

# **CURRICULUM**

**Technical School Leaving Certificate**

## **Electrical Engineering**

**(24 Months Apprenticeship Programme)**



Council for Technical Education and Vocational Training

## **Curriculum Development Division**

**Sanothimi, Bhaktapur**

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## **Introduction**

Nepal Government, Ministry of Education implemented the Letter grading system in SLC. The door of TSLC program is open for those who have appeared 10th grade exam and achieved any GPA and any grade in any subject. Focusing on such students the curriculum of TSLC (Apprenticeship Programme) of 29 months has been converted into TSLC (Apprenticeship Programme) 24 months.

The world is using many electrical appliances and equipment. We cannot imagine the world without Electrical devices. Nepal is lacking to produce basic level Electrical workforce in the country, especially in the grass root level of rural and urban communities. training of this level in electrical field, called TSLC in Electrical Engineering (Apprenticeship Programme) presently becomes the one of the major responsibilities of CTEVT. In this context a well-developed curriculum is a fundamental pre-requisite for the training program.

Mostly the trained candidates are employed in the the world of work, national and international organizations working as a basic level electrical workforce and rest are employed in NGOs and INGOs, which are working in the national/international labour market and some of them work as entrepreneurs emphasizing on the preventive care and repair and maintenance of electrical devices.

## **Title:**

The title of the programme is TSLC in Electrical Engineering Apprenticeship.

## **Aims**

- To produce competent work force in electrical engineering able to provide services in different community.

## **Objectives**

After the completion of the training program the trainees will be able to:

- Familiarize with basic electrical engineering.
- Install basic electric and electronics appliances.
- Perform basic electrical functions.
- Repair and maintain electrical devices and machines.
- Find fault in electrical system's appliances and machines.
- Repair and maintain faults of electrical system.
- Perform simple calculation related to electrical works.
- Familiarize with electrical and electronics components related with electrical system.
- Familiarize with basic computer and computerized drawing system.
- Promote trainees for entrepreneurship development.

## **Program Description**

This course is based on the job required to perform by a basic level electrical technician as an electrical sub-overseer. This program offers 100% absolutely general electrical courses. The fundamental subjects related to electrical engineering such Applied Mathematics, Bench Work, Electrical, Repair & Maintenance, Engineering Drawing & AutoCAD, Electro Technology, Power Distribution System, Basic Electronics, Motor Installation & Control System, Entrepreneurship Development and Industrial Practice are offered to produce basic level competent electrical engineering workforce.

The program is designed on the basis of 20% theory and 80% practical classes.

## **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 3120 hours in the 24 months of period.

Pre-training course including Trade Training (maximum 3 months) and at the last month of the whole course Block Released Training (maximum 1 month) programme will be conducted in the Institute. Industrial Practice & related skills will be learned in the related sponsoring industries. Admitted trainees will have the three parties training agreement among trainees, sponsoring industries and training institute. The Agreement term and conditions will be implemented during the whole training period.

**Entry criteria:**

Individuals with following criteria will be eligible for this program:

- SLC with any grade and any GPA (Since 2072 SLC).
- SLC appeared (Before 2072 SLC).
- Boys & girls must be 16 to 25 years of age and Nepali Citizenship.
- Pass entrance examination administered by CTEVT.
- Candidates will be selected on the merit basis of entrance examination.
- Selected merit candidates will be interviewed by training institute.
- Candidates should pass the interview.
- Should be mentally & physically fit for training course.

**Group size:**

The group size will be maximum 20 (twenty) in a batch.

**Medium of Instruction:**

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

**Pattern of Attendance:**

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

**Instructors' Qualification:**

- Instructors should have bachelor degree in Electrical Engineering or Diploma in Electrical Engineering with minimum 5 years practical based experiences.
- The demonstrator should have Diploma in Electrical Engineering with minimum 2 years practical based experiences.
- Good communicative/instructional skills.

**Teacher and Student Ratio:**

- Overall at institutional level: 1:10
- Theory: 1:40
- Practical: 1:10
- Minimum 60% 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, procedure sheets, performance check lists, textbooks, newspapers etc.).
- Non-projected media materials (display, photographs, flip chart, writing board etc.).
- Projected media materials (multimedia/overhead transparencies, slides etc.).

- Audio-visual materials (films, videodiscs, videotapes 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, discussion, assignment, group work, question-answer.
- Practical: demonstration, observation, guided practice and self-practice in industry as well as in institute.
- Apprenticeship: Industries, under guidance of seniors and supervisors.

**Evaluation Details:**

- The ratio between the 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%

- There will be three internal assessments conducted by institute and one final examination in each subject. 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.
- Every student must pass in each internal assessment to appear the final exam.
- Continuous evaluation of the students' performance is to be done by the related instructor/trainer to ensure the proficiency over each competency under each area of a subject specified in the curriculum.

**Grading System:**

The grading system will be as follows:

<u>Grading</u>	<u>Overall marks</u>
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 in “**Technical School Leaving Certificate in Electrical Engineering**” to those graduates who successfully complete the requirements as prescribed by the curriculum.

**Job Opportunity:**

The graduate will be eligible for the position equivalent to Non-gazetted 2nd class/level 4 (technical) as Electrical Sub-Overseer or as prescribed by the Public Service Commission or the concerned authorities. The graduate is eligible for registration with the professional council in the grade as mentioned in the related professional council Act (if any).

## Course Structure

S. No.	Subjects	Nature	Hours/week			2 Years Total Class Hours			Full Marks			Pass Marks		
			T	P	Total	T	P	Total	T	P	Total	T	P	Total
1	Applied Mathematics	T	1	0	1	78	0	78	50	0	50	20	0	20
2	Bench Work	P	0	1	1	0	78	78	0	50	50	0	30	30
3	Electrical Installation (Domestic, Industrial & Commercial)	T+P	1	3	4	78	234	312	50	150	200	20	90	110
4	Repair & Maintenance	P	0	1	1	0	78	78	0	50	50	0	30	30
5	Engineering Drawing & AutoCAD	P	0	2	2	0	156	156	0	100	100	0	60	60
6	Electro Technology	T	2	0	2	156	0	156	100	0	100	40	0	40
7	Power Distribution System	P	0	1	1	0	78	78	0	50	50	0	30	30
8	Basic Electronics	T+P	1	1	2	78	78	156	50	50	100	20	30	50
9	Motor Installation & Control System	P	0	1	1	0	78	78	0	50	50	0	30	30
10	Entrepreneurship Development	T	1	0	1	78	0	78	50	0	50	20	0	20
11	Industrial Practice	P	0	24	24	0	1872	1872	0	1200	1200	0	720	720
<b>Total</b>			<b>6</b>	<b>34</b>	<b>40</b>	<b>468</b>	<b>2652</b>	<b>3120</b>	<b>300</b>	<b>1700</b>	<b>2000</b>	<b>120</b>	<b>1020</b>	<b>1140</b>

## **Subjects**

1. Applied Mathematics
2. Bench Work
3. Electrical Installation (Domestic, Industrial& Commercial)
4. Repair & Maintenance
5. Engineering Drawing & AutoCAD
6. Electro Technology
7. Power Distribution System
8. Basic Electronics
9. Motor Installation & Control System
10. Entrepreneurship Development
11. Industrial Practice

## Applied Mathematics

**Course Nature: Theory**  
**Full Marks: 50**

**Class per week: 1 hr.**  
**Total Class: 78 hrs.**

Subject 1: Applied Mathematics	
<b>Description:</b>	This course provides skill and knowledge to solve the numerical problem related to the TSLC in Electrical Engineering course.
<b>Objectives:</b>	At the end of the course the participants will be able to: <ul style="list-style-type: none"> <li>▪ Calculate and convert units.</li> <li>▪ Interpret graphical representation.</li> <li>▪ Calculate electrical parameters.</li> <li>▪ Apply and calculate different laws related to electrical fields.</li> <li>▪ Apply fundamental of AC circuits calculation.</li> <li>▪ Apply the different types of electrical machines' related calculation.</li> </ul>

S.N.	Skills	Contents	Time Hours
1.	<b>Calculate Workshop:</b> <ul style="list-style-type: none"> <li>• Length</li> <li>• Area</li> <li>• Volume</li> <li>• Trigonometry</li> <li>• Conversion units</li> </ul>	<b>Units and measurement</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• SI units</li> <li>• Pythagorus theorem</li> <li>• Temperature</li> <li>• Formulae</li> </ul>	5
2.	<ul style="list-style-type: none"> <li>• Calculate work, power and energy</li> <li>• Calculate cost per unit.</li> </ul>	<b>Work, power and energy</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Joule's law of electric heating</li> <li>• SI units</li> <li>• Unitary method</li> <li>• Formulae</li> </ul>	4
3.	<ul style="list-style-type: none"> <li>• Calculate simple linear equation</li> </ul>	<b>Linear equation</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Method</li> </ul>	2
4.	<ul style="list-style-type: none"> <li>• Calculate scalar and vector quantity</li> </ul>	<b>Scalar and vector quantity</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Speed</li> <li>• Velocity</li> <li>• Acceleration</li> <li>• Formulae</li> </ul>	2
5.	Calculate : <ul style="list-style-type: none"> <li>• Resistance</li> <li>• Voltage</li> <li>• Current</li> <li>• Power</li> </ul>	<b>Fundamental of Electricity</b> <ul style="list-style-type: none"> <li>• Law of resistance</li> <li>• Ohm's law</li> <li>• Kirchoff's law</li> <li>• Resistivity</li> <li>• Resistance in series and parallel circuit</li> <li>• Formulae</li> </ul>	6
6.	<b>Calculate :</b> <ul style="list-style-type: none"> <li>• Self induction</li> </ul>	<b>Electromagnetic induction</b> <ul style="list-style-type: none"> <li>• Introduction</li> </ul>	5



	<ul style="list-style-type: none"> <li>• Mutual induction</li> <li>• Induced e.m.f.</li> <li>• Inductance</li> </ul>	<ul style="list-style-type: none"> <li>• Faraday's law</li> <li>• Lenz's law</li> <li>• series/parallel inductive circuit</li> <li>• Formulae</li> </ul>	
7.	<b>Calculate :</b> <ul style="list-style-type: none"> <li>• Capacitance</li> <li>• Charge and potential difference</li> <li>• Energy store</li> </ul>	<b>Capacitance</b> <ul style="list-style-type: none"> <li>• Coulomb's law</li> <li>• Charging and discharging</li> <li>• series/parallel capacitive circuit</li> <li>• Formulae</li> </ul>	4
8.	<b>Calculate:</b> <ul style="list-style-type: none"> <li>• Cycle</li> <li>• Time period</li> <li>• Frequency</li> <li>• Average value</li> <li>• Effective value/RMS</li> </ul>	<b>A.C Fundamental</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Formulae</li> </ul>	6
9.	<b>Calculate:</b> <ul style="list-style-type: none"> <li>• resistance/capacitance/ inductance</li> <li>• R-L, R-C and R-L-C circuit</li> <li>• Impedance</li> <li>• Power factor</li> <li>• Phase angle</li> <li>• Active/reactive and apparent power</li> </ul>	<b>A.C. circuit</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Pure resistive/capacitive/inductive circuit</li> <li>• Effect of power factor (low/high)</li> <li>• Series and parallel circuit</li> <li>• Formulae</li> </ul>	7
10.	<b>Calculate :</b> <ul style="list-style-type: none"> <li>• Power</li> <li>• Current</li> <li>• Voltage</li> </ul>	<b>Poly-phase circuit</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Work, power, energy in delta/star connection</li> <li>• Two watt meter method</li> </ul>	6
11.	<b>Calculate:</b> <ul style="list-style-type: none"> <li>• Input/output voltage</li> <li>• No. of turns in primary/secondary</li> <li>• Transformation ratio</li> <li>• Losses and efficiency</li> <li>• E.m.f. calculation</li> </ul>	<b>Transformer</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• E.m.f. equation</li> <li>• Transformation ratio</li> <li>• Formulae</li> </ul>	8
	<b>Calculate:</b> <ul style="list-style-type: none"> <li>• Generator emf and terminal voltage</li> <li>• Armature current and field current</li> <li>• Losses and efficiency</li> </ul>	<b>DC generator</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• E.m.f. equation</li> <li>• Formulae</li> </ul>	6
	<b>Calculate:</b> <ul style="list-style-type: none"> <li>• Phase and line voltage</li> <li>• Voltage regulation.</li> <li>• Efficiency</li> </ul>	<b>Synchronous generator</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Formulae</li> </ul>	5
	<b>Calculate:</b> <ul style="list-style-type: none"> <li>• Synchronous speed.</li> <li>• Back e.m.f.</li> <li>• Mechanical power</li> </ul>	<b>Synchronous motor</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Formulae</li> </ul>	4

	<b>Calculate:</b> <ul style="list-style-type: none"> <li>• Synchronous speed</li> <li>• Back e.m.f.</li> <li>• Slip, Normal speed</li> </ul>	<b>Induction motor</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Working principle</li> <li>• Formulae</li> </ul>	4
	<b>Calculate tariff</b> <ul style="list-style-type: none"> <li>• Domestic</li> <li>• Commercial</li> </ul>	<b>Tariff</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Ratio and proportion</li> <li>• Percentage</li> <li>• Formulae</li> </ul>	4
<b>Grand Total</b>			<b>78</b>

**Reference Books:**

- Electrical Technology- B.L. Thereja
- Basic Electrical Engineering – M. L. Anwani
- Basic Electrical Engineering Vol. 1 & 2 – P.S. Dhogal

## Bench Work

**Course Nature: Practical**

**Class per Week: 1 hr.**

**Full Marks: 50**

**Total Class: 78 hrs.**

<b>Subject 2: Bench Work</b>	
<b>Description:</b>	This subject provides skill and knowledge to perform basic mechanical work. Which consists of filling, measuring, marking, sawing, punching, drilling, tapping, cutting, folding, riveting, bending etc.
<b>Objectives:</b>	<p>At the end of the course the participants will be able to:</p> <ul style="list-style-type: none"> <li>▪ Identify hazards</li> <li>▪ Apply safety rules</li> <li>▪ Use and care mechanical tools, instrument and machines</li> <li>▪ Perform basic operation related to mechanical work, such as: measure, mark, cut, bend, file, drill, rivet according to the specification.</li> <li>▪ Perform sheet metal works</li> </ul>

S.N.	Skill/Tasks	Contents/Topics	Time Hours		
			Th.	Pr.	Total
1	Perform filling	<b>Filling</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Tools/materials</li> <li>• Importance &amp; Applications</li> <li>• Process</li> <li>• Safety precautions</li> <li>• Demonstration of filling</li> <li>• Exercises on filling</li> </ul>	2	4	6
2	Perform measuring & marking	<b>Measuring &amp; marking</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Tools/materials</li> <li>• Importance &amp; Applications</li> <li>• Process</li> <li>• Safety precautions</li> <li>• Demonstration of measuring &amp; marking</li> <li>• Exercises on measuring &amp; marking</li> </ul>	2	2	4
3	Perform the punching	<b>Letter/number/centre punch</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types &amp; size</li> <li>• Tools/materials</li> <li>• Importance &amp; Applications</li> <li>• Process</li> <li>• Safety precautions</li> <li>• Demonstration of punching</li> <li>• Exercises on punching</li> </ul>	1	1	2
4	Perform the sawing	<b>Sawing</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> </ul>	1	1	2

		<ul style="list-style-type: none"> <li>• Tools/materials</li> <li>• Importance &amp; Applications</li> <li>• Procedures</li> <li>• Safety precautions</li> <li>• Demonstration of sawing</li> <li>• Exercises on sawing</li> </ul>			
5	Perform the drilling	<b>Drilling</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types &amp; Parts</li> <li>• Tools/materials</li> <li>• Importance &amp; Applications</li> <li>• Process</li> <li>• Method of selection RPM and drill bit size</li> <li>• Safety precautions</li> <li>• Demonstration of drilling</li> <li>• Exercises on drilling</li> </ul>	2	4	6
6	Perform threads cutting <ul style="list-style-type: none"> <li>• Cut external threads by die</li> <li>• Cut internal threads by taps</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Thread and its nomenclature</li> <li>• Describe Tap and die</li> <li>• Selection of drill bit for tapping(TDS)</li> <li>• Measuring and marking tools, drill bits, tap and die</li> <li>• Procedure of tapping and die</li> <li>• Safety precautions</li> <li>• Demonstration of threads cutting</li> <li>• Exercises on threads cutting</li> </ul>	2	2	4
7	Perform sheet metal work (figure cutting)	<b>Sheet metal</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Tools and materials</li> <li>• Application</li> <li>• Safety precautions</li> <li>• Demonstration</li> </ul>	1	3	4
		<b>Folding</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and uses</li> <li>• Methods</li> <li>• Safety precautions</li> <li>• Demonstration of folding</li> <li>• Exercises on folding</li> </ul>	1	3	4
		<b>Riveting</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and application</li> <li>• Types</li> <li>• Uses</li> <li>• Methods</li> <li>• Demonstration of riveting</li> <li>• Exercises on riveting</li> </ul>	1	3	4
<b>Perform the project works</b>					

8	Skill	Tasks	Th.	Pr.	Total
	Job I - Manufacture a T-Joint.	<ul style="list-style-type: none"> <li>Obtain the drawing as Instructor's instruction</li> </ul>	3	39	42
	Job II - Manufacture a Dove – tail Joint.	<ul style="list-style-type: none"> <li>Read &amp; understand given drawing</li> </ul>			
	Job III - Manufacture a V & radius profiles.	<ul style="list-style-type: none"> <li>Obtain tools, equipments &amp; materials from the tools room</li> </ul>			
	Job IV - Exercises on wire bending.	<ul style="list-style-type: none"> <li>Clean the work pieces by using wire brush if needed</li> </ul>			
	Job V - Manufacture a 's' Fittings.	<ul style="list-style-type: none"> <li>Check flatness &amp; squareness</li> </ul>			
	Job VI - Manufacture a Male & Female profile Fittings.	<ul style="list-style-type: none"> <li>Layout/Mark the work pieces as per given drawing</li> <li>Cut the raw materials</li> <li>Prepare the work pieces per given drawing</li> <li>Select &amp; use appropriate tools, equipments &amp; machines</li> <li>Assemble/Fit the work pieces &amp; check it</li> <li>Correction the wrong work pieces if necessary</li> <li>Finish the surface of the work pieces</li> <li>Stamp the Number &amp; Letter Punch on the work pieces</li> <li>Follow all the necessary safety rules &amp; regulations</li> <li>Exercises on above skill</li> </ul>			
<b>Grand Total</b>			<b>16</b>	<b>62</b>	<b>78</b>

**Reference Book:**

- G.S Sethi & Balbir Singh - Machinist 1<sup>st</sup> & 2<sup>nd</sup> Year
- Work Shop Technology (Volume I &II) – Hajra & Chaudhary

### Required Tools and Equipments

• Bench Vice	• Metal Chisel
• Bench Cleaning Brush	• Metal Scissor
• Anvil	• Micro meter
• C- Clamp	• Number punch
• Center punch	• Oil Cane
• Chipping Hammer	• Pin Punch
• Clamp	• Pipe Vice
• Divider	• Pliers
• Draft Punch	• Rivet Punch
• Drill Machine with drill bit	• Safety Gloves
• File Brush	• Safety Goggles
• Files	• Screw Driver
• Letter punch	• Spanner
• Hack saw With Blade	• Steel rular
• Hammer	• Taps Set
• Mallet	• Tongs
• Marking scriber	• Try square
• V-block	• Varnier caliper

### Material List

• G I pipe	• MS black sheet
• MS flat	• PVC pipe
• Rivet	• Sheet metal
• Steel strip	• U channel
• V channel	

## **Safety Rules**

### **Work shop safety rules.**

1. Keep the work shop neat and clean.
2. Wear workshop/lab apron.
3. Wear covered footwear, never use rubber chappals.
4. Don't run, sought, smoke inside the workshop.
5. Never place sharp materials such as scribers and scraps on the floor.
6. Place heated work piece under the board.
7. Store the inflammable materials such as oil, grease etc, away from the working place.

### **Hand tools Safety Rules.**

1. The right tools should be used and handled carefully.
2. Place the tools in the proper place in a perfect manner.
3. Never use files, screw drivers, scrapers etc. without handle.
4. Check up hammer, see it is well wedged or not, don't use a cracked handle.
5. Remove oil substances on the face of the hammer and no top of the chisel while working.
6. Wear goggles and place chipping screen while chipping.
7. Don't use mushroom head chisels.
8. Never store more tools in the working place than required.

### **Machine Safety Rules**

1. Don't start any machine before getting instruction or permission.
2. Never operate a new machine unless you know thoroughly of its mechanism and working conditions.
3. Ensure that metal body of electrical machine is earthed.

## Electrical Installation

**Course Nature: Theory & Practical**  
**Full Marks: T = 50, P = 150**

**Class per week: 1+3 = 4 hrs.**  
**Total Class: 78+234 = 312 hrs.**

<b>Subject 3 : Electrical Installation</b>	
<b>Description:</b>	This subject provides skill and knowledge related to electrical installation. It also covers classification of wiring, selection of materials, simple design and installation of domestic, industrial and commercial building.
<b>Objectives:</b>	<p>At the end of the course the participants will be able to:</p> <ul style="list-style-type: none"> <li>▪ Select electrical tools, equipment, materials, accessories, fitting and safety device as per drawing.</li> <li>▪ Install panel board, capacitor bank, cable tray, lightning arrestor, PABX, telephone distribution board.</li> <li>▪ Interpret lay out and wiring diagram.</li> <li>▪ Perform board wiring and brick wall wiring.</li> <li>▪ Install supporting accessories (PVC conduit, metal box, distribution box, L.T. cable etc.).</li> <li>▪ Perform wiring system and electrical safety test.</li> <li>▪ Connect and control single &amp; three phase motor system.</li> </ul>

S.N.	Skill/Tasks	Contents/Topics	Time Hours		
			Th.	Pr.	Total
1.	Electrical tools and equipments	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance &amp; uses</li> <li>• Safety rules and regulation</li> </ul>	2	-	2
2.	Handle electrical tools and equipments	<b>Tools and equipments for Electrical installation</b> <ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Uses</li> </ul>	2	4	6
3.	Electrical materials and accessories	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance</li> </ul>	4	2	6
4.	Selection of electrical materials	<b>Electrical materials</b> <ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Uses</li> </ul>	2	4	6
5.	Selection of electrical accessories	<b>Electrical accessories</b> <ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Uses</li> <li>• Different type of lighting system wiring</li> </ul>	2	24	26
6.	Protective devices	<b>Protective device</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance &amp; use</li> </ul>	3.5	-	3.5
7.	Selection of protective devices	<b>Protective device</b> <ul style="list-style-type: none"> <li>• Demonstration</li> </ul>	2	2	4



		<ul style="list-style-type: none"> <li>• Methods to use</li> <li>• Selection</li> </ul>			
8.	First aid	<b>First aid</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and application</li> <li>• Process</li> </ul>	1.0		1.0
9.	Provide first aid services Perform simulation first aid to simulated electrocuted person	<ul style="list-style-type: none"> <li>• Procedures</li> <li>• Group practice</li> </ul>	0.5	2	2.5
10.	Electrical fittings	<b>Electrical fittings</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance &amp; use</li> <li>• Process</li> <li>• Safety precautions</li> </ul>	4	-	4
11.	Installation of electrical fittings	<ul style="list-style-type: none"> <li>• Fitting rules and regulations</li> <li>• Procedures</li> <li>• Installation</li> </ul>	2	9	11
12.	Electrical Circuit	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Uses and working areas</li> <li>• Selection of wiring</li> </ul>	2	-	2
13.	Interpret lay out and circuit diagram	<b>Electrical diagram</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and use</li> </ul>	-	4	4
14.	Jointing of electrical wire	<b>Joint</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and use</li> <li>• Advantages</li> </ul>	2	-	2
15.	Perform joints <ul style="list-style-type: none"> <li>• Conduit</li> <li>• wire and cable</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstration</li> <li>• Performing joints</li> </ul>	2	10	12
16.	Wiring	<b>Wiring</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Controlling and protective devices</li> <li>• Importance and use</li> <li>• Process and mechanism</li> <li>• safety</li> </ul>	4	-	4
17.	Perform board wiring	<ul style="list-style-type: none"> <li>• One way switching</li> <li>• Two way switching</li> <li>• Intermediate switching.</li> <li>• Tunneling switch</li> <li>• Call bell circuit</li> <li>• Go down circuit</li> <li>• Power and light socket/light indicator</li> </ul>	4	46	50

		<ul style="list-style-type: none"> <li>• Fuse and protective devices.</li> </ul>			
18.	Brick wall wiring	<b>Wiring</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types of wiring system</li> <li>• Merits and demerits</li> <li>• Importance and use</li> <li>• Process</li> <li>• Concept and importance of estimating and costing of installation</li> <li>• Safety</li> </ul>	4	-	4
19.	Perform wiring on brick wall (surface and concealed)	<ul style="list-style-type: none"> <li>• Main switch</li> <li>• Installation of DB</li> <li>• Kwhr meter</li> <li>• Fan and fan regulator/dimmer</li> <li>• corridor lighting</li> <li>• Laying pipes in concrete slab on building.</li> </ul>	2	28	30
20.	Supporting materials	<b>Supporting materials</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and use</li> <li>• Process</li> <li>• safety</li> </ul>	4	-	4
21.	Install supporting materials (surface and conceal) <ul style="list-style-type: none"> <li>• distribution board</li> <li>• cable tray</li> </ul>	<ul style="list-style-type: none"> <li>• PVC conduit</li> <li>• metal box</li> <li>• Elbow</li> </ul>	2	22	24
22.	LT cable	<b>LT cable</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and use</li> <li>• Testing Process</li> <li>• safety</li> </ul>	2	-	2
23.	Perform Laying of L.T. cable	Indoor field visit	2	4	6
24.	Earthing	<b>Earthing</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and application</li> <li>• Types</li> <li>• Process of earthing</li> </ul>	2	-	2
25.	Perform earthing	<ul style="list-style-type: none"> <li>• Field work</li> </ul>	2	6	8
26.	PABX, telephone distribution board and tag	<b>PABX telephone distribution board and tag.</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and application</li> <li>• color code and tag termination method.</li> <li>• Process</li> </ul>	2	-	2

		<ul style="list-style-type: none"> <li>• safety</li> </ul>			
27.	Install PABX, telephone distribution board and tag	<ul style="list-style-type: none"> <li>• Installation</li> </ul>	2	4	6
28.	Change over switch	<b>Change over switch</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and application</li> <li>• Process</li> <li>• safety</li> </ul>	2	-	2
29.	Installation of change over switch	Connect single and three phase supply by using change over switch	2	8	10
30.	Electrical safety testing	<b>Electrical safety test</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and application</li> <li>• Process</li> <li>• safety</li> </ul>	2	-	2
31.	Test electrical safety	Testing <ul style="list-style-type: none"> <li>• Insulation test.</li> <li>• Earth test</li> <li>• Continuity test</li> </ul>	1	5	6
32.	Isolating switch	<b>Isolating switches</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and application</li> <li>• Process</li> <li>• safety</li> </ul>	2	-	2
33.	Operate circuit breaker switch	Installation of breaker <ul style="list-style-type: none"> <li>• MCB</li> <li>• MCCB</li> <li>• ACB</li> </ul>	-	6	6
34.	Circuit test	<b>Circuit test</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and application</li> <li>• Process</li> <li>• safety</li> </ul>	2	-	2
35.	Perform circuit test	Performing tests: <ul style="list-style-type: none"> <li>• Open</li> <li>• Close</li> <li>• Short</li> </ul>	-	4	4
36.	Energy conservation and solar system	<b>Solar home system</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and application</li> <li>• Components</li> <li>• Process</li> <li>• Safety</li> </ul>	2	-	2
37.	Identify energy conservation and perform	Installation of solar system	2	6	8

	solar home system installation			
<b>Grand Total</b>			<b>78</b>	<b>234</b>
			<b>312</b>	

**Reference Books:**

- Electrical Wiring – Ramu subedi.
- Viduit Bitaran – Sambhu Prasad Upadhya.
- Fundamental of Electricity – Binod and Shreekrishna Panthi.

### Required tools and equipment

• Metal electrical tool box	• Augur/barma
• Allen key set	• Measuring tape
• Flat pliers	• Cable cutter
• Cable drawer	• Chisel
• Spanner set	• Ttry square/bottom
• Clamp on meter	• Combinational pliers
• Crimping tools	• Cutting pliers
• Earth resistance tester	• Extension ladder (sliding type)
• File different size/ models	• Finishing towel (Ruksa)
• Hand drill machine	• Folding ladder
• Screw driver set	• Hammer
• Marking scribe	• Hand grinder
• Hand hacksaw frame with blade	• Level pipe
• Nose pliers	• Phase tester
• Frequency meter	• Pipe cutter
• Megger	• Pulling spring
• Multi meter	• Shovel
• Ammeter(AC/DC)	• Soldering lead, paste and flux
• Voltmeter (AC/DC)	• Sprit level
• Ohm meter	• Wire stripper/cable stripper
• Phase tester	• Whole saw cutter
• Plumb bob	• Soldering iron with stand

### Materials list

• All types of one way switch	• Bracket holder
• Ceiling rose	• Dimmer switch
• Floating switch	• Fluorescent lamp holder
• Lamp holder	• Lux switch/photo switch
• Main switch	• Pendent holder
• Push bottom switches	• Rotary switch
• Screw type bulb holder	• Socket outlet terminal
• Starter holder	• Surface tumbler switch
• Timer.	• Two way switch
• MCB, MCCB, ACB, OCB, ELCB	• Complete solar home system set 35 W

## Repair and Maintenance

**Course nature: Practical**  
**Full Marks: 50**

**Class per Week: 1 hr.**  
**Total hours: 78 hrs.**

<b>Subject: 4: Repair &amp; Maintenance</b>	
<b>Description:</b>	This course provides skill and knowledge of domestic and commercial electrical appliances and equipment. The fundamental facts of preventive and post fault maintenance have been emphasized in this course. This course also provides skill and knowledge to repair and maintenance of single, three phase electrical motor, their rewinding, transformer and D.C. motor.
<b>Objectives:</b>	<p>At the end of the course the participants will be able to:</p> <ul style="list-style-type: none"> <li>▪ Repair and maintenance of domestic appliances.</li> <li>▪ Repair and maintenance of Industrial machine and tools.</li> <li>▪ Develop simple lay out and wiring diagram of different types of electric machine/equipment and appliances.</li> <li>▪ Disassemble and assemble various types of electrical machine and equipment.</li> <li>▪ Perform basic maintenance of transformer.</li> <li>▪ Perform single phase and three phase motor rewinding.</li> <li>▪ Apply safety precautions for electrical repair and maintenance work.</li> </ul>

S.N.	Skill	Contents	Time hrs		
			Th	Pr.	Total
1.	Repair/maintenance electrical appliances and accessories (Immersion heater/rod, Iron, kettle and hot plate)	<p>Concept of preventive and corrective maintenance</p> <p><b>Immersion heater, rod heater, Iron, Kettle, Hotplate, heating element</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Working principle and function</li> <li>• Process</li> <li>• connection diagram</li> <li>• Log book/ work report</li> </ul>	2	2	4
2.	Repair/maintain Rice Cooker, geyser	<p><b>Electrical Cooker, Geyser, heating element</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Working principle and function</li> <li>• Process</li> <li>• connection diagram</li> <li>• Log book/ work report</li> </ul>	2	4	6
3.	Repair and maintain electrical oven	<p><b>Electrical oven</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> </ul>	2	2	4

		<ul style="list-style-type: none"> <li>• Working principle and function</li> <li>• Process</li> <li>• connection diagram</li> <li>• Log book/ work report</li> </ul>			
4.	Repair and maintain fan heater	<b>Fan heater</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Working principle and function</li> <li>• Process</li> <li>• connection diagram</li> <li>• Log book/ work report</li> </ul>	2	2	4
5.	Repair and maintain vacuum cleaner	<b>Vacuum cleaner</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Working principle and function</li> <li>• Process</li> <li>• connection diagram</li> <li>• Log book/ work report</li> </ul>	1	2	3
6.	Repair and maintain mixture/grinder.	<b>Mixture/grinder</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Working principle and function</li> <li>• Process</li> <li>• connection diagram</li> <li>• Log book/ work report</li> </ul>	1	2	3
7.	Repair and maintain portable drill machine	<b>Drill machine</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Working principle and function</li> <li>• Process</li> <li>• connection diagram</li> <li>• Log book/ work report</li> </ul>	1	2	3
8.	Repair and maintain table fan, ceiling fan/exhaust fan.	<b>Fan</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and use</li> <li>• Working principle and function</li> <li>• Process</li> <li>• connection diagram</li> <li>• Log book/ work report</li> </ul>	1	2	3
9.	Repair and maintain Domestic/Commercial/ Industrial installation	<b>Electrical Installation</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> </ul>	2	4	6

		<ul style="list-style-type: none"> <li>• Process</li> <li>• connection diagram</li> <li>• Fault finding &amp; remedies</li> <li>• Log book/ work report</li> </ul>			
10.	and maintain AC single phase motor.	<b>AC single phase motor</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Process of repair and maintenance</li> <li>• Process of dismantle and assemble</li> <li>• Size/types</li> <li>• connection diagram</li> <li>• calculation of turns and size</li> <li>• Rewinding and installing process of coil</li> <li>• Log book/ work report</li> </ul>	2	3	5
11.	and maintain AC three phase motor (Squirrel)	<b>AC three phase motor</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Process of repair and maintenance</li> <li>• Process of dismantle and assemble</li> <li>• Size</li> <li>• connection diagram</li> <li>• calculation of turns and size</li> <li>• Rewinding and installing process of coil</li> <li>• Log book/ work report</li> </ul>	2	8	10
12.	and maintain AC three phase motor (Slipping)	<b>AC three phase motor</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Process of repair and maintenance</li> <li>• Process of dismantle and assemble</li> <li>• Size</li> <li>• connection diagram</li> <li>• calculation of turns and size</li> <li>• Rewinding and installing process of coil</li> <li>• Log book/ work report</li> </ul>	2	8	10
13.	Repair and maintain Generator Set	<b>Generator</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Types of generator</li> <li>• Process of maintenance</li> <li>• Trouble shooting</li> </ul>	2	3	5



<b>14.</b>	Repair and maintain single phase low voltage transformer.	<b>Single phase low voltage transformer</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Parts/components</li> <li>• Importance and use</li> <li>• Process</li> <li>• connection diagram</li> <li>• calculation of turns and size</li> <li>• Binding and installing process</li> <li>• Log book/ work report</li> </ul>	2	2	4
<b>15.</b>	Repair and maintain Invertors, converters, solar panel, Battery	<b>Invertors, converters, solar panel</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Process</li> <li>• connection diagram</li> <li>• Log book/ work report</li> </ul>	2	6	8
		<b>Total</b>	<b>26</b>	<b>52</b>	<b>78</b>

**Reference Books:**

- Electrical installation by Heinz Graff
- Industrial Wiring by J.A. Faindery

**Required tools and equipment**

• Adjustable wrench	• Allen key set
• Ammeter(AC/DC)	• Cable knife
• Combination pliers	• Cutter pliers
• File different size/ models	• Flat pliers
• Hammer	• Hand hacksaw with blade
• Line tester	• mallet
• Marking scribe	• Measuring tape
• Metal electric tool box set	• Micro miter
• Multi meter	• Nose pliers (flat and round)
• Ohm meter	• Screw driver set (star and philips)
• Slide wrench	• Soldering iron with stand
• Soldering lead	• Soldering paste/flux
• Standard wire gauge	• Voltmeter (AC/DC)
• Wire stripper	• Pyranometer
• Solar Panel set	• Hydrometer

**Safety Precaution:**

- Never use broken handle tools
- Use always insulated tools
- Beware of live wires.

**References Books:**

- Basic Electrical Engineering - M.L.Anwani
- Text Book of Electrical Engineering – B. L. Theraja
- Installation Servicing and Maintenance – S.N.Bhattacharya
- Generation, transmission and utilization of electrical power – A. T. Star
- Generation, transmission and utilization of electrical power – A. K. Showny
- Basic electrical engineering volume I and II – P.S. Dhogal
- NEA Rules and Standards
- Skill Standards for Building and Industrial Electrician Level 1, 2 & 3– NSTB, CTEVT

**Required Materials**

- Board Markers
- Paper Markers
- Charts
- Demonstration kit
- Graphs
- Overhead projectors
- Photographic visuals etc.

## Engineering Drawing & AutoCAD

**Course Nature: Practical**

**Class per Week: 2 hrs.**

**Full Marks: 100**

**Total Class: 156 hrs.**

<b>Subject 5: Engineering Drawing &amp; AutoCAD</b>	
<b>Description:</b>	<p>This course provides skill and knowledge on drawing instrument, standard drawing symbol, lettering, lines, scales, geometrical drawing, electric circuit diagram of domestic, commercial &amp; Industrial installation.</p> <p>This Computer application is the very basic computer course. This course familiarizes trainees about computer.</p> <p>This course also covers layout diagram &amp; connection diagram of electrical appliance, machines service drop cable in transmission &amp; distribution system using computer aided design.</p>
<b>Objectives:</b>	<p>At the end of the course the participants will be able to:</p> <ul style="list-style-type: none"> <li>▪ Draw line, curve and plan of geometrical solids.</li> <li>▪ Sketch freehand and three dimensional objects.</li> <li>▪ Read, interpret Electrical symbols to use in different circuit diagram.</li> <li>▪ Read, interpret and draw electrical connection diagram in transmission &amp; distribution system.</li> <li>▪ Draw the development diagram of single phase &amp; three phase motors' component, equipment, &amp; machines.</li> <li>▪ Understand the concept of computer.</li> <li>▪ Able to work with Ms Word.</li> <li>▪ Can create Spreadsheet.</li> <li>▪ Formulate charts with data.</li> <li>▪ Send and receive Email.</li> <li>▪ Search information on the Internet.</li> <li>▪ Familiarize with Windows operating system.</li> <li>▪ Use Computer Aided Drafting (CAD) Software.</li> <li>▪ Use AutoCAD as electrical drafting tool.</li> <li>▪ Construct 2D Engineering Drawing using AutoCAD.</li> <li>▪ Annotate a drawing with Text, Dimensioning.</li> <li>▪ Edit drawing using CAD Software.</li> </ul>

S.N.	Skill/Tasks	Contents/Topics	Time hrs.		
			Th.	Pr.	Total
<b>1. Geometrical Engineering Drawing</b>					
1	Explain engineering/technical drawing	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Classification</li> <li>• Applications</li> <li>• Distinguish</li> </ul>	2	-	2
2	Identify and handle drawing instruments	<ul style="list-style-type: none"> <li>• Selection of drawing instruments</li> <li>• Types, uses and sizes</li> <li>• Handling techniques</li> <li>• Precautions</li> <li>• Demonstration of instruments</li> </ul>	1	1	2

3	<p>Draw/Construct a title block and lines</p> <ul style="list-style-type: none"> <li>• Set up paper in drawing board</li> <li>• Prepare a drawing sheet using Mini Drafter</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Layout of the drawing sheet</li> <li>• Convention for lines and materials</li> <li>• Uses of lines and title block</li> <li>• Types and Thickness of lines</li> <li>• Demonstration</li> <li>• Exercises</li> </ul>	1	3	4
4	Practice lettering	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Requirements of good lettering</li> <li>• Spacing and sizes of letters</li> <li>• Single-stroke, freehand gothic and italic lettering</li> <li>• Demonstration</li> <li>• Exercises</li> </ul>	1	1	2
5	Identify and construct of four sided plane figures, triangles and regular polygons	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Concept and Importance</li> <li>• Handling techniques</li> <li>• Types</li> <li>• Procedure for making geometrical constructions</li> <li>• Drawing exercises</li> </ul>	1	3	4
6	Construct an ellipse	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Drawing exercises on rectangle and two circles method</li> </ul>	0.5	1.5	2
7	Dimension the drawing objects	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Elements of dimensioning</li> <li>• Method of dimensioning</li> <li>• Arrangement of dimensioning</li> <li>• Symbols for shape indication</li> <li>• General rules for dimensioning <ul style="list-style-type: none"> <li>▪ Flat work pieces with straight edges</li> <li>▪ Flat work pieces with holes &amp; round edges</li> <li>▪ Practical hints on dimensioning</li> </ul> </li> <li>• Problems on dimensioning</li> <li>• Demonstration</li> </ul>	1	2	3
8	Draw in scales	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses and sizes of scale</li> <li>• Metric and British measurement</li> <li>• Drawing exercises on sizes of scale</li> </ul>	0.5	1.5	2

9	Identify pictorial views	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Differences between isometric and oblique views</li> <li>• Drawing exercises</li> </ul>	0.5	1.5	2
10	Explain and obtain orthographic views	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Selection of views</li> <li>• Spacing of views</li> <li>• Principles of orthographic views</li> <li>• Comparison of first and third angle projection</li> <li>• Demonstration</li> <li>• Drawing exercises</li> </ul>	1	1.5	2
11	Select and identify orthographic views from pictorial views	<ul style="list-style-type: none"> <li>• Analysis of three views including missing views</li> <li>• Simple cuboids shapes</li> <li>• Angles and slopes</li> <li>• Demonstration</li> <li>• Drawing exercises</li> </ul>	1	1	2
12	Draw orthographic views from isometric & oblique views by first & third angle projection	<ul style="list-style-type: none"> <li>• Procedure for making orthographic views</li> <li>• Rectangular objects with horizontal</li> <li>• Vertical and inclined surfaces</li> <li>• Objects with cylindrical surfaces</li> <li>• Demonstration</li> <li>• Drawing exercises</li> </ul>	1	5	6
13	Copy/Draw isometric views	<ul style="list-style-type: none"> <li>• Procedures for making isometric views</li> <li>• Demonstration</li> <li>• Drawing exercises</li> </ul>	0.5	5	5.5
<b>Total</b>			<b>12</b>	<b>27</b>	<b>39</b>
<b>2. Electrical Engineering Drawing</b>					
1	Draw electrical symbols	<b>Electrical Symbols</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Process</li> </ul>	1	3	4
2	Draw the electrical diagram <ul style="list-style-type: none"> <li>• Lay out</li> <li>• Wiring</li> <li>• Connection</li> </ul>	<b>Electrical diagram</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and use</li> <li>• Process</li> </ul>	1	5	6
3	Draw complete diagram of domestic, commercial building system with	<b>Building drawing</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance</li> <li>• Material estimating and costing</li> </ul>	3	17	20

	architectural building plan and cost calculation.	<ul style="list-style-type: none"> <li>Process</li> </ul>			
4	Draw Motor control system diagram <ul style="list-style-type: none"> <li>DOL</li> <li>Star/Delta</li> <li>Forward/reverse</li> <li>Remote control</li> </ul>	<b>Motor control and power diagram.</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Importance and use</li> <li>Process</li> </ul>	2	24	26
5	Draw winding diagram of different types motor and connection diagram of single phase motor.	<b>winding diagram of motors and connection diagram of single phase motor.</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Types of motors</li> <li>Types of winding</li> <li>Types of layer</li> <li>Importance and use</li> <li>Name plate</li> <li>Parts of motor</li> </ul>	2	14	16
6	Draw single line diagram of generation, transmission, distribution and sub station system.	<ul style="list-style-type: none"> <li>Single line diagram of power supply system</li> <li>Introduction</li> <li>Types</li> <li>Importance and use</li> <li>Nepal Electrical authority (NEA) rule, regulation and standard.</li> </ul>	2	4	6
Total			11	67	78
<b>3. Computer Application</b>					
1	Turn on computer/start program/paint/typing tutor	<ul style="list-style-type: none"> <li>Explain about computer</li> <li>Switch on computer</li> <li>Explain about mouse and keyboard</li> <li>Log in to the computer</li> <li>Mouse and keyboard practice</li> </ul>	0.20	0.40	1.00
2	Controlling program windows/ Introduce program menus/ Keyboard keys	<ul style="list-style-type: none"> <li>Explain about how to control opened program windows (minimize, maximize/restore, close)</li> <li>Explain about program menus (file, edit, view)</li> <li>Explain keyboard different keys</li> </ul>	0.20	0.40	1.00
3	Introduce MS Word Fundamental of MS Word	<ul style="list-style-type: none"> <li>Open MS Word program</li> <li>Save a document</li> <li>Close a document</li> <li>Create a New document</li> <li>Exit from Ms Word Program</li> </ul>	0.20	0.40	1.00
4	Formatting text in MS Word	<ul style="list-style-type: none"> <li>Formatting Text Font, Size, color, align text</li> <li>Spell checker</li> <li>Copy, cut, move and paste</li> </ul>	0.20	0.40	1.00

5	Writing reports and letters with 'Word'	<ul style="list-style-type: none"> <li>• Introduce the concept of <i>styles</i></li> <li>• Bullets and numbering</li> <li>• Write simple reports and letters</li> </ul>	0.20	0.40	1.00
6	Inserting tables and drawing objects in 'Word'	<ul style="list-style-type: none"> <li>• Create tables</li> <li>• Format rows and columns in table</li> <li>• Simple drawing with drawing toolbar</li> <li>• Create lines and shapes</li> </ul>	0.20	0.40	1.00
7	Inserting pictures, clip art into 'Word'	<ul style="list-style-type: none"> <li>• Insert clip art into word</li> <li>• Insert picture into word</li> <li>• Wrapping or positioning picture</li> <li>• Crop insert picture</li> <li>• Manage inserting pictures.</li> </ul>	0.20	0.40	1.00
8	Working with my computer (drives, files and folders)	<ul style="list-style-type: none"> <li>• Familiarize with my computer</li> <li>• Familiarize with computer drives</li> <li>• Manage files and folders</li> <li>• Fundamental of files and folders</li> </ul>	0.20	0.40	1.00
9	Introduction to 'Ms Excel'	<ul style="list-style-type: none"> <li>• Introduce to MS Excel</li> <li>• Fundamental and use of MS Excel</li> <li>• Workbook and worksheet</li> <li>• Rows columns and cells borders</li> <li>• Editing and formatting cells</li> <li>• Adding text in cells</li> <li>• Formula bar, selecting cells</li> </ul>	0.20	0.40	1.00
10	Formatting borders and sorting, calculating data	<ul style="list-style-type: none"> <li>• Format borders</li> <li>• Sorting data (alphabetically or by columns)</li> <li>• Improve look of the table</li> <li>• Formatting tables</li> </ul>	0.20	0.40	1.00
11	Complete data automatically Merging cells/Simple calculations/freeze cell	<ul style="list-style-type: none"> <li>• Merge cells</li> <li>• Use of toolbar</li> <li>• Calculate data (adding, subtracting, multiply, divide)</li> <li>• Use formula</li> <li>• Competing sequences automatically</li> <li>• Freezing reference cell</li> <li>• Copying cells</li> </ul>	0.20	0.40	1.00
12	Useful functions Plotting data on a chart	<ul style="list-style-type: none"> <li>• Useful functions (sum, if,&lt; &gt;)</li> <li>• Plotting a chart (column, pie)</li> <li>• Format chart</li> <li>• Data for plotting chart</li> </ul>	0.20	0.40	1.00
13	Windows operating system Customizing the desktop	<ul style="list-style-type: none"> <li>• Explain Windows operating system</li> <li>• Customizing the desktop</li> <li>• Changing date and time</li> </ul>	0.20	0.40	1.00

		Change desktop background Manage desktop icons			
14	Internet	<ul style="list-style-type: none"> <li>• Introduction to Internet</li> <li>• Fundamentals of internet</li> <li>• Use of internet</li> <li>• Browsers</li> <li>• Network</li> <li>• Connect with internet</li> </ul>	0.20	0.40	1.00
15	Email and social network	<ul style="list-style-type: none"> <li>• Email</li> <li>• Social networks</li> <li>• Send and receive emails</li> <li>• Attach document with emails</li> <li>• Create email accounts</li> <li>• Register with social networking sites</li> </ul>	0.20	0.40	1.00
Total			5	10	15
<b>4. AutoCAD</b>					
<b>Unit: 1. Familiarize with Computer Aided Drafting (CAD) Software</b>					
1	Startup Computer Aided Drafting (CAD) software	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Enlist different types of CAD software.</li> <li>▪ System requirement for CAD</li> <li>▪ Startup CAD by start menu</li> <li>▪ Interpret CAD graphics window including screen layout, pull-down menus, screen icons, command line and dialogue boxes.</li> <li>▪ Modify display</li> <li>▪ Introduce and arrange toolbar</li> <li>▪ Managing unit/limit</li> <li>▪ Start, organize and save file</li> </ul>	0.25	0.5	0.75
2	Setup a Drawing	<ul style="list-style-type: none"> <li>▪ Explain how to start drawing from scratch, using wizard and, using and creating a template file.</li> <li>▪ Describe setting preferences (units, angle, direction, area)</li> </ul>	0.25	0.25	0.50
3	Manage Toolbar	<ul style="list-style-type: none"> <li>▪ Standard tool bar</li> <li>▪ Draw tool bar</li> <li>▪ Modify toolbar</li> <li>▪ Dimensioning tool bar</li> <li>▪ Other</li> </ul>	0.25	0.25	0.50
<b>Unit: 2 Construct 2-D drawing using CAD Software</b>					
1	Draw lines	<ul style="list-style-type: none"> <li>▪ Different system Relative, Cartesian and absolute coordinate system.</li> <li>▪ Start and end point of a line</li> <li>▪ Different methods of drawing a line in CAD</li> </ul>	0.25	0.75	1.00



		<ul style="list-style-type: none"> <li>▪ Options available in drawing line in CAD (Undo, Close)</li> </ul>			
2	Draw rectangle	<ul style="list-style-type: none"> <li>▪ Corner points (first and other)</li> <li>▪ Options available in drawing rectangle (chamfer, fillet)</li> <li>▪ Chamfer distance</li> <li>▪ Fillet radius</li> </ul>	0.25	0.25	0.50
3	Draw arc	<ul style="list-style-type: none"> <li>▪ Identify arc among various types of geometric shapes.</li> <li>▪ Describe different options for drawing arc (3 points method, Start Center method, Start End method, Center Start method)</li> </ul>	0.25	0.25	0.50
4	Draw circle	<ul style="list-style-type: none"> <li>▪ Describe different options for drawing arc (Center Radius method, Center Diameter method, 2P method, 3P method, Tan, Tan Radius method, Tan, Tan, Tan method)</li> </ul>	0.25	0.25	0.50
5	Draw polygon	<ul style="list-style-type: none"> <li>▪ Describe different options for drawing polygon (center, edge)</li> </ul>	0.25	0.25	0.50
6	Manage lines	<ul style="list-style-type: none"> <li>▪ Line properties</li> <li>▪ Line weight</li> <li>▪ Line color</li> <li>▪ Line loading</li> </ul>	0.25	0.25	0.50
7	Draw an Isometric drawing	<ul style="list-style-type: none"> <li>▪ Concept Isometric snap and rectangular snap</li> <li>▪ Setting of isometric snap</li> </ul>	0.25	0.25	0.50
8	Draw Ellipse	<ul style="list-style-type: none"> <li>▪ Ellipse in rectangular snap <ul style="list-style-type: none"> <li>▪ Center Radius method</li> <li>• Center Diameter method</li> </ul> </li> <li>▪ Ellipse in isometric snap</li> </ul>	0.25	0.25	0.50
<b>Unit: 3 Edit drawing using CAD Software</b>					
1	Relocate object using Move command	<ul style="list-style-type: none"> <li>▪ Different methods of selecting objects for editing such as window, crossing, fence, all ... <ul style="list-style-type: none"> <li>• Base point</li> <li>• Second point of displacement</li> </ul> </li> </ul>	0.25	0.25	0.50
2	Relocate object using rotate command	<ul style="list-style-type: none"> <li>▪ Define rotation angle</li> <li>▪ Explain Reference Point.</li> </ul>	0.25	0.25	0.50
3	Duplicate object using Copy command	<ul style="list-style-type: none"> <li>▪ Differentiate multiple copy and Single copy.</li> <li>▪ Explain the procedure for duplicating object using copy command.</li> </ul>	0.25	0.25	0.50
4	Duplicate object using Mirror command	<ul style="list-style-type: none"> <li>▪ State the purpose of Mirror.</li> <li>▪ Explain First point and Second point of mirror line</li> <li>▪ Second point of mirror line</li> </ul>	0.25	0.25	0.50

		<ul style="list-style-type: none"> <li>Describe options available in mirror command</li> </ul>			
5	Duplicate object using Offset command	<ul style="list-style-type: none"> <li>Describe options available for <ul style="list-style-type: none"> <li>Offset distance</li> <li>Through</li> </ul> </li> </ul>	0.25	0.25	0.50
6	Duplicate object using Array command	<ul style="list-style-type: none"> <li>Differentiate Rectangular Array and Polar Array</li> <li>Explain Rows, Columns and Distance, Center point, number, angle and rotation</li> </ul>	0.25	0.25	0.50
7	Modify object using Break command	<ul style="list-style-type: none"> <li>Define break line</li> <li>Break the selected object between two points</li> </ul>	0.25	0.25	0.50
8	Modify object using Explode command	<ul style="list-style-type: none"> <li>Define explode</li> <li>Break a compounded object into its component object</li> </ul>	0.25	0.25	0.50
9	Modify object using Trim command	<ul style="list-style-type: none"> <li>Define Cutting edge</li> <li>Explain the options available for trimming object (project, edge, undo)</li> </ul>	0.25	0.25	0.50
10	Modify object using Extend command	<ul style="list-style-type: none"> <li>Define Boundary edge</li> <li>State the procedure for modifying object using Extend command.</li> </ul>	0.25	0.25	0.50
11	Modify object using Fillet command	<ul style="list-style-type: none"> <li>Differentiate Chamfer and Fillet.</li> <li>Explain the options available for filleting object i.e. fillet radius</li> </ul>	0.25	0.25	0.50
12	Modify object using chamfer command	Explain the options available for chamfering object i.e. Distance, angle	0.25	0.25	0.50
<b>Unit: 4 Annotate a drawing with Text, layer, lock, Hatching and Dimensioning</b>					
1	Create a Layer	<ul style="list-style-type: none"> <li>Define Layer.</li> <li>Explain different attributes and properties of a Layer (Line type, line weight, Global Scale Factor, Current Object Scale, Names, Of/Off, Freeze/Thaw, Lock/unlock, Color, Plot style, Plot/don't plot)</li> <li>Explain the procedure for creating a layer.</li> </ul>	0.25	0.25	0.50
2	Create text and text styles.	<ul style="list-style-type: none"> <li>Differentiate Single line text [TEXT] and Multiline Text [MTEXT]</li> <li>Explain Style name, Font Name, Style and Height</li> </ul>	0.25	0.25	0.50

		<ul style="list-style-type: none"> <li>▪ Describe Font effect, Width factor and Oblique angle</li> <li>▪ Explain the procedure for creating text styles.</li> </ul>			
3	Edit text	<ul style="list-style-type: none"> <li>▪ Multiline Text Editor <ul style="list-style-type: none"> <li>• Character</li> <li>• Properties</li> <li>• Line spacing</li> <li>• Find/replace, import text</li> </ul> </li> <li>Layer and symbol</li> </ul>	0.25	0.25	0.50
4	Hatch the sectional area	<ul style="list-style-type: none"> <li>▪ Define hatching.</li> <li>▪ Differentiate ISO Hatch Pattern, User Defined Hatch Pattern, Pre-Defined Hatch and Associative Hatch</li> <li>▪ Explain Boundary set, copying of hatch properties, pick point, hatch angle, scale, pattern, and object selection.</li> <li>▪ modify the hatched pattern</li> </ul>	0.25	0.25	0.50
5	Create Block	<ul style="list-style-type: none"> <li>▪ Definition</li> <li>▪ Name</li> <li>▪ Pick point</li> <li>▪ selection</li> </ul>	0.25	0.25	0.50
6	Add dimensions to a drawing	<ul style="list-style-type: none"> <li>▪ Interpret dimension elements (dimension text, lines and arrowheads, leader, extension lines, units, tolerance and center marks)</li> <li>▪ Describe dimension types (linear, aligned, ordinate, radius, diameter, angular, baseline and continue)</li> <li>▪ Dimension dialog box <ul style="list-style-type: none"> <li>▪ Lines and arrow</li> <li>▪ Dimension and text</li> <li>▪ Fit</li> <li>▪ Unit</li> <li>▪ Tolerances</li> </ul> </li> <li>▪ Modify Dimension style</li> <li>▪ Dimension in isometric drawing</li> </ul>	0.25	0.50	0.75
<b>Unit: 5 Create output</b>					
1	Configure Plotters/Printers	<ul style="list-style-type: none"> <li>▪ Define Plotter Manager</li> <li>▪ Explain Plot Style Manager</li> <li>▪ State the Printer/Plotter Installation process</li> </ul>	0.25	0.25	0.50
2	Plot drawing	<ul style="list-style-type: none"> <li>▪ Explain paper size and paper units, drawing orientation, plot area and plot scale, plot offset.</li> <li>▪ Describe the procedure for printing a drawing.</li> </ul>	0.25	0.25	0.50

<b>Unit: 6 Project works</b>				
1	Following drawings are to be prepared and submitted (e-copy and hard copy both) using CAD software <ul style="list-style-type: none"> <li>• Draw an Isometric/ Oblique drawing</li> <li>• Draw Orthographic drawing</li> <li>• Draw an assembly drawing</li> <li>• Draw Orthographic drawing</li> <li>• Draw Workshop drawing</li> <li>• Give dimension (Orthographic, Isometric)</li> </ul>	0.5	7.0	7.5
<b>Total</b>		<b>8.25</b>	<b>15.75</b>	<b>24</b>
<b>Grand Total Hours</b>		<b>24.25</b>	<b>131.75</b>	<b>156</b>

### ReferencesBooks:

- Fundamental of Engineering Drawing for Polytechnics - Er. R. K. Dhawan
- Electrical Engineering Drawing - Gupta
- Electrical Estimating and Costing - A K Shawney
- Electric Circuit Diagram -GTZ Handout
- Motor Rewinding - Rosenberg
- Electro Westernman table
- Engineering Drawing – N.D. Bhatta
- Engineering Drawing - W. J Lujadhar
- आधारभूत कम्प्युटर परिचय भाग १, २ र ३- कमल भट्टराई
- Kognet learning solution, *Simple steps in AutoCAD*, Dream tech press, India
- George Omura, *Mastering AutoCAD 2013 and AutoCAD LT 2013*, India

### Required Tools and Instrument

• Compass	• Auto CAD software
• Drawing Board	• Computer
• Drawing sheet/paper	• Drawing sheet
• Pencil	• Eraser
• Rotary Pen (set) etc	• Protector
• Set square	• Ruler
• Tape	• T square

## Electro-Technology

**Course nature: Theory**  
**Full Marks: 100**

**Class per Week: 2**  
**Total hours: 156**

<b>Subject 6: Electro-technology</b>	
<b>Description:</b>	This subject provides to equip selected general SLC graduates with Electro-Technology knowledge required for performing electrical installation of domestic, commercial and industrial complexes.
<b>Objectives:</b>	<p>At the end of the course the participants will be able to:</p> <ul style="list-style-type: none"> <li>▪ Apply personal, equipment, machine, tools and workplace safety including electrical rules.</li> <li>▪ Identify tools, equipment, machines, materials used in electrical system.</li> <li>▪ Apply the standard terms and terminologies used by electricians.</li> <li>▪ Explain SI definitions, constitution of matter, and fundamental laws of electricity and electromagnetism.</li> <li>▪ Explain the basic concept and utilization of power generation, transmission and distribution.</li> <li>▪ Explain, define and solve problems in D.C. and A.C. single and three phase circuits.</li> <li>▪ Explain and apply the principles of operation, function and construction of electrical machines.</li> <li>▪ Explain and apply electrical measuring instrument and measurement.</li> <li>▪ Explain and apply switchgear, control and protection devices.</li> </ul>

S.N.	Skills	Contents	Time hrs.
1.	Apply electricity rules and regulations	<b>Electricity rules and regulation</b> <ul style="list-style-type: none"> <li>• Concept of electrical energy development in Nepal</li> <li>• Rules for – consumer, standard voltage for distribution</li> <li>• Concept of NEA code of practice</li> </ul>	2
2.	Explain: <ul style="list-style-type: none"> <li>• Modern theory of electron</li> <li>• Structure of Atom</li> </ul>	<b>Constitution of matter</b> <ul style="list-style-type: none"> <li>• Concept of modern electron theory: Matter, Molecule, Atom, Protons, Neutrons, Electrons</li> <li>• Structure of Atom</li> </ul>	3
3.	Explain advantages and application of A.C. and D.C.  Define : <ul style="list-style-type: none"> <li>• EMF and P.D.</li> <li>• Current, voltage, resistance and power</li> <li>• Cells and battery</li> </ul>	<b>Fundamental SI definitions</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and Application</li> <li>• Advantages and disadvantages</li> <li>• Current, Voltage and Resistance and their measuring units</li> <li>• Cells and batteries</li> <li>• EMF and potential difference</li> </ul>	6

4.	<p>Explain :</p> <ul style="list-style-type: none"> <li>• Law of conservation of energy</li> <li>• Ohm's law</li> <li>• Kirchhoff's law and their application</li> <li>• Laws of resistance</li> <li>• Specific resistance</li> <li>• Effect of temperature on resistance</li> <li>• Connection of cells and battery</li> </ul>	<p><b>Laws of electricity</b></p> <ul style="list-style-type: none"> <li>• Law of conservation of energy</li> <li>• Ohm's law</li> <li>• Kirchhoff's laws</li> <li>• Laws of resistance</li> <li>• Specific resistance</li> <li>• Effect of temperature on resistance, temperature co-efficient of resistance</li> <li>• Connection of cells and battery</li> <li>• Effects of electric current</li> </ul>	20
5.	<p>Explain</p> <ul style="list-style-type: none"> <li>• Conductor and insulator</li> <li>• Metal and non-metal</li> <li>• Ferrous/non ferrous metal</li> </ul>	<p><b>Engineering materials</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and use</li> <li>• Properties</li> </ul>	8
6.	<p>Explain and compare :</p> <ul style="list-style-type: none"> <li>• Resistances in series and parallel</li> <li>• Relation of voltage, current, resistance, and power in series and parallel circuits</li> </ul>	<p><b>Electrical circuits</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and use</li> <li>• Comparison</li> <li>• Relation of voltage, current, resistance, and power in series and parallel circuits</li> </ul>	12
7.	<p>Explain work, energy and power in electric circuit and their measuring units</p>	<p><b>Work, power and Energy</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and use</li> <li>• Measuring units in M.K.S. and F.P.S. system</li> </ul>	4
8.	<ul style="list-style-type: none"> <li>• Explain the importance of magnetism in electricity</li> <li>• Define magnetic terms and their measuring units</li> </ul>	<p><b>Magnetism Electromagnetism</b></p> <ul style="list-style-type: none"> <li>• Importance of magnetism in electricity</li> <li>• Magnetism terms- magnetic poles, magnetic axis, magnetic field, magnetic lines of force, magnetic flux, magnetic field strength, magnetic force (MMF) magnetic field intensity, reluctance, permeability</li> <li>• Properties of lines of force</li> <li>• Dimagnetic, Paramagnetic, Ferromagnetic materials</li> </ul>	16

	<ul style="list-style-type: none"> <li>• Explain electromagnetism and its laws</li> <li>• Explain magnetic losses</li> </ul>	<ul style="list-style-type: none"> <li>• Advantages of electro-magnetism</li> <li>• Laws of electromagnetism</li> <li>• Faraday's law of electromagnetic induction</li> <li>• Comparison between electric circuit and magnetic circuit</li> <li>• Self and mutual inductance</li> <li>• Eddy current and Hysteresis loss</li> </ul>	
9.	<p>Define:</p> <ul style="list-style-type: none"> <li>• Period, Cycle or frequency</li> <li>• Amplitude, Peak</li> <li>• Instantaneous and R.M.S. values</li> <li>• Form factor, in phase, out of phase</li> <li>• Inductance and inductive reactance</li> <li>• Capacitance and capacitive reactance</li> </ul>	<p><b>AC definition and circuit</b></p> <ul style="list-style-type: none"> <li>• Comparison between A.C. and D.C.</li> <li>• Definition of :</li> <li>• Period</li> <li>• Cycle or frequency</li> <li>• Amplitude</li> <li>• Peak</li> <li>• Instantaneous and R.M.S. values,</li> <li>• Form factor, peak factor in phase, out of phase</li> <li>• Inductance and inductive reactance</li> <li>• Capacitance and capacitive reactance,</li> </ul>	20
	<p>Explain and solve simple A.C. circuits</p> <ul style="list-style-type: none"> <li>• Poly phase A.C.</li> </ul>	<ul style="list-style-type: none"> <li>• Condensers in series and parallel</li> <li>• Impedance</li> <li>• Addition of vectors</li> <li>• Pure resistive, inductive and capacitive circuit in A.C</li> <li>• Impedance triangle and power factor</li> <li>• Cause of low power factor in industrial areas and its improvement</li> <li>• Single and three phase circuits</li> </ul>	
10.	<p>Explain the basic concept of energy sources and power generation in Nepal</p>	<p><b>Generation, transmission, distribution and Utilization of Electrical power</b></p> <ul style="list-style-type: none"> <li>• Sources of electrical Energy in Nepal:</li> <li>• Production of power sources: <ul style="list-style-type: none"> <li>• Solar and wind power station</li> <li>• Hydroelectric power station</li> <li>• Diesel and thermal power station etc.</li> </ul> </li> <li>• Power development of Nepal</li> <li>• Total Power Generation of Nepal</li> </ul>	20
	<p>Describe basic concept in sub-station and sub-station equipment</p>	<p>Concept of sub-station:</p> <ul style="list-style-type: none"> <li>• Sub-station equipment</li> <li>• Circuit breakers</li> <li>• Isolators</li> <li>• Bus-bars</li> <li>• Lightning arrestors</li> </ul>	

		<ul style="list-style-type: none"> <li>• Types of sub-station</li> <li>• Pole type sub station</li> <li>• Out door sub station</li> <li>• Indoor sub station</li> <li>• Switchgear, control and protection devices</li> </ul>	
	Explain transmission system	<ul style="list-style-type: none"> <li>• Importance of transmission system</li> <li>• Concept of tower, pole, hardware and Insulators</li> <li>• Advantages of H.V. Transmission</li> </ul>	
	Describe distribution system and service connection	<ul style="list-style-type: none"> <li>• Methods of power distribution</li> <li>• Comparison between overhead line and Underground cable</li> <li>• Domestic service connection and its components (feeder, distributor, service mains)</li> <li>• Poles, insulators, stay set and other accessories</li> <li>• Voltage ranges</li> <li>• Conductor spacing and sag</li> </ul>	
	Explain utilization of electric power Explain illumination and its units Control and protection	<ul style="list-style-type: none"> <li>• Utilization of electrical energy</li> <li>• Agricultural sector</li> <li>• Industrial sector</li> <li>• Domestic sector</li> <li>• Commercial sector</li> <li>• Transportation sector</li> <li>• Concept of illumination</li> <li>• Luminous flux, intensity</li> <li>• Candle power and solid angle</li> <li>• Concept of energy efficiency</li> <li>• Relays</li> <li>• Lighting arrester</li> <li>• System earthing</li> <li>• Equipment earthing</li> </ul>	
11.	<b>Electrical Machines</b> Define and explain the basic construction and working of electrical machines	<p>Definition, Basic construction, working principles and types of :</p> <ul style="list-style-type: none"> <li>• D.C. generator and its types</li> <li>• Alternator</li> <li>• Transformer</li> <li>• EMF equation of transformer</li> <li>• Transformer ratio</li> <li>• Transformer tests and losses</li> <li>• Parallel operation of alternator and transformer</li> </ul> <p><b>D.C and A.C. Motors</b> <b>(Definition, Basic construction, working principles)</b></p> <ul style="list-style-type: none"> <li>• Single phase</li> <li>• Three phase motors</li> </ul>	25



		<ul style="list-style-type: none"> <li>• Split phase motor</li> <li>• Synchronous motors</li> <li>• Capacitor start induction motor</li> <li>• Capacitor start capacitor run motors</li> <li>• Universal and sheded pole motors</li> <li>• Permanent capacitor motors</li> <li>• Principle of induction motor</li> <li>• Torque formula</li> <li>• Motor speed and sleep</li> </ul>	
12.	Explain and apply electrical measuring instrument and measurement	<p><b>Electrical measuring instruments</b></p> <ul style="list-style-type: none"> <li>• Concept of measuring units of electrical quantities</li> <li>• Types of measuring Instrument</li> </ul> <p>Basic Construction of measuring instruments on the basis of:</p> <ul style="list-style-type: none"> <li>• Working principles</li> <li>• Construction</li> <li>• Measurement</li> </ul> <p>Basic Concept of different torques</p> <p>Construction and working principles of:</p> <ul style="list-style-type: none"> <li>• Megger</li> <li>• Earth tester</li> <li>• Single and Three phase Energy meter</li> <li>• Watt meters</li> <li>• Power factor meter</li> <li>• Frequency meter</li> <li>• Synchroscope</li> <li>• Lux meter</li> </ul> <p>Increasing range of measuring instruments</p> <ul style="list-style-type: none"> <li>• Concept and use of C.T. and P.T.</li> <li>• Measurement of specific gravity of electrolyte in battery</li> </ul>	20
		<b>Total</b>	<b>156</b>

**References Books:**

- Basic Electrical Engineering - M.L.Anwani
- Text Book of Electrical Engineering – B. L. Theraja
- Installation Servicing and Maintenance – S.N.Bhattacharya
- Generation, transmission and utilization of electrical power – A. T. Star
- Generation, transmission and utilization of electrical power – A. K. Showny
- Basic electrical engineering volume I and II – P.S. Dhogal
- NEA Rules and Standards
- Skill Standards for Building and Industrial Electrician Level 1, 2 & 3– NSTB, CTEVT

**Required Materials**

- Board Markers
- Paper Markers
- Charts
- Demonstration kit
- Graphs
- Overhead projectors
- Photographic visuals etc.

## Power Distribution System

**Course nature: Practical**  
**Full Marks: 50**

**Class per Week: 1 hr.**  
**Total Class: 78 hrs.**

<b>Subject 7: Power Distribution System</b>	
<b>Description:</b>	This subject provides skill and knowledge related to the overhead primary distribution line 11KV and secondary distribution line 400/230V, construction of the distribution system and service connection to the customers.
<b>Objectives:</b>	<p>At the end of the course the participants will be able to:</p> <ul style="list-style-type: none"> <li>• Apply safety rules, tools and equipment.</li> <li>• Follow NEA distribution rules and regulations.</li> <li>• Follow 11KV &amp; 400/230V overhead line construction standards of NEA.</li> <li>• Familiarize with 11 KV and 400V/230V distribution System.</li> <li>• Select proper ACSR conductors &amp; ABC cables.</li> <li>• Familiarize with pole erection</li> <li>• String ACSR conductors on 11KV and 400/230V poles.</li> <li>• Install fitting accessories of ABC Cable &amp; ACSR conductors.</li> <li>• Install Stay on poles of 11 KV and 400/230 V lines.</li> <li>• Install earthing on pole mounted transformers.</li> <li>• Demonstrate 11 KV primary and 400/230V secondary distribution lines, Pole mounted transformers.</li> <li>• Connect service line to the consumers.</li> </ul>

S.N.	Skills	Contents	Time hrs.		
			Th.	Pr.	Total
Unit 1.	<b>Overhead Line Construction</b>				
1.	Interpret occupational documentation	<ul style="list-style-type: none"> <li>• Electrical drawing symbols and legends</li> <li>• Drawings, specifications and standards</li> <li>• NEA distribution rules &amp; regulations and 11 KV and 400/230 V overhead line construction standards</li> </ul>	2	2	4
2.	Draw the single line diagram of distribution lines	<ul style="list-style-type: none"> <li>• Electrical drawing standards</li> <li>• Symbols and legends</li> <li>• Process</li> <li>• Single line diagram of 11 KV feeders &amp; 400/230 distribution lines</li> <li>• NEA distribution rules &amp; regulations</li> <li>• NEA 11 KV and 400V/230V overhead line construction standards.</li> </ul>	2	4	6

3.	Perform route clearance	<b>Route clearance</b> <ul style="list-style-type: none"> <li>• Importance</li> <li>• Tool &amp; equipment for clearing routes</li> <li>• Process and measurement</li> <li>• Safety</li> </ul>	1	-	1
4.	Install Guy wire on 11 KV & 400V/230V pole	<b>Guy wire installation</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types and size of guy wire</li> <li>• Use of guy wire on 11 KV</li> <li>• Fitting accessories</li> <li>• Tools used</li> <li>• Process</li> <li>• Safety</li> </ul>	1	4	5
5.	String the Aluminum conductors steel Reinforced (ACSR) 11 KV & 400V/230V.	<b>ACSR conductors</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types and size</li> <li>• Current carrying capacity</li> <li>• Commercial names</li> <li>• Advantages and disadvantages</li> <li>• Fitting accessories</li> <li>• Tools used</li> <li>• Process</li> <li>• Safety</li> </ul>	1	4	5
6.	String the Aerial Bundle Conductors (ABC) cable (11 KV & 400V/230V)	<b>Aerial Bundle Conductors (ABC) cable</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Size</li> <li>• Importance and use</li> <li>• Single and double suspension clamp of proper sizes</li> <li>• Anchor clamp</li> <li>• Fitting accessories</li> <li>• Tools used</li> <li>• Process</li> <li>• Safety</li> </ul>	1	4	5
7.	Introduce and Demonstrate pole mounted distribution transformer	<b>Transformer connection</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Size and capacity</li> <li>• Use</li> <li>• Process</li> <li>• Protective devices (D.O. fuse)</li> <li>• Gang operating switch</li> <li>• Lighting arrester</li> <li>• Channels of proper sizes</li> <li>• MCCB of proper capacity on the LT line of the transformer</li> </ul>	2	4	6

		<ul style="list-style-type: none"> <li>• Four core cable of proper for connection from LT side of the transformer to the MCCB</li> <li>• Safety</li> </ul>			
8.	Install earthing on the pole mounted transformer	<b>Earthing</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Type</li> <li>• Importance and use</li> <li>• Earthing materials</li> <li>• Process of earthing</li> <li>• Measurement of earth resistance and testing</li> </ul>	1	6	7
9.	Repair and maintain overhead line 380 V/11KV	<b>Repair and Maintenance of Overhead line 380 V/11KV</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Type</li> <li>• Importance</li> <li>• Testing and commissioning Process</li> </ul>	2	10	12
<b>Unit 2</b>	<b>Overhead Line Construction 400/230V</b>				
10.	Install/binding(pin, scale, disk insulator) D-iron and Shackle insulators on poles	<b>D-iron and shackle insulators</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Use</li> <li>• Fitting accessories</li> <li>• Tools used</li> <li>• Process</li> <li>• Safety</li> </ul>	4	12	16
<b>Unit 3</b>	<b>Underground cables</b>				
11.	<ul style="list-style-type: none"> <li>• Perform cable joint</li> <li>• Laying of underground cable</li> </ul>	<b>Cable joint</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Importance and use</li> <li>• Components of cable joints</li> <li>• Cable joint material for overhead cable joint (Reychem)</li> <li>• Cable jointing materials for underground (straight through joint)</li> <li>• Process</li> <li>• Application</li> <li>• Use of trench</li> <li>• Process of trench</li> </ul>	2	4	6

Unit 4.	<b>Consumers' Service Line Construction 400/230Volts.</b>				
12.	Install & connect single phase and three phase consumers' service lines as per NEA's distribution rules and standards	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types, sizes</li> <li>• Consumer service lines</li> <li>• Concentric cables</li> <li>• Importance and use</li> <li>• Process</li> <li>• Wall bracket</li> <li>• Shackle insulator</li> <li>• NEA distribution rules &amp; regulations</li> <li>• Insulated connector for connection of concentric cable on ABC cable</li> <li>• Safety</li> </ul>	1	4	5
		<b>Total</b>	<b>20</b>	<b>58</b>	<b>78</b>

**Reference Books:**

- NEA distribution rules and regulations
- 11 KV and 400/230 V construction standard of NEA
- Transmission and Distribution – Raina

**Required Tools &Equipment:**

• Insulated Tools	• Long rubber gloves
• Helmet	• Rubber shoes
• Safety belt	• Normal Sun glass
• Wooden or fiber laffer	• Insulatd cross spanner
• Mechanical dynameter	• Shrink on end cap
• come along clamp for ABC cable	• Cable tensioner
• Mounting wedge	• Sabel
• Earth Tester	• Pik
• Come along clamp for ACSR conductor	• Other tools & equipment as per need

## Basic Electronics

**Course nature: Theory +Practical**  
**Full Marks: 50+50**

**Class per Week: 2 hrs.**  
**Total class: 156 hrs.**

<b>Subject 8 : Basic Electronics</b>	
<b>Description:</b>	This subject provides skill and knowledge related to basic electronics. This consists of simple electronics projects, simple design and general concept of digital electronics. It also covers electronics components used in electronics circuits.
<b>Objectives:</b>	<p>At the end of the course the participants will be able to:</p> <ul style="list-style-type: none"> <li>▪ Describe various electronics components.</li> <li>▪ Interpret their characteristics and applications.</li> <li>▪ Calculate the value of electronics components.</li> <li>▪ Test electronics components.</li> <li>▪ Design electronic circuits using diodes.</li> <li>▪ Construct voltage regulator with transistor and zener diode.</li> <li>▪ Construct NOT, AND, OR, NAND, NOR Logic gate in IC.</li> <li>▪ Apply safety precaution during electronics works.</li> </ul>

S.N.	Skills/Tasks	Contents/Topics	Time Hours		
			Th./Demo.	Pr.	Total
1.	Calculate and check the value of fixed and variable resistor	<b>Calculate the value of Resistor (Multi-meter and color code)</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Purpose</li> <li>• Importance and uses</li> <li>• Types</li> <li>• Function</li> <li>• Setting procedure</li> <li>• Advantage</li> <li>• Log book/ Work report</li> </ul>	8	8	16
2.	Check the value of capacitor	<b>Capacitor</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and uses</li> <li>• Types</li> <li>• Advantage</li> <li>• Procedure</li> </ul>	4	8	12
3.	Check the value of Inductor	<b>Inductor</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and uses</li> <li>• Types</li> <li>• Advantage</li> <li>• Procedure</li> </ul>	6	6	12
4.	Measure voltage and current in series and parallel circuit	<b>Series and Parallel circuits</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and uses</li> <li>• Connection procedure</li> </ul>	8	8	16

5.	Perform silicon/ germanium diode characteristic	<b>Semiconductor diode</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and uses</li> <li>• Types</li> <li>• Function</li> </ul> <b>Biases</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and uses</li> <li>• Types</li> <li>• Advantage</li> <li>• Connection</li> </ul> <b>DC power supply, V/I curve</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and uses</li> <li>• Connection</li> </ul>	6	6	12
6.	Characterize Zener diode	<b>Zener Diode</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses/application</li> <li>• Function</li> <li>• Advantage</li> </ul> <b>V/I curve</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and uses</li> </ul>	6	4	10
7.	Perform bridge rectifier circuits	<b>Rectifier Circuits</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and uses</li> <li>• Types</li> <li>• Function</li> <li>• Connection method</li> <li>• Advantage</li> <li>• Procedure</li> </ul> <b>Oscilloscope</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Types</li> <li>• Connection</li> <li>• Procedure</li> </ul>	6	6	12
8.	Perform transistor biasing plot and its characteristics	<b>Transistor, biasing, data, amplification switching</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses/application</li> <li>• Types</li> <li>• Function</li> <li>• Advantage</li> <li>• Connection</li> <li>• Procedure</li> </ul>	10	8	18



9.	Construction voltage regulators with transistor and zener diode	<b>Soldering Iron, Lead,PCB plate/matrix board,FeCl3</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and uses</li> <li>• Function</li> <li>• Advantage</li> <li>• Procedure</li> </ul>	8	8	16
10.	Perform NOT, OR, AND, NAND, NOR, Logic gate in IC	<b>Logic Gate ICs</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance and uses</li> <li>• Types</li> <li>• Function</li> <li>• Circuit diagram</li> <li>• Advantage</li> <li>• Procedure</li> </ul> <b>DC supply to the gate, bread board</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Advantage</li> <li>• Importance</li> </ul>	8	8	16
11.	Perform Projects works	<b>Skill/Tasks</b>	<b>Th./Demo.</b>	<b>Pr.</b>	<b>Total</b>
		<ul style="list-style-type: none"> <li>• Make a Doorbell</li> <li>• Make a Emergency light</li> <li>• Make a Battery Charger</li> <li>• Make a FM circuit</li> <li>• Make a Mobile charger</li> </ul>	8	8	16
<b>Total</b>			<b>78</b>	<b>78</b>	<b>156</b>

#### Reference Books:

- Principle of Electronics - V.K. Meheta
- Saral Basic Electronics - Hari Bahadur Paudel
- Four in one practical books - Ram Chandra Tiwari
- Digital Fundamental - Floyed

### Required tools and equipment

• Analogue multimeter	• Combination Plier
• Crimping Tools	• DC Ammeter
• DC power supply	• DC Voltmeter
• Digital IC Trainer	• Digital multimeter
• Di-soldering Pump	• Function Generator
• Jewelry screw driver set	• LCR Meter
• Line Tester	• Nose Plier
• Oscilloscope	• Portable drill machine Screw Driver
• Side Cutter	• Small dusting brush
• Soldering Iron	• Step Down Transformer
• Wire striper	•

### Materials List

• AC Cord	• Bread Board
• Color coded Wires	• Connection Wires
• Desoldering wire	• Digital IC
• Extension Cord	• Fixed Inductor
• Fixed Resistor	• Jumper
• Non Polar Capacitor	• NPN Transistor
• PCB Plate	• PNP Transistor
• Polar Capacitor	• Rectifier Diode
• Soldering lead, flux	• Soldering stand
• Tweezers	• Variable Capacitor
• Variable Inductor	• Variable Resistor
• Zener Diode	

## Motor Installation and Control System

**Course nature: Practical**  
**Full Marks: 50**

**Class per Week: 1 hr.**  
**Total Class: 78 hrs.**

<b>Subject 9: Motor Installation and Control System</b>	
<b>Description:</b>	This subject provides skill and knowledge related to motor installation and control system of single and three phase electrical system.
<b>Objectives:</b>	At the end of the course the participants will be able to: <ul style="list-style-type: none"> <li>• Interpret connection diagram of three phase induction motors.</li> <li>• Connect three phase induction motors with various control and protection arrangements.</li> <li>• Connect and start three phase induction motor using PLC</li> </ul>

S.N.	Skill	Related Technical Knowledge	Time Hours		
			Th.	Pr.	Total
1.	Install DOL starter to control induction motor	<b>3-Phase starter/single phase (Relay,contractor,switch,multi-meter and MCB)</b> <ul style="list-style-type: none"> <li>•Introduction</li> <li>•Types</li> <li>•Importance and uses</li> <li>•Function</li> <li>• Advantages and limitations</li> <li>•Procedure</li> <li>• Control and power circuit diagram</li> <li>• Log Book/work report</li> </ul>	2	4	6
2.	Install forward/reverse starter to control 3 phase induction motor (two direction motor	<b>3-Phase starter (forward/reverse)</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>•Types</li> <li>•Importance and uses</li> <li>•Function</li> <li>• Advantages and limitations</li> <li>•Procedure</li> <li>• Control and power circuit diagram</li> <li>• Log Book/work report</li> </ul>	2	6	8
3.	Install star/delta starter (manual) to control 3 phase induction motor.	<b>3-Phase starter (star/delta)</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>•Types</li> <li>•Importance and uses</li> <li>•Function</li> <li>• Advantages and limitations</li> <li>•Procedure</li> <li>• Control and power circuit diagram</li> <li>• Log Book/work report</li> </ul>	2	10	12
4.	Install star/delta starter (semi-auto) to control 3 phase induction motor.	<b>Star/delta semi- automatic</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>•Types</li> </ul>	2	10	12

		<ul style="list-style-type: none"> <li>●Importance and uses</li> <li>●Function</li> <li>● Advantages and limitations</li> <li>● Procedure</li> <li>● Control and power circuit diagram</li> <li>● Log Book/work report</li> </ul>			
5.	Install star/delta starter (automatic) to control 3 phase induction motor.	<b>Star/delta automatic</b> <ul style="list-style-type: none"> <li>● Introduction</li> <li>●Types</li> <li>●Importance and uses</li> <li>●Function</li> <li>● Advantages</li> <li>●Procedure</li> <li>● Control and power circuit diagram</li> <li>● Log book/work report</li> </ul>	2	10	12
6.	Install slip ring starter to control slip ring motor.	<b>3-Phase starter slip ring motor (Compact)</b> <ul style="list-style-type: none"> <li>● Introduction</li> <li>●Types</li> <li>●Importance and uses</li> <li>●Function</li> <li>● Advantages and limitations</li> <li>● Procedure</li> <li>● Control and power circuit diagram</li> <li>● Log book/work report</li> </ul>	2	10	12
7.	Install PLC starter for 3 phase induction motor control (DOL starter)	<b>3 phase starter ( PLC, Relay, Contractor, switch)</b> <ul style="list-style-type: none"> <li>● Introduction</li> <li>●Types</li> <li>●Importance and uses</li> <li>●Function</li> <li>● Advantages and limitations</li> <li>● Procedure</li> <li>● Control and power circuit diagram</li> <li>● Log book/work report</li> </ul>	4	12	16
		<b>Total</b>	<b>16</b>	<b>62</b>	<b>78</b>

#### Reference Books:

- Basic Electrical Engineering- A.L Anwani
- Basic Electrical Engineering- M.L Anwani
- Basic Electrical Engineering- P.S. Dhogal

## Required Tools and Equipment

• Ammeter	• Cable Drum (Extension Cord)
• Clamp on Meter	• Combination Plier
• Crimping tools	• DC Shunt Motor
• Electrical Knife	• Frequency Meter
• Hammer	• Long Nose Plier
• Marking Scriber	• Measuring Tape
• Meggar meter	• Phase Tester
• Programmable Logic Control (PLC)	• Portable drill Machine
• Safety Gloves	• Screw Driver set
• Side cutter	• Single Phase Induction Motor
• Slide wrench	• Slip ring Induction motor
• Tacho meter	• Three Phase Induction Motor
• Voltmeter	• Wire Striper

## Required Materials

• Bi metal relay	• Cable Shoe
• Cable Tie	• Cartridge fuse
• Connector	• Contactor
• DOL Starter	• ELCB
• Flexible Wire	• Indicator
• Nut bolts	• PVC Insulated Wire
• Screws	• Selector Switches
• SP MCB	• Time Relay Switch
• TP MCB	•

## Entrepreneurship Development

**Course Nature: Theory**  
**Full Marks: 50**

**Class/week: 1**  
**Total: 78 hrs.**

**Description:**

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

**Course objectives**

After completion of this course students will be able to:

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

S.No.	Skills	Contents	Time (hrs)		
			T	P	Total
<b>Unit 1: Introduction to Entrepreneurship</b>					
1	Introduce business	Introduction of business: <ul style="list-style-type: none"> <li>• Definition of business/enterprise</li> <li>• Types of business</li> <li>• Classification of business</li> <li>• Overview of MSMEs(Micro, Small and Medium Enterprises) in Nepal</li> </ul>	1.5		1.5
2	Define entrepreneur/entrepreneurship	<u>Definition of entrepreneur:</u> <ul style="list-style-type: none"> <li>• Definition of entrepreneur</li> <li>• Definition of entrepreneurship</li> <li>• Entrepreneurship development process</li> </ul>	1.0		1.0
3	Describe entrepreneur's characteristics	<u>Entrepreneur's characteristics:</u> <ul style="list-style-type: none"> <li>• Characteristics of entrepreneurs</li> <li>• Nature of entrepreneurs</li> </ul>	1.5		1.5

4	Assess entrepreneur's characteristics	<u>Assessment of entrepreneur's characteristics:</u> <ul style="list-style-type: none"> <li>List of human characteristics</li> <li>Assessment of entrepreneurial characteristics</li> </ul>	1.5		1.5
5	Compare entrepreneur with other occupations	<u>Entrepreneur and other occupations:</u> <ul style="list-style-type: none"> <li>Comparison of entrepreneur with other occupations</li> <li>Types and styles of entrepreneurs</li> </ul>	1.0		1.0
6	Differentiate between entrepreneur and employee	<u>Entrepreneur and employee:</u> <ul style="list-style-type: none"> <li>Difference between entrepreneur and employee</li> <li>Benefit of doing own business</li> </ul>	1.0		1.0
7	Assess "Self"	<u>"Self" assessment:</u> <ul style="list-style-type: none"> <li>Understanding "self"</li> <li>Self disclosure and feedback taking</li> </ul>	0.5	0.5	1.0
8	<b>Entrepreneurial personality test:</b> <ul style="list-style-type: none"> <li>Assess "Self" inclination to business</li> </ul>	<u>Entrepreneurial personality test:</u> <ul style="list-style-type: none"> <li>Concept of entrepreneurial personality test</li> <li>Assessing self entrepreneurial inclination</li> </ul>	0.75	0.75	1.5
<b>Unit 2: Creativity and Assessment</b>					
9	Create viable business idea	<u>Creativity:</u> <ul style="list-style-type: none"> <li>Concept of creativity</li> <li>Barriers to creative thinking</li> </ul>	1.5	0.5	2.0
10	Innovate business idea	<u>Innovation:</u> <ul style="list-style-type: none"> <li>Concept of innovation</li> <li>SCAMPER Method of innovation</li> </ul>	0.75	0.75	1.5
11	Transfer ideas into action	<u>Transformation of idea into action:</u> <ul style="list-style-type: none"> <li>Concept of transferring idea into action</li> <li>Self-assessment of creative style</li> </ul>	1.0	0.5	1.5

12	Assess personal entrepreneurial competencies	<u><b>Personal entrepreneurial competencies:</b></u> <ul style="list-style-type: none"> <li>• Concept of entrepreneurial competencies</li> <li>• Assessing personal entrepreneurial competencies</li> </ul>	1.0	0.5	1.5
13	Assess personal risk taking attitude	<u><b>Risk taking attitude:</b></u> <ul style="list-style-type: none"> <li>• Concept of risk</li> <li>• Personal risk taking attitude</li> <li>• Do and don't do while taking risk</li> </ul>	1.5	1.0	2.5
14	Make decision	<u><b>Decision making:</b></u> <ul style="list-style-type: none"> <li>• Concept of decision making</li> <li>• Personal decision making attitude</li> <li>• Do and don't do while making decision</li> </ul>	1.0	0.5	1.5
<b>Unit 3: Identification and Selection of Viable Business Ideas</b>					
15	Identify/ select potential business idea <ul style="list-style-type: none"> <li>• Analyze strength, Weakness, Opportunity and Threat (SWOT) of business idea</li> </ul>	<u><b>Identification and selection of potential business:</b></u> <ul style="list-style-type: none"> <li>• Sources of business ideas</li> <li>• Points to be considered while selecting business idea</li> <li>• Business selection process</li> <li>• Potential business selection among different businesses</li> <li>• Strength, Weakness, Opportunity and Threats (SWOT) analysis of business idea</li> <li>• Selection of viable business idea matching to "self"</li> </ul>	1.0	3.5	4.5
<b>Unit 4: Business Plan</b>					
16	Assess market and marketing	<u><b>Market and marketing:</b></u> <ul style="list-style-type: none"> <li>• Concept of market and marketing</li> <li>• Marketing and selling</li> <li>• Market forces</li> <li>• 4 Ps of marketing</li> <li>• Marketing strategies</li> </ul>	1.5	0.5	2.0



17	<b>Business exercise:</b> Explore small business management concept	<b><u>Business exercise:</u></b> <ul style="list-style-type: none"> <li>• Business exercise rules</li> <li>• Concept of small business management</li> <li>• Elements of business management <ul style="list-style-type: none"> <li>• Planning</li> <li>• Organizing</li> <li>• Executing</li> <li>• Controlling</li> </ul> </li> </ul>	2.75	0.5	3.25
18	Prepare market plan	<b><u>Business plan/Market plan</u></b> <ul style="list-style-type: none"> <li>• Concept of business plan</li> <li>• Concept of market plan</li> <li>• Steps of market plan</li> </ul>	2.0	2.0	4.0
19	Prepare production plan	<b><u>Business plan/Production plan:</u></b> <ul style="list-style-type: none"> <li>• Concept of production plan</li> <li>• Steps of production plan</li> </ul>	1.75	1.0	2.75
20	Prepare business operation plan	<b><u>Business plan/Business operation plan:</u></b> <ul style="list-style-type: none"> <li>• Concept of business operation plan</li> <li>• Steps of business operation plan</li> <li>• Cost price determination</li> </ul>	5.0		5.0
21	Prepare financial plan	<b><u>Business plan/Financial plan:</u></b> <ul style="list-style-type: none"> <li>• Concept of financial plan</li> <li>• Steps of financial plan</li> <li>• Working capital estimation</li> <li>• Pricing strategy</li> <li>• Profit/loss calculation</li> <li>• BEP and ROI analysis</li> <li>• Cash flow calculation</li> </ul>	12.0		12.0
22	Collect market information /prepare business plan	<b><u>Information collection and preparing business plan:</u></b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Market survey <ul style="list-style-type: none"> <li>• Precaution to be taken while collecting information</li> <li>• Sample questions for market survey</li> <li>• Questions to be asked to the customers</li> <li>• Questions to be asked to the retailer</li> </ul> </li> </ul>	2.0	13.0	15.0

		<ul style="list-style-type: none"> <li>• Questions to be asked to the stockiest/suppliers</li> <li>• Preparing business plan</li> </ul>			
23	Appraise business plan	<p><b>Business plan appraisal:</b></p> <ul style="list-style-type: none"> <li>• Return on investment</li> <li>• Breakeven analysis</li> <li>• Cash flow</li> <li>• Risk factors</li> </ul>	3.0	3.0	6.0
24	Maintain basic book keeping	<p><b>Basic book keeping:</b></p> <ul style="list-style-type: none"> <li>• Concept and need of book keeping</li> <li>• Methods and types of book keeping</li> <li>• Keeping and maintaining of day book and sales records</li> </ul>	1.5	1.5	3.0
<b>Total hours</b>			<b>48</b>	<b>30</b>	<b>78</b>

**Text book:**

- क) प्रशिक्षकहरुकालागिनिर्मित निर्देशिकातथा प्रशिक्षण सामग्री, प्राविधिकशिक्षातथाव्यावसायिकतालीम परिषद् , २०६९
- ख) प्रशिक्षार्थीहरुकालागिनिर्मित पाठ्यसामग्रीतथाकार्यपुस्तिका, प्राविधिकशिक्षातथाव्यावसायिकतालीम परिषद् (अप्रकाशित), २०६९

**Reference book:**

Entrepreneur's Handbook, Technonet Asia, 1981.

# Industrial Practice

**Course Nature: Practical**  
**Full Marks: 1200**

**Class Per week: 24 hrs.**  
**Total Class: 1872 hrs.**

<b>Subject 11: Industrial Practice</b>	
Description:	This is completely the different type of subject and this is the core subject of the apprenticeship training program. In this subject all important skills are enlisted. The trainees will have to practice during staying in sponsoring industries. This course is 100% practical nature. Industrial Practice is 1872 hours apprenticeship training program that aims to provide trainees an opportunity for meaningful career related experience by working fulltime in industries where they can practice and expand their classroom based knowledge and skills before graduating. It will also help trainees gain a clear sense of their future opportunity to build professional networks. The first assessment will be evaluated by the institute. The three assessments will be evaluated by the industry.
Objectives:	<p>The overall objective of the Industrial Practice is to make trainees familiar with firsthand experience of the real work of industrial world as well as to provide them an opportunity to enhance skills. At the end of the course the participants will be able to:</p> <ul style="list-style-type: none"> <li>• Apply knowledge and skills learnt in the classroom to actual work settings or conditions and develop practical experience before graduation</li> <li>• Familiarize with working environment.</li> <li>• Work effectively with professional colleagues and share experiences of their activities and functions</li> <li>• Strengthen portfolio or resume with practical experience and projects</li> <li>• Develop professional/work culture</li> <li>• Broaden professional contacts and network</li> <li>• Develop entrepreneurship skills on related occupation</li> </ul>

S.N.	Skill	Tasks	Time Hours		
			Th./ Demo.	Pr.	Total
1	<ul style="list-style-type: none"> <li>• Introduction</li> </ul>	<ul style="list-style-type: none"> <li>▪ Introduction of Industry</li> <li>▪ Objectives</li> <li>▪ Rules &amp; regulations</li> <li>▪ Job description</li> <li>▪ Level of employees</li> <li>▪ Facilities for trainees</li> <li>• Importance of industry</li> <li>• Production</li> <li>• Quality Control</li> </ul>		39	
	<ul style="list-style-type: none"> <li>• Provide for orientation and workshop safety</li> <li>• Provide first aid services</li> <li>• Perform simulation first aid to simulated electrocuted person</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain work area</li> <li>• Maintain shop equipment</li> <li>• Utilize personal protection equipment</li> <li>• Provide safety instructions</li> </ul>			

		<ul style="list-style-type: none"> <li>Recognize &amp; control hazards</li> <li>Perform safety-related administrative functions</li> <li>Perform emergency procedures</li> </ul>			
	<ul style="list-style-type: none"> <li>Maintain Log Book</li> </ul>	<ul style="list-style-type: none"> <li>Recording monthly project</li> <li>Report to Institute</li> <li>Verification by Industry</li> </ul>			
2	Handle electrical tools and equipments	<ul style="list-style-type: none"> <li>Identify, selection &amp; correctly uses of electrical tools and equipment</li> </ul>		<b>39</b>	
3	Select the electrical materials	<ul style="list-style-type: none"> <li>Identify the job</li> <li>Select of the materials</li> <li>Use the correct materials</li> </ul>		<b>39</b>	
4	Select the electrical accessories	<ul style="list-style-type: none"> <li>Identify the job</li> <li>Select of the accessories</li> <li>Use &amp; handle the electrical accessories</li> </ul>		<b>39</b>	
5	Select protective device	<ul style="list-style-type: none"> <li>Identify the job</li> <li>Select of the protective device</li> <li>Use the protective device</li> </ul>		<b>39</b>	
7	Install electrical fittings	<ul style="list-style-type: none"> <li>Identify &amp; select the materials</li> <li>Select the tools</li> <li>Check the electrical fittings</li> </ul>		<b>39</b>	
8	Interpret lay out and circuit diagram	<ul style="list-style-type: none"> <li>Understand &amp; sketch circuit diagram</li> </ul>		<b>39</b>	
9	Perform joints <ul style="list-style-type: none"> <li>conduit</li> <li>wire and cable</li> </ul>	<ul style="list-style-type: none"> <li>Collect tools &amp; materials</li> <li>Cut &amp; prepare the wire, cable &amp; pipe</li> <li>Perform joints</li> <li>Perform soldering</li> <li>Check the joints</li> </ul>		<b>39</b>	
11	Perform wiring on brick wall (surface and concealed) Install <ul style="list-style-type: none"> <li>Main switch</li> <li>Install DB</li> <li>Kwhr meter</li> </ul>	<ul style="list-style-type: none"> <li>Collect tools &amp; materials</li> <li>Prepare layout diagram</li> </ul>		<b>78</b>	

	<ul style="list-style-type: none"> <li>• Fan and fan regulator/dimmer</li> <li>• corridor lighting</li> <li>• Lay the pipe in concrete slab on building</li> </ul>	<ul style="list-style-type: none"> <li>• Mark on the wall</li> <li>• Drill/Chisel on the wall</li> <li>• Fit the electrical accessories</li> </ul>			
12	Install supporting materials (surface and conceal) <ul style="list-style-type: none"> <li>• PVC conduit</li> <li>• metal box</li> <li>• distribution board</li> <li>• cable tray</li> </ul>	<ul style="list-style-type: none"> <li>• Collect tools &amp; materials</li> <li>• Prepare layout diagram</li> <li>• Mark on the wall</li> <li>• Drill/Chisel on the wall</li> <li>• Fit the electrical accessories</li> </ul>		<b>78</b>	
16	Connect single and three phase supply	<ul style="list-style-type: none"> <li>• Collect tools, instruments &amp; materials</li> <li>• Connect the power supply &amp; check it</li> <li>• Follow safety rules &amp; regulation</li> </ul>		<b>117</b>	
17	Test electrical safety: <ul style="list-style-type: none"> <li>• Insulation test</li> <li>• Earth test</li> <li>• Continuity test</li> </ul>	<ul style="list-style-type: none"> <li>• Select appropriate instruments</li> <li>• Provide safety &amp; operating instructions</li> <li>• Test insulation, earth &amp; continuity</li> <li>• Repeat the test if necessary</li> </ul>		<b>117</b>	
18	Operate circuit breaker and switch: <ul style="list-style-type: none"> <li>• MCB/Fuse</li> <li>• MCCB</li> <li>• Change over switch</li> </ul>	<ul style="list-style-type: none"> <li>• Read and understand given instruction</li> <li>• Follow safety rules</li> <li>• Operate and check it</li> </ul>		<b>39</b>	
19	Perform circuit test. <ul style="list-style-type: none"> <li>• Open</li> <li>• Close</li> <li>• Short</li> </ul>	<ul style="list-style-type: none"> <li>• Select appropriate instruments</li> <li>• Provide safety &amp; operating instructions</li> <li>• Test open, close and short circuit</li> </ul>		<b>78</b>	
23	Operate electrical devices <ul style="list-style-type: none"> <li>• Motor</li> <li>• Generator</li> <li>• Transformer</li> <li>• Panel board</li> </ul>	<ul style="list-style-type: none"> <li>• Identify devices</li> <li>• Orientation class for safety to operate</li> <li>• Operate electrical devices &amp; demonstrate</li> </ul>		<b>117</b>	
24	Dismantle & assemble electrical simple devices <ul style="list-style-type: none"> <li>• Motor</li> <li>• Generator</li> </ul>	<ul style="list-style-type: none"> <li>• Find problem</li> <li>• Collect required tools and materials</li> </ul>		<b>195</b>	

	<ul style="list-style-type: none"> <li>Transformer</li> <li>Panel board</li> </ul>	<ul style="list-style-type: none"> <li>Mark on electrical devices before dismantle</li> <li>Record all the dismantle part and keep it safely</li> <li>Assemble the dismantle parts correctly</li> <li>Check the function of devices</li> </ul>			
30	Repair and maintain grinder, portable drill machine, table fan, ceiling fan exhaust fan	<ul style="list-style-type: none"> <li>Find problem</li> <li>Collect required tools and materials</li> <li>Mark on electrical devices before dismantle</li> <li>Record all the dismantle part and keep it safely</li> <li>Take data</li> <li>Repair it properly</li> <li>Assemble the dismantle parts correctly</li> <li>Check its function</li> </ul>		<b>234</b>	
34	Repair and maintain of AC single phase motor, three phase motor, generator set, single phase & three phase voltage transformer	<ul style="list-style-type: none"> <li>Find problem</li> <li>Collect required tools and materials</li> <li>Mark on electrical devices before dismantle</li> <li>Record all the dismantle part and keep it safely</li> <li>Take data</li> <li>Repair it properly</li> <li>Assemble the dismantle parts correctly</li> <li>Check its function</li> </ul>		<b>429</b>	
35	Repair and maintain of lathe machine, welding machine and crane	<ul style="list-style-type: none"> <li>Find problem</li> <li>Collect required tools and materials</li> <li>Mark on electrical devices before dismantle</li> <li>Record all the dismantle part and keep it safely</li> </ul>		<b>39</b>	

		<ul style="list-style-type: none"> <li>• Take data</li> <li>• Repair it properly</li> <li>• Assemble the dismantle parts</li> <li>• Check its function</li> </ul>			
36	Test lead acid battery	<ul style="list-style-type: none"> <li>• Find the problem</li> <li>• Collect required tools, instruments and materials</li> <li>• Test voltage, specific gravity, water level</li> <li>• Maintain it if necessary</li> </ul>		<b>39</b>	
<b>Grand Total</b>			<b>-</b>	<b>1872</b>	<b>1872</b>

## **Experts Involved in Curriculum Revision**

- |                                |   |
|--------------------------------|---|
| 1. Mr. P. L. Shrestha          | - Executive Director-BTI, Butwal                                      |
| 2. Mr. Dilip Kumar Thapa       | - Deputy Director-BTI, Butwal   |
| 3. Mr. Chandra Bahadur Chhetri | - Chief, Business & Admin. Deptt. - BTI, Butwal                       |
| 4. Mr. Manoj Bhattra           | - Training Officer-BTI, Butwal  |
| 5. Mr. Man Kaji Kumal          | - Training Officer-BTI, Butwal  |
| 6. Ms. Santosh Shrestha        | - Electrical Section-BTI, Butwal                                      |
| 7. Mr. Prakash Acharya         | - Computer Administrator-BTI, Butwal                                  |
| 8. Mr. Dor Bahadur Bhandari    | - TSLC Programme Co-ordinator-BTI, Butwal                             |
| 9. Mr. Ramesh Kumar Yadav      | - Mechanical Instructor-BTI, Butwal                                   |
| 10. Mr. Chola Kanta Kandel     | - Asst. Welding Instructor, BTI, Butwal                               |
| 11. Mr. Raj Kumar Thapa        | - Electrical Instructor, Korean Nepal Institute of Technology, Butwal |
| 12. Mr. Giri Shrees            | -Senior Supervisor, Nepal Hydro & Elect. Ltd., Butwal                 |
| 13. Ms. Kalpana Poudel         | -Technical Officer, Nepal Hydro & Elect. Ltd., Butwal                 |
| 14. Mr. Bom Bahadur Thapa      | - CEO, Orient Hydro P. Ltd., Butwal                                   |
| 15. Mr. Yadav Prasad Bhandari  | - CEO, Rupandehi Chamber of Industries, Butwal                        |