

B. Pre-Industry Examination: Weeks 16 to 17 (2 weeks)

Administered by the Controller of Examinations, CTEVT prior to the commencement of industrial practice

C. Industry-Based Training: Weeks 18 to 95 (65 weeks @ 40 hours per week = 2600 hours)

S. N	Subjects	Teaching Scheme				Examination Scheme						Total Marks	Remarks
		Mode		Hours/ Week	Credit Hours	Theory			Practical				
						Assmt. Marks	Final		Assmt. Marks	Final			
		T	P				Marks	Time (hrs.)		Marks	Time (hrs.)		
Workplace Orientation Phase (5 weeks)													
1.	Safety and Protection	-	3	3	2	-	-	-	30	20	3	50	
Fundamental Skills Development Phase (10 weeks)													
2.	Instrumentation and Measurement	-	7	7	4	-	-	-	60	40	4	100	
Applied Skills Development Phase (25 weeks)													
3.	Hydropower Plant Operation	-	15	15	8	-	-	-	120	80	6	200	
Problem-Solving Skills Development Phase (25 Weeks)													
4.	Hydropower Plant Maintenance	-	15	15	8	-	-	-	120	80	6	200	
	Total		**40**	**40**	**22**				**330**	**220**		**550**	

D. Institute-Based Training: Weeks 18 to 95 (13 weeks @ 6 hours per week = 78 hours) **Online and/or physically mode, with structured and integrated activities into the weekly plan** Submission of practice logbook as per provided instructions Sharing field experiences, discussion of problems faced, resolved and unresolved issues supported by simulated practice and project work Presentation of field report, assessment and evaluation, reflection of learning, exchange of feedback, sharing of upcoming task and activities and progress reporting
E. Block Release Session: Weeks 96 to 99 (4 weeks @ 40 hours per week) **According to the structured weekly activity plan** Addressing critical queries from the apprentice Providing supplementary instruction in remaining key theory and workshop practices Conducting refresher training, independent and project/problem-based practice activities, including simulated workplace tests and feedback
F. Final Industrial Competency Test: Weeks 100 to 104 (5 Weeks) Administered at accredited industry/institute-based test centers Collaborated with partner industries, employer associations, and training institutes, under the supervision of CTEVT

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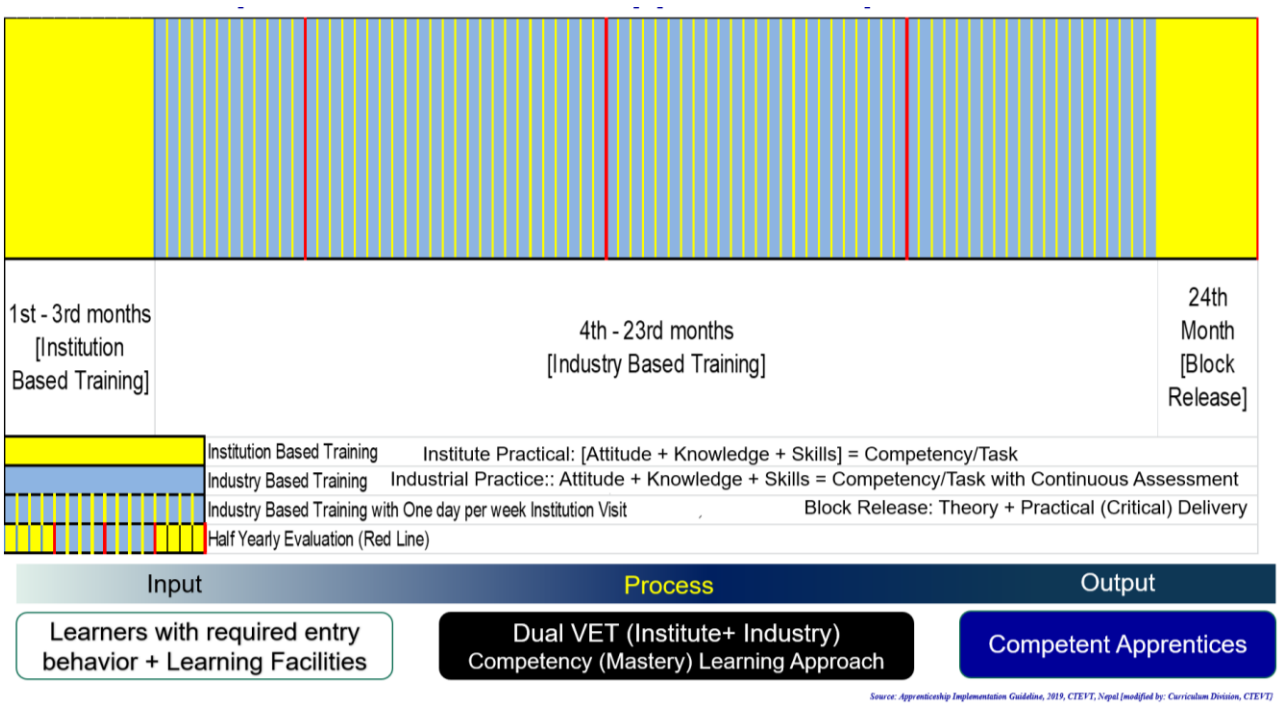
Credit System

S. N	Subjects	Credits-A (15 weeks Institution-Based)	Credits-C (65 weeks Industry-Based)	Credits-D (13 weeks Institution-Based)	Credits-E (4 weeks Block Release)	Maximum Credits
1.	Fundamentals of Hydropower Engineering	1.71	-	-	0.46	**2**
2.	Workshop Technology	2.14	3.71	0.74	0.57	**7**
3.	Instrumentation and Measurement	2.14	7.43	1.49	0.57	**12**
4.	Hydropower Plant Operation	2.14	14.86	2.97	0.57	**21**
5.	Hydropower Plant Maintenance	1.29	14.86	2.97	0.34	**19**
6.	Engineering Drawing	1.29	-	-	0.34	**2**
7.	Entrepreneurship Development	1.29	-	-	0.34	**2**
8.	Applied Communication & Professionalism	1.29	-	-	0.34	**2**
	Total	13.29	40.86	8.17	3.53	**67**

Notes:
T: Theory
P: Practical
Credit Hour: Represents instructor-led contact time, used for calculating evaluation weightage based on weekly hours for theory, workshop, and/or industrial practice.
Credit (Annual System): Indicates the total volume of learning completed over 3,880 hours across 97 weeks [15 (A) + {65 (C) + 13 (D)} + 4 (E)] at 40 hours per week. In this model, Credits are calculated using the formula: Credit Hours × (Phase Weeks ÷ 35 Annual Weeks) across all phases, with **Phase E** following the same weekly planning structure as **Phase A**, and **Phase D** following that of **Phase C**.

Conceptual Framework of Apprenticeship Model



Source: Apprenticeship Implementation Guideline, 2019, CTEVT, Nepal [modified by: Curriculum Division, CTEVT]

Fundamentals of Hydropower Engineering

Total Class: 75 hours
Theory: 45 hours
Practical: 30 hours

Course description:

This course provides a comprehensive introduction to the fundamental principles and practices of hydropower generation. It covers the history and current status of hydropower, the classification of hydropower plants, basic hydraulics, energy conversion processes, mechanical and electrical components, civil structures, and the layout of hydropower systems. Emphasis is given to the basic technical aspects essential for working in hydropower development.

Course Objectives:

Upon successful completion of this course, students will be able to:

1. Explain the basic principles of hydropower generation and its role in the global energy mix.
2. Describe the types and components of hydropower plants.
3. Describe the functions of the civil, mechanical, and electrical components in hydropower systems.
4. Apply fundamental hydraulics and power equations to hydropower system calculations.

Course content

Section A: Institute Based Training (15 Academic Weeks) 90 hours

S.N.	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
1.	Introduce the concept of Hydropower	• History of hydropower, sources of energy. • Advantages and disadvantages. • Classification of hydropower plants, scheme. • Current status of hydropower development in Nepal. • General layout of a hydropower plant.	3		3

2.	Explain the hydrology for hydropower development	• Hydrologic cycle and components:
		  o Evaporation
		  o Transpiration
		  o Condensation
		  o Precipitation
		  o Infiltration
		  o Percolation
		  o Run-off
		  o Groundwater flow
		• Catchment area
		• Rainfall-Runoff relationships
		• Concept of flow duration curve
		• Perform stream flow measurement.
			3	15	21

		• Sediment monitoring and flushing mechanism			
3.	Apply hydraulics for hydropower system.	• Define the technical terms: o Pressure o Head o Flow rate/ Discharge • Energy conversion stages; Potential Energy →Kinetic Energy → Mechanical Energy → Electrical Energy. • Power equation; $P = \rho * g * Q * H * \eta$ and related numerical. • Concept of gross head and net Head, and head losses; friction, minor losses. • Turbine and generator efficiencies and factors affecting.	9		12
4.	Describe civil structures in headworks	• Define and purposes: o dams o spillways o intakes structure o gravel trap o Diversion weir o under sluice-system o Desander/settling basin o Fish ladder o Protection works (slope and river)	9		12
5.	Explain water conveyance components	• Define and purposes: o headrace canal/tunnel/pipeline o Rock trap o surge shaft (tank) o forebay o Penstock o draft tube o Tailrace	4		4
6.	Explain the layout and types of powerhouses	• Introduction • Classification; surface and underground powerhouse • Layout plan	2		2
7.	Familiarize with mechanical components in hydropower	• Types of gates and stoplogs • Trash rack • Types and functions of turbines; Pelton, Francis and Kaplan	9	6	18

		• Bearing and its types • Governing system • Valves types and their functions • Emergencies slide doors and safety mechanism. • Cooling system. • Compressed air system. • Oil pressure unit • Central lubrication and exhaust systems • Firefighting system • Demonstrate mechanical components.			
8.	Familiarize with electrical Components in hydropower	• Generator; types, excitation systems • Transformer and switchyard; types, and protection systems. • Control and protection system; SCADA system, sensors alarms, protection relays and grounding system • Demonstrate electrical components.	6	9	18
		Total	45	30	75

References:

1. Sharma, R. K., & Sharma, T. K. (n.d.). *Fundamentals of hydropower engineering*. S.K. Kataria & Sons.
2. Ghimire, D. (n.d.). *जलविद्युत* [Hydropower]. Sajha Prakashan. *(Original work published in Nepali)*

Workshop Technology

Total Class: 320 hours
Theory: 30 hours
Practical: 290 hours

Course Description:
This course provides fundamental practical skills and knowledge about security, safety, and protection systems in hydropower plants. It addresses key subjects such as fire protection, electrical safety, disaster management, equipment labeling, and transmission line maintenance, which prepare students for real-world challenges in the hydropower plants.

Course Objectives:
After completion of this course, apprentices will be able to:

1. Utilize essential safety measures and practices during the operational and maintenance work of Civil, Mechanical and Electrical equipment.
2. Perform hazard identification and risk mitigation measures to hydropower plants
3. Apply safety in operational procedures relevant to substations and transmission line maintenance to prevent accidents and system reliability.
4. Recognize potential disaster situations in power system facilities and comprehend basic emergency response procedures.
5. Gain hands on experience with emergency protocols, logging and equipment labeling.

Course content

Section A: Institute Based Training (15 Academic Weeks) 120 hours

S.N.	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
General Safety Measures					

1.	Maintain Workshop Safety	• Introduction to safety
		• Types of hazards
		• Safety management principle;
		  o Elimination
		  o Substitution
		  o Isolation
		  o Use of Personal Protective Equipment (PPE)
		• Perform basic first aid:
		  o Cuts
		  o Injuries
		  o Electric shock
		  o Burning
		  o Emergency management (CPR/Rescue techniques)
		• Apply tools and equipment safety:
		  o Safety guards
		  o Record keeping
		  o Tagging
		  o Machine fixing and positioning
		  o Safety sensing devices
			2	5	7

		• Apply workplace safety
		  o Lighting and ventilation
		  o Signs and signals
		  o Placement of tools, equipment and materials
		  o Working space and layouts
		  o Safety rules and administrative procedures
		• Use fire extinguishers
		  o Fire triangle and types of fire
		  o Location identification
		  o Selection criterion
		  o Procedure to use
		  o Check functionality
		• Electrical safety
		  o Sign and signals
		  o Electrical protective devices			

Basic Civil Works					

2.		• Introduction
		• Use various hand tools
		  o Hammer
		  o Spade
		  o Sprit level
		  o Plum bob
		  o Trowels
		  o Try square
		  o Chisels
		• Use basic equipment/machine
		  o Concrete mixer
		  o Compactor
		• Perform cleaning, storage, and routine maintenance of tools and equipment
			2	2	4

3.		• Basics on brick masonry construction
		  o Technical terms
		  o Types of brick
		  o Properties of brick
		  o Bonds
		  o Junctions
		  o Common defects in brick
		  o Mortar
		  o Curing
		• Construct English bond brick wall
			2	12	14

		• Construct Flemish bond brick wall
		• Stone masonry
		  o Technical terms
		  o Stone dressing; rubble, Ashlar
		  o Special consideration in stone masonry construction
		• Construct rubble stone masonry wall
		• Construct Ashlar stone masonry wall
		• PCC and RCC works
		  o Properties
		  o Grade
		  o Batching
		  o Mixing
		  o Transport
		  o Placing
		  o Compaction and finishing
		  o Curing
		• Formwork
		  o Definition
		  o Materials
		  o Fixing
		  o Removing
		• Reinforcement
		  o Size,
		  o Classification (MS bar, Tor Steel, TMT)
		  o Corrosion and treatment
		  o Cutting
		  o Arrangement
		  o Binding
		  o Bending
		  o Lapping and coupling
		  o Anchoring
		  o Coverage
		• Construct a RCC slab/beam			

Electrical Works					
4.	Use basic hand tools and measuring instruments	• Introduction • Use various hand tools: screwdrivers, pliers, Wire strippers, crimping tools, hacksaw, drill machine	1	2	3

		• Use of basic electrical measuring instruments: camp-on meter, multimeter, megohmmeter/insulation tester, tachometer,			
5.	Draw electrical diagrams of hydropower system	• Identification of standard electrical symbols in hydropower plant layouts • Interpretation of single-line diagrams used in hydropower generation and distribution • Draw substation wiring and protection diagrams • Draw basic control panel wiring layouts based on actual practice			
6.	Perform wiring practice	• Wiring layout for one-way and two-way light control circuits • Installation of power and light circuit wiring systems • Tunnel wiring • Low current works (networking, telephone, internet, surveillance system, smoke detecting system) • Godown wiring • Wiring and connection of DOL starter for three-phase induction motors • Forward and reverse control wiring for three-phase motors • Installation of panel board components: bus-bar, CT, selector switch, voltmeter, ammeter, power factor meter, frequency meter, MCCB, RCCB, MCB, load balance, emergency switch, indicators, and protection relays • Relay and breaker connection techniques in powerhouse control panels • Current measurement using a clamp-on meter • Testing of winding insulation using appropriate instruments	8	24	32

Mechanical Works					
7.	Perform linear, angular and surface measurement and marking operation	• Use linear measuring instrument • Use angular measuring instrument • Use surface measuring instrument • Perform marking operation • Check fit and tolerance	4	6	10
8.	Perform basic benchwork	• Maintain benchwork safety • Introduction to basic benchwork tools; files, hammer, chisel, plier, punch, wrench, vice, c-clamps, v-block, hack-saw, tap and dies • Interpret mechanical drawing in benchwork operation • Measure and marking the given objects as per drawing • Use different techniques of holding work piece • Perform filing; plane, curve, external radius, angular surfaces • Perform the flatness check • Perform sawing operation • Perform punching operation • Perform drilling operation • Use of tap and dies • Perform grinding and deburring operation • Perform sheet metal works	9	18	27

9.	Perform welding operation	• Basic principles of welding:
		  ○ Arc
		  ○ Gas
		  ○ Tig-Mig
		• Perform arc welding
		• Perform gas welding
		• Perform tig, mig
		• Perform gas cutting
			2	15	17

		Total	30	90	120

Section C: Industry-based practical (5 weeks/200hrs)

S.N.	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
1.	Apply safety principles in hydropower operation	• Introduction to machine and personal safety. • Use of first-aid kit. • Identify safety signs and hazard zones. • Identify common hazards: o Electric shock from exposed conductors or defective insulation. o Arc blast or flash from switchgear and control panels. o Failure of protection systems; relays, breakers. o Identify high voltage zone o Leaks from penstock or valves. o Sudden water surges or pressure spikes. o Flooding. o Slippery areas o Oil leaks from transformers and governor. o Low oxygen level and humidity o Combustion of flammable materials such as lubricants and insulation. o Hydraulic actuator failures o Poor lighting o Weakening of structures o Misalignment of Equipment. o Earthquakes o Landslides			
2	Perform fire prevention and firefighting techniques	• Identify the prone to fire areas • Use of fire extinguishers • Use fire alarm system and fire hydrant • Perform evacuation and fire drills in groups.			
3	Perform electrical safety procedures	• Use of personal protective equipment			

		• Familiarize with LOTO (Logout Tagout) procedure • Follow emergency instruction			
4	Apply mechanical and hydraulic safety procedures	• Safe handling of valves and gates • Follow safety instruction while using rotating and moving parts • Perform thermographic scanning.			
5	Prepare for disaster risk reduction and management	• Introduction to roles and responsibilities of emergency task force members during disasters, disaster risk reduction and preparedness • Perform evacuation drills using alarms, sirens, and warning signs to reach safe areas during natural calamities			
7	Maintain safety in transmission line operation	• Identify risks • Perform maintenance procedures • Perform vegetation management in hydropower plant transmission line.			
8	Maintain equipment labeling and logging	• Identify risks of mislabeling • Perform labeling and maintain log-book			
		Total			

References:

1. Government of Nepal, Department of Electricity Development. (2017). *Guidelines for operation and maintenance of hydropower plant, substations and transmission lines*.
2. Dandekar, M. M., & Sharma, S. K. (2013). *Water power engineering* (2nd ed.). Vikas Publishing House.
3. Central Electricity Authority. (n.d.). *Best practices in operation & maintenance of hydro power stations*. *(Add publisher and year if known)*.

Instrumentation and Measurement

Total Class: 505 hours
Theory: 45 hours
Practical: 460 hours

Course description:

This course introduces the principles and applications of instrumentation and measurement systems used in hydropower plants. It covers sensor technologies, data acquisition, signal processing, and control systems essential for the efficient and safe operation of hydropower facilities. The course includes both theoretical concepts and hands-on laboratory work with modern instruments.

Course Objectives:

After completion of this course, apprentices will be able to:

1. Describe the key components of power transmission and control system.
2. Explain the significance and functions of instrumentation within hydropower plant operations.
3. Use various sensors and transducers used in hydropower systems.
4. Operate basic data acquisition systems to record data/parameter measurements.
5. Interpret performance parameters of hydropower equipment through appropriate measurement techniques.
6. Implement basic control strategies using instrumentation system.

Course content

Section A: Institute Based Training (15 Academic Weeks) 105 Hours

S.N.	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total

1.	Introduce to Instrumentation	• Importance in hydropower systems
		• Classification of instruments
		• Measurement systems and accuracy
		  o Measurement terms
		  o Instrumentation system
		  o System of international units (SI) & symbols
		  o Unit conversion
		  o Sources of error
		• Electrical instruments
		  o Types; indicating, recording and integrating
		  o Schematic symbols
		  o Application
			6		6

2.	Familiarize with sensors and transducers	• Function of sensors • Types of sensors, operating characteristics and its application	6		6

		○ Pressure, flow, level, torque, speed and temperature sensors			
3.	Describe actuators	• Operating characteristics and applications of linear actuators: ○ Electric ○ Hydraulic ○ Pneumatic • Operating principles of control valves and its types	6		6
4.	Use surveying instruments	• Definition of surveying • Surveying instruments and their uses • Tape measurements: ○ Direct and indirect methods ○ Accuracy (sagging, hogging, instrumental error, measurement techniques) • Leveling surveying ○ Introduction ○ Purpose ○ Terminologies ○ Instrument handling ○ Contouring • Collect filed data using a level machine	6	24	30
5.	Describe Signal Conditioning and Data Acquisition system	• Amplification, filtering, and analog-to-digital conversion • DAQ systems and interfacing • SCADA systems in hydropower	**3**		**3**
6.	Carryout measurement	• Measurement of low, medium and high resistance • Power measurement in single-phase with wattmeter and three-phase with two and three wattmeter methods • Reactive power measurement using VAR meter. • Single-phase and three phase energy measurement using single and three phases energy meter. • Measurement of frequency using frequency meter. • Measurement of maximum demand using maximum demand meter	12	36	48

		• Application of 'Time of Day' (TOD) meter, data download • Vibration and displacement measurement • Air gap measurement: feeler gauge • Vibrometer • Flow relay, visual flow indicator and flow meter • Measurement of thickness by ultrasonic testing • Measurement of clearances • Use of lux meter and piezometer • Condition monitoring (vibration analysis, thermal monitoring) • Miscellaneous measurement o Force and torque, level, pH, Gas analyzer, Emissivity, Viscosity, surface tension, color			
7.	Describe Instrument Transformers	• Current transformer – operating principle, construction, characteristics and application in measurements • Potential transformer – operating principle, construction, characteristics and application in measurements	3		3
8.	Describe Smart metering system	• Introduction to Smart metering technology: AMR (Automatic Metering Reading), MRI (Meter Reading Instrument) • Introduction to AMI (Advanced metering infrastructure), functions of AMI, cyber-security	3		3
		Total	45	60	105

Section C: Industry-based practical (10 weeks/400hrs)

S. N	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
1.	Familiarize with sensors and transducers	• Recognize the sensors and transducers used in hydropower plants • Ensure/check all the sensors and transducers are working properly			
2.	Familiarize actuators and control valves	• Identify electrical, hydraulic and pneumatic actuators used			

		• Identify types of control valves used • Check for any issues in actuators and control valves			
3.	Apply basic surveying principles	• Perform linear measurement • Head calculation (using Auto level) • Collect filed data using a level machine			
4.	Perform measurement of electrical quantity	• Measure power in single-phase with wattmeter and in three-phase with two and three wattmeter methods • Measure reactive power using VAR meter. • Measure energy of single-phase and three phase using energy meter. • Measure frequency using frequency meter. • Measure maximum demand using maximum demand meter • Check the readings of TOD meter • Measure illumination using luxmeter • Data acquisition/extraction from measuring instruments			
5.	Perform measurement of non-electrical quantity	• Measure vibration of machines and observe their placements in plant • Measure air gap using feeler gauge and observe their placements plant • Measure discharge using flow meter and observe their placements in plant • Measure thickness by ultrasonic testing and observe their placements in plant • Perform vibration analysis, thermal monitoring • Perform miscellaneous measurement of force and torque, level, pH, gas analyzer, emissivity, viscosity, surface tension and color			
6.	Troubleshoot instrument transformers	• Perform the activity of finding the CT ratio and PT ratio by measuring necessary parameter in their terminals. • Measure the insulation level of bushing of faulty and fresh instrument transformer.			

		• Measure the leakage current in instrument transformer.			
6.	Familiarize with SCADA system	• Understand the basic architecture and components • Navigate and operate the HMI screens and interpret real time data and respond to system alarms • Monitor and control hydropower equipment			
		Total			

References:

1. *Surveying (Vol. 1, 2 & 3)* – B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain
2. *A Course in Electrical & Electronics Measurements and Instrumentation* – A.K. Sawhney
3. *Modern Electronic Instrumentation and Measurement Techniques* – Helfrick & Cooper
4. *Electrical Measurements and Measuring Instruments* – Golding & Widdis

Hydropower Plant Operation

Total Class: 1090 hours
Theory: 60 hours
Practical: 1030 hours

Course description:

This subject deals with theory knowledge and practical skills regarding the operation of hydroelectric power plant and substation equipment. This subject aims an imparting knowledge and skills of general guidelines for operation of hydroelectric power plant and making them competent in the field of operation of hydropower plant.

Course Objectives:

After completion of this course, apprentices will be able to:

1. Operate mechanical and electromechanical components of hydropower plant.
2. Perform plant operation in isolated, parallel and interconnected mode.
3. Synchronize the generation with national grid.
4. Operate the switchgear and substation equipment.
5. Perform operational activities in emergency conditions.

Course content

Section A: Institute Based Training (15 Academic Weeks) 90 Hours

S.N.	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total

1.	Operate Hydromechanical System	• Identify duties of operation in charge, authorized person, working party.
		• Gate operation
		• Valve operation
		• Cooling system
		• Central exhaust system
		• Guide vanes/nozzles
		• Operate governor
		  o Hydraulic system
		  o Servo mechanism
		• Operate pressure relief and cavitation control
		• Operate braking system
		• Operate dewatering system
			11	4	15

2.	Operate Electromechanical System	• Operate synchronous generator:
		  o Concept of electromagnetism
		  o Faraday's law of electromagnetism
		  o Introduction to synchronous generator
		  o Alternator excitation
		  o Types of synchronous generator
			20	10	30

		• specification of turbines and generators
		• Automatic Voltage Regulator (AVR)
		• Load Frequency Control (LFC)
		• HVAC system
		• Starting of power units
		  o Plant operation in isolated mode
		  o Units (turbine) operated in parallel/synchronization steps
		  o Plant in interconnected with grid
		• Shut down steps of plant
		• Operational activities in emergency condition
		• Balancing generation and load
		• Economic system operation
		• On-line monitoring system of turbine, generator and transformer
		• Protection of generator			

3.	Operate Substation Equipment	• High voltage danger zone
		• Working clearance
		• Familiarize with single line diagram and its components
		• Protection of power transformer
		• Perform switching sequences
		  o Isolator, circuit breaker and earth line
		  o Feeder, isolator and circuit breaker
		  o Main transmission line
		• Operate circuit breaker and its types
		• Protective relay and actuator
		• Fault isolation and system restoration
		• Safe load-shedding and re-synchronization
		• Fuse and protection system
			18	8	26

4.	Operate Back-up System	• Purpose and importance of backup system • DC system and battery bank	7	4	11

		• Uninterruptable power supply (UPS) • Diesel generator sets and auto start mechanism • Emergency oil pump system • Accumulator tank and pressure backup • Cooling water system redundancy • Emergency ventilation system • Application of redundant sensors and relay systems			
5.	Test lightening and Earthing System	• Necessity and importance of earthing • System and equipment earthing • Soil resistivity measurement • Grounding grid/mat • Touch and step potential • Lightning protection integration with grounding • Surge Protecting devices • Earth resistance testing • Layout diagram of earthing in hydropower plant	4	4	8
		Total	60	30	90

Section C: Industry-based practical (25 weeks/1000hrs)

S.N.	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
Operate Hydromechanical System					

1.	Operate Gate; Intake, Radial, Flushing, Sluice	• Perform pre-operation check
		  o Inspect mechanical, electrical and control panel
		  o Communicate with control room or operator
		  o Monitor upstream and downstream water level
		• Unlock the gate
		• Start gate hoist system
		• Gradual open/close the gate
		• Monitor the flow rate, pressure and vibration
		• Monitor the gate position			

		• Co-ordinate with turbine operator • Follow the safety instructions			

2.	Operate Valve; MIV, By-Pass, Spare/Guide Vane	• Perform pre-operation check
		  ○ Inspect valve for physical damage or leaks
		  ○ Check actuators and control system
		  ○ Verify pressure and water levels
		  ○ Communicate with control room
		• Unlock the valve
		• Initiate valve actuator
		• Increase the % of opening/closing
		• Monitor water flow and pressure gauge
		• Observe turbine speed and flow stability
		• Follow the safety instructions			

3.	Operate Central Cooling system	• Identify components that need cooling
		• Familiarize with the cooling methods:
		  ○ Air cooling
		  ○ Water cooling
		  ○ Oil cooling
		• Check pre-operation
		  ○ Check leaks
		  ○ Confirm operational condition of pump and fan motor
		  ○ Ensure cleanness of filter and strainer
		  ○ Verify coolant level
		  ○ Ensure cooling backup system
		• Start circulation pump or fan
		• Check pressure for fluid cooling
		• Start power plant after enabling cooling system
		• Monitor temperature across generator winding, bearing, transformer
		• Check the coolant flow			

		• Observe the cooling action until the temperature is normal • Monitor HVAC system • Follow the safety instructions •			

4.	Operate Central Exhaust System	• Enlist the purpose of exhaust system
		• Check pre-operation
		  o Inspect the ventilation ducts
		  o Ensure the operational condition of exhaust fan, sensors and motor
		  o Check percentage of humidity and oxygen level
		• Turn ON the exhaust system
		• Monitor the fan speed and air flow rates
		• Open all motorized dampers to allow air movement
		• Ensure the ambient temperature and air quality
		• Operate emergency exhaust system if need
		• Follow the safety instructions			

5.	Operate Governor	• Check pre-operation of governor system
		  o Speed sensor
		  o Control unit
		  o Actuator/ servomotor
		  o Hydraulic system
		  o Feedback system
		• Familiarize electronic Governor operation
		• Demonstrate automatic, manual and local/remote control modes
		• Handle emergency situation			

Operate Electromechanical system					
6.	Operate AVR	• Observe the generated voltage • Match the generated voltage with the reference voltage • Operate excitation control according to error signal if any			
7.	Operate brushless excitation	• Operate Permanent Magnet Generator (PMG) or manage			

		supply from station service transformer • Check supply AC power to AVR • Check the rectifier operation • Check dc output to the exciter field • Check rated output of generator			
8.	Start hydropower units	• Ensure sufficient water level in reservoir • Check penstock gates are operational or in the closed position • Verify lubrication, cooling, oil/water leaks and control system are functioning • Ensure back up supply is available • Check excitation system, protection relays and SCADA interface • Ensure proper alignment of turbine-generator shaft • Activate lubrication system for bearing • Start cooling system • Start air compressor for pneumatic control • Open the main inlet valve • Open the guide-vane/ spare valve gradually • Check the rpm of turbine, pressure of spiral casing, draft tube and penstock • Listen the unusual noise • Observe temperature rise • Activate AVR and LFC • Match the generator voltage and frequency with grid			
9.	Synchronize the generation to grid	• Activate the excitation system to match with grid voltage • Adjust the generator frequency with grid frequency • Match the phase sequence			

		• Match the phase angle by synchronoscope • Close the circuit breaker			
10.	Balance generation and load	• Interpret the trend of load demand • Perform real time monitoring: o Generator output o Grid demand o System frequency o Water flow and reservoir level • Coordinate with grid operator/load dispatched Centre (LDC) • Handle emergency situation			
11.	Shutdown the generation units	• Obtain permission for shutdown from authority • Reduce the generator output to minimum level • Stop excitation/ disconnect AVR • Open generator breaker • Close spare valve or guide vane • Close inlet valve • Ensure cooling for generator and bearing • Apply braking system if need • Apply safety lockout and tagout procedure			
12.	Operate substation components	• Interpret single line diagram • Check the protection system of power transformer: o Differential protection o Buchholz relay operation o Temperature protection o Overcurrent protection o Overvoltage/undervoltage protection o Restricted earth fault protection o Surge protection o Fire protection • Perform switching sequences: o Isolator, circuit breaker and earth line			

		○ Feeder, isolator and circuit breaker ○ Main transmission line • Operate circuit breaker • Observe the operational function of protective relay and actuator • Perform fault isolation and system restoration			
13.	Operate backup system	• Check battery backup system: ○ Battery bank connection ○ UPS ○ Recharge battery (bulk and float modes) ○ DC distribution board ○ DC circuit breaker/fuses ○ Battery status monitoring system • Operate diesel generator backup system: ○ Standby mode ○ Power failure detection ○ DG start up ○ Auto start and auto load transfer			
14.	Test lightning and earthing system	• Interpret earthing layout diagram of power plant • Test earthing: ○ system ○ equipment earthing ○ Lightning protection			

References:

1. Mosonyi, E. (n.d.). *Hydropower development* (Vols. I & II).
2. Xiao, J. K., Liu, N. G., Wu, K. L., & Dai, G. S. (2012). Research and design of power system operation and maintenance visualization platform. *Electric Power Information Technology*.
3. Government of Nepal, Ministry of Energy, Department of Electricity Development. (2017). *Guidelines for operation and maintenance of hydropower plant, substation and transmission lines*.

Hydropower plant Maintenance

Total Class: 1060 hours
Theory: 30 hours
Practical: 1030 hours

Course description:

This subject deals with theory knowledge and practical skills regarding the Maintenance of hydroelectric power plant and substation equipment. This subject aims an imparting knowledge and skills to perform the maintenance work of hydroelectric power plant equipment according to set guidelines, ensuring reliable operation of hydropower plant components.

Course Objectives:

After completion of this course, apprentices will be able to:

1. Describe the basics of maintenance for various components of hydropower plants.
2. Carry out maintenance of civil, mechanical and electrical components within a hydropower plant.
3. Develop routine inspection and maintenance schedules for hydropower plants.
4. Perform routine inspection and maintenance tasks for hydropower plant components effectively.

Course content

Section A: Institute Based Training (15 Academic Weeks)

S.N.	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
1.	Introduce hydropower maintenance	• Definition • Causes of deterioration; wear, corrosion • Types and importance of maintenance • Types of log sheet in hydro power • Necessity to maintain log book • Spare parts and its' management • Prepare a log sheet • Prepare maintenance schedule	1	1	3

2.	Maintain transformer and its accessories	• Introduction
		• Working principle
		• Construction
		• Types
		• Verify transformer terminals
		  o Single phase-three-phase
		  o HT/LT, RYB
		  o Calculate transformation ratio
		• Identify components
		  o Core and its types
		  o Windings
			9	8	24

		○ Insulator ○ Bushing • Significant of calibration of: ○ OTI (Oil temperature indicator) ○ Winding temperature indicator (WTI) • Fundamental of oil leakage and necessity to top up oil such as: ○ Bushings ○ diverter switch ○ shunt reactor ○ Transformer • Introduction for breather: ○ Functions ○ Components • Purposes to check for tightness of terminals in Marshalling box • Measure IR value to earth and between windings. ○ Standard value of insulation ○ Measurement procedures • Basic for alarm, trip and protection circuit ○ Testing idea for circuit. • Definition of transformer oil ○ Types ○ Properties ○ Causes of deterioration ○ Purification methods • Inspect the mechanical condition of Buchholz relay. ○ Principal of operational ○ Components • lightning arrestors ○ Types of arrestors ○ Functions ○ Measure IR value ○ Leakage current • Routine maintenance and inspection of hydro transformer and accessories.			
3.	Maintain alternator and its accessories	• Synchronous generator: ○ Constructional feature ○ Operating principal ○ Types	9	6	21

		○ Necessity to control the temperature of the stator ○ Excitation and its types • Introduction to accessories of generator. ○ Describe the IR, PI value and RTDs ○ Test stator core and winding-looseness, cooling system, electromagnetic core imperfection test, dc resistance, IR and PI value, function of RTDs ○ Methods to improve IR and PI value • Basic for Rotor: ○ winding insulation level, ○ inter turn fault, ○ cleaning dust, gap, vibration ○ measure dc resistance IR value of winding, • DC exciter/commutator: ○ Checking slip rings ○ brushes- cleaning, ○ checking distance of brush holder ○ spring tension, replacing ○ brush gear- check visually, cleaning, ○ Adjustment of brushes, ○ Compare IR value, excitation voltage level • Brushless excitation system ○ Operating principle ○ Working principle of rotating diode • Prepare a routine maintenance and inspection schedule of generator and accessories. • Demonstrate the generator floor log sheet and interpret .			
4.	Maintain hydro-turbine and its accessories	• Introduction of hydro-turbine accessories • Listing of the accessories • Explain about: ○ foundation gallery ○ water seal	3	5	14

		○ turbine guide bearing ○ guide apparatus ○ oil leakage unit ○ top cover drain system ○ centralized lubricating system ○ oil pressure unit ○ oil cooling unit, pipes, pumps, valves. ○ Draft tube • Idea to dismantle and inspect: ○ turbine bearing, ○ gland seals and isolating air inflated seal ○ Wicket gate servomotor, guide vanes bush housing. • Common problems and maintenance in turbines: ○ erosion, cavitations and cracking, ○ turbine guide bearing failure. • Knowledge to check/ replace the Sensor: ○ RTD ○ TSD in guide vane (if applicable) • Maintenance of pump: ○ relay switch of oil cooling unit, • Important of non-destructive testing method / ultrasonic test in machine • basis for anticorrosive/tar-based paints • Application of anti-erosion coating to runner • Routine maintenance and inspection of hydro turbine and accessories. • Demonstrate the turbine floor- log sheet			
5.	Maintain governor	• Introduction and Types • Sketch layout of mechanical governor and its operating principle • Impurities in hydraulic oil and its testing methods	3	3	9

		• Perform the periodic maintenance of servo valves and motor. • Test the hydraulic oil • Purify the hydraulic oil by centrifugal and electrostatic liquid cleaner. • Prepare a routine maintenance and inspection schedule of hydraulic governor and accessories.			
6.	Maintain intake gate	• Introduction to intake gate o Types of gates o Operating mechanism and its components • Necessity to inspect the dust accumulation, twist in rope, and clean up, adjust, lubricate , replace (if any) • General checks for electrical control panel and motor operation (check toggle switch, indicating lamp, overload relay, meter reading etc.) • Prepare a routine maintenance and schedule for intake gate	2	2	7
7.	Maintain main inlet valve	• Introduction to valve o Types of valves used in hydropower plants o Operating mechanism and its components • General check /inspection for operation, leakage, sealing ring, servomotor supply, switches replace main seals (if any) etc • Dismantling joints if any leakage • Limit switch and its' operation • Check MIV servo linkage and look for backlash • Bypass valve and its accessories • Opening and closing times of the MIV. • Prepare a routine maintenance and schedule for main inlet valve.	2	2	7

8.	Explain maintenance of different types of civil constructions	• Inspect the dams, gates, machines gallery and other major civil structural system • Manage the level of sediment in reservoirs/forebay, de-silting basin, canal and tunnels • Minimize the impact of extreme weather on hydro structure • Perform mortar maintenance job on partial crack, fatigue, leakage in spill way, simple machine foundation in power house and its periphery. • Identify leakages from structures. • Inspect cracks, erosion, water leakage, clogging sedimentation and landslides near site.	1	3	5
		Total	30	30	60

Section C: Industry-based practical (25 weeks/1000hrs)

S.N.	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
1.	Introduction to hydropower plant maintenance	• Maintain different log sheet • Manage spare parts records			

2.	Perform Maintenance of transformer and its accessories	• Calibrate OTI (Oil temperature indicator) and Winding temperature indicator (WTI)
		• Test the transformer oil and filter.
		• Fix oil leakage and top up oil
		  o Bushings
		  o Diverter switch
		  o Shunt reactor
		  o Transformer
		• Check and maintain breather:
		• Check for tightness of terminals in Marshalling box
		• Measure IR value to earth and between windings
		• Test for alarm, trip and protection circuit
		• Inspect the mechanical condition of Buchholz relay.
		• Perform a test in lightning arrestors
		  o Measure IR value			

		○ Measure the leakage current			
3.	Conduct maintenance of alternator and its accessories	• Test cooling system, dc resistance, IR and PI value, function of RTDs. • Apply the methods to improve IR and PI value • Testing of Rotor: ○ Winding insulation level, ○ Inter turn fault, ○ Cleaning dust, gap, vibration ○ Measure dc resistance ○ IR value of winding, • Check DC exciter/ commutator: ○ Checking slip rings ○ Brushes- cleaning, ○ Checking distance of brush holder ○ Spring tension, replacing ○ Brush gear- check visually, cleaning, ○ Adjustment of brushes, ○ Compare IR value, excitation voltage level • Check the brushless excitation system ○ Rotating diodes- check the looseness, function			
4.	Perform maintenance of hydro turbine and its accessories	• Inspection for: ○ Water seal ○ Turbine guide bearing ○ Guide apparatus ○ Oil leakage unit ○ Top cover drain system ○ Centralized lubricating system ○ Oil pressure unit ○ Oil cooling unit, pipes, pumps, valves. • Dismantle and inspect: ○ turbine bearing, ○ gland seals and isolating air inflated seal ○ Guide vane servomotor, guide vanes bush housing. • Perform the maintenance work on common problems: ○ erosion, cavitation and cracking in turbine,			

		○ Turbine guide bearing failure. ○ Surface preparation for flange and gasket installation ○ Filing and preparation of pump housing bases ○ Cutting and fabrication of gaskets for pipe joints ○ Manual lapping of valve discs • Checking/ replacing the Sensor: ○ Resistance temperature Detector (RTD) ○ Thermal shutdown TSD in guide vane • Maintenance of pump: ○ relay switch of oil cooling unit, • Calibration of OTI (Oil Temperature Indicator) and WTI (Winding Temperature Indicator) • Perform the Ultrasonic Test, Dye Penetrant Test (DPT) • Perform paint anticorrosive/tar-based paints • Apply anti erosion coating to runner • Maintain log sheets			
5.	Maintain governor system	• Repair and maintenance of governor: ○ Speed sensing device ○ Hydraulic pressure oil system: Compressor air filters, pumps • Perform the periodic maintenance of servo valves and motor.			
6.	Carry out maintenance of gate and penstock	• Inspect the dust accumulation, twist in rope, and clean up, adjust, lubricate, replace, • Inspect and checks gate operation • Perform a general check for electrical control panel and motor operation (check toggle switch, indicating lamp, overload relay, meter reading etc.) • Welding of supports for penstock anchorage • Creation of basic weld beads on hydro frames			

		• Cleaning and finishing welds for structural integrity • Check the water leakage in gates • Perform gate seal maintenance			
7.	Carry out maintenance of main inlet valve (MIV)	• Check /inspection operation, any leakage, replace main seals • Dismantling leakage joints • Fix servomotor leakages • Attain the limit switch operation smoothness • Check MIV servo linkage and look for backlash • Inspect the bypass valve and its accessories • Check the opening and closing times of the MIV.			
8.	Perform maintenance of civil structures	• Inspect the dams, gates, machines gallery and other civil structural system • Check the level of sediment in reservoirs/forebay, de-silting basin, canal and tunnels • Prepare to minimize the impact of extreme weather on hydro structure • Inspect cracks, erosion, water leakage, clogging sedimentation and landslides near the site. • Perform mortar grouting			
Total hours					

References:

1. Xiao, J. K., Liu, N. G., Wu, K. L., & Dai, G. S. (2012). Research and Design of Power System Operation and Maintenance Visualization Platform. *Electric Power Information Technology*, 11.
2. Singh, J., & Bhatia, S. L. (1977). Maintenance and Repairs of Earth-moving Equipment at Beas Dam. *Water and Energy International*.
3. Government of Nepal, Ministry of Energy, Department of Electricity Development (2017). *Guidelines for Operation and Maintenance of Hydropower Plant, Substation and Transmission Lines*.

Engineering Drawing

Total Class: 60 hours
Theory: 15 hours
Practical: 45 hours

Course description:

This course is designed to provide apprentices with foundational knowledge and practical skills in engineering drawing. It introduces the tools, symbols, conventions, and principles used in creating technical drawings essential for manufacturing, installation and construction. The course emphasizes the development of visualization skills and accuracy in creating orthographic, isometric, sectional, and assembly drawings.

Course Objectives:

After completion of this course, apprentices will be able to:

1. Explain the fundamental concepts, types, and applications of engineering drawing.
2. Draw basic elements of engineering drawings, including lines, symbols, scales, and dimensions.
3. Prepare detailed and assembly drawings using standard conventions and techniques.

Contents

Section A: Institute Based Training (15 Academic Weeks)

S.N.	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
1.	Define engineering drawing	• Definition • Types of drawing • Classification of engineering drawing • Application of engineering drawing	2		2
2	Handle drawing instruments	• Introduction • Types, uses and sizes • Handling techniques • Precautions to take • Exercises and assignments	1	2	3
3	Describe and draw elements of the engineering drawing	• Lines type and uses • Symbols (Basic Electrical, Basic Electronics, Basic Civil, Basic Mechanical, Basic Hydraulic and Pneumatic) • Title block/layout • Annotation (texts) • Scale	1	2	3
4	Familiarize with dimensions in drawing.	• Importance of dimensioning • Elements and rules of dimensioning o Direction of dimensioning o Dimensioning angles o Dimensioning arcs	1	1	2

		○ Dimensioning through and blind holes • Exercises and assignments			
5	Draw geometric construction	• Introduction • Layout of the drawing paper • Procedure of drafting title block • Conventional lines and their usages • Procedure for bisect/trisect a line • Procedure for bisect/trisect an angle • Procedure of drawing perpendicular and parallel line • Procedure of drawing tangents (circle to circle, line to circle, arc to line) • Procedure for constructing circle, polygons (inscribed/circumscribed) • Procedure of construction of ellipse (four center and concentric method/rhombus method) • Procedure of construction of oval • Exercises and assignments	2	8	10
6	Draw orthographic projection	• Introduction • Types of projection • Projection of point and line • Basic concept of true line and shape • Orthographic projection (first angle and third angle) of different solid and combined solid which includes including cube, solid and hollow cylinder, pyramid, cone, different mechanical and electrical components) • Exercises and assignments	3	9	12
7	Draw isometric drawing	• Introduction to isometric projection and oblique projection • Rules for presenting the lines in isometric and oblique projection.	2	8	10

		• Methods of constructing isometric and oblique drawings. • Isometric drawing of rectangular object, circular object and combination of rectangular and circular object. • Oblique drawing of rectangular plane, circular plane and combined plane of rectangle and circle. • Exercises and assignments			
8	Draw sectional views	• Introduction • Cutting plane line • Types of section views • Method of section views • Full section drawing • Half section drawing • Exercises and assignments	1	9	10
9	Interpret assembly/disassembly and detailed drawing	• Introduction • Types of fits and their uses • Exercise in identifying parts in Assembly drawing of different automobile parts. • Exercise in detailing assembly drawing. • Exercises and assignments	2	6	8
		Total	15	45	60

References:

1. *Fundamentals of Engineering Drawing for Polytechnics* – Er. R.K. Dhawan
2. *Engineering Drawing + AutoCAD* – K. Venugopal, V. Prabhu Raja
3. *A Textbook of Machine Drawing (First Angle Projection)* – Er. R.K. Dhawan
4. *Engineering Drawing (Geometrical Drawing)* – P.S. Gill
5. *Engineering Drawing: Plane & Solid Geometry* – N.D. Bhatta
6. *Geometrical and Mechanical Engineering Drawing* – Caribbean Examinations Council, Barbados

Entrepreneurship Development

Total Class: 45 hours
Theory: 30 hours
Practical: 15 hours

Course Description:
This course is designed to impart knowledge and the skills on formulating business plan and managing small business in general. This course intends to deal with exploring, acquiring and developing enterprising tasks, identification of suitable business idea and developing of business plan.

Course Objectives:
After completion of this course, apprentices will be able to:

1. Define business and entrepreneurship;
2. Explore entrepreneurial tasks;
3. Analyze business ideas and viability;
4. Formulate business plan; and
5. Learn to manage small business.

Section A: Institute Based Training One Day Per Week (78 days/13 Academic Weeks)

S. N	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
Introduction to Entrepreneurship			**8**	**2**	**10**
1	Introduce business.	• Definition of business/enterprise • Types of business • Classification of business • Overview of MSMEs (micro, small and medium enterprises) in Nepal	1		1
2	Define entrepreneur/entrepreneurship.	• Definition of entrepreneur • Definition of entrepreneurship • Entrepreneurship development process	1		1
3	Describe entrepreneur's characteristics.	• Characteristics of entrepreneurs • Nature of entrepreneurs	1	1	2
4	Assess entrepreneur's characteristics.	• List of human characteristics • Assessment of entrepreneurial characteristics	1		1
5	Compare entrepreneur with other occupations.	• Comparison of entrepreneur with other occupations • Types and styles of entrepreneurs	1		1
6	Differentiate between entrepreneur and employee.	• Difference between entrepreneur and employee • Benefit of doing own business	1		1
7	Assess "Self.'	• Understanding "self" • Self-disclosure and feedback taking	1		1

8	Test entrepreneurial personality	• Concept of entrepreneurial personality test • Assessing self-entrepreneurial inclination	1	1	2
Creativity and Assessment			**7**	**3**	**10**
9	Create viable business idea.	• Concept of creativity • Barriers to creative thinking	2		2
10	Innovate business idea.	• Concept of innovation • SCAMPER method of innovation	1	1	2
11	Transfer ideas into action.	• Concept of transferring idea into action • Self-assessment of creative style	1		1
12	Assess personal entrepreneurial tasks.	• Concept of entrepreneurial tasks • Assessing personal entrepreneurial tasks	1	1	2
13	Assess personal risk-taking attitude.	**Risk** • Concept of risk • Personal risk-taking attitude • Do and don't do while taking risk	1	1	2
14	Make decision.	• Concept of decision making • Personal decision-making attitude • Do and don't do while making decision	1		1
Identification and Selection of Viable Business Ideas			**1**	**3**	**4**
15	Identify/ select potential business idea. • Analyze strength, Weakness, Opportunity and Threat (SWOT) of business idea.	• Sources of business ideas • Points to be considered while selecting business idea • Business selection process • Potential business selection among different businesses • Strength, Weakness, Opportunity and Threats (SWOT) analysis of business idea • Selection of viable business idea matching to "self"	1	3	4
Business Plan			**14**	**37**	**51**
16	Assess market and marketing	• Concept of market and marketing • Marketing and selling • Market forces	1	1	2

		• 4 Ps of marketing • Marketing strategies			
17	Explore small business management concept.	• Business exercise rules • Concept of small business management • Elements of business management o Planning o Organizing o Executing o Controlling	1	2	3
18	Prepare market plan.	• Concept of business plan • Concept of market plan • Steps of market plan	1	2	3
19	Prepare production plan.	• Concept of production plan • Steps of production plan	1	2	3
20	Prepare business operation plan.	• Concept of business operation plan • Steps of business operation plan • Cost price determination	3	2	5
21	Prepare financial plan.	• Concept of financial plan • Steps of financial plan • Working capital estimation • Pricing strategy • Profit/loss calculation • BEP and ROI analysis • Cash flow calculation	3	8	11
22	Collect market information /prepare business plan.	• Introduction • Market survey o Precaution to be taken while collecting information o Sample questions for market survey o Questions to be asked to the customers o Questions to be asked to the retailer o Questions to be asked to the stockiest/suppliers • Preparing business plan	1	12	13
23	Appraise business plan.	• Return on investment • Breakeven analysis • Cash flow • Risk factors	1	6	7
24	Maintain basic book keeping.	• Concept and need of book keeping	1	2	3

		• Methods and types of book keeping • Keeping and maintaining of day book and sales records			
		Total	30	15	45

Textbooks:

क) प्रशिक्षकहरुका लागि निर्मित निर्देशिका तथा प्रशिक्षण सामग्री, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद् २०६९

ख) प्रशिक्षार्थीहरुका लागि निर्मित पाठ्यसामग्री तथा कार्यपुस्तिका, प्राविधिक शिक्षा तथा व्यावसायिक तालीम परिषद् (अप्रकाशित), २०६९

Reference book:

Technonet Asia. (1981). *Entrepreneur's handbook*.

Applied Communication and Professionalism

Total Class: 30 hours
Theory: 45 hours
Practical: 0 hours

Course Description

This course is designed for the development of communication skills in Nepali and English languages, intending to enhance professional skills of apprentices at work places. The communication skills are incorporated here with the perspectives to applying in speaking and writing for to-be professional apprentices or technicians so that they can exhibit such skills while working in national and international labor market work places. This course includes speaking and writing skills, self-motivation, positive attitudes, decision making skill, creativity skill, stress and time management knowledge, team work and leadership skills.

Course Objectives:

After completion of this course, apprentices will be able to:

1. Apply speaking and writing skills of communication skills on day-to-day organizational activities;
2. Write different types of letters, job applications, simple reports and memos in English and Nepali medium;
3. Bring into operation the decision making & creative activities through acquiring self-motivation and positive thinking;
4. Apply time and stress management skills; and
5. Follow decision making process, team building and leadership for effective organizational functioning.

Section A: Institute Based Training (15 Academic Weeks)

Units	Objectives	Related Contents/Tasks	Time (hrs.)		
			Th.	Pr.	Total
1	Communicative functions/ Conversation skills	• Everyday functions: o Greetings, o Welcoming, o Introductions, o Thanking, o Excuses/apologizing/forgiving • Everyday Activities: o Asking about activity o Asking about trouble/problems/conditions o Asking about health status o Telling not to interrupt/disturb • Requests and offers o Making requests o Offers: offering, accepting, declining o Excuses: asking to be excused, Excusing	6		6

		○ Permission: asking for permission, giving permission • Expressing ○ Likes/dislikes ○ Hopes/wishes ○ Advice/suggestions/recommendations ○ Prohibitions • Compose a dialogue introducing new friend in the class. • Compose a dialogue ting new friend in the class. • Make a request to the teacher for checking your practical work. • Compose a dialogue offering drinks to the (supposed) guests			
2	Comprehension and Writing skills	• Comprehension passages • Technical terms • Writing Paragraphs • Writing letters ○ Resume/bio-data ○ Applications letters ○ Business letters • Writing work reports • Writing Instructions • Writing dialogues • Prepare your own resume/bio-data. • Write a job application. • Write a letter to the Business Company or industry for the delivery of goods. • Write a report of a complete task you performed.	8		8
३	नेपाली संचार	• प्राविधिक शब्दहरु • बोधअभिव्यक्ति • अनुच्छेद लेखन • पत्रलेखनः ○ व्यापारिक पत्र ○ निवेदनपत्र ○ व्यक्तिगतविवरण (बायोडाटा) लेखन • निबन्ध लेखन • कार्य प्रतिवेदन लेखन • भौचर लेखन • नेपाली निवेदन लेख्नुहोस् ।	८		८

		• आफुनो अभ्यास कार्यलाई आवश्यक पर्ने सामान अर्डर गरी सम्बन्धितउद्योगलाई एक पत्र लेख्नुहोस्। • आफुनो व्यक्तिगतविवरण तयार पार्नुहोस्। • वर्तमान सन्दर्भमा सूचनाप्रविधिको आवश्यकताविषयमा २५० शब्दमा एक निबन्ध लेख्नुहोस्। • आफूले एक दिन गरेको अभ्यासकाआधारमाकार्य प्रतिवेदन लेख्नुहोस्। • बैंक भौचरको नमूना तयार पार्नुहोस् ।			
4	Motivation, Attitudes, Decision Making & Creativity	• Motivation: o Self-motivation o Features of self-motivation; honesty, enthusiasm, dedication, Productiveness • Attitudes: o Positive and negative attitudes o Factors affecting attitudes o Positive attitude and advantages o Negative attitude & disadvantages • Decision making to solve problem: o Decision making and problem solving; o Steps of problem solving; o Steps of decision-making process. • Creativity o Meaning o Purpose o Technique to improve creative thinking skills. • Demonstrate and show the self-motivate people's behaviors in class room. • Demonstrate and show the positive and negative attitudes peoples behave in class room. • Take decision using decision making process on given problems by class teacher. • Perform the creativity skill on class room on the given situation.	10		10
5	Stress and Time Management	• Stress management o Definition of stress o Causes and consequences of stress o Stress management techniques • Time management o Meaning	5		5

		○ Time wasters ○ Effective time management strategy • Apply the stress management techniques in class room. • Apply the time management techniques in class room.			
6	Team work and Leadership	• Team Work ○ Definition ○ Purpose ○ Characteristic of champion team ○ Interpersonal relationship • Leadership skills ○ Leadership power ○ Leadership Styles ○ Public speaking and presentation • Perform the team building practices and team work activities in class room. • Perform public speaking applying presentation skills on given topic in class room.	8		8
		Total	**45**		**45**

References:

1. GRANT TAYLOR, English conversation practice.
2. R C Poudel, A manual to Communicative English, K P Pustak Bhandar , Dillibazaar, Kathmandu.
3. सुवेदी ला, इन्जिनियरिङ्ग नेपाली
4. Surya Sinha (2017). Complete Personality Development Course (Hindi Edition).
5. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
6. Lucas, Stephen (2001). Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill.

Industrial Practice

Description:
The training institute will make arrangement for apprenticeship. Admitted trainees will have the three parties training agreement among trainees, sponsoring industries and training institute. The Agreement terms and conditions will be implemented during the whole training period.

The proposed apprentice students have three and half months (15 weeks) theoretical and practical classes in the training institute. At the end of this institute-based training phase, the **Pre-Industry Exam** is conducted for each subject and serves as a mandatory for continuing to the industry-based training. Subsequently, students are placed as apprentices under the supervision of In-company Trainer, whereas industrial practice & related skills will be learned. The nature of the training is practical works and the duration will be of approximately 18 months (65 weeks/2600 hours). Students will work in the related sponsoring industries for 5 days a week and one day per week to attend the training either virtually via online platforms and/or physically at the institute as per scheduled plan for review sessions, sharing field experiences, discussion of problems faced, resolved and unresolved issues for consultation, presentation and evaluation of the final field report, exchange of feedback, sharing of upcoming activities and reporting.

Students will work across all four cores areas for first 65 weeks as mentioned in the structure of this curriculum. The sponsoring industries or companies will provide industrial practice platforms to the agreed apprentices for the above-mentioned duration. Furthermore, the sponsoring industries could change industrial practice venues in different geographical locations on their volume of works and convenience.

General objectives:
The objective of the apprenticeship is to make students familiar with/gain firsthand experience of the world of work as well as to provide them an opportunity to acquire skills that are theoretically learnt in the institute.

Complete Apprenticeship plan

S. N.	Activities	Duration	Remarks
1	Orientation	Two days	Before Apprenticeship
2	Report to the site	One day	Before placement
3	Actual work at site	65 weeks	During apprenticeship
4	Evaluation by the sponsoring industries		Regular
6	Evaluation by the training Institute		At least one time in every three months
7	Final evaluation		Last month of the apprenticeship program by the industries
6	Final report preparation and presentation	5 days	After completion of apprenticeship

Note:
- Students should maintain the daily diary during the apprenticeship program.
- Students should prepare the apprenticeship report and present in training institution in the presence of In-company Trainer.
- Evaluation of apprenticeship program should be done by the In-company Trainer (Industrial Supervisor).

Industrial Orientation

Course Description:
The students will be assigned to various auto-workshop/service stations on a full-time basis as a trainee or intern. At the end of the course, students will submit a report conforming to a standard format along with the daily diary. Industrial orientation shall consist of exposure of work to learn skills and techniques in operation, diagnosis, maintenance and repair of automobile vehicle concerns based on the nature of the interned organization.

Course Objectives:
After completing the course, the students will be able to:
- Match the technical skills learn in the institute with the needs of the employer.
- Increase self-confidence to face the real work of world.
- Develop the strong linkage between industry and institution.
- Ensure the standard of the training as per the market demand.
- Sensitize with modern and new technologies applied in the industry.

The company/industry/organizations may provide orientations focusing on following areas:
1. Profile of the industry
2. Mission, Vision, Value and believes
3. Layout of workshop/industry
4. Basic features of the workshop
5. The service provided by industry
6. Organization structure of the industry
7. Special technology adapted
8. Safety concerns of the workshop
9. General rule and regulations of the workshop
10. Departmental divisions and their responsibility and functions
11. General problems in the workshop
12. Make them familiar with their supervisors, departmental head and staffs.
13. Prepare a plan to utilize the interns in systematic way and daily record keeping.

Format/Content of Report:
A report needs to be submitted by student on the basis of the following minimum guidelines at the end of their industrial intern.
1. A hardcopy of report with simple binding.
2. The font through-out the report must be of 12 size and Times New Roman.
3. Cover page including name of Institute, industry, student and report submission date.
4. Approval page from the side of Industry.
5. Acknowledge
6. Abstract
7. Table of contents
8. Chapter one: Introduction
    - Background of apprenticeship program
    - Introduction to industry, goal and organizational structure with role
    - Product/ Service summary of the industry
9. Chapter two: Description of the industry
    - Industry/workshop layout

- Department/unit with their responsibility
- List of major tools and equipment with their functions
- Material handling equipment with purpose.

10. Chapter three: Practices on the industry
    - Basic and frequent practices
    - Special practices
    - Special technology found on industry and vehicle
11. Chapter four: Conclusion and recommendation
    - Conclusion on attachment: practices, industry management and human behavior, problems and better terms.
    - Recommendation for industry: practices, industry management and human behavior, any other personnel opinion
12. References if any
13. Annexes: Daily dairy, drawings, photographs and so others.

Curriculum Development Expert Team

S. N.	Name	Name of Office
1.	Er. Prajwal Bhattarai	Shankharapur Polytechnic Institute, Kathmandu
2.	Er. Bikash Bhatt	Rasuwa Gadhi Hydropower Company Limited, Rasuwa
3.	Er. Pradeep Neupane	Balaju School of Engineering and Technology, Kathmandu
4.	Er. Rajendra Prasad Bhatt	Balaju School of Engineering and Technology, Kathmandu
5.	Er. Rakesh Kumar Pandit	Shankharapur Polytechnic Institute, Kathmandu
6.	Er. Suman Shrestha	Shankharapur Polytechnic Institute, Kathmandu
7.	Er. Rajan Sharma	Balaju School of Engineering and Technology, Kathmandu
8.	Er. Surwat Aryal	Nepal Electricity Authority, Ratnapark, Kathmandu
9.	Er. Shivaram Tamrakar	Nepal Electricity Authority, Ratnapark, Kathmandu
10.	Er. Ganesh Sapkota	National Skill Testing Board, Bhaktapur
11.	Er. Sushant Bakhunche	Balaju School of Engineering and Technology, Kathmandu
12.	Er. Tej Prakash Sapkota	Nepal Banepa Polytechnic Institute, Banepa
13.	Er. Khem Bahadur Pun	Upper Tamakoshi Hydropower Limited, Gyaneshwor, Kathmandu
14.	Mr. Dipak Raj Poudel	Coronet Energy Pvt. Ltd., Kathmandu
15.	Er. Rajesh Prakash Chataut	Balaju School of Engineering and Technology, Kathmandu
16.	Er. Raju Ghimire	High Himalaya Hydropower Construction Pvt. Ltd., Kathmandu
17.	Er. Shivahari Koirala	Niranjana Technical Solution Pvt. Ltd., Kathmandu
18.	Mr. Lekhnath Joshi	LMS Builders & Consult Pvt. Ltd., Bhaktapur
19.	Mr. Shiv Karanjit	Balaju School of Engineering and Technology, Kathmandu
20.	Mr. Arun Rajouria	President, Nepal Hydropower Association, Nepal
21.	Mr. Manoj Mali	High Himalaya Hydropower Construction Pvt. Ltd., Kathmandu
22.	Mr. Kamal Karki	Society of Consulting Architecture and Engineering Pvt. Ltd., Kathmandu
23.	Mr. Jay Kumar Yadav	Nepal Electricity Authority, Balaju Branch, Kathmandu
24.	Mr. Alish Thapa	Building Expert Services Pvt. Ltd., Kathmandu
25.	Mr. Ramraja Ojha	Nepal Electricity Authority, Chabahil Branch, Kathmandu
26.	Er. Khushiram Adhikari	Balaju School of Engineering and Technology, Kathmandu
27.	Er. Unish Bhattarai	Chirlchwa Hydropower Ltd.
28.	Er. Samjhna Chhushyabag	Nepal Electricity Authority (MJCL)
29.	Er. Divya Karki	Independent Power Producers Association, Nepal (IPPAN)
30.	Mr. Prayasha K.C.	Federation of Nepalese Chambers of Commerce and Industry, Thapathali, Kathmandu
31.	Mr. Kavindra Gautam	Simbuwa Remit Hydro Limited

Annex 1: Weekly Report (Logbook)

To be filled by apprentices regularly

Week ...

Month:

S. No.	Date	Description of work	Sign of Industry Supervisor
1.			
2.			
3.			
4.			
5.			
6.			

Name of Supervisor: _____

Sign of Supervisor: _____

Date: _____

Remarks by Supervisor: _____

Name of Internal Guide: _____

Sign of Internal Guide: _____

Weekly Summary

Duration From _____ To _____

Work/Task Assigned by the Supervisor: _____

Learning Outcome: _____

Remarks: _____

Name of Supervisor: _____

Sign of Supervisor: _____

Annex 2: Industry Practice Monitoring Tools

Monitoring Tools (For Industry/Company Purpose)

To be filled by the industrial Supervisor (In-company Trainer)/Roving Instructor/at the time of monitoring

Kindly refer to the mark scale provided below in assessing the performance of apprentices.

Mark Scale	**Very Poor**	**Poor**	**Fair**	**Good**	**Very Good**
	0	**1**	**2**	**3**	**4**

Evaluation Criteria	**Score**
1. Behavior and Attitude	**32**
1.1. Grooming/ Personal Appearance	…/4
1.2. Overall Attendance	…/4
1.3. Punctuality	…/4
1.4. Compliance to company Policies	…/4
1.5. Interest in work	…/4
1.6. Reliability and Accountability	…/4
1.7. Ability to cope	…/4
1.8. Acceptance of constructive criticisms and feedback	../4
2. Knowledge	**8**
2.1. Business knowledge/ General knowledge	…/4
2.2. Work ethics/ Professionalism	…/4
3. **Skills**	**36**
3.1. Problem Solving	…/4
3.2. Interaction with the work environment (e.g. Supervisor, colleagues)	…/4
3.3. Appropriate interaction with clients/ External Parties	…/4
3.4. Oral Communication Skills	…/4
3.5. Written Communication Skills	…/4
3.6. Leadership	…/4
3.7. Team Work	…/4
3.8. Technical Skills (e.g. computer software, etc.)	…/4
3.9. Creative Thinking	.../4
4. **Performance**	**24**
4.1. Quality of work performed	…/4
4.2. Ability to prioritize multi tasks	…/4
4.3. Initiative to learn	…/4
4.4. Ability to work independently	…/4
4.5. Commitment to work	…/4
4.6. Value- added contribution	…/4
Total Marks Obtained	…/**100**
Comments (if any):	

Name of Supervisor:	
Designation:	
Tel/ Mobile No:	
Signature:	
Date:	
Comments/Feedback/ Remarks from Internal Guide	
Name of Internal Guide:	
Sign of Internal Guide:	
Date filed:	

Monitoring Tools (For Training Institute/CTEVT Purpose)

To be filled by the Instructor /Training Coordinator/ /Principal/CTEVT Official at the time of monitoring.

Kindly refer to the mark scale provided below in assessing the performance of apprentices

	Very Poor	Poor	Fair	Good	Very Good
Mark Scale	**0**	**1**	**2**	**3**	**4**

Evaluation Criteria	Score
1. Behavior and Attitude	**32**
1.1. Grooming/ Personal Appearance	…/4
1.2. Overall Attendance	…/4
1.3. Punctuality	…/4
1.4. Compliance to company Policies	…/4
1.5. Interest in work	…/4
1.6. Reliability and Accountability	…/4
1.7. Ability to cope	…/4
1.8. Acceptance of constructive criticisms and feedback	.. /4
2. Knowledge	**8**
2.1. Business knowledge/ General knowledge	…/4
2.2. Work ethics/ Professionalism	…/4
3. Skills	**36**
3.1. Problem Solving	…/4
3.2. Interaction with the work environment (e.g. Supervisor, colleagues)	…/4
3.3. Appropriate interaction with clients/ External Parties	…/4
3.4. Oral Communication Skills	…/4
3.5. Written Communication Skills	…/4
3.6. Leadership	…/4
3.7. Team Work	…/4
3.8. Technical Skills (e.g. computer software, etc.)	…/4
3.9. Creative Thinking	.../4
4. **Performance**	**24**
4.1. Quality of work performed	…/4
4.2. Ability to prioritize multi tasks	…/4
4.3. Initiative to learn	…/4
4.4. Ability to work independently	…/4
4.5. Commitment to work	
4.6. Value- added contribution	…/4
Total Marks Obtained	…/**100**
Comments (if any):	

Name of Monitoring Official:	
Designation:	
Tel/ Mobile No:	
Signature:	
Date:	
Comments/Feedback/from Training Coordinator/Principal:	
Name of Training Coordinator/Principal:	
Sign of Training Coordinator/Principal:	
Date filed:	

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