

**CURRICULUM**

**TSLC in**

**Electronics Engineering**

(Pre-SLC Intake)



Council for Technical Education and Vocational Training

**Curriculum Development Division**

**Sanothimi, Bhaktapur**

**Second Revision 2014**

## Table of Contents

1. Introduction: .....	4
2. Aims: .....	4
3. Program objectives: .....	4
4. Program description: .....	4
5. Duration: .....	5
6. Target group: .....	5
7. Group size: .....	5
8. Target location: .....	5
9. Entry qualification: .....	5
10. Entry criteria: .....	5
11. Selection: .....	6
12. Medium of instruction: .....	6
13. Pattern of attendance: .....	6
14. Focus of the program: .....	6
15. Teacher and student ratio: .....	6
16. Instructional media and materials: .....	6
17. Teaching learning methodologies: .....	6
18. Evaluation scheme: .....	7
19. Grading system: .....	7
20. Certificate requirements: .....	8
21. Career path: .....	8
22. Curriculum Structure .....	9
प्रयोगात्मक नेपाली .....	11
Applied English .....	13
Applied Math I .....	15
Applied Science .....	19
Mechanical Workshop Practice .....	23
Basic Electronics .....	54
Digital Electronics .....	81
Electrical Installation .....	101
Technical Drawing .....	125
Repair and Maintenance of Radio Set .....	131

Basic Computer .....	142
Applied Math II.....	151
Electronics Trade Technology.....	153
Computer Aided Circuit Design.....	156
Repair and Maintenance of Electronics Appliances .....	160
Repair and Maintenance of Television.....	191
Computer Hardware and Networking .....	203
Repair and Maintenance of Audio Video and Multimedia System .....	217
Repair and Maintenance of Telecommunication Devices .....	229
Entrepreneurship Development.....	235

### **1. Introduction:**

Electronics Engineering is one of the prominent and popular disciplines within engineering and technology sectors. Many people in the developed countries, developing countries and under developed countries have given emphasis for the broader application of Electronics Engineering. This field has been helping the world for the rapid growing electronic items production and has been providing services in large electronics and communication fields. It has been creating wage and self employment opportunities immensely both in public and private sectors. This curriculum is designed to prepare basic level technical workforce equipped with knowledge and skills related to the field of Electronics Engineering so as to meet the demand of such workforce in the country to contribute in the national economic development of Nepal. The knowledge and skills incorporated in this curriculum will be helpful to deliver the individual needs as well national needs in the field of Electronics Engineering.

The Council for Technical Education and Vocational Training (CTEVT) has been running its pre SLC intake electronics engineering (Electronics Sub-overseer) programme since 1995 A. D. Till date, this programme had been revised for one time (2007 A.D.) to incorporate new skills and technologies. During this second revision, the structure of the curriculum has been changed from the previous curriculum. Although it follows the same contents as of older version new tasks are added according to new innovation in this field.

### **2. Aims:**

The aim of this curricular program is to prepare competent basic level workforce in the field of electronics engineering who can work in rapid growing electronics items manufacturing industries as well as can provide service in electronics and communication fields.

### **3. Program objectives:**

After the completion of this curricular program, graduates will be able to:

1. Perform basic mechanical fitting practices
2. Perform basic electrical installation
3. Perform basic electronics and computer works
4. Assist to install telecommunication system
5. Repair and maintain radio and television devices and equipments
6. Repair and maintain electronic devices, solar components, and household appliances
7. Install and maintain audio video and multimedia system
8. Create self employment opportunity to reduce the unemployment problems this helps to alleviate the poverty in the country.

### **4. Program description:**

This course is based on the job required to perform by the Junior Electronics Technicians (Electronics Sub-overseer) in manufacturing and service sectors. The manufacturing sector

includes electronic items production and service sector includes electronics and communication system installation and maintenance. Therefore, this curriculum is designed to provide knowledge and skills focusing on Electronics Engineering related to the occupation. The curricular program consists of two years in house course and five months on the Job Training. The first year courses are offered focusing on foundational and disciplinary subjects of electronics engineering; the second year courses are focused on basic disciplinary subjects of Electronics Engineering. Similarly, the On-the-Job Training (OJT) for 5 months insists on the application of learned skills and knowledge in formal setting as well as the provision of OJT is also included to establish a linkage with employers and provides hands on work experience to students and promotes employability of graduates. Moreover, OJT takes place immediately after completing second year final examination.

**5. Duration:**

This course will be completed within 24 months / 104 weeks / 3120 hours. In addition, 5 months/ 800 hours on-the-job training should also be completed for successful completion of the course. Moreover, one academic year consists of 39 weeks and one week consists of 40 hours.

**6. Target group:**

The target group for this training will be all the interested individuals of the country with academic qualification of class 10 pass (Sent up). Preference will be given to the individuals of rural, poor, female, Dalit, Janjati, Disadvantaged Groups (DAGs), conflict affected people and the disables.

**7. Group size:**

The group size will be maximum of 24 (Twenty four) in a batch.

**8. Target location:**

The target location will be all over Nepal.

**9. Entry qualification:**

The minimum entry qualification of the applicant should be of class 10 pass.

**10. Entry criteria:**

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

- Class 10 pass
- Should pass entrance examination administered by CTEVT
- Candidates should submit the following documents at the time of application
  - Class 10 pass (Sent up) certificate
  - Character certificate
  - Citizenship certificate (for the name, parents' name, age, date of birth and address verification purpose only)

- Students quota for different category of students will be as per the enrollment policy of CTEVT

#### **11. Selection:**

Applicants fulfilling the entry criteria will be selected for admission on the basis of merit.

#### **12. Medium of instruction:**

The medium of instruction will be in Nepali.

#### **13. Pattern of attendance:**

Minimum of 90% attendance in each subject is required to appear in the respective final examination.

#### **14. Focus of the program:**

This is a competency based curricular program. This program emphasizes on competent performance of the task specified in it. In this programme, 80% time is allotted to the competencies and remaining is allotted to the related technical knowledge. Therefore, this curriculum is designed focussing on the performance of the specified competencies/tasks /skills included in this program.

#### **15. Teacher and student ratio:**

- Overall ratio of teacher and student must be 1:10 (at the institution level).
- Teacher and student ratio for practical demonstration 1:12
- Teacher and student ratio for bench work 1:12
- Minimum of 75% of the teachers must be full time.

#### **16. Instructional media and materials:**

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

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

#### **17. Teaching learning methodologies:**

The methods of teachings for this curricular program will be a combination of several approaches. Such as Illustrated Lecture, Group Discussion, Demonstration, Simulation, Guided practice,

Practical experiences, Fieldwork, Report writing, Term paper presentation, Case analysis, Tutoring, Role-playing, Heuristic and Other Independent learning.

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

#### 18. Evaluation scheme:

- 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.
- Related technical knowledge learnt by students will be evaluated through written tests.
- Students must score a minimum mark of 40% in theory test and 60% in practical test in all subjects.
- There will be three internal assessments and one final examination in each subject. Moreover, the mode of an assessment and an examination includes both theory and practical or as per the nature of instruction as mentioned in the curriculum structure.
- Students should pass internal assessments both in theory and practical tests in all subjects.
- The ratio between the theory and practical tests will be 20:80 in case of a practical nature subject.
- Out of 100%, 50% weightage is allotted for the internal assessments and the remaining is allotted for the final examination
- The on-the-job training has to be evaluated keeping 500 as full marks. The evaluation of the performance of the student is to be carried out by the three agencies; **the concerned institute, industry/organization where the student worked and the CTEVT** unless otherwise directed by office of the controller of examinations /Technical Division of the CTEVT. Here also the student has to score 60% or above for successful completion of the course.

#### 19. Grading system:

The grading system will be as follows:

<b><u>Grading</u></b>	<b><u>Overall marks</u></b>
Distinction	80% or above
First division	75% or above
Second division	65% or above
Third division	Pass aggregate to below 65%

#### 20. Certificate requirements:

The council for technical education and vocational training will award certificate in “**Technical School Leaving Certificate in Electronics Engineering**” to those students who successfully complete all the requirements as prescribed by the curriculum.

#### 21. Career path:

The graduates will be eligible to work in the position of Electronics Sub-overseer in the government related organizations as prescribed by the Public Service Commission or the concerned authorities of the Republic of Nepal



## 22. Curriculum Structure

### Curriculum Structure of TSLC in Electronics Engineering

#### First year

S. No.	Course Title	Nature	Class/Week		Total Class/Year			Full Marks		
			T	P	T	P	Total	T	P	Total
1	Applied Nepali	T	1	0	39	0	39	25	0	25
2	Applied English	T	2	0	78	0	78	50	0	50
3	Applied Math I	T	2	0	78	0	78	50	0	50
4	Applied Science	T	2	0	78	0	78	50	0	50
5	Mechanical Workshop Practice	P	0	3	0	117	117	0	75	75
6	Basic Electronics	T+P	2	4	78	156	234	50	100	150
7	Digital Electronics	T+P	1	3	39	117	156	25	75	100
8	Electrical Installation	T+P	1	4	39	156	195	25	100	125
9	Technical Drawing	P	0	2	0	78	78	0	50	50
10	Repair & Maintenance of Radio set	T+P	2	6	78	234	312	50	150	200
11	Basic Computer	T+P	1	4	39	156	195	25	100	125
	<b>Total</b>		<b>14</b>	<b>26</b>	<b>546</b>	<b>1014</b>	<b>1560</b>	<b>350</b>	<b>650</b>	<b>1000</b>

#### Second Year

S. No.	Course Title	Nature	Class/Week		Total Class/Year			Full Marks		
			T	P	T	P	Total	T	P	Total
1	Applied Math II	T	2	0	78	0	78	50	0	50
2	Electronics Trade Technology	T	2	0	78	0	78	50	0	50
3	Computer Aided Circuit Design	P	0	2	0	78	78	0	50	50
4	Repair & Maintenance of Electronics Appliances	P	2	6	78	234	312	50	150	200
5	Repair & Maintenance of Television	T+P	2	8	78	312	390	50	200	250
6	Computer Hardware and Networking	T+P	1	3	39	117	156	25	75	100
7	Repair & Maintenance of Audio, Video and Multimedia Systems	T+P	1	3	39	117	156	25	75	100
8	Repair & Maintenance of Telecommunication Devices	T+P	1	5	39	195	234	25	125	150
9	Entrepreneurship Development	T	2	0	30	48	78	20	30	50
	<b>Total</b>		<b>13</b>	<b>27</b>	<b>507</b>	<b>1053</b>	<b>1560</b>	<b>325</b>	<b>675</b>	<b>1000</b>

*On the Job training (OJT) is placed for 5 months after completion of the above course.*

Subject Title	Nature of instruction	Duration (Hours)	Full marks
On the job training (OJT)	Practical	800	500

# **First Year**

### कोर्ष वर्णन :

यस कोर्षले प्रशिक्षार्थीहरूलाई नेपाली भाषामा प्रयुक्त हुने इलेक्ट्रोनिक्स सम्बन्धी प्राविधिक शब्दहरू स्पष्ट बोल्न, पढ्न, इलेक्ट्रोनिक्स व्यवसाय सम्बन्धी संचार गर्न, नेपाली भाषामा इलेक्ट्रोनिक्स सम्बन्धी कुरा बुझ्न र इलेक्ट्रोनिक्स सम्बन्धी प्राविधिक नेपाली शब्द लेख्न सक्षम बनाउँछ । नेपालमा रहेका सबै स्थान वा समुदायमा रहेका विभिन्न भाषाभाषीको साझा तथा माध्यम भाषा नेपाली भाषाको प्रयोग गर्न सक्षम बनाउन यो कोर्ष तयार पारिएको हो ।

यस कोर्षमा शुद्धसंग इलेक्ट्रोनिक्स पेशा वा व्यवसायका विषयमा संचार गर्ने प्रक्रिया सिकाइने छ । यो कोर्ष सिकेका प्रशिक्षार्थी आफू काममा कार्यरत रहेको अवस्थामा आफूले जानेको ज्ञान र सीपलाई सफल प्रयोग गर्न स्थानीय समुदायको रहन सहन, संस्कृति, चालचलन र परम्परा अनुसारको संचार गर्न सक्षम बनाउन आवश्यक प्रयोगात्मक नेपालीको विषयवस्तु यस कोर्षमा समावेश गरिएको छ ।

### उद्देश्य :

यो कोर्ष पूरा गरेपछि प्रशिक्षार्थीहरू देहायका कुरामा सक्षम हुनेछन् :

- ◆ नेपाली भाषामा इलेक्ट्रोनिक्स पेशा व्यवसायका कुराहरू सुनेर बुझ्न र त्यस्ता कुरामा सहभागी भई आफ्ना धारणा बताउन ।
- ◆ इलेक्ट्रोनिक्स व्यवसाय सम्बन्धी आफूले जानेका कुरा नेपाली भाषामा मौखिक रूपमा अभिव्यक्त गरी अरूलाई बुझाउन ।
- ◆ इलेक्ट्रोनिक्स व्यवसायका विषयमा नेपाली भाषामा लेखिएका कुराहरू पढेर बुझ्न र पढेका कुरा प्रयोग गर्न ।
- ◆ आफूले जानेका इलेक्ट्रोनिक्स सम्बन्धी कुरा लिखितरूपमा अभिव्यक्त गर्न ।
- ◆ आफूले बोल्दा वा लेख्दा नेपाली व्याकरणको उचित प्रयोग गर्न ।
- ◆ नेपाली भाषामा प्रयोग हुने इलेक्ट्रोनिक्स सम्बन्धी शब्द बुझ्न र उचित तरिकाले ती शब्दको प्रयोग गर्न ।
- ◆ विषय सम्बन्धी शब्दको प्रयोग गरी चिठी, अनुच्छेद, निबन्ध, स्मरणपत्र प्रतिवेदन लेखन गर्न ।
- ◆ आफ्नो व्यक्तिगत विवरण तयार गर्न ।

### कोर्ष विवरण

## इकाई १ व्याकरण

अ) अक्षर ३ घण्टा

- क) नेपाली अक्षरको पहिचान
- ख) नेपाली अक्षरको प्रकार र पहिचान : १. स्वर, २. व्यञ्जन
- ग) नेपाली अक्षरको शुद्ध उच्चारण र प्रयोग

आ) शब्द ६ घण्टा

- क) नेपाली भाषाका शब्दको पहिचान
- ख) नेपाली भाषाका शब्दको प्रकारको पहिचान तिनका किसिम: नाम, सर्वनाम, क्रियापद, विशेषण, क्रियाविशेषण, नामयोगी, संयोजक, विशमयादिवोधक
- ग) नेपाली शब्दको प्रकारका तिनका किसिम र तिनको प्रयोग:
- घ) सम्बन्धित विषयका शब्दको ज्ञान र प्रयोग

इ) वाक्य १० घण्टा

- क) वाक्यको पहिचान
- ख) वाक्य निर्माण प्रक्रियाको पहिचान र वाक्य निर्माण
- ग) वाक्यका किसिमको पहिचान, प्रयोग र परिवर्तन: सामान्य, मिश्र र संयुक्त
- घ) वाक्यको पहिचान, प्रयोग र परिवर्तन: करण र अकरण
- ङ) कालको पहिचान, प्रयोग र परिवर्तन: भूत, वर्तमान र भविष्यत्
- च) वचनको पहिचान, प्रयोग र परिवर्तन: एकवचन र बहुवचन
- छ) लिङ्गको पहिचान, प्रयोग र परिवर्तन: पुलिङ्ग, स्त्रीलिङ्ग र उभय लिङ्ग
- ज) पुरुषको पहिचान, प्रयोग र परिवर्तन: प्रथम, द्वितीय र तृतीय
- झ) वाच्यको पहिचान, प्रयोग र परिवर्तन: कर्तृवाच्य, कर्मवाच्य र भाववाच्य

इकाई २ विषय सम्बन्धित लेख, कथा, निबन्ध आदिको पहिचान र बोध ४ घण्टा

इकाई ३ रचनाको पहिचान र रचना प्रयोग १२ घण्टा

- ◆ अनुच्छेद लेखन
- ◆ चिठी लेखन
- ◆ निबन्ध लेखन
- ◆ स्मरणपत्र लेखन
- ◆ प्रतिवेदन लेखन
- ◆ व्यक्तिगत विवरण

इकाई ४ योजना अनुमान र लागतको पहिचान र प्रयोग ४ घण्टा

## Applied English

<b>Total:</b>	2 hrs/wk
<b>Theory:</b>	2 hrs/wk
<b>Practical:</b>	0 hrs/wk

### Course Description:

This course is designed to enable the students to speak, read, write and understand through listening the English language in a standard manner. In general, English is essential and a means of communication to the people of outer world.

### Course Objectives:

After completion of this course students will be able to:

1. Develop an understanding of and competence in spoken English
2. Communicate fluently and accurately with other speakers of English
3. Develop competence in understanding a variety of reading texts
4. Gain the skills necessary to write English appropriately and effectively
5. Develop ability to use simple reference materials

Unit	Content	Time
1	<ul style="list-style-type: none"> <li>▪ Introduction to English language</li> <li>▪ Parts of speech</li> <li>▪ Identification of parts of speech</li> <li>▪ Sounds (Vowel, consonants, diphthongs)</li> </ul>	5 hrs
2	<ul style="list-style-type: none"> <li>▪ Nouns, types and uses</li> <li>▪ Pronoun, types and uses</li> <li>▪ Adjectives, types and uses</li> <li>▪ Adverbs, types and uses</li> <li>▪ Verbs, types and uses</li> <li>▪ Prepositions, types and uses</li> </ul>	10 hrs
3	<ul style="list-style-type: none"> <li>▪ Words, word formation, synonyms and antonyms</li> </ul>	5 hrs
4	<ul style="list-style-type: none"> <li>▪ Sentences, types, formation and uses</li> </ul>	5 hrs
5	<ul style="list-style-type: none"> <li>▪ Tense, tense contrast, types and uses</li> </ul>	10 hrs
6	<ul style="list-style-type: none"> <li>▪ Conditional and causative sentences, types and uses</li> </ul>	5 hrs
7	<ul style="list-style-type: none"> <li>▪ Articles, types and uses</li> </ul>	5 hrs
8	<ul style="list-style-type: none"> <li>▪ Reported speech, types and uses</li> </ul>	10 hrs

9	▪ Voice, types and uses	5 hrs
10	▪ Reading different stories, essays and articles with comprehensive practices	6 hrs
11	Composition	12 hrs
	▪ Application	
	▪ Letters (personal, official and business)	
	▪ Story development	
	▪ Paragraph writing	
	▪ Essay writing	
	▪ Story writing	
	▪ Instruction writing	
	▪ Bio-data preparation	
	▪ Memo writing	
	▪ Report writing	
	▪ Speech preparation	
	▪ Debates	

**References:**

# Applied Math I

<b>Total:</b>	<b>2 hrs/wk</b>
<b>Theory:</b>	<b>2 hrs/wk</b>
<b>Practical:</b>	<b>0 hrs/wk</b>

## Course Description:

This course is designed to help students to calculate and apply the mathematics in a standard applied manner. This course also imparts knowledge on statistic and probability in addition to practical mathematics. This course mainly focuses on applied electronics and digital mathematics.

## Course Objectives:

After completion of this course students will be able to:

- Develop the skill needed for the calculation of electronics engineering mathematics
- Communicate Mathematical calculation fluently and accurately with Nepali

## Course Objectives:

After completion of this course students will be able to:

- Develop skill of simple mathematic calculation.
- Acquire knowledge on mensuration as well as volume and density.
- Develop the skill needed for the calculation of electronic engineering mathematics
- Communicate Mathematical calculation fluently and accurately with Nepali

## Contents

<b>1. Unit</b>	<b>4</b>
• Explain unit	
• Explain type of unit(FPS,MKS,CGS,SI)	
• Conversion of unit.	
• Conversion of centigrade to Fahrenheit and vice versa	
• Solve some conversion of unit	
<b>2. Arithmetic expression (factorization)</b>	<b>4</b>
• Define arithmetical expression	
• Calculate four fundamental arithmetic,	
• Perform fraction.	
• Simplify fractions	
• Convert fractions to decimal	
• Convert decimal to fractions	
• Calculate square and square root	
• Calculate ratio and proportion	

### **3. Percentage**

**2**

- Explain percentage
- Calculate percentage
- Convert percentage into fraction / decimal or vice versa

### **4. Profit and Loss**

**4**

- Introduction
- Explain Cost price, Selling price, Profit and loss, VAT, Discount
- Find out profit or loss of the product/sell

### **5. Home arithmetic**

**4**

- Explain home arithmetic
- Explain costing
- Compare income and expenditure
- Make balance between income and expenditure

### **6. Areas/ Mensuration**

**8**

- Introduction
- Area & its unit
- Calculate areas of different regular shapes (Square, Different type of triangle, parallelogram, rhombus, trapezoid, circle, sector of circle, circular ream, sphere, pyramid, cone, prism, cylinder, hollow cylinder, Polygons)
- Calculate areas of different irregular and composite shapes

### **7. Volume, Weight, Mass and Density**

**6**

- Introduction
- Explain Volume, Weight, mass and Density
- Calculate volume and weight of circular shape
- Calculate volume and weight of Square shape
- Calculate volume and weight of Triangular shape
- Calculate volume and weight of Cylindrical shape
- Calculate volume and weight of Conical shape
- Calculate volume of composite shapes
- Calculate Mass and density

### **8. Unitary Calculations**

**4**

- Introduction
- Calculate some simple exercise related time and work

### **9. Simple and Compound Interest**

**6**

- Introduction
- Explain principal
- Explain simple interest



<ul style="list-style-type: none"> <li>• Explain compound interest</li> <li>• Explain time for interest</li> <li>• Explain interest rate</li> <li>• Calculate simple interest, rate, time, principal and amount</li> <li>• Calculate compound interest, rate, time, principal and amount</li> </ul>	
<b>10. Trigonometry</b>	
<b>6</b>	
<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Explain Trigonometric ratios and their relationship</li> <li>• Pythagoras theorem</li> <li>• Measure of angles</li> <li>• Read Trigonometric table and Trigonometric formula</li> <li>• Solve heights and distances, angle of elevation, angle of depression, sine bar</li> <li>• Solve simple trigonometry problems</li> </ul>	
<b>11. Equation</b>	<b>6</b>
<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Simultaneous and quadratic equation</li> <li>• Solve simple Simultaneous and quadratic equation</li> </ul>	
<b>12. Graph</b>	<b>2</b>
<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Simple linear equation</li> <li>• Explain sign of coordinates</li> <li>• Perform drawing procedure</li> <li>• Draw simple graphical exercises</li> </ul>	
<b>13. Statistics</b>	<b>8</b>
<ul style="list-style-type: none"> <li>• Introduction of Mean, Mode, Median, Quartile, Percentile</li> <li>• Solve simple exercise</li> </ul>	
<b>14. Sets</b>	<b>6</b>
<ul style="list-style-type: none"> <li>• Introduction of Set</li> <li>• Uses of venn diagram</li> <li>• Cardinality of a set</li> <li>• Notation of set</li> <li>• Types of sets</li> <li>• Solving set related more than two</li> <li>• Some simple exercise of set</li> </ul>	
<b>15. Probability</b>	
<b>8</b>	
<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Observe experiment, outcomes and random experiments</li> <li>• Set statistical experiment of sample space.</li> <li>• Observe mutually exclusive events and independent events</li> <li>• Probability of an event</li> <li>• Explain three approaches of probability               <ol style="list-style-type: none"> <li>a) Classical, Statistical</li> <li>b) Limitation of classical</li> </ol> </li> </ul>	

- c) Statistical or Empirical
- Practice empirical probability
- Probability scale
- Laws of probability
  - Addition law
  - Multiplication law
- Non mutually exclusive events
  - Addition law for non-mutually exclusive events
  - Independent events, dependent events & tree diagram
  - Multiplication law for independent events
  - Multiplication law for dependent events.

### **References**

- CDC, Compulsory Mathematics for Class 10, Curriculum Development Centre (CDC), MOE, Government of Nepal, Janak Educational Materials Center, sanothimi, Bhaktapur
- HP Dahal, Compulsory Mathematics for Class 10,

# Applied Science

<b>Total:</b>	<b>2 hrs/wk</b>
<b>Theory:</b>	<b>2 hrs/wk</b>
<b>Practical:</b>	<b>0 hrs/wk</b>

## Course description:

This subject consists of applied science related to contents that supports for the understanding and practicing the electrical and electronics related engineering works.

## Course Objectives:

After the completion of this course students will be able to explain the basic concepts related to the followings and apply them in the field of the electronics engineering.

1. Insulator, conductor and semiconductor
2. Energy band diagram.
3. Measurements
4. Lights, lens and electro-magnetic waves
5. Elements, atoms, compound and radical
6. Magnet and electricity
7. Boyles's law, charle's Law and Gas equation

## Contents:

- 1. Insulator (3 hrs)**
  - Define insulator
  - List the types of insulator and introduce them
  - Explain the functions of insulator
  - Write the importance of insulator
  - Explain uses of insulator in electronic trade
- 2. Conductor (3 hrs)**
  - Define conductor
  - List the types of conductor and introduce them
  - Explain the functions of conductor
  - Write the importance of conductor
  - Explain uses of conductor in electronic trade
- 3. Semiconductor (5 hrs)**
  - Define semiconductor
  - List the types of semiconductor and introduce them
  - Explain the functions of semiconductor
  - Write the importance of semiconductor
  - Explain uses of semiconductor in electronic trade
- 4. Energy band diagram (5 hrs)**
  - Define energy
  - Define energy band diagram

- List the types of energy band diagram and introduce them
- Explain the functions of energy band diagram
- Write the importance of energy band diagram
- Explain uses of energy band diagram in electronic trade

**5. Measurements (4 hrs)**

- Define measurement
- List the types of measurement and introduce them
- Explain the functions of measurement
- Write the importance of measurement
- Explain uses of measurement in electronic trade

**6. Light (5 hrs)**

- Define light
- List the types of lights and introduce them
- Explain the functions of light
- Write the importance of light
- Explain uses of light in electronic trade
- Explain movement characteristics of light
- Explain reflection of light with diagram
- Explain refraction of light with diagram
- Explain dispersion of light with diagram

**7. Lens (6 hrs)**

- Define lens
- List the types of lens and introduce them
- Explain the functions of lens
- Write the importance of lens
- Explain uses of lens in electronic trade
- Explain characteristics of lens
- Explain reflection of light with diagram
- Explain refraction of light with diagram
- Explain dispersion of light with diagram
- Explain refraction through lens

**8. Magnet (7 hrs)**

- Define magnet
- List the types of magnet and introduce them
- Explain the functions of magnet
- Write the magnet of radical
- Explain uses of magnet in electronic trade
- Write the properties of magnet
- Explain the magnetic materials
- Explain the magnetic types
- Explain the magnet field
- Explain the induction of magnet
- Explain lines of force
- Define Coulombs law
- Explain the functions of Coulombs law
- Explain the importance of Coulombs law

- Explain the uses of Coulombs law
- 9. Electricity** **(10 hrs)**
- Define electricity
  - Explain the importance of electricity
  - Explain the sources of electricity
  - Define cell and batteries
  - Explain the connection on electric power
  - List the type of battery and their functions
  - Explain the Concept of electrolysis
  - Explain the Faraday's law of electrolysis
  - Uses
- 10. Electro-magnetic waves** **(6 hrs)**
- Define electro-magnetic waves
  - List the types of electro-magnetic waves and introduce them
  - Explain the functions of electro-magnetic waves
  - Write the importance of electro-magnetic waves
  - Explain uses of lens in electronic trade
  - Explain characteristics of electro-magnetic waves
  - Explain spectrum in electro-magnetic waves
- 11. Element** **(5 hrs)**
- Define element
  - List the types of element and introduce them
  - Explain the functions of element
  - Write the importance of element
  - Explain uses of element in electronic trade
  - Explain characteristics of element
- 12. Atoms** **(5 hrs)**
- Define atoms
  - List the types of atoms and introduce them
  - Explain the functions of atoms
  - Write the importance of atoms
  - Explain uses of atoms in electronic trade
  - Explain the atomic structure of different elements
  - Define valency
  - Define molecular formula
  - Explain the balancing of simple comical equations
  - Solve numerical problems
- 13. Compound** **(4 hrs)**
- Define compound
  - List the types of compound and introduce them
  - Explain the functions of compound
  - Write the importance of compound
  - Explain uses of compound in electronic trade

**14. Radical****(5 hrs)**

- Define radical
- List the types of radical and introduce them
- Explain the functions of radical
- Write the importance of radical
- Explain uses of radical in electronic trade

**15. Laws of gas****(5 hrs)**

- Explain Boyles's law and its application in electronic
- Explain Charles law and its application in electronic
- Explain the Gas equation
- Gas application

**References:**

# Mechanical Workshop Practice

Total:	3 hrs/wk
Theory:	0 hrs/wk
Practical:	3 hrs/wk

## Course Description:

This course provides basic skills and knowledge related to mechanical workshop practice. It imparts skills to use, care and maintain basic hand tools for metal work. Mechanical workshop practice undertakes shaping jobs of all basic mechanical fittings carry out on bench work.

## Course Objectives:

After completion of this course students will be able to:

1. Explain and follow and follow general safety rules.
2. Perform measuring and marking.
3. Perform filling.
4. Perform Drilling, Countersinking and Tapping.
5. Perform sheet metal works.
6. Perform brazing.
7. Perform bench work/sheet metal related project work.

## List of tasks:

1. Familiarize with mechanical tools, materials and equipment.
2. File flat surface.
3. Measure and mark on the work piece.
4. File external radius.
5. Punch dot and center on the object.
6. Stamp letters and numbers on metal plate.
7. Saw metal by hand hack –saw.
8. Drill a hole
9. Countersink hole
10. Cut internal thread using hand taps
11. Cut external thread using threading dies
12. Check square-ness using back square
13. Cut metal sheet with snip
14. Fold metal sheet
15. Perform riveting joints
16. Perform soldering
17. Perform project(Bench work Project/ Sheet metal Project)

**Task: 1 Familiarize with mechanical tools, materials and equipment**

Time:-2 hrs  
Theory:-0.5 hrs  
Practical:-1.5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain tools / materials and equipment as per list.</li> <li>2. Introduce tools / materials and equipment.</li> <li>3. Explain objectives.</li> <li>4. Explain working principle</li> <li>5. Explain safety precaution.</li> <li>6. Explain care and maintenance.</li> <li>7. State work using tools / material/ equipment.</li> <li>8. Store the tools.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Tool/ materials and Equipment as per given list.</li> <li>• Well-equipped workshop.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Familiarize with mechanical tools, materials and Equipment.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Tools, equipment and material should be identified as per given list.</li> <li>• Applied different tools equipment and materials safely</li> <li>• Explained the functions of different tools equipment and materials</li> </ul>	<p><b>Mechanical tools, materials and equipment</b></p> <ul style="list-style-type: none"> <li>• Bench work tools and equipment</li> <li>• Definition</li> <li>• Objective</li> <li>• Working principle</li> <li>• Uses</li> <li>• Importance</li> <li>• Handling and caring</li> <li>• Safety precaution</li> </ul>

**Tools and Equipment:-** Steel scale, Different types of file, Back square, Marking scribe, Center punch, Hammers, Hand hack saw,  
**Materials:** Mild steel, Carbon steel, Tool steel

**Safety:-**

1. Handle the tools carefully.
2. Store the tools and material systematically.



**Task: 2 File flat surface**

Time:-21 hrs

Theory:-1 hr

Practical:-20 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing.</li> <li>2. Read drawing thoroughly.</li> <li>3. Obtain rough flat file.</li> <li>4. Obtain material as per drawing.</li> <li>5. Clean up the vice and working surroundings.</li> <li>6. Obtain steel scale, marking scribe and back square.</li> <li>7. Mark on the work piece as per drawing.</li> <li>8. Clamp the work-piece centrally on Bench vice so that the flat file can be file down the surface of w/p.</li> <li>9. Hold the file by one hand with gripping the file handle so that the end of the handle presses against the ball of the thumb.</li> <li>10. Press the tip file blade with the ball of the thumb by the other hand.</li> <li>11. Position the feet to safe distance during filling.</li> <li>12. Position the body to speedy and regular movements of the body.</li> <li>13. Put the file on top of the work-piece pressing and pushing from one hand and pressing only from other hand.</li> <li>14. Return the file without pressure.</li> <li>15. Apply the same motion to produces even removal of filling surface.</li> <li>16. Apply full length of file.</li> <li>17. Check the flatness in cross and diagonally with back square</li> <li>18. Check measurement by steel scale</li> <li>19. Repeat the same motion</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> File flat surface</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Filing work piece should be match given check list.</li> <li>• Tolerances of filing work piece is within the <math>\pm 0.1</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Material of w/p</li> <li>• Material of files and introduction</li> <li>• w/p clamping devices</li> <li>• care and safety features of files, bench vices, steel rule, try square</li> <li>• Type of file</li> <li>• Proper way of holding file while filing</li> <li>• Position of feet and body while filing</li> <li>• Measuring and marking tools.</li> <li>• State basis units of length, measurements and its multiples</li> <li>• Techniques of flat filing i.e. straight, cross and draw filing</li> </ul> <p><b>Safety:</b> General, personal, machine, tool and equipment, workshop</p>

<p>of filing across and diagonally until produce even surface.</p> <p>20. De-burr the work piece.</p> <p>21. Punch the roll no on work piece.</p> <p>22. Oil the surface of the work piece.</p> <p>23. Store the work piece and tools.</p> <p>24. Clean the vice and work shop.</p>		
---	--	--

**Tools and Equipment:-** Flat files, steel scale, Back square (try square), Marking scriber, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan

**Materials:** MS Flat, Oil

**Safety:-**

1. Follow safety rule.
2. The height of bench vice should be set before filing.
3. The handle of file should be fixed tightly.
4. Avoid using broken files on files without handle
5. Do not leave the files above work pieces on bench vice

**Task: 3 Measure and Mark on the work piece.**

Time:-4 hrs  
Theory:-0.5 hrs  
Practical:-3.5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing.</li> <li>2. Study the drawing thoroughly.</li> <li>3. Obtain required tools and materials.</li> <li>4. Measure the work piece according to given drawing.</li> <li>5. Mark the work piece according to drawing.</li> <li>6. Punch the roll no on work piece.</li> <li>7. Oil the surface of the work piece.</li> <li>8. Store the work piece and tools.</li> <li>9. Clean the vice and work shop.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Working bench and Bench vice with fully equipped workshop.</li> <li>• Drawing</li> </ul> <p><b>Tasks (What):</b> Measure and mark on the work piece.</p> <p><b>Standard (How well):</b> The measured and marked work piece should be within the given check list.</p>	<p><b>Measuring and Marking</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Importance</li> <li>• Tool and equipment</li> <li>• Method</li> <li>• Safety</li> </ul>

**Tools and Equipment:-** Steel scale, Steel Protractor, Marking scribe, Center punch, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan

**Materials:** MS Sheet, Oil

**Safety:-** Hold marking tools carefully because of sharpen tip of marking tools may injured.

**Task: 4 File external radius**

Time:-13 hrs  
 Theory:-0.5 hrs  
 Practical:-12.5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing.</li> <li>2. Read drawing thoroughly.</li> <li>3. Obtain rough, medium and fine flat files.</li> <li>4. Obtain work-piece material.</li> <li>5. Obtain a radius gauge of the required size.</li> <li>6. Obtain a centre punch and hammer.</li> <li>7. Obtain a steel Scale/rule.</li> <li>8. Obtain a divider/compass.</li> <li>9. Clean up the bench vice and surrounding.</li> <li>10. Mark the centre point of the radius by center punch.</li> <li>11. Make the radius by divider.</li> <li>12. Clamp the w/p projecting the corner part which has to be made radius.</li> <li>13. File down to make flat surface close to the marked radius line using rough file.</li> <li>14. Change medium flat file and start filing in SEE SAW motion along the curved line until all marked line touches.</li> <li>15. Check periodically with radius gauge.</li> <li>16. Remove the w/p and check the measurement</li> <li>17. File down further in</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b>                      File external radius.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Filing work piece should be match given check list.</li> <li>• Tolerances of filing work piece is within the <math>\pm 0.1</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of making and layout using steel rule, compass.</li> <li>• Radius gauge.</li> <li>• Method of filing radius surface.</li> <li>• State the feature of compass.</li> <li>• Radius filing procedure</li> </ul>

<p>see saw motion with fine flat file until required radius is obtained</p> <ol style="list-style-type: none"> <li>18. Remove the w/p and check the final measurement.</li> <li>19. Punch the roll no on work piece.</li> <li>20. Oil the surface of the work piece.</li> <li>21. Store the work piece and tools.</li> <li>22. Clean the vice and work shop.</li> </ol>		
---	--	--

**Tools and Equipment:-** Flat files (Rough, medium, fine), radius gauge, Marking scribe, Center punch, Number punch, Steel scale Oil can, Number punch, Bench cleaning brush, File brush, Dust pan

**Materials:** MS Square, Oil

**Safety:** - Refer the same safety precautions of the task "File flat surface."

**Task: 5 Punch dot and center on the object**

Time:-4hrs  
Theory:-0.5 hrs  
Practical:-3.5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the w/p drawing.</li> <li>2. Read drawing thoroughly.</li> <li>3. Obtain the w/p material.</li> <li>4. Obtain steel rule, marking scribe, steel hammer, centre or dot punch.</li> <li>5. Prepare the w/p material in flat position as per required dimension.</li> <li>6. Mark the symmetrical lines as per drawing using steel rule (scale) and marking scribe.</li> <li>7. Place the w/p on flat anvil.</li> <li>8. Hold the dot/centre punch by three fingers of one hand and the hammer on other hand.</li> <li>9. Place the tip of the centre punch at the cross of symmetrical lines of w/p.</li> <li>10. Apply trial stroke on the punch by hammer.</li> <li>11. Assess that the punch is at the correct centre.</li> <li>12. Align if required.</li> <li>13. Punch further stroke to get good impression.</li> <li>14. Take next cross line and punch the centre.</li> <li>15. Move center from self-ward while punching numerous dotted in same line.</li> <li>16. Repeat the same steps for other cross lines until finished.</li> <li>17. Punch the roll no on work piece.</li> <li>18. Oil the surface of the work piece.</li> <li>19. Store the work piece and tools.</li> <li>20. Clean the vice and work shop.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Punch dot and centre on the object.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Check trial stroke.</li> <li>• Punching work piece should be match with given check list.</li> <li>• Tolerances of marking line is within the <math>\pm 0.1</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Dot punch, its included angle and its uses.</li> <li>• Dots punch material.</li> <li>• Centre punch, its included angles and its uses.</li> <li>• Centre punches material.</li> </ul>

**Tools and Equipment:-** Steel rule, marking scribe, steel hammer, centre punch or dot punch, anvil, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan

**Materials:** MS Sheet, Oil

**Safety:-**

1. **Ascertain** the head of the punch is flat .i.e. avoid mushroom head punch.
2. Wipe off oily substance, if any, from the face of the hammer.
3. Look at the punch tip, not at the head of the punch while punching.
4. While punching remove bangles and wrist watches.

**Task: 6 Stamp letters and numbers on metal plate**

Time:-12 hrs  
Theory:-1 hr  
Practical:-11 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the w/p drawing.</li> <li>2. Read drawing thoroughly.</li> <li>3. Obtain w/p material.</li> <li>4. Obtain letter and number punch of required size.</li> <li>5. Prepare the material in flat and in required dimensions.</li> <li>6. Layout the base lines as per drawing.</li> <li>7. Make the centre line to locate the position of the middle letter.</li> <li>8. Place the work piece on anvil block facing up the surface to be stamped.</li> <li>9. Check and Select the number or letter to be stamped.</li> <li>10. Stamp the middle letter on the centre column line by holding the punch with three fingers of one hand and striking the hammer on head of punch by other hand.</li> <li>11. Check the impressions.</li> <li>12. Stamp the remaining letters to the right of centre and then to the left of centre.</li> <li>13. Punch the roll no on work piece.</li> <li>14. Oil the surface of the work piece.</li> <li>15. Store the work piece and tools.</li> <li>16. Clean the vice and work shop.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Stamp letters and numbers on metal plate.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Stamping work piece should be match with given check list.</li> <li>• Tolerances of marking line is within the <math>\pm 0.1</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Letter and number punches.</li> <li>• Stamping process.</li> <li>• Three step stroking procedure</li> </ul>

**Tools and Equipment:-** Steel rule, Steel hammer, Marking scribe, Letter & number punch, Flat anvil, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan



**Materials:** MS Sheet, Oil

**Safety:-**

1. **Ascertain** the head of the punch in flat.
2. Avoid mushroom head punch.
3. Wipe off oily substance, if any from the face of the hammer.
4. Make sure that the face of the hammer strikes on punch head, use on fingers.
5. While punching remove bangles and wrist watches.

**Task: 7 Saw metal by hand hack-saw**

Time:-6 hrs  
Theory:-0.5 hr  
Practical:-5.5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the w/p drawing.</li> <li>2. Read drawing thoroughly.</li> <li>3. Obtain the w/p material.</li> <li>4. Obtain steel rule.</li> <li>5. Obtain marking scribe.</li> <li>6. Obtain dot punch, hammer.</li> <li>7. Obtain hand hacksaw frame with blade.</li> <li>8. Make symmetrical line.</li> <li>9. Punch dotted on marked line.</li> <li>10. Clamp the work piece so that the marked line must be outside the vice.</li> <li>11. Set the hand hack saw blade on hacksaw frame making teeth pointing towards forward.</li> <li>12. Check the tightness of the blade in frame.</li> <li>13. Take a small triangular file.</li> <li>14. Mark a small Vee-notch by triangular file on start point.</li> <li>15. Hold the hacksaw frame firmly as per file handling.</li> <li>16. Start cutting slowly moving the blade forward.</li> <li>17. Apply pressure only during the forward stroke.</li> <li>18. Release pressure during the return stroke.</li> <li>19. Repeat the strokes.</li> <li>20. Check the cutting line to be straight.</li> <li>21. Move slowly while finishing the cut.</li> <li>22. Apply cutting on the blade frequently while sawing.</li> <li>23. Check the part that has been sawed.</li> <li>24. Punch the roll no on work piece.</li> <li>25. Oil the surface of the work piece.</li> <li>26. Store the work piece and tools.</li> <li>27. Clean the vice and work shop.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Saw the metal by hand hack saw.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Sawing work piece should be match with given check list.</li> <li>• Tolerances of dimensions are within the <math>\pm 0.1</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of hacksaw.</li> <li>• Types of hacksaw.</li> <li>• Parts of hack saw.</li> <li>• Hacksaw blades and their types and material.</li> <li>• Selecting blade for different materials and sections.</li> <li>• Holding different sections of w/p for hack sawing.</li> <li>• Procedure of sawing the metal by hand.</li> </ul>

**Tools and Equipment:-** Hand Hacksaw frame, Hacksaw blade, steel rule, marking scribe, steel hammer, flat anvil, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan, Triangular file, Finishing file

**Materials:** MS Flat or MS Angle, Oil

**Safety:-**

1. Hold the job so as to cut on flat side rather than edge.
2. The teeth of the hacksaw blade should point towards the forwards direction.
3. The cutting movement should be steady and straight.
4. The full length of the blade should be engaged per stroke.
5. Avoid moving the blade too fast; slow down while finishing the cut.
6. The blades too much neither tighten nor loose.
7. Avoid clamping the w/p over hang.

**Task: 8 Drill a hole**

Time:-4 hrs  
Theory:-1 hr  
Practical:-3 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the w/s drawing.</li> <li>2. Read drawing.</li> <li>3. Obtain pre-finished w/p material.</li> <li>4. Obtain drill bit as per the required size.</li> <li>5. Mark layout line on the w/p.</li> <li>6. Punch the centre.</li> <li>7. Clamp the w/p on m/c vice of m/c table.</li> <li>8. Clamp the drill bit on drill chuck by drill chuck key.</li> <li>9. Set the RPM as per the drill bit size and the w/p material.</li> <li>10. Start the machine.</li> <li>11. Set the coolant housing pipe.</li> <li>12. Give hand feed.</li> <li>13. Apply the coolant on the rotating drill bit.</li> <li>14. Reduce the feeding pressure at the bottom to the end.</li> <li>15. Make sure the drill passes through.</li> <li>16. Stop the machine.</li> <li>17. Remove the w/p from m/c vice.</li> <li>18. De-burr the drilled hole.</li> <li>19. Clean oil and chips.</li> <li>20. Punch the roll no on work piece.</li> <li>21. Oil the surface of the work piece.</li> <li>22. Store the work piece and tools.</li> <li>23. Clean the vice and work shop.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Drill a hole.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Drilling work piece should be match with given check list.</li> <li>• Tolerances of dimensions are within the <math>\pm 0.1</math> mm except drill hole</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of drill m/c.</li> <li>• Types of drill m/c</li> <li>• Parts of drill machine</li> <li>• Twist drills and its types.</li> <li>• Parts of drill bit</li> <li>• Cutting speed, feed and RPM.</li> <li>• RPM calculation according to the drill size and w/p material.</li> <li>• Handling of drill m/c(Operation and changing of belt )</li> <li>• Safety</li> </ul>

**Tools and Equipment:-** Drill m/c with drill chuck key and drill bits, centre punch, steel hammer, Drill vice, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan, Finishing file

**Materials:** MS Flat, Oil, Coolant

**Safety:-**

1. Tighten the table lock to avoid dislocation of the w/p.
2. Use parallel block to prevent drilling on m/c vice or table.
3. Check the cutting edge of drill before drilling.
4. Mount the drill shank to its maximum length inside the drill chuck.
5. Check the drill centre alignment to avoid breading of drill.
6. Apply coolant fluently.
7. Use cleaning brush to clean out the chips.

**Task: 9 Countersink a hole**

Time:-2 hrs  
 Theory:-0.5 hr  
 Practical:-1.5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain workshop drawing.</li> <li>2. Read drawing thoroughly.</li> <li>3. Obtain previously drilled w/p material.</li> <li>4. Obtain countersink as per the required size.</li> <li>5. Mount the same size of twist drill on drill spindle on drill chuck.</li> <li>6. Clamp the w/p in drill vice or hold by hand placing at the m/c table.</li> <li>7. Align the centre of m/c spindle with the drilled hole to cut uniform angle.</li> <li>8. Change countersink on drill machine chuck.</li> <li>9. Set the RPM</li> <li>10. Start machine.</li> <li>11. Check the alignment giving feed by hand.</li> <li>12. Re-align if necessary.</li> <li>13. Give feed as per depth required.</li> <li>14. Stop the machine.</li> <li>15. Remove the w/p</li> <li>16. Chamfer (De-burr) if necessary.</li> <li>17. Check the final measurement.</li> <li>24. Clean oil and chips.</li> <li>25. Punch the roll no on work piece.</li> <li>26. Oil the surface of the work piece.</li> <li>27. Store the work piece and tools.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b>                      Countersink a hole.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Countersinked work piece should be match with given check list.</li> <li>• Tolerances of dimensions are within the <math>\pm 0.1</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to countersink.</li> <li>• Types of countersink.</li> <li>• Importance of countersinking.</li> <li>• Safety</li> </ul>

**Tools and Equipment:-** countersink 60° and 90°, Drill m/c with drill chuck key and drill bits, centre punch, steel hammer, Drill vice, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan, Finishing file

**Materials:** MS Flat, Oil

**Safety:-**

1. Check the cutting edge of the countersink.
2. Use drift to remove taper shank from drill spindle.
3. Use cleaning brush to clear out the chips.
4. Refer to the safety precaution of taste "drill a hole"

**Task: 10 Cut internal thread using hand taps (Tapping)**

Time:-3 hrs  
Theory:-0.5 hr  
Practical:-2.5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain w/s drawing.</li> <li>2. Read drawing thoroughly.</li> <li>3. Obtain pre-machined work material.</li> <li>4. Obtain drill size and required tools for internal threads.</li> <li>5. Obtain sets of taps and tap handle/wrench.</li> <li>6. Mark and punch on centre to drill hole.</li> <li>7. Drill hole of required tap drill size.</li> <li>8. Countersink the hole.</li> <li>9. De-burr the hole.</li> <li>10. Re-clamp the w/p on bench vice in horizontal position slightly above the vice jaws.</li> <li>11. Fix the first tap in the tap handle/wrench.</li> <li>12. Position the tap (90° with horizontal surface) in the countersinked hole.</li> <li>13. Hold the tap handle closer to the centre.</li> <li>14. Exert steady downward pressure and turn the tap handle in clockwise direction to start the thread.</li> <li>15. Ensure the thread as well as check the tap alignment removing the tap handle.</li> <li>16. Check the tap alignment with Back Square to ensure the tap being 90 ° with the w/p surface.</li> <li>17. Make corrections, if necessary by exerting slightly more pressure downward in the side having angle greater than 90°</li> <li>18. Fit the tap handle without disturbing the tap alignment.</li> <li>19. Make 1-2 clockwise turn and re-check the alignment.</li> <li>20. Turn the tap handle lightly without exerting any downward pressure.</li> <li>21. Turn anticlockwise quarterly after every clockwise full turn.</li> <li>22. Apply cutting oil frequently.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Cut internal thread using hand taps (Tapping).</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Tapping work piece should be match with given check list.</li> <li>• Tolerances of dimensions are within the <math>\pm 0.1</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction thread and its types</li> <li>• Introduction of tap and tapping</li> <li>• Types of tap</li> <li>• Thread nomenclature</li> <li>• Selection of drill bit for required tapping</li> </ul>



<p>23. Cut thread until the tap is fully inside the hole being threaded.</p> <p>24. Remove the first tap.</p> <p>25. Repeat the steps (18) to (23) for intermediate (Tap no 2) and bottoming tap (Tap no 3).</p> <p>26. Remove the chips from thread.</p> <p>27. Clean oil and chips.</p> <p>28. Clean the vice.</p> <p>29. Punch the roll no on work piece.</p> <p>30. Oil the surface of the work piece.</p> <p>31. Store the work piece and tools.</p>		
---	--	--

**Tools and Equipment:-** Drill m/c, Sets of twist drills, Bench vice, Set of hand tap, Cutting oil can, Countersink 60° and 90°, Centre punch, Steel hammer, Number punch, Bench cleaning brush, File brush, Dust pan, Finishing file

**Materials:** MS Flat, Oil

**Safety:-**

1. Use cutting fluid while cutting threads to avoid heat.
2. Avoid applying side pressure without giving turning motion to tap.
3. Tap alignment should be correct since starting of thread to avoid breaking of taps.
4. Tap handle should be chosen as per tap size.
5. Chips after cutting threads must be cleaned out from the hole and vice.

**Task: 11 Cut external thread using threading dies(Dieing)**

Time:-6 hrs  
Theory:-0.5 hr  
Practical:-5.5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain w/p drawing.</li> <li>2. Read drawing thoroughly.</li> <li>3. Obtain w/p material.</li> <li>4. Obtain set of files.</li> <li>5. Obtain caliper, threading die, die handle, check nut and hole gauge.</li> <li>6. Mark square at the end face as per thread diameter.</li> <li>7. File roughly using the procedure of filing a square block.</li> <li>8. File round bar of blank using the steps of task "File external radius".</li> <li>9. Check the blank size with hole gauge.</li> <li>10. Re-file until the blank diameter is obtained.</li> <li>11. Chamfer 45° at the end of the blank.</li> <li>12. Fix the die in die handle</li> <li>13. Re-clamp the w/p on vice projecting the blank upward above the vice in 90° with the horizontal.</li> <li>14. Place the leading side of the die on the chamfer of the w/p</li> <li>15. Ensure the die is fully open by tightening the centre screw.</li> <li>16. Hold the die handle close to the centre.</li> <li>17. Apply pressure on die handle evenly and turn clockwise to advance the die on the bolt blank.</li> <li>18. Ensure the thread starts by the time reverse frequently at about every quarter turn.</li> <li>19. Cut thread until the die is fully down the length to be threaded.</li> <li>20. Increase the depth of cut gradually by adjusting</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Cut external thread using threading dies.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Dieing work piece should be match with given check list.</li> <li>• Tolerances of dimensions are within the <math>\pm 0.1</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of Dies and Dieing.</li> <li>• Required blank size for external thread.</li> </ul>

<p>the outer screw and repeat above steps (16-19).</p> <ol style="list-style-type: none"> <li>21. Check the thread with check nut.</li> <li>22. Clear the die and the bench vice.</li> <li>23. Clean oil and chips.</li> <li>24. Punch the roll no on work piece.</li> <li>25. Oil the surface of the work piece.</li> <li>26. Store the work piece and tools.</li> </ol>		
---	--	--

**Tools and Equipment:-** Set of files, hole gauge, Check nut, caliper, Set of threading dies, Die handle, oil can with cutting oil, Bench vice, Centre punch, Steel hammer, Number punch, Bench cleaning brush, File brush, Dust pan

**Materials:** MS Flat, Oil

**Safety:-**

1. Check screws on the die handle before starting.
2. Check the depth of cut too much depth can damage die and threads.
3. Apply cutting fluid frequently to reduce heat and wash out the chips avoid clogging.
4. Keep the die handle at right angle to the job.

**Task: 12 Check square-ness using back square**

Time:-3 hrs  
Theory:-0.5 hr  
Practical:-2.5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain work shop drawing.</li> <li>2. Read drawing thoroughly.</li> <li>3. Obtain pre-machined w/p material.</li> <li>4. Obtain a back square of required size.</li> <li>5. Hold the w/p in one hand and place the stock of the square against the vertical surface.</li> <li>6. Slide the stock down the vertical surface until the blade touches the flat surface of work piece.</li> <li>7. Position the work so that the light falls on it from behind.</li> <li>8. Check whether any light passes between the work-piece and the blade if not, the surfaces of w/p are 90° to each other.</li> <li>9. If yes correct the surface by re-filing.</li> <li>10. Check other adjacent angles as same as the first one.</li> <li>11. Wipe the back square.</li> <li>12. Clean any oil and chips from the work piece.</li> <li>13. Punch the roll no on work piece.</li> <li>14. Oil the surface of the work piece.</li> <li>15. Store the work piece and tools.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Check square ness using back square.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Adjacent sides must be 90° to each other i.e. no light should pass between the blade and the surface.</li> <li>• Work piece should be match with given check list.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of back square.</li> <li>• Features of back square.</li> <li>• Checking back Square before use.</li> <li>• Care of back square.</li> </ul>

**Tools and Equipment:-** Back square, Steel rule, marking scriber, steel hammer, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan, Finishing file

**Materials:** MS Flat, Oil

**Safety:-**

- Ensure that blade and the stock of back square are not damaged and are 90° to each other.
- Clean the w/p and de-burr before checking with back square.
- Hold the stock firmly against the w/p while sliding it down.
- Avoid placing back square where there is chance of falling and damaging.

**Task: 13 Cut metal sheet with snip.**

Time:-5 hrs  
Theory:-1 hr  
Practical:-4 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the work piece drawing.</li> <li>2. Study the drawing thoroughly.</li> <li>3. Obtain the piece of sheet metal as per drawing size.</li> <li>4. Obtain required tools.</li> <li>5. Straighten and de-burr the sheet metal.</li> <li>6. Layout (Measure and mark) the notches and line for cutting.</li> <li>7. Check the layout for accuracy.</li> <li>8. Put the work piece on the table.</li> <li>9. Place the snip on the edge of marking line.</li> <li>10. Cut the metal slowly at beginning and proceeding it for required cutting.</li> <li>11. Straighten and de-burr the sheet metal.</li> <li>12. Check dimension of the complete job.</li> <li>13. Punch the roll no on work piece.</li> <li>14. Oil the surface of the work piece.</li> <li>15. Store the work piece and tools.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Cut metal sheet with snip.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Cutting work piece should be match with given check list.</li> <li>• Tolerances of dimensions are within the <math>\pm 0.5</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Sheet and its types</li> <li>• Size and gauges of sheet metal available in marked.</li> <li>• Importance and use of sheet</li> <li>• Introduction of snips and their types i.e. straight and curve.</li> <li>• Marking and layout.</li> <li>• Hand tools, equipment and machine used in sheet metal works.</li> <li>• Notching</li> <li>• Sheet metal operation</li> </ul>

**Tools and Equipment:-** Steel rule, Snips, Back square, marking scribe, steel hammer, Mallet, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan, Finishing file

**Materials:** GI Sheet, Oil

**Safety:-**

- Place snips and material on bench.
- De-burr the metal sheet edges.
- Avoid carrying scribe in pockets.

**Task: 14 Fold metal sheet**

Time:-3 hrs  
Theory:-0.5 hr  
Practical:-2.5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the work piece drawing.</li> <li>2. Read drawing thoroughly.</li> <li>3. Obtain the metal sheet of required size and required sheet metal tools.</li> <li>4. Straighten and de-burr the sheet metal.</li> <li>5. Layout the pattern.</li> <li>6. Layout the folding lines by marking with marking scriber.</li> <li>7. Check the layout for accuracy.</li> <li>8. Notch and cut the unnecessary part.</li> <li>9. Bend the open folds by mallet and hardies.</li> <li>10. Check dimensions of the completed job.</li> <li>11. Punch the roll no on work piece.</li> <li>12. Oil the surface of the work piece.</li> <li>13. Store the work piece and tools.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Fold metal sheet.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Folding work piece should be match with given check list.</li> <li>• Tolerances of dimensions are within the <math>\pm 0.5</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Hand tools (Hardies) used in folding metal sheets.</li> <li>• Mallet and types.</li> <li>• Folding m/c and application</li> <li>• Pattern</li> </ul>

**Tools and Equipment:-** Steel rule, marking scriber, try square, snips, hardies, steel hammer, Mallet, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan, Finishing file

**Materials:** GI Sheet, Oil

**Safety:-**

- Take care of marked lines; folds must not be collecting together.
- Use only mallet hammer to bend sheet.
- To avoid damage on surface of sheet insert a protecting jaw of aluminum or vice jaw cover.

**Task: 15 Perform riveting joints**

Time:-5 hrs  
Theory:-1 hr  
Practical:-4 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the w/p drawing.</li> <li>2. Study the drawing thoroughly.</li> <li>3. Obtain the required number of sheet metal of required size.</li> <li>4. Obtain required hand tools.</li> <li>5. Straighten and de-burr the sheet metal.</li> <li>6. Layout the sheet metal.</li> <li>7. Cut the sheet metal accordingly if necessary.</li> <li>8. Punch the centre by centre punch where holes are to be drilled.</li> <li>9. Bunch the sheet metal in layer so that the holes to be drilled are aligned on above another.</li> <li>10. Clamp the bunch of sheet metal with c-clamp.</li> <li>11. Drill holes on every centre punched marks.</li> <li>12. Remove and de-burr the pieces individually.</li> <li>13. Place the drilled sheet together for riveting as per drawing.</li> <li>14. Calculate rivet length and select rivet.</li> <li>15. Insert the rivet.</li> <li>16. Insert rivet head set for aligning on the tail of rivet.</li> <li>17. Punch slightly on the rivet head until align.</li> <li>18. Remove the rivet head set.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Perform riveting work.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Riveting work piece should be match with given check list.</li> <li>• Tolerances of dimensions are within the <math>\pm 0.5</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of Rivet and types.</li> <li>• Different riveting joint.</li> <li>• Calculation of reverting length.</li> <li>• Calculation of Rivet hole.</li> <li>• Rivets available in market.</li> <li>• Rivet material</li> <li>• Causes of riveting defects</li> </ul>



<p>19. Strike on the tail of rivet to make mushroom head by ball pin hammer.</p> <p>20. Insert rivet head cap on the tail of rivet.</p> <p>21. Punch the rivet head until the required head forms and the pieces join together.</p> <p>22. Repeat the same steps for next riveting.</p> <p>23. Check dimensions of the completed job.</p> <p>24. Punch the roll no on work piece.</p> <p>25. Oil the surface of the work piece.</p> <p>26. Store the work piece and tools.</p>		
--	--	--

**Tools and Equipment:-** Rivet head set, Ball pin hammer, Steel rule, marking scribe, try square, snips, hardies, steel hammer, Mallet, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan, Finishing file

**Materials:** GI Sheet, Rivet (Aluminum or MS), Oil

**Safety:-**

- Take care of your hand while striking tail of riveting and riveting the head.
- Take care while you bushing out the sheet metal.
- The length of the rivet should be carefully calculated.
- Avoid mushroom head rivet head set.

**Task: 16 Perform soldering**

Time:-5 hrs  
Theory:-1hr  
Practical:-4 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain the w/p drawing.</li> <li>2. Study the drawing thoroughly.</li> <li>3. Obtain the sheet metal as per required size.</li> <li>4. Obtain required tools.</li> <li>5. Heat the soldering iron.</li> <li>6. Clean up the soldering areas with zinc chloride.</li> <li>7. Apply flux in all areas to be soldered.</li> <li>8. Join the areas together and support them.</li> <li>9. Hold soldering lead in one hand and soldering iron in other hand.</li> <li>10. Touch the lead by soldering iron until it melts and apply in the joining areas.</li> <li>11. Use the soldering iron frequently to spread melted lead in all joining areas.</li> <li>12. Repeat spreading lead until it covers and joins the pieces.</li> <li>13. Allow the soldered area to be cool for solid deposition.</li> <li>14. Clean soldered area and tools after completing.</li> <li>15. Check dimensions of the completed job.</li> <li>16. Punch the roll no on work piece.</li> <li>17. Oil the surface of the work piece.</li> <li>18. Store the work piece and tools.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Perform soldering.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Soldering work piece should be match with given check list.</li> <li>• Tolerances of dimensions are within the <math>\pm 0.5</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of soldering joints.</li> <li>• Characteristics of soldering lead.</li> <li>• Soldering method.</li> <li>• Characteristics of soldering flux.</li> <li>• Causes of soldering defects.</li> </ul>

**Tools and Equipment:-** Soldering iron, Soldering iron stand, Steel rule, marking scribe, try square, snips, steel hammer, Mallet, Oil can, Number punch, Bench cleaning brush, File brush, Dust pan, Finishing file

**Materials:** Zinc chloride, soldering lead, flux, Oil

**Safety:-**

- Take care while using zinc chloride.
- Take care while heating the soldering iron.
- Flux should be applied in whole joining areas.
- Avoid overheating of soldering iron.
- Make proper ventilation and well lighted working areas.
- Beware from toxic fumes generated while soldering.
- Use safety goggles.
- Work safety to avoid burn.

**Task: 17 Perform Project work****Bench work** : Steel Hammer 500gm, Center punch, Back square or any**Sheet Metal**: Rectangular Box, Dust pan, Junction box, Adaptor box, Stabilizer box or any

Time:-19 hrs

Theory:-1 hr

Practical:-18 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain project drawing.</li> <li>2. Study the drawing thoroughly.</li> <li>3. Obtain material for project.</li> <li>4. Obtain required tools.</li> <li>5. Perform bench work's tasks for bench work's project.</li> <li>6. Perform sheet metal's tasks for sheet metal's project.</li> <li>7. Clean oil, chips and burr from project and working area.</li> <li>8. Punch the roll no on project.</li> <li>9. Oil the surface of the bench work's project.</li> <li>10. Store the project and tools.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped workshop with set of hand tools in tool box.</li> <li>• Drawing instruction and work piece.</li> </ul> <p><b>Tasks (What):</b> Perform project work.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Project work piece should be match with given check list.</li> <li>• Tolerances of dimensions are within the <math>\pm 0.5</math> mm</li> </ul>	<ul style="list-style-type: none"> <li>• Preparing group for project</li> <li>• Uses of project.</li> <li>• Instruction for Working</li> <li>• Project guide line</li> </ul>

**Tools and Equipment:-** All tool, equipment and machine which are used in above task**Materials:** As per project**Safety:-**

1. Follow safety related bench work task and sheet metal task

2. De-burr the edges of project.
3. Use safety equipment.

**References:**

- Raghuwanshi, B. S., **A Course in Workshop Technology Vol 1**, Dhanpat Rai and Company, India
- Chaudhary, S. K. Hajra, **Workshop Technology (Vol. 1)**, Media promoter and publishers, India
- Henp Fort, **Shop Theory (Vol. 1)**, Trade School
- Chapman, **Workshop Technology (Vol. 1)**,

# Basic Electronics

<b>Total:</b>	<b>6 hrs/wk</b>
<b>Theory:</b>	<b>2 hrs/wk</b>
<b>Practical:</b>	<b>4 hrs/wk</b>

## Course description:

This course is designed to provide knowledge and skills on essential modern components particularly on linear circuits. It is imparted with view that the use of electronics, specially the semiconductors has expanded in recent years has made a strong need of knowledge.

## Course Objectives:

After completion of this course students will be able to:

1. Describe various electronics components such as resistor, inductors, capacitors, diode, transistor, Zener diode, FET, MOSFET, JFET, SCR, DIAC, TRIAC, UJT and **various** ICs interpret their characteristics and applications.
2. Provide **essential practical theory** on transistor amplifier, AF& RF amplifier.
3. Design electronics power supply using diodes, Zener diode **and regulator ics: 78\*\*, 79\*\* series etc.**

## List of Tasks

1. Maintain safe electronics workshop/lab.
2. Familiarize with electronics devices, tools, equipment.
3. Perform first aid treatment.
4. Measure AC mains voltage & secondary voltage.
5. Measure DC voltages at different terminals.
6. Measure DC Current.
7. Measure AC Current.
8. Apply passive components.
9. Familiarize **electronics**.
10. Apply Practical electronics equipment and circuits.
11. Apply different types of Diodes.
12. Draw V-I characteristics curve of rectifier and zener diode.
13. Apply Zener diode as voltage stabilizer.
14. Introduce different power supply circuits and filter **circuits**.
15. Operate Oscilloscope.
16. **Identify** different types of Transistors.
17. Study CB, CE, CC configuration of Bipolar Junction Transistors.
18. **Use** Transistors as a switch.
19. **Apply** AF & RF Amplifiers.
20. **Apply** JFET and MOSFET.
21. Study the characteristics of JFET & MOSFET.
22. Identify Power Diode, Power Transistor, SCR, DIAC, TRIAC and UJT.
23. Study the characteristics of SCR, DIAC and TRIAC.
24. Introduce oscillator & operational amplifiers.
25. Introduce **741 and 555** ICs.

## Task Analysis

### Task: 1 Maintain safe electronics workshop/lab

Total: 8 hrs  
Theory: 2 hrs  
Practical: 6 hrs

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Install necessary equipment and maintain appropriate (25-30) degree temperature.</li> <li>2. Manage dust free workshop.</li> <li>3. Apply insulated tools to work with voltage and current.</li> <li>4. Install two pin, three pin sockets to each table.</li> <li>5. Install TV coaxial cable to each room.</li> <li>6. Apply cable splitter to get individual terminals.</li> <li>7. Place soldering iron stand to each table.</li> <li>8. Install drawer in each table to store tools.</li> <li>9. Install fire extinguisher.</li> <li>10. Place flexible table lamp</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Physical Facilities</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Establish safe Electronics Workshop/Lab</li> </ul> <p><b>Standard (How Well):</b></p> <ul style="list-style-type: none"> <li>• Maintain dust free workshop</li> <li>• Installed sockets to proper location.</li> <li>• Installed TV coaxial cable.</li> <li>• Adequate illumination.</li> <li>• Maintained appropriate room temperature.</li> </ul>	<p><b>Safety materials</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Use</li> <li>• Importance</li> </ul> <p style="color: red;">Safety precautions and first aid fundamentals</p> <p>Coaxial cable</p> <p>Temperature</p> <p>Tools and equipment used in lab</p> <p>Operational manual of fire extinguisher</p> <p style="color: red;">Know how to use fire extinguisher and alarm system.</p>

**Tools and Materials:-**  
**Safety:-**

**Task: 2 Familiarize electronic devices, tools, equipment**

**Total: 8 hrs**  
**Theory: 2hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Maintain appropriate temperature (25-30 degree) in electronics devices.</li> <li>2. Avoid High tension line near to the electronics devices.</li> <li>3. Maintain dust free store of electronics devices.</li> <li>4. Apply tool box to store electronics tools and equipment.</li> <li>5. Remove battery from electronics equipment to store it long time.</li> <li>6. <b>Keep room humidity properly.</b></li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• An electronic store room.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Store electronics devices, tools, equipment.</li> </ul> <p><b>Standard (How Well):</b></p> <ul style="list-style-type: none"> <li>• Dust free store room maintained.</li> <li>• Maintained in electronics devices.</li> <li>• Battery removed from electronics equipment before storing it for long time.</li> <li>• Tool box used for storing tools and equipment.</li> </ul>	<p><b>Concept of</b></p> <ul style="list-style-type: none"> <li>• HT (High Tension Line)</li> <li>• Tool Box</li> <li>• Battery and its types.</li> <li>• <b>Use of battery chemicals.</b></li> </ul>

**Tools and Materials:-**

**Safety:-**



**Task: 3 Perform first aid treatment**

**Total: 9 hrs**  
**Theory: 3 hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect first aid materials.</li> <li>2. Use first aid box to store first aid materials.</li> <li>3. Avoid first aid box from direct sun light.</li> <li>4. Place the first aid box to eye sight and within reach location.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• First Aid Box.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Perform first aid treatment.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Place/keep First Aid Box at eye sight and within reach location.</li> <li>• Avoid First Aid Box from direct sun lights.</li> </ul>	<p>➤ <b>First Aid.</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Importance</li> <li>• Uses</li> <li>• First Aid Materials</li> </ul> <ul style="list-style-type: none"> <li>➤ Drugs</li> <li>➤ Tapes</li> <li>➤ Bandages</li> </ul> <ul style="list-style-type: none"> <li>• Procedure</li> <li>• First Aid Treatment</li> <li>• Hazards</li> </ul> <p>➤ <b>Wound/ Cut</b></p> <p>➤ <b>Fracture/ Sprain</b></p> <p>➤ <b>Burn</b></p> <p>➤ <b>Temperature</b></p>

**Tools and Materials:-**

**Safety:-**

**Task: 4 Measure AC mains voltage & secondary voltage**

**Total: 9 hrs  
Theory: 3 hrs  
Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect multi meter.</li> <li>2. Plug in AC mains cord of the set to AC main socket.</li> <li>3. Select the AC voltage range in the voltmeter/multi meter in maximum range.</li> <li>4. Connect the AC voltmeter parallel to the AC mains voltage,</li> <li>5. Connect the AC volt meter parallel to the secondary coil of the main transformer.</li> <li>6. Measure AC mains voltage &amp; secondary voltage.</li> <li>7. Compare the reading with circuit diagram.</li> <li>8. Record measure voltage.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• AC main socket with supply.</li> <li>• Transformer</li> <li>• Multi meter</li> <li>• Circuit diagram</li> <li>• Log book</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Measure AC mains voltage &amp; secondary voltage.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Safety rules for voltage measurement strictly followed.</li> <li>• Select maximum voltage range while measuring the AC mains voltage &amp; secondary voltage at secondary of mains transformer measured.</li> <li>• Condition of transformer identified and recorded safely.</li> </ul>	<ul style="list-style-type: none"> <li>• Explanation of the circuit diagram and working principle of the power supply.</li> <li>• Use Multimeter</li> <li>• Define AC voltage.</li> <li>• Define transformer.</li> <li>• Use of transformer</li> <li>• Advantages.</li> <li>• Importance.</li> </ul>

**Tools and Materials:-**

**Safety:-**

- Check the input voltage selector range of the equipment.
- Voltmeter probes correctly connected across the terminals.
- Check the insulation of the meter probes.
- Use only one hand while connecting meter probes in to the main source.
- Stand on insulation while connecting meter probes in to the main source.

**Task: 5 Measure DC voltages at output of the power supply**

**Total: 9 hrs**  
**Theory: 3 hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect multi meter.</li> <li>2. Insert battery; switch on power on off switch.</li> <li>3. Insert AC mains cord of the DC power supply in to the AC socket.</li> <li>4. Select the DC voltmeter range to correct range and in correct polarity at the DC output terminals.</li> <li>5. Measure the Dc voltage.</li> <li>6. Compare reading with circuit diagram.</li> <li>7. Note and recorded any abnormal reading at the output.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Battery pack.</li> <li>• AC mains socket.</li> <li>• Multi meter with suitable DC volt/<b>current</b> range.</li> <li>• Log book</li> <li>• DC power supply</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Measure DC voltage at the output of the power supply.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Meter range in Dc volt selected correctly</li> <li>• Meter probes correctly connected.</li> <li>• Any abnormal DC voltage at the output identified and recorded.</li> </ul>	<ul style="list-style-type: none"> <li>• Explanation of the circuit diagram and working principle of the power supply.</li> <li>• Define DC voltage/<b>current</b>.</li> <li>• Advantages.</li> <li>• Importance.</li> </ul>

**Tools and Materials:-**

**Safety:-**

- Check the input voltage selector range of the equipment.
- Voltmeter probes correctly connected across the terminals.
- Check the insulation of the meter probes.
- Stand on insulation not while connecting meter probes in to the main source.

**Task: 6 Measure DC Current**

**Total: 6 hrs**  
**Theory: 2 hrs**  
**Practical: 4 hrs**

<b>Steps</b>	<b>Terminal Performance Objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Collect multi meter.</li> <li>2. Select the correct DC current range.</li> <li>3. Select correct polarity at the DC current output terminals.</li> <li>4. Measure the DC current by connecting ammeter in series with source and load.</li> <li>5. Compare the reading with theoretical value.</li> <li>6. Note and record any abnormal reading at the output terminals.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Battery pack.</li> <li>• AC mains socket.</li> <li>• Multi meter with suitable DC current range.</li> <li>• Log book</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Measure DC current.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Meter range in DC current selected correctly</li> <li>• Meter probes correctly connected.</li> <li>• Any abnormal DC current at the output identified and recorded.</li> </ul>	<ul style="list-style-type: none"> <li>• Explanation of the circuit diagram.</li> <li>• Operating Principle.</li> <li>• Define DC Current.</li> <li>• Use of DC Current.</li> <li>• Advantages.</li> <li>• Introduction and use of ammeter.</li> </ul>

**Tools and Materials:-****Safety:-**

- Check the input Current.
- Select range of the equipment

**Task: 7 Measure AC Current.****Total: 6 hrs****Theory: 2 hrs****Practical: 4 hrs**

<b>Steps</b>	<b>Terminal Performance Objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Collect multi meter/ampere meter.</li> <li>2. Plug in AC mains cord of the set to AC main socket.</li> <li>3. Select the AC current range in the ampere meter.</li> <li>4. Connect the AC ampere meter series to the AC mains source.</li> <li>5. Measure AC current by connecting Ammeter in series with load and source.</li> <li>6. Compare the reading with circuit diagram.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• AC mains socket.</li> <li>• Ampere meter.</li> <li>• Load</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Measure AC current</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Meter range in AC current selected correctly.</li> <li>• Meter probes correctly connected safely.</li> </ul>	<ul style="list-style-type: none"> <li>• Define AC Current.</li> <li>• Advantages.</li> <li>• Importance.</li> </ul>

**Tools and Materials:-****Safety:-**

- Safety precautions related to handling the AC main current strictly followed.

**Task: 8 Apply** passive components.

**Total: 16 hrs**

**Theory: 6 hrs**

**Practical: 10 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect passive components.</li> <li>2. Identify resistors.</li> <li>3. Identify capacitors.</li> <li>4. Identify inductors.</li> <li>5. Calculate the resistance value using color code.</li> <li>6. Test passive components.</li> <li>7. List the types of resistors, capacitors &amp; inductors.</li> <li>8. Connect passive components in series &amp; parallel.</li> </ol>	<p><b>Condition (Given):</b> Workshop, components, multi meter.</p> <p><b>Tasks (What):</b> Use passive components.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Identified passive component and tested.</li> <li>• Found values of passive components.</li> <li>• Connected in series &amp; parallel.</li> </ul>	<p><b>Resistors</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Color codes &amp; value markings.</li> <li>• Series, parallel connections.</li> <li>• Equivalent values.</li> </ul> <p><b>Inductors</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Color codes &amp; value markings.</li> <li>• Series, parallel connections.</li> <li>• Equivalent values.</li> </ul> <p><b>Capacitors</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Color codes &amp; value markings.</li> <li>• Series, parallel connections.</li> <li>• Equivalent values.</li> </ul> <p><b>Parameters of R,C</b></p> <ul style="list-style-type: none"> <li>• Working voltage &amp; leakage current.</li> <li>• Tolerance, stability factor and power rating.</li> </ul>

**Tools and Materials:-Multi meter, Passive Components.**

**Safety:-**

**Task: 9 Familiarize with electronics**

**Total: 6 hrs**  
**Theory: 2 hrs**  
**Practical: 4 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Define electronics.</li> <li>2. Define electronics components, circuits and system.</li> <li>3. Differentiate linear and digital circuits.</li> </ol>	<p><b>Condition (Given):</b> Clearly stated problem/question.</p> <p><b>Tasks (What):</b> Familiarize with electronics.</p> <p><b>Standard (How well):</b> Learners should be able to</p> <ul style="list-style-type: none"> <li>• Define electronics, electronic components, circuit and systems.</li> <li>• Distinguish between linear and digital circuits.</li> </ul>	<ol style="list-style-type: none"> <li>1. Definition <ul style="list-style-type: none"> <li>• Electronics</li> <li>• Electronics Components</li> <li>• Circuits systems</li> <li>• Linear &amp; digital Circuits.</li> </ul> </li> <li>2. Distinguish between linear &amp; digital circuits.</li> <li>3. Applications of electronics in modern technology.</li> </ol>

**Tools and Materials:-**  
**Safety:-**





**Task: 10 Apply practical electronics equipment and circuits. Total: 9 hrs**  
**Theory: 3 hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Identify basic test equipment (Ammeter, Voltmeter, Ohm meter)</li> <li>2. Identify multimeter.</li> <li>3. Locate selector switch of multi-meter.</li> <li>4. Measure AC, DC values of current &amp; voltage using multi-meter.</li> <li>5. Measure resistance.</li> <li>6. Distinguish conductor &amp; insulator using multi-meter.</li> <li>7. Identify closed &amp; open circuit using multi-meter.</li> <li>8. Identify oscilloscope.</li> <li>9. Use soldering.</li> <li>10. Verify Ohm's law, Kirchhoff's law.</li> <li>11. Draw practical circuits.</li> </ol>	<p><b>Condition (Given):</b>  Workshop, multi-meter, operation manuals and electronics components</p> <p><b>Tasks (What):</b>  Use practical electronic equipment &amp; circuits.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Identified test equipment.</li> <li>• Performed ohm's &amp; Kirchhoff's law.</li> <li>• Draw simple practical circuits. (voltage divider, current divider)</li> </ul>	<ol style="list-style-type: none"> <li>1. Test Equipment <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Operation manual</li> </ul> </li> <li>2. Oscilloscope &amp; soldering iron, de-soldering pump <ul style="list-style-type: none"> <li>• Definition</li> <li>• Working Principle</li> <li>• Applications</li> <li>• Operation manual.</li> </ul> </li> <li>3. Ohm's law &amp; Kirchhoff's law <ul style="list-style-type: none"> <li>• Statements.</li> <li>• Demonstration circuits.</li> <li>• Applications.</li> </ul> </li> <li>4. Voltage divider circuit</li> <li>5. Current divider circuit.</li> </ol>

**Tools and Materials:-**

Multi meter, Oscilloscope, Soldering iron, power supply connecting leads, De-soldering Pump.

**Safety:-**

**Task: 11 Apply different types of Diodes.**

**Total: 10 hrs**  
**Theory: 4 hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. List semiconductors (Si, Ge) from conductors, insulators &amp; semiconductors.</li> <li>2. Identify PN junction diodes.</li> <li>3. Demonstrate unbiased, forward biased and reverse biased PN junctions.</li> <li>4. Perform rectification using diodes. (Rectifier).</li> <li>5. Perform voltage regulator using zener diode.</li> <li>6. Feel capacitive effect using varactor diode.</li> <li>7. Find out characteristics of diodes.</li> <li>8. Test diodes.</li> </ol>	<p><b>Condition (Given):</b> Workshop, multi-meter.</p> <p><b>Tasks (What):</b> Use different types of diodes.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Listed semiconductors.</li> <li>• Demonstrated unbiased, FB, RB.</li> <li>• Performed rectification.</li> <li>• Made regulated power supply circuits.</li> <li>• Tested diodes.</li> <li>• Found characteristics.</li> </ul>	<ol style="list-style-type: none"> <li>1. Semiconductors <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Define extrinsic &amp; intrinsic semiconductor</li> <li>• Define N-type &amp; P-type semiconductors.</li> </ul> </li> <li>2. PN Junction</li> <li>3. Biasing of PN Junction.</li> <li>4. Operation Symbol &amp; characteristics of <ul style="list-style-type: none"> <li>• Rectifier Diode</li> <li>• Zener Diode</li> <li>• Point Contact Diode</li> <li>• LED</li> <li>• Varactor Diode</li> <li>• Photo Diode</li> </ul> </li> <li>5. Application of above mention diodes.</li> </ol>

**Tools and Materials:-** Multi meter, Diodes, Power Supply (DC & AC)

**Safety:-**

**Task: 12 Draw V-I characteristics curve of rectifier and zener diode.**

**Total: 8 hrs  
Theory: 2 hrs  
Practical: 6 hrs**

<b>Steps</b>	<b>Terminal Performance Objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. List semiconductors (Si, Ge) from conductors, insulators &amp; semiconductors.</li> <li>2. Identify PN junction diodes.</li> <li>3. Demonstrate unbiased, forward biased and reverse biased PN junctions.</li> <li>4. Perform rectification using diodes. (Rectifier).</li> <li>5. Find out characteristics of rectifier and zener diodes.</li> <li>6. Test diodes.</li> </ol>	<p><b>Condition (Given):</b> Workshop, multi-meter, rectifier, zener diode, Bread Board, Jumper wires</p> <p><b>Tasks (What):</b> Draw V-I characteristics curve of rectifier and zener diode.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Listed semiconductors.</li> <li>• Demonstrated unbiased, FB, RB.</li> <li>• Performed V-I characteristics.</li> <li>• Tested diodes.</li> <li>• Found characteristics.</li> </ul>	<ol style="list-style-type: none"> <li>1. PN Junction</li> <li>2. Biasing of PN Junction.</li> <li>3. V- I Characteristics of rectifier and zener diode</li> <li>4. Application of rectifier Diode</li> <li>5. Application of zener diode</li> </ol>

**Tools and Materials:-Multi meter, Diodes, Power Supply (DC)  
Safety:-**

**Task: 13 Apply Zener diode as voltage regulator.**

**Total: 8 hrs**

**Theory: 2 hrs**

**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. List semiconductors (Si, Ge) from conductors, insulators &amp; semiconductors.</li> <li>2. Identify PN junction diodes.</li> <li>3. Perform voltage stabilizer using zener diode.</li> <li>4. Find out characteristics of Zener diodes.</li> <li>5. Test diodes.</li> </ol>	<p><b>Condition (Given):</b> Workshop, multi-meter. Zener Diode, Resistor, Bread Board, Jumper wires, variable resistor</p> <p><b>Tasks (What):</b> Apply Zener Diode as Voltage regulator.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Listed semiconductors.</li> <li>• Made regulator circuits.</li> <li>• Tested diodes.</li> <li>• Found characteristics.</li> </ul>	<ul style="list-style-type: none"> <li>• Operation Symbol &amp; voltage regulator of Zener Diode.</li> <li>• Operating principle of voltage regulator.</li> <li>• Application of Zener diodes as DCV regulator.</li> </ul>

**Tools and Materials:-** Multi meter, Diodes, Power Supply (DC), Resistor

**Safety:-**

**Task: 14 Introduce different power supply circuits and filter circuits.**

**Total: 14 hrs**  
**Theory: 4 hrs.**  
**Practical: 10 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
1. Demonstrate rectifier circuits. a. Half Wave Rectifier with wave form b. Full Wave Rectifier with wave form c. Full Wave Bridge Rectifier with wave form 2. Build smoothing circuits. 3. Build <b>regulating</b> circuits. 4. Build Power supply circuits. 5. Apply filter circuits.	<b>Condition (Given):</b> Simulated lab, multi-meter.  <b>Tasks (What):</b> Introduce different power supply circuits & filters.  <b>Standard (How well):</b> <ul style="list-style-type: none"> <li>• Rectified AC in to DC.</li> <li>• Build smoothing Circuits.</li> <li>• Build stabilizing circuits.</li> <li>• Build Power supply circuits.</li> <li>• Applied filter circuits.</li> </ul>	1. Rectifier <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types (HW,FW, FW Bridge)</li> <li>• Applications</li> </ul> 2. Working principle of <ul style="list-style-type: none"> <li>• Smoothing circuits</li> <li>• Stabilizing Circuits</li> <li>• Power supply circuits</li> </ul> 3. Filters <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types (High pass, Low pass, Band pass, Band stop)</li> <li>• Applications</li> <li>• <b>Regulator ICs</b></li> </ul>

**Tools and Materials:** - Multi meter, Diodes, Power Supply transformer, passive components, connecting leads, **regulator ICs.**

**Safety:-**

**Task: 15 Operate Oscilloscope**

**Total: 7 hrs**  
**Theory: 2 hrs**  
**Practical: 5 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain operating/user's manual.</li> <li>2. Study operating /user's manual.</li> <li>3. Turn on power switch of Oscilloscope/pattern generator.</li> <li>4. Select proper functional button for operation of Oscilloscope.</li> <li>5. Select desired range of Volt/division and time/division by the selector switch.</li> <li>6. Select desired channel by selector switch.</li> <li>7. Create reference line on screen by pushing ground button.</li> <li>8. Check the desired frequency using probes.</li> <li>9. Check the performance of various operations.</li> <li>10. Read just output performance of Oscilloscope as per requirement.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Oscilloscope with probe</li> <li>• Signal generator</li> <li>• Operational manual</li> <li>• Pattern generator</li> </ul> <p><b>Tasks (What):</b></p> <p style="text-align: center;">Operate Oscilloscope</p> <p><b>Standard(How Well)</b></p> <ul style="list-style-type: none"> <li>• Desired frequency checked and recorded correctly using Oscilloscope's probe.</li> <li>• Oscilloscope operated with correct procedures or as instructed in manual and signal output displayed accurately with correct frequency.</li> </ul>	<p><b>Oscilloscope</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operating Procedure</li> <li>• Tuning</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety Precautions</li> </ul> <p><b>Pattern Generator</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operating Procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety Precautions</li> </ul>

**Tools and Materials:-**

**Safety:-**

**Task: 16 Identify** different types of Transistors

**Total: 10 hrs**  
**Theory: 4 hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. <b>Collect bipolar</b> junction transistors(NPN or PNP)</li> <li>2. Test transistors <b>for their types and identification of leads.</b></li> <li>3. Apply Data Book.</li> <li>4. <b>Collect</b> Field effect Transistor.</li> <li>5. <b>Test field effect trans</b></li> <li>6. Bias <b>BJT and FET.</b></li> </ol>	<p><b>Condition (Given):</b> Workshop, multi-meter.</p> <p><b>Tasks (What):</b> Use different types of transistors.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Identified NPN, PNP.</li> <li>• Tested junction and FET transistor.</li> <li>• Biased transistors.</li> </ul>	<ol style="list-style-type: none"> <li>1. <b>Bipolar</b> junction transistor <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operation</li> <li>• Types (NPN, PNP )</li> <li>• Biasing</li> <li>• As an amplifier</li> <li>• Applications</li> </ul> </li> <li>2. Field Effect Transistors. <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operation</li> <li>• Types: <b>JFET, MOSFET</b></li> <li>• Biasing</li> <li>• As an amplifier</li> <li>• Applications</li> </ul> </li> <li>3. Comparison between junction &amp; FET transistors.</li> </ol>

**Tools and Materials:-** Multi meter, Transistors, Data Book

**Safety:-**

**Task: 17 Study CB, CE, CC configuration of Bipolar Junction Transistors**

**Total: 14 hrs**

**Theory: 4 hrs**

**Practical: 10 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. <b>Collect BJT.</b></li> <li>2. Identify bipolar junction transistors (NPN or PNP)</li> <li>3. Test transistors.</li> <li>4. Apply Data Book.</li> <li>5. Connect junction transistor.</li> <li>6. Connect &amp; check different configuration (CB, CE, and CC).</li> </ol>	<p><b>Condition (Given):</b> Workshop, multi-meter.</p> <p><b>Tasks (What):</b>  Study CB, CE, CC configuration of bipolar transistor.</p> <p><b>Standard (How Well):</b></p> <ul style="list-style-type: none"> <li>• <b>Measured DCV terminals demonstrate the proper amplification.</b></li> </ul>	<p><b>Bipolar Junction transistor</b></p> <ul style="list-style-type: none"> <li>• Characteristics of (CB, CE, CC) in bipolar transistors.</li> <li>• Applications of <b>them.</b></li> <li>• <b>Voltage gain, Current gain and dc biasing of the amplifiers.</b></li> </ul>

**Tools and Materials:-Multi meter, Transistors, Data Book**

**Safety:-**



**Task: 18. Use Transistors as switch**

**Total: 8 hrs**  
**Theory: 2 hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Identify bipolar junction transistors (NPN or PNP)</li> <li>2. Test transistors.</li> <li>3. Apply Data Book.</li> <li>4. Connect junction transistor.</li> <li>5. <b>Wire inverter amplifier circuit using BJT.</b></li> </ol>	<p><b>Condition (Given):</b>                      Workshop, multi-meter, variable regulated power supply</p> <p><b>Tasks (What):</b>  <b>Use</b> Transistors as a switch.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Identified NPN, PNP transistor.</li> <li>• Check the transistors as a switch.</li> </ul>	<p><b>Bipolar Junction transistor</b></p> <ul style="list-style-type: none"> <li>• Transistor as a switch.</li> <li>• Applications</li> </ul>

**Tools and Materials:-** Multi meter, Transistors, Data Book, Bread Board, Jumpers wire, Power supply.

**Safety:-**

**Task: 19 Apply AF & RF Amplifiers.**

**Total: 10 hrs**  
**Theory: 4 hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Build simple voltage amplifier using junction transistor.</li> <li>2. Build voltage amplifier using FET.</li> <li>3. Develop power matching circuits.</li> <li>4. Make two stages amplifiers.</li> <li>5. Couple amplifiers using passive components.</li> <li>6. Build radio frequency amplifiers (single &amp; Double tuned)</li> <li>7. Developed tuned circuit (Series &amp; Parallel resonance)</li> </ol>	<p><b>Condition (Given):</b>                      Simulated lab.</p> <p><b>Tasks (What):</b>                      Use AF &amp; RF amplifiers</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Built voltage amplifier using junction &amp; FET transistors.</li> <li>• Coupled amplifiers.</li> <li>• Made two stage amplifiers.</li> <li>• Built RF amplifiers.</li> <li>• Developed tuned circuit.</li> </ul>	<ol style="list-style-type: none"> <li>1. Definition of amplifier.</li> <li>2. Types of AF amplifier.                             <ul style="list-style-type: none"> <li>• Current amplifier</li> <li>• Voltage amplifier</li> <li>• Power amplifier</li> </ul> </li> <li>3. Operation &amp; working of voltage amplifier.                             <ul style="list-style-type: none"> <li>• Definition</li> <li>• Single &amp; double tuned.</li> </ul> </li> <li>4. Tuned circuit                             <ul style="list-style-type: none"> <li>• Series &amp; parallel resonance.</li> </ul> </li> <li>5. The decibel scale.</li> </ol>

**Tools and Materials:-** Multi meter, Transistors, passive components, trainer kit for tuned circuit, trainer for Signal amplifier.

**Safety:-**

**Task: 20 Apply JFET and MOSFET****Total: 7 hrs****Theory: 3 hrs****Practical: 4 hrs**

<b>Steps</b>	<b>Terminal Performance Objectives</b>	<b>Related Technical Knowledge</b>
1. Collect multimeter. 2. Identify JFET & MOSFET. 3. Test JFET & MOSFET. 4. Apply Data Book.	<b>Condition (Given):</b> Workshop, multi-meter.  <b>Tasks (What):</b> Identify JFET & MOSFET  <b>Standard (How well):</b> <ul style="list-style-type: none"> <li>• Identified JFET &amp; MOSFET</li> <li>• Tested JFET and MOSFET</li> </ul>	<b>1. JFET</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operation</li> <li>• Types</li> <li>• Advantages</li> <li>• Applications</li> </ul> <b>2. MOSFET</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operation</li> <li>• Types</li> <li>• Advantages</li> <li>• Applications</li> </ul> <b>3. Comparison between JFET &amp; MOSFET.</b>

**Tools and Materials:-** Multi meter, JFET, MOSFET, Data Book**Safety:-**

**Task: 21 Study the characteristics of JFET & MOSFET**

**Total: 10 hrs**  
**Theory: 4hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect multimeter.</li> <li>2. Test JFET &amp; MOSFET.</li> <li>3. Apply Data Book.</li> <li>4. Identify JFET &amp; MOSFET.</li> <li>5. Bias JFET and MOSFET.</li> <li>6. Characteristics of JFET &amp; MOSFET.</li> </ol>	<p><b>Condition (Given):</b> Workshop, multi-meter.</p> <p><b>Tasks (What):</b> Study the characteristics of JFET &amp; MOSFET.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Biased FET &amp; MOSFET.</li> <li>• Characteristics of JFET &amp; MOSFET.</li> </ul>	<ol style="list-style-type: none"> <li>1. <b>JFET</b> <ul style="list-style-type: none"> <li>• Characteristics of JFET</li> <li>• Effect of gate to source voltage on drain characteristics.</li> <li>• Transfer characteristics.</li> </ul> </li> <li>2. <b>MOSFET</b> <ul style="list-style-type: none"> <li>• Characteristics of MOSFET.</li> <li>• Gain characteristics of Depletion Type MOSFET.</li> <li>• Transfer characteristics of Depletion type MOSFET.</li> <li>• Drain characteristics of Enhancement type MOSFET.</li> <li>• Transfer characteristics of Enhancement type MOSFET.</li> </ul> </li> </ol>

**Tools and Materials:-** Multi meter, JFET, MOSFET, Data Book  
**Safety:-**

**Task: 22 Identify Power Diode, Power Transistor, SCR, DIAC, TRIAC and UJT.**

**Total: 11 hrs**  
**Theory: 5 hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Identify Power Diode.</li> <li>2. Identify Power Transistor.</li> <li>3. Identify SCR.</li> <li>4. Identify DIAC.</li> <li>5. Identify TRIAC.</li> <li>6. Identify UJT.</li> <li>7. Test Power Diode, Power transistor, SCR, DIAC, TRIAC &amp; UJT.</li> <li>8. Apply Data Book.</li> </ol>	<p><b>Condition (Given):</b> Workshop, multi-meter.</p> <p><b>Tasks (What):</b> Use power diode, power transistor, SCR, DIAC, TRIAC and UJT</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Identified Power diode, power transistor, SCR, DIAC, TRIAC &amp; UJT.</li> <li>• Tested Power diode, power transistor, SCR, DIAC, TRIAC and UJT</li> </ul>	<ol style="list-style-type: none"> <li><b>1. Power Diode</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operation</li> <li>• Types</li> <li>• Advantages</li> <li>• Applications</li> </ul> </li> <li><b>2. Power Transistor &amp; SCR</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operation</li> <li>• Types</li> <li>• Advantages</li> <li>• Applications</li> </ul> </li> <li><b>3. DIAC &amp; TRIAC</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operation</li> <li>• Types</li> <li>• Advantages</li> <li>• Applications</li> </ul> </li> <li><b>4. UJT</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operation</li> <li>• Types</li> <li>• Advantages</li> <li>• Applications</li> </ul> </li> </ol>

**Tools and Materials:-** Multi meter, Power diode, power transistor, SCR, DIAC, TRIAC, UJT, Data Book

**Safety:-**

**Task: 23 Study the characteristics of SCR, DIAC and TRIAC**

**Total: 14 hrs**  
**Theory: 4 hrs**  
**Practical: 10 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect multimeter.</li> <li>2. Test SCR, DIAC &amp; TRIAC.</li> <li>3. Apply Data Book to identify SCR, DIAC &amp; TRIAC.</li> <li>4. <b>Wire circuits using SCR, DIAC and TRIAC.</b></li> <li>5. <b>Note</b> Characteristics of SCR, DIAC &amp; TRIAC.</li> </ol>	<p><b>Condition (Given):</b> Workshop, multi-meter.</p> <p><b>Tasks (What):</b> Study the characteristics of SCR, DIAC &amp; TRIAC.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Identified SCR, DIAC, &amp; TRIAC.</li> <li>• Tested SCR, DIAC, &amp; TRIAC.</li> <li>• Identified the characteristics of SCR, DIAC &amp; TRIAC.</li> </ul>	<ol style="list-style-type: none"> <li>1. <b>SCR</b> <ul style="list-style-type: none"> <li>• V-I Characteristics of SCR.</li> <li>• Turn On characteristics of SCR.</li> <li>• Turn Off characteristics of SCR.</li> </ul> </li> <li>2. <b>DIAC</b> <ul style="list-style-type: none"> <li>• V-I Characteristics of DIAC.</li> </ul> </li> <li>3. <b>TRIAC</b> <ul style="list-style-type: none"> <li>• V-I characteristics of TRIAC.</li> <li>• Operating mode of TRIAC.</li> </ul> </li> </ol>

**Tools and Materials:-** Multi meter, SCR, DIAC, TRIAC, Data Book

**Safety:-**

**Task: 24 Introduce oscillator & operational amplifiers.**

**Total: 10 hrs**  
**Theory: 4 hrs**  
**Practical: 6 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. <b>Know</b> operating frequency of oscillator.</li> <li>2. Operate UJT blocking oscillator.</li> <li>3. Explain characteristics of operational amplifier.</li> <li>4. Explain following operational amplifier circuits.               <ol style="list-style-type: none"> <li>a. Summing amplifier</li> <li>b. Non-inverting/<b>inverting amplifiers.</b></li> <li>c. OP-AMP circuits using single power supply.</li> <li>d. Voltage comparator.</li> </ol> </li> <li>5. <b>Wire Hartley, Colpitt and square wave oscillator using OP-AMP</b></li> </ol>	<p><b>Condition (Given):</b>            Simulated lab with trainer kits.</p> <p><b>Tasks (What):</b>            Introduce Oscillator &amp; Operational amplifiers.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Found operating frequency of oscillators.</li> <li>• Operated UJT blocking oscillator.</li> <li>• Explained characteristics of operational amplifier.</li> </ul>	<ol style="list-style-type: none"> <li>1. <b>Oscillator</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• What does do it?</li> <li>• Operating frequency</li> <li>• Types with working principle.</li> <li>• RF oscillator</li> <li>• LC oscillator</li> <li>• Hartley oscillator</li> <li>• Colpitts oscillator</li> <li>• Crystal Oscillator</li> </ul> </li> <li>2. <b>OP-Amps.</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• What does it do?</li> <li>• Characteristics.</li> </ul> </li> <li>3. <b>Circuit diagram &amp; mathematical equation of</b> <ul style="list-style-type: none"> <li>• Summing amplifier</li> <li>• <b>Inverting/Non-inverting amplifier</b></li> <li>• Op-amp <b>circuit</b> with single power supply.</li> <li>• Voltage comparator</li> </ul> </li> </ol>

**Tools and Materials:-** Trainer kit, UJT blocking oscillator, Oscilloscope

**Safety:-**

**Task: 25 Understand ICs.**

**Total: 7 hrs**  
**Theory: 2 hrs**  
**Practical: 5 hrs**

Steps	Terminal Performance Objectives	Related Technical Knowledge
1. Collect ICs Tester. 2. Identify ICs. 3. Test ICs. 4. Apply Data Book.	<p><b>Condition (Given):</b>            Simulated lab with ICs.</p> <p><b>Tasks (What):</b>            Introduce ICs.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Identify ICs.</li> <li>• Test different ICs.</li> </ul>	<p><b>ICs</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• What does do it?</li> <li>• Types</li> <li>• Working principle.</li> <li>• Advantages.</li> <li>• Applications.</li> <li>• Importance.</li> </ul>

**Tools and Materials:-** ICs Tester, ICs, Data Book

**Safety:-**

**References:**

- V.K. Metha, Electronics Principles, Khanna publishers
- J. B. Gupta, Basic Electronics Principle
- हरि बहादुर पौडेल, (टाई जी), सरल बेसिक इलेक्ट्रॉनिक्स



# Digital Electronics

**Total: 4 hrs /wk**  
**Theory: 1 hr/wk**  
**Practical: 3 hrs/wk**

## Course Description:

This course deals with the principles and applications of digital electronics. This course imparts knowledge and skills on number system, basic gates, logic circuits, Boolean algebra, combinational circuits and sequential circuits.

## Course Objectives:

After the completion of this course students will be able to:

1. Represent numerical values in various number systems and perform number conversions between different number systems.
2. Provide the knowledge of:
  - a. Operation of logic gates (AND, OR, NOT, NAND, NOR, XOR and XNOR).
  - b. Boolean algebra including algebraic simplification, and application of De Morgan's theorems
3. Impart the knowledge of operation of basic types of flip-flops, decoders, encoders, multiplexers, and de-multiplexers, counter
4. Analyze and design digital combinational circuits including arithmetic circuits (half adder and full adder).

## List of Tasks

1. Verify Decimal to Binary Number System Conversion.
2. Verify truth table of OR, AND & NOT gates.
3. Verify truth table of NOR and NAND gate.
4. Verify universal property of NOR and NAND gates.
5. Verify truth table of Exclusive OR and Exclusive NOR gates
6. Verify truth table of half and full adder
7. Verify truth table of half and full subtractor
8. Verify Boolean Algebra
9. Verify the rules of Boolean Algebra
10. Verify simplification of logic expressions using Boolean algebra.
11. Verify De Morgan's Theorems.
12. Verify truth table of encoder/decoder.
13. Verify truth table of multiplexer and de-multiplexer.
14. Verify basic comparator.
15. Verify the flip flops
16. Verify Seven Segment display decoder
17. Verify truth table of counter.

**Task: 1 Verify Decimal to Binary Number System Conversion.**

Time:- 6 hrs  
Theory:- 2 hrs  
Practical:- 4 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required components.</li> <li>2. Connect the trainer kit to ac main supply.</li> <li>3. Connect the circuit as per diagram.</li> <li>4. Turn on the power supply</li> <li>5. Set inputs 0 to 9 respectively.</li> <li>6. Observe the corresponding outputs.</li> <li>7. Turn off the power supply.</li> <li>8. Disconnect the components.</li> <li>9. Store the components safely.</li> </ol>	<p><b>Condition (Given)</b> Given a digital IC trainer kit set and jumpers/jack</p> <p><b>Tasks (What):</b> Verify Decimal to Binary Number System Conversion.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Circuit must be connected securely and correctly as per given diagram.</li> <li>• Verified converted output must be according to Truth Table.</li> </ul>	<p><b>Number system</b></p> <ul style="list-style-type: none"> <li>• Explanation of number systems.</li> <li>• Types: <ul style="list-style-type: none"> <li>▪ Binary.</li> <li>▪ Decimal.</li> <li>▪ Octal.</li> <li>▪ Hexadecimal.</li> </ul> </li> <li>• Method of decimal to binary number system conversion.</li> <li>• Introduction to digital trainer kit.</li> <li>• Truth table.</li> </ul>

**Tools and Materials: -**

1. Digital IC trainer kit.
2. AC Cord.
3. Jumpers/jack

**Safety:-**

- Turn off supply before disconnecting component.
- Connection should be made properly.

**Task: 2 Verify truth table of OR, AND & NOT gates.**

Time:- 10 hrs  
Theory:- 2 hrs  
Practical:- 8 hrs

Steps	Terminal Performance Objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required components</li> <li>2. Identify logic gates.</li> <li>3. Take a specific logic gate.</li> <li>4. Connect the gate as per logic diagram.</li> <li>5. Set the inputs to possible logic states.</li> <li>6. Observe the output logic.</li> <li>7. Repeat step 4 through 6 for remaining gates.</li> <li>8. Disconnect the components.</li> <li>9. Restore the components safely.</li> </ol>	<p><b>Condition (Given):</b> Given digital ICs, logic diagram and IC trainer kit, bread board, jumper, regulated variable pointer</p> <p><b>Tasks (What):</b> Verify the Truth Table of</p> <ul style="list-style-type: none"> <li>• OR gate</li> <li>• AND gate and</li> <li>• NOT gate</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Verified truth table of basic logic gates must be correct.</li> <li>• Insert and detach ICs without damage.</li> </ul>	<p><b>Truth table.</b></p> <ul style="list-style-type: none"> <li>• Explanation of logic gates.</li> <li>• OR gate <ul style="list-style-type: none"> <li>➤ Definition.</li> <li>➤ Circuit diagram.</li> <li>➤ Logic function.</li> <li>➤ Truth table.</li> <li>➤ IC pin diagram</li> </ul> </li> <li>• AND gate. <ul style="list-style-type: none"> <li>➤ Definition.</li> <li>➤ Circuit diagram.</li> <li>➤ Logic function.</li> <li>➤ Truth table.</li> <li>➤ IC pin diagram</li> </ul> </li> <li>• NOT gate <ul style="list-style-type: none"> <li>➤ Definition.</li> <li>➤ Circuit diagram.</li> <li>➤ Logic function.</li> <li>➤ Truth table.</li> <li>➤ IC pin diagram</li> </ul> </li> <li>• Know use of trainer kit to give inputs and observe outputs.</li> <li>• Know the internal connection of bread board</li> <li>• Safety precautions.</li> </ul>

**Tools and Materials: -**

1. IC trainer kit

2. 7432 IC (OR gate)
3. 7408 IC (AND gate)
4. 7404 IC (NOT gate)
5. Jumpers
6. Tweezer
7. AC cord
8. I.C. extractor
9. Regulated variable power supply 0.32 V DC

**Safety:** - Insertion and detachment of ICs must be without damage.

**Task: 3 Verify truth table of NOR and NAND gate.**

Time:- 8 hrs  
Theory:- 1 hr  
Practical:- 7 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required components</li> <li>2. Identify logic gates.</li> <li>3. Take a specific logic gate.</li> <li>4. Connect the gate as per logic diagram.</li> <li>5. Set the inputs to possible logic states.</li> <li>6. Observe the output logic.</li> <li>7. Repeat step 4 through 6 for remaining gates.</li> <li>8. Disconnect the components.</li> <li>9. Restore the components safely.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped laboratory, IC trainer kit, jumpers, 7402 IC, 7400 IC, bread board, regulated variable power supply 0-32 V DC,</p> <p><b>Tasks (What):</b> Verify truth table of</p> <ul style="list-style-type: none"> <li>• NOR gate and</li> <li>• NAND gate.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Verified T.T. of NOR and NAND gates must be correct.</li> <li>• Insertion and detachment must be without damage.</li> <li>• Circuit must be connected securely and correctly as per given diagram.</li> </ul>	<p><b>NOR gate</b></p> <ul style="list-style-type: none"> <li>➤ Definition.</li> <li>➤ Circuit diagram.</li> <li>➤ Logic function.</li> <li>➤ Truth table.</li> <li>➤ IC pin diagram</li> </ul> <p><b>NAND gate</b></p> <ul style="list-style-type: none"> <li>➤ Definition.</li> <li>➤ Circuit diagram.</li> <li>➤ Logic function.</li> <li>➤ Truth table.</li> <li>➤ IC pin diagram.</li> </ul> <ul style="list-style-type: none"> <li>• Know use of trainer kit to give inputs and observe outputs.</li> <li>• Safety precautions.</li> </ul>

**Tools and Materials: -**

1. IC trainer kit
2. Jumpers
3. 7402 IC
4. 7400 IC
5. Tweezer
6. AC cord.
7. Bread board

**Safety:** - Proper insertion of IC.

**Task: 4 Verify universal property of NOR and NAND gates.**

Time:- 14 hrs  
Theory:- 2 hrs  
Practical:- 12 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect necessary components.</li> <li>2. Take a NOR gate.</li> <li>3. Connect NOR gate to perform as NOT gate.</li> <li>4. Set the inputs to possible logic states.</li> <li>5. Observe the outputs.</li> <li>6. Connect NOR gate to perform as OR gate.</li> <li>7. Repeat steps 4 through 5.</li> <li>8. Connect NOR gate to perform AND gate.</li> <li>9. Repeat step 7.</li> <li>10. Disconnect the components.</li> <li>11. Restore the components.</li> <li>12. Repeat steps 2 through 11 for NAND gate.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped lab, IC trainer kit, 7402 IC, 7400 IC, jumpers and tweezers.</p> <p><b>Tasks (What):</b> Verify universal property of NOR and NAND gates.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Verified truth table must be correct.</li> <li>• Insertion and detachment must be without damage.</li> <li>• Circuit must be connected securely and correctly as per given diagram.</li> </ul>	<p><b>Universal property</b></p> <ul style="list-style-type: none"> <li>• Know NOR and NAND gate function.</li> <li>• Know conversion of NOR and NAND gate to NOT, OR and NAND gate.</li> <li>• Use of trainer kit to give inputs and observe outputs</li> <li>• Safety precautions.</li> </ul>

**Tools and Materials:-**

1. IC trainer kit
2. Jumpers
3. 7402 IC
4. 7400 IC
5. Tweezer
6. AC cord.
7. I.C. extractor

**Safety:** - Take safety precaution.

**Task: 5 Verify truth table of Exclusive OR and Exclusive NOR gates**

Time:- 8 hrs  
Theory:- 1 hr  
Practical:- 7 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required components.</li> <li>2. Take EX-OR (7486 IC) gate.</li> <li>3. Insert EX-OR gate in IC socket of trainer kit.</li> <li>4. Connect inputs to input pin of IC.</li> <li>5. Connect output pin of IC to output LEDs.</li> <li>6. Set the inputs to possible logic states.</li> <li>7. Observe the outputs.</li> <li>8. Repeat steps 2 through 7 for EX-NOR (74266) gate.</li> <li>9. Disconnect the components.</li> <li>10. Restore components safely.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped lab with required components.</p> <p><b>Tasks (What):</b> Verify T.T of</p> <ul style="list-style-type: none"> <li>• EX-OR gate.</li> <li>• EX-NOR gate.</li> </ul> <p><b>Standard (How well):</b> Verified T.T. of EX-OR and EX-NOR gates must be correct.</p>	<p><b>EX-OR gate</b></p> <ul style="list-style-type: none"> <li>➤ Definition.</li> <li>➤ Circuit diagram.</li> <li>➤ Logic function.</li> <li>➤ Truth table.</li> <li>➤ IC pin diagram.</li> </ul> <p><b>EX-NOR gate</b></p> <ul style="list-style-type: none"> <li>➤ Definition.</li> <li>➤ Circuit diagram.</li> <li>➤ Logic function.</li> <li>➤ Truth table.</li> <li>➤ IC pin diagram.</li> </ul> <ul style="list-style-type: none"> <li>• Use of trainer kit to give inputs and observe outputs.</li> <li>• Safety precautions.</li> </ul>

**Tools and Materials:-**

1. IC trainer kit
2. Jumpers
3. 7486 IC
4. 74266 IC
5. Tweezer
6. AC cord.

**Safety: -**

- Proper insertion/extraction of ICs.
- Apply proper power supply to IC (refer data book)

**Task: 6 Verify truth table of half and full adder**

Time:- 8 hrs

Theory:- 2 hrs

Practical:- 6 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Collect necessary tools and materials.</li> <li>2. Take required logic gates for verifying half adder.</li> <li>3. Connect the gates as per logic diagram.</li> <li>4. Set the possible input logic states.</li> <li>5. Observe the corresponding outputs</li> <li>6. Repeat the operation for full adder.</li> <li>7. Disconnect the components.</li> <li>8. Restore components safely.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped lab with required tools and materials.</p> <p><b>Tasks (What):</b> Verify truth table of half and full adder.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Verified truth table of half adder and full adder must be correct.</li> </ul>	<p><b>Binary addition.</b> <b>Half adder.</b></p> <ul style="list-style-type: none"> <li>➤ Explanation.</li> <li>➤ Circuit diagram.</li> <li>➤ Truth Table.</li> </ul> <p><b>Full adder</b></p> <ul style="list-style-type: none"> <li>➤ Explanation.</li> <li>➤ Circuit diagram.</li> <li>➤ Truth Table.</li> </ul> <p><b>Use of trainer kit to give inputs and observe outputs.</b></p> <p><b>Safety precautions.</b></p>

**Tools and Materials: -**

1. IC trainer kit.
2. 7408 IC.
3. 7486 IC.
4. Jumpers.
5. Tweezer.
6. AC cord.

**Safety: -** Proper insertion of ICs.



**Task: 7 Verify truth table of half and full subtractor**

Time:- 8 hrs  
Theory:- 2 hrs  
Practical:- 6 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required tools and materials.</li> <li>2. Take required logic gates to verify half subtractor.</li> <li>3. Connect the gates as per logic diagram.</li> <li>4. Set the possible input logic states.</li> <li>5. Observe the outputs for corresponding inputs.</li> <li>6. Repeat steps 2 through 6 for full subtractor.</li> <li>7. Disconnect the components.</li> <li>8. Store the components safely.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped lab with required tools and materials.</p> <p><b>Tasks (What):</b> Verify truth table of half and full subtractor.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Verified truth tables of half subtractor and full subtractor must be correct.</li> <li>• ICs must be disconnected without damage.</li> </ul>	<p><b>Binary subtraction.</b></p> <p><b>Half subtractor.</b></p> <ul style="list-style-type: none"> <li>➤ Explanation.</li> <li>➤ Circuit diagram.</li> <li>➤ Truth Table.</li> </ul> <p><b>Full subtractor.</b></p> <ul style="list-style-type: none"> <li>➤ Explanation.</li> <li>➤ Circuit diagram.</li> <li>➤ Truth Table.</li> </ul> <ul style="list-style-type: none"> <li>• Use of trainer kit to give inputs and observe outputs.</li> <li>• Data sheet of IC</li> </ul> <p>Safety precautions.</p>

**Tools and Materials: -**

1. IC trainer kit.
2. 7404 IC.
3. 7408 IC.
4. 7486 IC.
5. Jumpers.
6. Tweezer.
7. AC cord.

**Safety: -** Proper insertion of ICs.

**Task: 8 Verify Boolean Algebra**

Time:- 8 hrs

Theory:- 2 hrs

Practical:- 6 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required tools and materials.</li> <li>2. Take a required logic gate for corresponding law.</li> <li>3. Connect the gate as per logic diagram.</li> <li>4. Set the inputs to possible logic states.</li> <li>5. Observe the outputs of corresponding inputs.</li> <li>6. Repeat steps 2 through 5 for other laws.</li> <li>7. Disconnect the components.</li> <li>8. Store components safely.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped lab with required tools and materials.</p> <p><b>Tasks (What):</b> Verify Boolean algebra.</p> <p><b>Standard (How well):</b> Verification of Boolean algebra must be correct. Components must be disconnected without damage.</p>	<p><b>Boolean Algebra</b></p> <ul style="list-style-type: none"> <li>• Laws.</li> <li>• Explanation.</li> <li>• Application.</li> </ul> <p>Use of trainer kit to give inputs and observe outputs. IC data sheet</p> <p>Safety precautions.</p>

**Tools and Materials: -**

- IC trainer kit.
- ICs
- Jumpers
- Tweezer
- AC cord.

**Safety: -** Proper insertion of ICs.

**Task: 9 Verify the rules of Boolean Algebra**

Time:- 10 hrs

Theory:- 2 hrs

Practical:- 8 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Prepare list of necessary components.</li> <li>2. Take a required logic gate for verification of one of the rule of Boolean algebra.</li> <li>3. Connect the components as per logic diagram.</li> <li>4. Set the inputs to possible logic states.</li> <li>5. Observe the corresponding output for given inputs.</li> <li>6. Repeat the operation for other rules.</li> <li>7. Disconnect the components.</li> <li>8. Store components safely.</li> <li>9. Take safety precautions.</li> <li>10. Components without damaging connected.</li> </ol>	<p><b>Condition (Given):</b> Lab with given components T.T.s, logic diagram and specifications.</p> <p><b>Tasks (What):</b> Verify rules of Boolean Algebra.</p> <p><b>Standard (How well):</b> Verified the rules of Boolean algebra with logic diagram correctly and disconnected component without damaging.</p>	<p><b>Boolean Algebra</b></p> <ul style="list-style-type: none"> <li>• Operation</li> <li>• Variables.</li> <li>• Literals.</li> <li>• Complements.</li> <li>• Rules</li> <li>• Duality.</li> <li>• Identify elements.</li> <li>• Application.</li> </ul> <p>Use of trainer kit to give inputs and observe outputs. Safety precautions.</p>

**Tools and Materials:-** IC trainer kit, jumpers, ICs, twizzer, AC cord.**Safety:-** Proper insentience of ICs.

**Task: 10 Verify simplification of logic expressions using Boolean algebra.**

Time:- 12 hrs  
Theory:- 2 hrs  
Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required tools and materials.</li> <li>2. Take required logic gates for verifying T.T. of given logic expression.</li> <li>3. Connect the logic gate as per given logic diagram.</li> <li>4. Set the input for possible logic states.</li> <li>5. Observe the output for corresponding input.</li> <li>6. Repeat steps 2 through 5 for verifying T.T. of simplified logic expression.</li> <li>7. Disconnect the components.</li> <li>8. Store components safely.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped lab with required tools and materials.</p> <p><b>Tasks (What):</b> Verify simplification of given logic expression using Boolean algebra.</p> <p><b>Standard (How well):</b> Verification of simplification of logic expressions using Boolean algebra must be correct.</p>	<p>Boolean algebra.</p> <p>Use of trainer kit to give inputs and observe outputs.</p> <p>Safety precautions.</p>

**Tools and Materials: -**

- IC trainer kit
- ICs
- Jumpers
- Tweezer
- AC cord.

**Safety: -** Proper insertion of ICs.

**Task: 11 Verify De Morgan's Theorems.**

Time:- 6 hrs

Theory:- 2 hrs

Practical:- 4 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Collect required tools and materials.</li> <li>2. Take required logic gates for verification of one of the theorem.</li> <li>3. Connect the gate as per logic diagram.</li> <li>4. Set the inputs to possible logic states.</li> <li>5. Observe the corresponding output for given inputs.</li> <li>6. Repeat steps 2 through 5 for another theorem.</li> <li>7. Disconnect the components.</li> <li>8. Store components safely.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped lab with required tools and materials.</p> <p><b>Tasks (What):</b> Verify De Morgan's Theorems.</p> <p><b>Standard (How well):</b> Verification of De Morgan's Theorems must be correct. The components must be disconnected without damage.</p>	<p><b>De Morgan's Theorem</b></p> <ul style="list-style-type: none"> <li>• First theorem.</li> <li>• Second theorem.</li> <li>• Truth table.</li> <li>• Application.</li> </ul> <p>Use of trainer kit to give inputs and observe outputs.</p> <p>Safety precautions.</p>

**Tools and Materials: -**

- IC trainer kit
- ICs
- Jumpers
- Tweezer
- AC cord.

**Safety: -** Proper insertion of ICs.

**Task: 12 Verify truth table of encoder/decoder.**

Time:- 8 hrs  
 Theory:- 3 hrs  
 Practical:- 5 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Collect required tools and materials.</li> <li>2. Take required logic gates for verifying T.T. of encoder.</li> <li>3. Connect the gates as per logic diagram.</li> <li>4. Set the possible input logic states.</li> <li>5. Observe the outputs for corresponding inputs.</li> <li>6. Repeat steps 2 through 5 for decoder.</li> <li>7. Disconnect the components.</li> <li>8. Store components safely.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped lab with required tools and materials.</p> <p><b>Tasks (What):</b> Verify truth table of encoder/decoder.</p> <p><b>Standard (How well):</b> Verified truth table of encoder/decoder must be correct.</p>	<p><b>Combinational logic</b></p> <p>Definition</p> <p>Implementation.</p> <p><b>Decoder/encoder.</b></p> <ul style="list-style-type: none"> <li>• Definition.</li> <li>• Truth table (T.T.)</li> <li>• Logic symbol.</li> <li>• Application.</li> </ul> <p>Use of trainer kit to give inputs and observe outputs.</p> <p>Safety precautions.</p>

**Tools and Materials: -**

- IC trainer kit.
- ICs.
- Jumpers.
- Tweezer.
- AC cord.

**Safety: -** Proper insertion of ICs.

**Task: 13 Verify truth table of multiplexer and de-multiplexer.**

Time:- 8 hrs  
Theory:- 3 hrs  
Practical:- 5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required tools and materials.</li> <li>2. Take required logic gates for verifying multiplexer.</li> <li>3. Connect the gates as per logic diagram.</li> <li>4. Set the possible input states.</li> <li>5. Observe the corresponding outputs.</li> <li>6. Repeat steps 2 through 5 for de-multiplexer.</li> <li>7. Disconnect the components.</li> <li>8. Store components safely.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped lab with required tools and materials.</p> <p><b>Tasks (What):</b> Verify truth table of multiplexer and demultiplexer.</p> <p><b>Standard (How well):</b> Verified multiplexer and demultiplexer truth table must be correct.</p>	<p><b>Multiplexer.</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operation</li> <li>• T.T.</li> <li>• Application.</li> </ul> <p><b>De-multiplexer</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Operation</li> <li>• T.T.</li> <li>• Application.</li> </ul> <p>Use of trainer kit to give inputs and observe outputs.</p> <p>Safety precautions.</p>

**Tools and Materials:-**

- IC trainer kit.
- ICs.
- Jumpers.
- Tweezer.
- AC cord.

**Safety:-** Proper insertion of ICs.

**Task: 14 Verify basic comparator.**

Time:- 10 hrs

Theory:- 3 hrs

Practical:- 7 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Prepare list of necessary components.</li> <li>2. Take required logic gates.</li> <li>3. Connect the gates as per logic diagram.</li> <li>4. Set the possible input logic states.</li> <li>5. Observe the outputs for corresponding inputs.</li> <li>6. Disconnect the components.</li> <li>7. Store safely.</li> <li>8. Take safety precautions.</li> </ol>	<p><b>Condition (Given):</b> Perform on lab with given components logic diagram and specification.</p> <p><b>Tasks (What):</b> Verify basic comparator.</p> <p><b>Standard (How well):</b> Verified basic comparator with logic diagram correctly and disconnected components with undamaging connected as per logic diagram correctly.</p>	<p><b>Comparator</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Application.</li> <li>• T.T.</li> </ul> <p><b>Use of trainer kit to give inputs and observe outputs.</b></p> <p><b>Safety precautions.</b></p>

**Tools and Materials: -**

- IC trainer kit.
- ICs.
- Jumpers.
- Tweezer.
- AC cord.

**Safety: -** Proper insertion of ICs.



**Task: 15 Verify the flip flops**

Time:- 12 hrs

Theory:- 4 hrs

Practical:- 8 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Prepare list of necessary components.</li> <li>2. Take required f.f. (gates) (IC)</li> <li>3. Connect the ff as per logic diagram</li> <li>4. Observe the output without giving any inputs.</li> <li>5. Set the possible input logic states.</li> <li>6. Observe the corresponding outputs.</li> <li>7. Repeat the operations for remaining flip flops.</li> <li>8. Disconnect the components.</li> <li>9. Store safely</li> <li>10. Take safety precaution.</li> </ol>	<p><b>Condition (Given):</b> Perform in lab with given components. T.T.s, logic diagrams and specification.</p> <p><b>Tasks (What):</b> Verify flip flops.</p> <p><b>Standard (How well):</b> Verified different kinds of flip-flop with logic diagram correctly and disconnected components with undamaging connected as per logic diagram correctly.</p>	<p><b>Flip flops.</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Logic operations.</li> <li>• T.T.s</li> <li>• Clocking signals.</li> </ul> <p>Use of trainer kit to give inputs and observe outputs. Safety precautions.</p>

**Tools and Materials: -**

- IC trainer kit.
- ICs.
- Jumpers.
- Tweezer.
- AC cord.

**Safety: -** Connections must be made properly.  
Output must be observed carefully.  
Clock signal should be applied properly.

**Task: 16 Verify Seven Segment display decoder**

Time:- 6 hrs

Theory:- 2 hrs

Practical:- 4 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required tools and components.</li> <li>2. Identify display common (anode /cathode).</li> <li>3. Connect the wires as per diagram.</li> <li>4. Check the connections properly.</li> <li>5. Switch on the power supply.</li> <li>6. Sequentially connect all the terminals one by one.</li> <li>7. Check that the display segments are lighted according to the order given on the table.</li> <li>8. Connect the terminals either to ground or to supply voltage so that binary pattern are generated to light the segment.</li> <li>9. Check that the display displays the ten decimal digits according to binary pattern.</li> <li>10. Disconnect the components.</li> <li>11. Store components safely.</li> </ol>	<p><b>Condition (Given):</b> Fully equipped lab with necessary component. Required data to identify display segments. Table of binary pattern. Circuit diagram.</p> <p><b>Tasks (What):</b> Verify seven segment display decoder.</p> <p><b>Standard (How well):</b> Seven segment display must be according to display pattern.</p>	<ul style="list-style-type: none"> <li>• LED</li> <li>• 7 segment display.</li> <li>• Binary number system.</li> </ul>

**Tools and Materials: -**

1. IC trainer kit
2. Seven segment display IC
3. Jumpers
4. AC Cord
5. Tweezer

**Safety:-** Seven segment display IC must be inserted without damage.

**Task: 17 Verify truth table of counter**

Time:- 12 hrs

Theory:- 4 hrs

Practical:- 8 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required tools and components.</li> <li>2. Identify display common (anode /cathode).</li> <li>3. Connect the wires as per diagram.</li> <li>4. Check the connections properly.</li> <li>5. Switch on the power supply.</li> <li>6. Sequentially connect all the terminals one by one.</li> <li>7. Check that the display segments are lighted according to the order given on the table.</li> <li>8. Connect the terminals either to ground or to supply voltage so that binary pattern are generated to light the segment.</li> <li>9. Check that the display displays the ten decimal digits according to binary pattern.</li> <li>10. Disconnect the components.</li> <li>11. Store components safely.</li> </ol>	<p><b>Condition (Given):</b> Fully equipped lab with necessary component. Required data to identify display segments. Table of binary pattern. Circuit diagram.</p> <p><b>Tasks (What):</b> Verify seven segment display decoder.</p> <p><b>Standard (How well):</b> Seven segment display must be according to display pattern.</p>	<ul style="list-style-type: none"> <li>• LED</li> <li>• 7 segment display.</li> <li>• Binary number system.</li> </ul>

**Tools and Materials: -**

6. IC trainer kit
7. Seven segment display IC
8. Jumpers
9. AC Cord
10. Tweezer

**Safety:-** Seven segment display IC must be inserted without damage.**References:**

- P. Malvino, Digital Electronics

# Electrical Installation

**Total: 5 hrs/wk**  
**Theory: 1 hr/wk**  
**Practical: 4 hrs/wk**

## **Course Description:**

This course provides knowledge and skills related on basic electrical installation techniques. It also covers classification of wiring, selection of materials, simple design and installation of domestic electrification.

## **Course Objectives:**

After completing this course students will be able to:

1. Familiarize with electrical components related with electrical system.
2. Interpret layout and wiring diagram.
3. Perform basic electrical installation and board wiring.
4. Repair and maintain faults of electrical system.
5. Perform wiring system and electrical safety test.

## **List of Tasks:**

1. Perform straight joint of Batten
2. Perform T joint of Batten
3. Perform L joint of Batten
4. Perform bridge joint of Batten
5. Perform straight wire/cable joint
6. Perform T joint of wire/cable
7. Interpret schematic Diagram
8. Interpret layout Diagram
9. Interpret wiring Diagram
10. Perform one bulb control by one way switch on the exercise board
11. Perform two bulb control by one way switch in series condition
12. Perform two bulb control by one way switch in parallel condition
13. Perform one bulb control by one way switch with 2 pin Socket
14. Perform one bulb control by one way switch with push button switch controlled by buzzer
15. Perform one bulb control by 2 way switch with 3 pin switch combined power socket
16. Perform one bulb control by one way switch and other bulb control by two way switch with 3 pin switch combined power socket
17. Perform one bulb control by 3 places using 2 ways switches and one cross way switch
18. Read and handle multi meter
19. Perform call bell system on board
20. Perform go down circuit on board
21. Install MCB electrical supply system
22. Install energy meter in electrical supply system
23. Control one bulb, one Tube light set and one fan by three one way switch and dimmer.

## Task Analysis Sheet

### Task 1: Perform straight joint of Batten.

Time : 4 hrs

Theory : 1hrs

Practical: 3hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing</li> <li>2. Study the drawing</li> <li>3. Obtain required tools and Materials</li> <li>4. Measure the Batten according to drawing</li> <li>5. Cut out in half depth of Batten towards one end of both Batten</li> <li>6. File the Batten according to drawing</li> <li>7. Overlap the joining part of batten each other</li> <li>8. Fix both Batten with help of nail</li> <li>9. Restore the tools and materials</li> <li>10. Clean the work shop</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped Electrical works shop with Tool set</li> <li>• Batten</li> <li>• Nail</li> </ul> <p><b>Task (What):</b> Perform straight joint of Batten</p> <p><b>Standard (How well):</b> Perform straight joint of Batten</p>	<p><b>Perform straight joint of Batten.</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Joint making procedure</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety:** use clean hammer, beware of nail, use hacksaw to batten, wear glove.

**Task 2: Perform T joint of Batten**

Time : 4 hrs

Theory : 1 hr

Practical: 3 hrs

<b>Task Steps</b>	<b>Training Performance Objective</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Obtain required drawing</li> <li>2. Study the drawing</li> <li>3. Obtain required tools and Materials</li> <li>4. Measure the Batten according to drawing</li> <li>5. Cut out in half depth of Batten towards one end of both Batten</li> <li>6. File the Batten according to drawing</li> <li>7. Overlap the joining part of batten each other</li> <li>8. Fix both Batten with help of nail</li> <li>9. Restore the tools and materials</li> <li>10. Clean the work shop</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped Electrical works shop with Tool set</li> <li>• Batten</li> <li>• Nail</li> </ul> <p><b>Task (What):</b> Perform T joint of Batten</p> <p><b>Standard (How well):</b> Perform T joint of Batten</p>	<p><b>Perform T joint of Batten</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Joint making procedure</li> </ul>

**Tools/Equipment:** Tools box set,**Safety:** use clean hammer, beware of nail, use hacksaw to batten, wear glove.

**Task 3 : Perform L joint of Batten**

Time : 4hrs  
 Theory : 1 hr  
 Practical: 3 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain required drawing</li> <li>2. Study the drawing</li> <li>3. Obtain required tools and Materials</li> <li>4. Measure the Batten according to drawing</li> <li>5. Cut out in half depth of Batten towards one end of both Batten</li> <li>6. File the Batten according to drawing</li> <li>7. Overlap the joining part of batten each other</li> <li>8. Fix both Batten with help of nail</li> <li>9. Restore the tools and materials</li> <li>10. Clean the work shop</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped Electrical works shop with Tool set</li> <li>• Batten</li> <li>• Nail</li> </ul> <p><b>Task (What):</b>                      Perform L joint of Batten</p> <p><b>Standard (How well):</b>                      Perform L joint of Batten.</p>	<p><b>Perform L joint of Batten</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Joint making procedure</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety:** use clean hammer, beware of nail, use hacksaw to batten, wear glove.



**Task 4 : Perform bridge joint of Batten**

Time : 4hrs

Theory : 1 hr

Practical: 3 hrs

<b>Task Steps</b>	<b>Training Performance Objective</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Obtain required drawing</li> <li>2. Study the drawing</li> <li>3. Obtain required tools and Materials</li> <li>4. Measure the Batten according to drawing</li> <li>5. Cut out in half depth of Batten towards middle of both Batten</li> <li>6. File the Batten according to drawing</li> <li>7. Overlap the joining part of batten each other</li> <li>8. Fix both Batten with help of nail</li> <li>9. Restore the tools and materials</li> <li>10. Clean the work shop</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped Electrical works shop with Tool set</li> <li>• Batten</li> <li>• Nail</li> </ul> <p><b>Task (What):</b> Perform Bridge joint of Batten</p> <p><b>Standard (How well):</b> Perform Bridge joint of Batten</p>	<p><b>Perform Bridge joint of Batten</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Joint making procedure</li> </ul>

**Tools/Equipment:** Tools box set,**Safety:** use clean hammer, beware of nail, use hacksaw to batten, wear glove.

**Task 5: Perform straight wire/cable joint**

Time : 4 hrs

Theory : 1 hr

Practical: 3 hrs

<b>Task Steps</b>	<b>Training Performance Objective</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Obtain required drawing</li> <li>2. Obtain required tools &amp; materials</li> <li>3. Measure the wire according to drawing</li> <li>4. Cut wire</li> <li>5. Remove 7 cm insulation of wire in both end</li> <li>6. Join both wire</li> <li>7. Twist the wire/cable each other slowly and carefully by combination pliers</li> <li>8. Restore tools &amp; Materials</li> <li>9. Clean the workshop</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Well-equipped electrical works shop with Tool set</li> <li>• PVC Wire</li> </ul> <p><b>Task (What):</b> Perform straight wire/cable joint</p> <p><b>Standard (How well):</b> Performed straight wire/cable joint</p>	<p><b>Perform straight wire/cable joint</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Joint making procedure</li> </ul>

**Tools/Equipment:** Tools box set,**Safety:** Care of tools, safely handle tools and materials.

**Task 6 : Perform T joint of wire/cable joint.**

Time : 4 hrs

Theory : 1 hr

Practical: 3 hrs

<b>Task Steps</b>	<b>Training Performance Objective</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Obtain required drawing</li> <li>2. Collect required tools &amp; materials</li> <li>3. Cut wire according to wiring length</li> <li>4. Remove 7 cm insulation of wire in both end</li> <li>5. Join both wire</li> <li>6. Overlap conductor of wire</li> <li>7. Twist one open wire in the middle of another open wire.</li> <li>8. Restore the tools and materials.</li> <li>9. Clean the workshop.</li> </ol>	<p><b>Condition (Given):</b> Equipped Electrical workshop with Tools Set.</p> <ul style="list-style-type: none"> <li>• PVC wire (7/22)</li> </ul> <p><b>Task (What):</b> Perform T joint of wire</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Performed T joint.</li> </ul>	<p><b>Perform T joint of wire</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Uses</li> <li>• Importance</li> <li>• Joint making procedure</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety:** care of tools, safely handle tools and materials,

**Task 7: Interpret Schematic Diagram**

Time : 4hrs

Theory : 1 hr

Practical: 3hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction.</li> <li>2. Prepare the drawing instruments.</li> <li>3. Prepare the drawing sheet.</li> <li>4. Draw Schematic diagram of one bulb control by one way switch.</li> <li>5. Wipe off unnecessary drawing Lines.</li> <li>6. Submit the drawing to instrument for Evaluation.</li> </ol>	<p><b>Condition (Given):</b> Fully Equipped Drawing classroom with drawing Instrument.</p> <p><b>Task (What):</b> Interpret Schematic Diagram</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Read and follow schematic diagram</li> <li>• Draw simple diagram of one bulb control by one way switch.</li> </ul>	<p><b>Interpret Schematic Diagram:</b></p> <ul style="list-style-type: none"> <li>• Introduction of Electrical Symbols.</li> <li>• Electrical schematic, wiring and layout diagram.</li> </ul>

**Tools/Equipment:** Drawing instruments.**Safety Precaution:** Follow the safety precaution of engineering drawing.

**Task 8 Interpret Layout Diagram**

Time : 4 hrs  
 Theory : 1hr  
 Practical: 3 hrs

<b>Task Steps</b>	<b>Training Performance Objective</b>	<b>Related Technical Knowledge</b>
1. Obtain instruction. 2. Obtain the layout diagram 3. Prepare electrical accessories as per layout diagram.	<p><b>Condition (Given):</b>                      Fully Equipped electrical workshop with different accessories.</p> <p><b>Task (What):</b>                      Interpret Layout Diagram</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Interpret layout diagram</li> <li>• Identify different electrical accessories.</li> </ul>	<p><b>Interpret Layout Diagram:</b></p> <ul style="list-style-type: none"> <li>• Introduction of layout diagram.</li> <li>• Introduction of Electrical accessories.</li> </ul>

**Tools/Equipment:** Tools set.

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
 Replace broken Switches and Plugs immediately.  
 Never pulls the flexible cable or wire to disconnect the plug.

Never place bear wire seen on plugs & socket.

**Task 9: Interpret Wiring Diagram**

Time : 4 hrs

Theory : 1hr

Practical: 3hrs

<b>Task Steps</b>	<b>Training Performance Objective</b>	<b>Related Technical Knowledge</b>
1. Obtain instruction. 2. Obtain the layout diagram 3. Prepare electrical accessories as per layout diagram.	<p><b>Condition (Given):</b> Fully Equipped electrical workshop with different accessories.</p> <p><b>Task (What):</b> Interpret Wiring Diagram</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Interpret wiring diagram</li> <li>• Use different electrical accessories.</li> </ul>	<p><b>Interpret Wiring Diagram:</b></p> <ul style="list-style-type: none"> <li>• Introduction of wiring diagram.</li> <li>• Use of Electrical accessories.</li> </ul>

**Tools/Equipment:** Tools set.

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
 Replace broken Switches and Plugs immediately.  
 Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.

**Task 10: Perform one bulb control by one way switch on the Exercise board.**

Time : 10 hrs  
 Theory : 2 hrs  
 Practical: 8 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction Layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Collect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b>                      Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b>                      Perform one bulb control by one way switch.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Perform one bulb control by one way switch.</li> </ul>	<p><b>Perform one bulb control by one way switch.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Importance</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
 Replace broken Switches and Plugs immediately.  
 Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.

**Task 11: Perform two bulb control by one way switch in series condition.**

Time : 11 hrs

Theory : 2 hrs

Practical: 9 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction and layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Connect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b> Perform two bulb control by one way switch in series condition.</p> <p><b>Standard (How well):</b> Perform two bulb control by one way switch in series condition.</p>	<p><b>Two bulb control by one way switch in series condition.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
Replace broken Switches and Plugs immediately.  
Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.



**Task 12: Perform two bulb control by one way switch in Parallel condition.**

Time : 11 hrs

Theory : 2 hrs

Practical: 10 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction and layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Connect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with tools &amp; materials.</p> <p><b>Task (What):</b> Perform two bulb control by one way switch in parallel condition.</p> <p><b>Standard (How well):</b> Perform two bulb control by one way switch in parallel condition.</p>	<p><b>Two bulb control by one way switch in Parallel condition.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
Replace broken Switches and Plugs immediately.  
Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.

**Task 13: Perform one bulb control by one way switch with 2 pin Socket**

Time : 12 hrs

Theory : 2 hrs

Practical: 10 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction and Layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Connect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b> Perform one bulb control by one way switch with 2pin Socket.</p> <p><b>Standard (How well):</b> Perform one bulb control by one way switch with 2pin Socket</p>	<p><b>One bulb control by one way switch with 2 pin Socket.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.

Replace broken Switches and Plugs immediately.

Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.

**Task 14: Perform one bulb control by one way switch with push button switch controlled by buzzer.**

Time : 14 hrs  
Theory : 2 hrs  
Practical: 12 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction and layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Connect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b> Perform one bulb control by one way switch with push button switch controlled by buzzer.</p> <p><b>Standard (How well):</b> Perform one bulb control by one way switch with push button switch controlled by buzzer.</p>	<p><b>One bulb control by one way switch with push button switch controlled by buzzer.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
Replace broken Switches and Plugs immediately.  
Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.

**Task 15: Perform one bulb control by Two way switch with 3pin switch combined power socket.**

Time : 14 hrs

Theory : 2 hrs

Practical: 12 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction and layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Connect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b> Perform one bulb control by Two way switch with 3pin switch combined power socket</p> <p><b>Standard (How well):</b> Oone bulb is controled by two way switch with 3pin switch combined power socket</p>	<p><b>One bulb control by Two way switch with 3 pin switch combined power socket.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
Replace broken Switches and Plugs immediately.  
Never pulls the flexible cable or wire to disconnect the plug.

Never place bear wire seen on plugs & socket.

**Task 16: Perform one bell control by one way switch and other bulb control by Two way switch with 3 pin switch combined power socket.**

Time : 14 hrs  
Theory : 2 hrs  
Practical: 12 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction and layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Connect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b> Perform one bell control by Push bottom switch and other bulb control by Two way switch with 3pin switch power socket.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• The bell is controlled by push bottom switch.</li> <li>• The bulb control by two way switch with 3 pin switch power socket.</li> </ul>	<p><b>One bell control by Push bottom switch and other bulb control by Two way switch with 3pin switch power socket.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
Replace broken Switches and Plugs immediately.  
Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.

**Task 17: Perform one bulb control by 3 places using 2 two way switch and one cross way switch.**

Time : 14 hrs  
Theory : 2 hrs  
Practical: 12 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction and layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Connect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b> Perform one bulb control by 3 places using 2 two switch and one cross way switch.</p> <p><b>Standard (How well):</b> The bulb is controlled by 3 places using 2 two switch and one cross way switch.</p>	<p><b>One bulb control by 3 places using 2 two switch and one cross way switch.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
Replace broken Switches and Plugs immediately.  
Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.

**Task 18: Read and Handle Multi meter.**

Time : 6 hrs

Theory : 3 hrs

Practical: 3 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain multi meter</li> <li>2. Insert Probe (jack) into positive terminal and negative terminal.</li> <li>3. Connect multi meter probe in respective supply.</li> <li>4. Read measure voltage.</li> <li>5. Note down the measurement.</li> <li>6. Follow the steps from 3 to 5 for adjusting selector switch to Ampere.</li> <li>7. Follow the steps from 3 to 6 for adjusting selector switch to Resistance.</li> <li>8. Clean and store the meter in safe and sound place.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Multi meter.</p> <p><b>Task (What):</b> Read and Handle Multi meter.</p> <p><b>Standard (How well):</b> Read and Handle Multi meter.</p>	<p><b>Multi meter</b></p> <ul style="list-style-type: none"> <li>• Introduction and types of multi meter</li> <li>• Advantage of using multi meter</li> <li>• Process of reading and handling multi meter</li> <li>• Handle and care of multi meter</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
Replace broken Switches and Plugs immediately.  
Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.

**Task 19: Perform call bell system on board.**

Time : 10 hrs

Theory : 2 hrs

Practical: 8 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction and layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Connect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram by Multi Meter.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b> Perform Call bell system on board.</p> <p><b>Standard (How well):</b> Perform call bell system on board.</p>	<p><b>Call bell system on board.</b></p> <p>Introduction</p> <ul style="list-style-type: none"> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
Replace broken Switches and Plugs immediately.  
Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.



**Task 20: Perform go down circuit on board.**

Time : 10 hrs

Theory : 2 hrs

Practical: 8 hrs

<b>Task Steps</b>	<b>Training Performance Objective</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Obtain instruction and layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Connect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram by Multi Meter.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b> Perform go down circuit on board.</p> <p><b>Standard (How well):</b> Perform go down circuit on board.</p>	<p><b>Go down circuit on board.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b></p> <ul style="list-style-type: none"> <li>• Electrical safety</li> <li>• Tools &amp; Equipment safety.</li> <li>• Personal safety.</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
Replace broken Switches and Plugs immediately.  
Never pulls the flexible cable or wire to disconnect the plug.

Never place bare wire seen on plugs & socket.

**Task 21: Install MCB electrical supply system**

Time : 10 hrs

Theory : 2 hrs

Practical:8 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction</li> <li>2. Collect required tools &amp; materials</li> <li>3. Identify main supply of electrical system</li> <li>4. Identify suitable place to install MCB</li> <li>5. Mark on location of energy meter</li> <li>6. Drill hole on wall</li> <li>7. Insert grip in hole</li> <li>8. Fix base bar of MCB with fastness</li> <li>9. Connect input and output supply through MCB</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b> Install MCB electrical supply system</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Installed MCB following proper procedure</li> <li>• Safety precautions were taken while performing the tasks</li> </ul>	<p><b>MCB electrical supply system</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Component installing procedure</li> <li>• Input and output supply</li> <li>• Input supply connecting procedure</li> <li>• output supply distribution procedure</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety:** Handle all electrical apparatus & Equipment carefully.  
 Replace broken Switches and Plugs immediately.  
 Never pulls the flexible cable or wire to disconnect the plug.  
 Never place bare wire seen on plugs & socket.

**Task 22: Install energy meter in electrical supply system**

Time : 8 hrs  
 Theory : 2 hrs  
 Practical: 6 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction</li> <li>2. Collect required tools &amp; materials</li> <li>3. Identify main supply of electrical system</li> <li>4. Identify suitable place to install Energy meter</li> <li>5. Mark on location of energy meter</li> <li>6. Drill hole on wall</li> <li>7. Insert grip in hole</li> <li>8. Fix Energy meter</li> <li>9. Connect input and output supply through Energy meter</li> </ol>	<p><b>Condition (Given):</b>                      Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b>                      Install Energy meter in electrical supply system</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Installed Energy meter following proper procedure</li> <li>• Safety precautions were taken while performing the tasks</li> </ul>	<p><b>Energy meter</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Component installing procedure</li> <li>• Input and output supply</li> <li>• Input supply connecting procedure</li> <li>• output supply distribution procedure</li> </ul>

**Tools/Equipment:** Tools box set,

**Safety:** Handle all electrical apparatus & Equipment carefully.  
 Replace broken Switches and Plugs immediately.  
 Never pulls the flexible cable or wire to disconnect the plug.

Never place bear wire seen on plugs & socket.

**Task 23: Control one bulb, one tube light set and one fan by two one way switch and dimmer (fan regulator).**

Time : 14 hrs  
Theory : 2 hrs  
Practical: 12 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain instruction and layout diagram.</li> <li>2. Prepare wiring diagram.</li> <li>3. Collect required tools &amp; materials</li> <li>4. Mark the layout on board as per diagram.</li> <li>5. Prepare the main &amp; auxiliary Electrical accessories as per measurement.</li> <li>6. Install the main &amp; auxiliary Electrical accessories on the board.</li> <li>7. Lay wire according to the wiring diagram.</li> <li>8. Connect all electrical accessories according to the wiring diagram.</li> <li>9. Recheck circuit diagram according to the wiring diagram by multi meter.</li> <li>10. Connect power supply.</li> <li>11. Check circuit operation.</li> <li>12. Dismantle circuit.</li> <li>13. Clean and store the electrical accessories.</li> </ol>	<p><b>Condition (Given):</b> Well-equipped electrical workshop with Tools &amp; Materials.</p> <p><b>Task (What):</b> Control one bulb, one Tube light set and one fan by three one way switch and dimmer.</p> <p><b>Standard (How well):</b> Control one bulb, one Tube light set and one fan by three one way switch and dimmer.</p>	<p><b>One bulb, one Tube light set and one fan by three one way switch and dimmer.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Uses</li> <li>• Importance</li> <li>• Advantage</li> <li>• Making procedure</li> </ul> <p><b>Safety Rules.</b> Electrical safety Tools &amp; Equipment safety. Personal safety.</p>

**Tools/Equipment:** Tools box set,

**Safety Precaution:** Handle all electrical apparatus & Equipment carefully.  
Replace broken Switches and Plugs immediately.  
Never pulls the flexible cable or wire to disconnect the plug.

**References:**

- P.S. Dhogal, Electrical Engineering, Vol I & II
- M.L. Anwani, Electrical Engineering

# Technical Drawing

<b>Total:</b>	<b>2 hrs/wk</b>
<b>Theory:</b>	<b>0 hrs/wk</b>
<b>Practical:</b>	<b>2 hrs/wk</b>

## Course description:

This course is designed to help the students to provide skills on handling of drawing instruments and materials and drawing free hand lettering, lines, and different geometrical shapes, isometric and orthographic drawings. This course also deals with ISO standard symbols of electrical /electronic and digital components and simple electrical and electronics circuits.

## Course Objectives:

After completion of this course students will be able to:

1. Project point, line, plane and other geometrical shapes
2. Understand and draw isometric and orthographic drawing
3. Represent three dimensional objects
4. Use freehand techniques to sketch different shapes.
5. Draw basic electronic symbols
6. Draw simple circuit diagram.

## List of Tasks:

1. Draw simple engineering drawing in prescribed scale
2. Draw various geometrical shapes
3. Draw isometric drawing
4. Draw orthographic views
5. Draw various electronic components/devices symbols and circuits

## Task Analysis

**Task: 1 Draw simple engineering drawing in prescribed scale**

Time:- 13 hrs

Theory:- 2 hrs

Practical:- 11 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect Drawing paper and instrument.</li> <li>2. Receive instruction and/or sketches to be drawn.</li> <li>3. Cut drawing sheet in to required size</li> <li>4. Fix drawing sheet/paper on drawing board.</li> <li>5. Draw boarder lines and Name plate.</li> <li>6. Select scale to be use.</li> <li>7. Plan the layout in the drawing sheet.</li> <li>8. Draw the object or the part of object according to layout planned with fin line.</li> <li>9. Complete main drawing.</li> <li>10. Project dimensional lines.</li> <li>11. Provide required dimensions and Title in drawing by free hand.</li> <li>12. Make / draw required Table and schedules.</li> <li>13. Detach and store drawing in safe place.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Drawing board and instruments.</li> <li>• Drawing paper</li> <li>• paper cutter</li> <li>• Cello / masking tape</li> <li>• Complete sketches of simple engineering drawing</li> <li>• scale</li> <li>• Drawing Tool and instrument</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Draw simple engineering drawing in prescribed scale.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Common drawing instruments properly handled and used.</li> <li>• Drawing sheet laid in standard format</li> <li>• Common symbols draw and interpreted correctly.</li> <li>• Draw and interpreted and deferent types of lines correctly.</li> <li>• Engineering scale used and interpreted correctly.</li> <li>• Draw and interpreted simple engineering drawing with required free hand lettering and numbering cleanly and neatly.</li> </ul>	<p><b>Drawing</b></p> <ul style="list-style-type: none"> <li>• Introduction, types, use, importance, advantages and sizes of drawing sheet...</li> <li>• Types, uses and importance of plan views and sections</li> <li>• Importance, uses and advantages of sketches and drawing symbols.</li> <li>• Importance of proper layout and cleanliness in drawing and drawing sheet.</li> <li>• Types of lines, uses and its importance.</li> <li>• Methods of dimensioning and its importance</li> </ul> <p><b>Instruments</b></p> <ul style="list-style-type: none"> <li>• Introduction, types, uses importance, advantages and methods of handling.</li> <li>• Types of pencils and it uses</li> <li>• Importance, uses, and methods of interpreting engineering scale (Life, reduce and enlarge size)</li> <li>• Importance and use of free hand lettering and numbering.</li> </ul>

**Tools and Materials:-**

**Safety:-**

**Task: 2 Draw various geometrical shapes**

Time:- 15 hrs  
Theory:- 3 hrs  
Practical:- 12 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect Drawing paper and instrument.</li> <li>2. Receive instruction and/or sketches to be drawn.</li> <li>3. Cut drawing sheet in to required size</li> <li>4. Fix drawing sheet/paper on drawing board.</li> <li>5. Draw boarder lines and Name plate.</li> <li>6. Select scale to be used.</li> <li>7. Plan the layout in the drawing sheet.</li> <li>8. Draw specified / various geometrical shapes in drawing sheet with fin and clear lines according to layout planning.</li> <li>9. Construct specified / various geometrical shapes in drawing sheet.</li> <li>10. Project dimensional lines.</li> <li>11. Provide required dimensions and Title in drawing by free hand.</li> <li>12. Detach and store drawing in safe place.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Drawing board and instruments.</li> <li>• Drawing paper</li> <li>• paper cutter</li> <li>• Cello / masking tape</li> <li>• Shape specified</li> <li>• scale</li> <li>• Drawing Tool and instrument</li> <li>• Geometrical shape specified</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Draw various geometrical shapes.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Neat and clean Specified /various geometrical shapes drawn with correct procedures.</li> </ul>	<p><b>Geometrical shape</b></p> <ul style="list-style-type: none"> <li>• Introduction, types, uses and importance of various shapes</li> <li>• Lines</li> <li>• Angles</li> <li>• Arcs of circle</li> <li>• Regular polygon</li> <li>• Tangent line of circle</li> <li>• Ellipse</li> <li>• Cube</li> <li>• Prism</li> <li>• Parabola</li> <li>• Hyperbola</li> <li>• Cycloid</li> <li>• Helix (Cylindrical)</li> <li>• Circular Involute</li> <li>• Procedure and methods of Using Drawing instruments</li> <li>• Procedure and methods of constructing various geometrical shape</li> </ul>

**Tools and Materials:-**

**Safety:-**

**Task: 3 Draw isometric Drawing**

Time:- 15 hrs  
 Theory:- 3 hrs  
 Practical:- 12 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect Drawing paper and instruments.</li> <li>2. Receive instruction object and/or sketches to be drawn.</li> <li>3. Cut drawing sheet in to required size</li> <li>4. Fix drawing sheet/paper on drawing board.</li> <li>5. Draw boarder lines and Name plate.</li> <li>6. Select scale to be use.</li> <li>7. Plan the layout in the drawing sheet.</li> <li>8. Project required lines with proper pencils and instruments as per planed layout.</li> <li>9. Complete main drawing.</li> <li>10. Project dimensional lines.</li> <li>11. Provide required dimensions and Title in drawing by free hand.</li> <li>12. Detach and store drawing in safe place.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Drawing board and instruments.</li> <li>• Drawing paper</li> <li>• paper cutter</li> <li>• Cello / masking tape</li> <li>• Two dimensional/ isometric sketches and/or real object.</li> <li>• Scale mention e.g. 1:2 or 1/4 size etc.</li> <li>• Drawing Tool and instrument</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Draw isometric drawing.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Draw neat and clean required isometric view in mention scale correctly with right procedure.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction, uses and importance of 2-D and 3-D Drawing.</li> <li>• FPS and metric system</li> <li>• Introduction to Axonometric projection</li> <li>• Introduction, uses and importance of isometric drawing</li> <li>• Procedure and methods of drawing isometric drawing.</li> </ul>

**Tools and Materials:-**

**Safety:-**



**Task: 4 Draw orthographic views**

Time:- 20 hrs

Theory:- 3 hrs

Practical:- 17 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Collect Drawing paper and instruments.</li> <li>2. Receive instruction object and/or sketches to be drawn.</li> <li>3. Cut drawing sheet in to required size</li> <li>4. Fix drawing sheet/paper on drawing board.</li> <li>5. Draw boarder lines and Name plate.</li> <li>6. Select scale to be use.</li> <li>7. Plan the layout in the drawing sheet.</li> <li>8. Project required lines with proper pencils and instruments as per planed layout.</li> <li>9. Complete main drawing.</li> <li>10. Project dimensional lines.</li> <li>11. Provide required dimensions and Title in drawing by free hand.</li> <li>12. Detach and store drawing in safe place.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Drawing board and instruments.</li> <li>• Drawing paper</li> <li>• paper cutter</li> <li>• Cello / masking tape</li> <li>• Two dimensional/ isometric sketches and/or real object.</li> <li>• Scale mention e.g. 1:2 or 1/4 size etc.</li> <li>• Drawing Tool and instrument</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Draw orthographic Drawing</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Draw neat and clean orthographic drawing in mention scale correctly with right procedure</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction, types, uses and importance of orthographic drawing</li> <li>• Procedure and methods of drawing orthographic drawing.</li> <li>• Systems of Orthographic Projection: First Angle and Third Angle</li> </ul>

**Tools and Materials:-****Safety:-**

**Task: 5 Draw various electronic components/ devices symbols and circuits**

Time:- 15hrs  
Theory:- 2 hrs  
Practical:- 13 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect Drawing paper and instruments.</li> <li>2. Receive instruction object and/or sketches to be drawn.</li> <li>3. Cut drawing sheet in to required size</li> <li>4. Fix drawing sheet/paper on drawing board.</li> <li>5. Draw boarder lines and Name plate.</li> <li>6. Select scale to be use.</li> <li>7. Plan the layout in the drawing sheet.</li> <li>8. Project required lines with proper pencils and instruments as per planed layout.</li> <li>9. Complete main drawing.</li> <li>10. Project dimensional lines.</li> <li>11. Provide required dimensions and Title in drawing by free hand.</li> <li>12. Detach and store drawing in safe place.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Drawing board and instruments.</li> <li>• Drawing paper</li> <li>• paper cutter</li> <li>• Cello / masking tape</li> <li>• Two dimensional/ isometric sketches and/or real object.</li> <li>• Scale mention e.g. 1:2 or 1/4 size etc.</li> <li>• Drawing Tool and instrument</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Draw various electronic components/devices symbols and circuits</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Draw neat and clean drawing of various electronic components/devices symbols and circuits correctly with right procedure</li> </ul>	<ul style="list-style-type: none"> <li>• Draw basic symbols for active components such as transistors PNP/NPN, diodes, SCR, MOSFET, CMOS, JFET, FET and thyristers.</li> <li>• Draw symbols for Logic Gates (AND,OR,NOT, NAND, NOR, XOR, XNOR and Flip-Flops)</li> <li>• Draw circuit diagram of simple measuring instruments (Voltmeter, Ammeter and Ohmmeter)</li> </ul>

**Tools and Materials:-**

**Safety:-**

**References:**

1. Luzadder, W.J., **Fundamental of Engineering Drawing**, Prentice-Hall of India Pvt-Ltd., New Delhi, Latest edition.
2. Bhatt N. D. and Panchal V.M., **Engineering Drawing**, Charotar Publishing House, 2001.
3. Gill P.S, **Engineering Drawing**, S. K. Kataraiya & Sons, New Delhi, 2004/2005
4. Surjit Singh, **General Electrical Drawing**, S.K. Kataria and sons

# Repair and Maintenance of Radio Set

Total:	8 hrs/wk
Theory:	2 hrs/wk
Practical:	6 hrs/wk

## Course Description:

This course intends to provide knowledge and skills on repairing and maintenance of power supply, amplifier and AM-FM radio set.

## Course Objectives:

At the end of the course students will be able to:

1. Operate multi-meter, signal generator, signal tracer,
2. Assemble multi voltage power supply
3. Repair multi voltage power supply
4. Assemble of AM radio receiver
5. Repair simple AM radio receiver set
6. Assemble of simple FM radio receiver set
7. Repair simple FM radio receiver
8. Repair radio with USB pen-drive player

## Theory

### Contents:

- 1. Signal generator - 2 hrs**
  - a. RF(radio frequency) signal generator
  - b. IF(Intermediate frequency) signal generator
  - c. AF(Audio frequency) signal generator
- 2. Power supply - 6 hrs**
  - a. Need of dc power supply and comparing to battery power supply
  - b. Function of step-down transformer in power supply
  - c. Function of rectifier circuits and filter circuits
  - d. Function of safety fuse and indicator in power supply
  - e. Basic faults and fault finding methods
- 3. AM Radio - 25 hrs**
  - a. AM modulation/Demodulation
  - b. Simple AM radio transmitter block diagram and explanation
  - c. Simple AM radio receiver block diagram and explanation
  - d. Basic faults and fault finding methods
- 4. FM Radio - 12 hrs**
  - a. FM modulation/Demodulation
  - b. Simple FM radio transmitter block diagram and explanation
  - c. Simple FM radio receiver block diagram and explanation
  - d. Basic faults and fault finding methods
- 5. Memory device and types - 5 hrs**
  - a. Pen-drive memory, flash memory chips functions
  - b. Basic faults and fault finding methods

## Practical

### List of Tasks:

1. Operate multi-meter, signal generator, signal tracer, oscilloscope - 18 hrs
2. Assemble multi voltage power supply (without using IC) - 48 hrs
3. Repair multi voltage power supply(without using IC) - 18 hrs
4. Assemble of an amplifier - 24 hrs
5. Repair an amplifier -18 hrs
6. Assemble of AM radio receiver - 54 hrs
7. Repair simple AM radio receiver set - 54 hrs
8. Assemble of simple FM radio receiver set - 30 hrs
9. Repair simple FM radio receiver - 30 hrs
10. Repair radio with USB pen-drive player - 18 hrs

## Task Analysis

### Task: 1 Operate signal generator (RF+IF+AF)

Time:- 10 hrs  
Theory:- 4 hrs  
Practical:-6 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtain operating / user's manual.</li> <li>2. Study operating / user's manual.</li> <li>3. Turn on power switch of generator and Oscilloscope.</li> <li>4. Select the functional button for proper operation of signal generator.</li> <li>5. Set desired frequency pattern (Sine /square )</li> <li>6. Check the selected frequency using Oscilloscope.</li> <li>7. Readjust output performance as per requirement.</li> <li>8. Check the performance of various operations.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Signal generator</li> <li>• Oscilloscope</li> <li>• Operational manual</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Operate single generator</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Desired frequency pattern set in Single generator and operated it correctly as instructed by manual and frequency produced as set when checked by Oscilloscope.</li> </ul>	<p><b>Signal generator</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types</li> <li>• Frequency range</li> <li>• Operating procedure</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precautions.</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-** 1. Use safety spectacle, rubber shoe, fitted working dress, globe  
2. Check electric lines and possible hazards before starting to work

**Task: 2 Assemble simple multi voltage dc voltage power supply (adaptor)**

Time:-28 hrs  
Theory:- 4 hrs  
Practical:- 24 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required components as per circuit diagram</li> <li>2. Collect required tools and equipment</li> <li>3. Check all the components</li> <li>4. Arrange the connections of components as in circuit</li> <li>5. Solder all the connections</li> <li>6. Fit or cover all possible high voltage with two pin and insulating tapes</li> <li>7. Check output voltages with dc voltage meter by supplying ac mains in input</li> <li>8. Fix the circuit device in enclosure box</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Required components as in circuit</li> <li>• Complete circuit diagram</li> <li>• Soldering iron with paste, soldering wire and all other instruments for workshop</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Assemble dc multi voltage power supply adaptor )</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• The wires cable &amp; components neatly soldered in the PCB</li> <li>• The connectors plugged into the socket</li> <li>• The set assembled as per circuit diagram and checked for normal operation mode</li> </ul>	<p><b>Simple multi voltage adaptor</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work



**Task: 3 Repair simple multi voltage dc voltage power supply (adaptor)**

Time:- 28 hrs  
Theory:- 4 hrs  
Practical:- 24 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Measure test pin voltage of unit</li> <li>4. Identify faulty components.</li> <li>5. Replace faulty components by right one.</li> <li>6. Measure and record output voltage</li> <li>7. Assemble unit in the enclosure.</li> <li>8. Perform final test for particular unit.</li> <li>9. Perform required adjustment</li> <li>10. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty simple multi voltage adaptor</li> <li>2. Circuit diagram</li> <li>3. Assortment of the component used in simple multi voltage adaptor</li> </ol> <ul style="list-style-type: none"> <li>• Tool set</li> <li>• Fully equipped electronic workshop.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain simple multi voltage adaptor</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Dismantle the unit without further damage</li> <li>• Replaced components correctly</li> <li>• Simple multi voltage adaptor repaired correctly and functioned normally</li> </ul>	<p><b>Simple multi voltage adaptor</b></p> <ul style="list-style-type: none"> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work



**Task: 4 Assemble radio receiver**

Time:- 28 hrs  
 Theory:- 4 hrs  
 Practical:- 24 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect components as per circuit diagram</li> <li>2. Collect required tools and equipment</li> <li>3. Check all the components</li> <li>4. Clean the required track of PCB plate and leads of components</li> <li>5. Solder the components in PCB starting from outside to input side carefully</li> <li>6. Check for soldering polarity of components and open circuit on the PCB track.</li> <li>7. Power on (AC or Dc)</li> <li>8. Check the functioning of the circuit by taking measurement at the test point as indicate in the circuit diagram</li> <li>9. Test the Audio detector and if and RF section using different single generator</li> <li>10. Assemble the complete circuit in the enclosure</li> <li>11. Test the object for operational function</li> <li>12. Align the IFT coils oscillator coils and Antenna coils if needed</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• L plate PCB</li> <li>• AC Mains socket</li> <li>• Circuit diagram</li> <li>• Well-equipped electronics work shop</li> </ul> <p><b>Tasks (What):</b> Assemble L plate Radio</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• The wires cable &amp; components neatly soldered in the PCB</li> <li>• The connectors plugged into the socket</li> <li>• The set assembled as per circuit diagram and checked for normal operation mode</li> <li>• Required track of L-plate PCB and leads of components cleaned without short circuit</li> </ul>	<ul style="list-style-type: none"> <li>• Radio receiver, definition</li> <li>• Radio communication definition</li> <li>• Block diagram of radio receiver</li> <li>• Operating principle radio</li> <li>• Circuit diagram of normal radio and it's explanation</li> <li>• Modulation &amp; demodulation</li> <li>• Measurements</li> <li>• Measuring instruments</li> <li>• Assembling procedure radio</li> <li>• Measuring instruments</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 5 Repair and maintain L-plate radio receiver**

Time:- 26 hrs  
 Theory:- 2 hrs  
 Practical:- 24 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical condition of component</li> <li>4. Check voltage of the test pins.</li> <li>5. Observe the condition of Mechanical unit.</li> <li>6. Identify the faulty components.</li> <li>7. Replace the faulty components.</li> <li>8. Test the unit for normal operation.</li> <li>9. Assemble the unit in the enclosure.</li> <li>10. Perform the final test of unit.</li> <li>11. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• A faulty Radio receiver set, soldering iron, de-soldering pump, soldering lead, Assortment of components used in radio, radio signal generator, tweezers, jumper wire, circuit diagram and power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain radio receiver.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Replaced Faulty component with proper value and rating component without damaging adjacent part.</li> <li>• Unit repaired correctly with proper connection and gained normal operational function.</li> </ul>	<ul style="list-style-type: none"> <li>• Circuit diagram of modern radio</li> <li>• Trouble shooting procedure.</li> <li>• Use of single generator</li> <li>• Advantage of repairing and maintaining radio</li> <li>• Application.</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 6 Assemble FM radio**

Time:- 28 hrs  
 Theory:- 4 hrs  
 Practical:- 24 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required components</li> <li>2. Collect required tools and equipment</li> <li>3. Plug soldering iron to the AC mains socket (35 watts)</li> <li>4. Remove Battery remove AC main cord from AC main socket</li> <li>5. Put ON-OFF switch to OFF position</li> <li>6. Soldering the wire cables components in the PCB as per circuit diagram</li> <li>7. Fix the main PCB in the cabinet and fasten the screws</li> <li>8. Plug in AC mains cord of the set/power switch to ON-position</li> <li>9. Check the functional operation of the fin radio</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• FM radio kit</li> <li>• AC main socket</li> <li>• Circuit diagram</li> <li>• Well-equipped electronics work shop</li> </ul> <p><b>Tasks (What):</b>                      Assemble FM radio</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Wire, cable and components neatly soldered in the PCB without short circuit</li> <li>• Connectors plugged in to the socket</li> <li>• FM radio set assembled correctly neatly without defect checked functional operation of radio</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of FM radio</li> <li>• Advantages</li> <li>• Importance of FM radio</li> <li>• Block diagram of FM radio and its functions</li> <li>• Circuit diagram of radio and it's explanation</li> <li>• Assembling procedures and techniques of FM radio components</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 7 Repair and maintain FM radio receiver**

Time:- 28 hrs.  
Theory:- 4 hrs  
Practical:- 24 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical condition of component</li> <li>4. Check voltage of the test pins.</li> <li>5. Observe the condition of Mechanical unit.</li> <li>6. Identify the faulty components.</li> <li>7. Replace the faulty components.</li> <li>8. Test the unit for normal operation.</li> <li>9. Assemble the unit in the enclosure.</li> <li>10. Perform the final test of unit.</li> <li>11. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• A faulty Radio receiver set, soldering iron, de-soldering pump, soldering lead, Assortment of components used in radio, radio signal generator, tweezers, jumper wire, circuit diagram and power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain radio receiver.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Replaced Faulty component with proper value and rating component without damaging adjacent part.</li> <li>• Unit repaired correctly with proper connection and gained normal operational function.</li> </ul>	<ul style="list-style-type: none"> <li>• Circuit diagram of modern radio</li> <li>• Trouble shooting procedure.</li> <li>• Use of single generator</li> <li>• Advantage of repairing and maintaining radio</li> <li>• Application.</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 8 Repair and maintain radio with USB pen-drive memory players**

Time:- 24 hrs  
Theory:- 6 hrs  
Practical:-18 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical condition of component</li> <li>4. Check voltage of the test pins.</li> <li>5. Observe the condition of Mechanical unit.</li> <li>6. Identify the faulty components.</li> <li>7. Replace the faulty components.</li> <li>8. Test the unit for normal operation.</li> <li>9. Assemble the unit in the enclosure.</li> <li>10. Perform the final test of unit.</li> <li>11. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• A faulty Radio receiver set, soldering iron, de-soldering pump, soldering lead, Assortment of components used in radio, radio signal generator, tweezers, jumper wire, circuit diagram and power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain radio receiver.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Replaced Faulty component with proper value and rating component without damaging adjacent part.</li> <li>• Unit repaired correctly with proper connection and gained normal operational function.</li> </ul>	<ul style="list-style-type: none"> <li>• Circuit diagram of radio with USB pen-drive memory</li> <li>• Trouble shooting procedure.</li> <li>• Use of single generator</li> <li>• Advantage of repairing and maintaining radio</li> <li>• Application.</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

# Basic Computer

<b>Total:</b>	<b>5 hrs/wk</b>
<b>Theory:</b>	<b>1 hr/wk</b>
<b>Practical:</b>	<b>4 hrs/wk</b>

## ***Course Description:***

This course deals with the fundamental of the Microsoft windows based computer operating and application software. It also imparts knowledge and skills on internet and email handling. Moreover, it intends to provide skills on computer virus cleaning.

## ***Course Objectives:***

After completion of this course students will be able to:

1. Explain Microsoft windows operating system.
2. Explain disk operating system.
3. Explain typing and key board format.
4. Explain MS word processing application program.
5. Explain MS Excel application program.
6. Explain MS Power point application program.
7. Explain Media player application program.
8. Explain Internet, E-mail.

## **List of Tasks**

1. Operate windows system
2. Perform typing work.
3. Operate MS Office word.
4. Operate MS Excel.
5. Operate MS Power Point.
6. Use Multimedia (Media player in PC)
7. Perform e-mail, internet, and virus cleaning.

## Task Analysis

Time:- 20 hrs

Theory:- 5 hr

Practical:- 15 hrs

### Task 1. Operate windows system

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Start programs.</li> <li>2. Quit programs</li> <li>3. Switch between programs.</li> <li>4. Open a document</li> <li>5. Open a document by using a program.</li> <li>6. Familiar with following commands. (Programs, Documents, settings, find, help, control panel, run, shut down.)</li> <li>7. Add icons to the desktop.</li> <li>8. Delete files &amp; folders to recycle bin.</li> <li>9. View what's on your computer explore computers.</li> <li>10. Customize the explorer file display.</li> <li>11. Create file &amp; folders.</li> <li>12. Save a document. (Create shortcut icons)</li> <li>13. Perform windows system tools</li> <li>14. Setup printer</li> <li>15. Execute DOS commands in windows command prompt.</li> <li>16. Apply external &amp; internal commands.               <ul style="list-style-type: none"> <li>• Create directory</li> <li>• Change directory</li> <li>• Switch back root directory</li> <li>• Switch parent directory</li> <li>• Display list of files sub-directory using DIR</li> </ul> </li> <li>17. Perform following commands.               <ol style="list-style-type: none"> <li>a. EDIT, CHKDSK, Copy Con, REN, DEL, TYPE</li> <li>b. COPY, XCOPY, MOVE</li> </ol> </li> <li>18. Introduce wild card characters*?</li> </ol>	<p><b>Condition (Given):</b> Personal computer</p> <p><b>Tasks (What):</b> Operate windows system.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Used windows commands.</li> <li>• Customized files &amp; folders.</li> <li>• Created files &amp; folders.</li> <li>• Operated windows system tools</li> <li>• Executed DOS commands in windows command prompt.</li> </ul>	<ol style="list-style-type: none"> <li>1. Familiarization with           <ul style="list-style-type: none"> <li>▪ Task bar</li> <li>▪ Start button</li> <li>▪ Recycle bin</li> <li>▪ My document</li> <li>▪ My computer</li> </ul> </li> <li>2. Use of tool bar, menu bar.</li> <li>3. Familiar with icons.</li> <li>4. Different program used in computer.</li> <li>5. Task bar</li> <li>6. Creating &amp; defining process.           <ul style="list-style-type: none"> <li>▪ Maximize</li> <li>▪ Minimize</li> <li>▪ Close.</li> </ul> </li> <li>7 Disk cleaning and disk defragment</li> <li>8 System information and system restore</li> <li>10 Defining printer connection and other devices</li> <li>11 Familiarization of Windows help and support</li> </ol>

**Tools and Materials:-**

**Safety:-** Resolution.

**Task 2. Perform typing work.**

Time:- 30 hrs

Theory:- 4 hr

Practical:- 26 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"><li>1. Load a typing program.</li><li>2. Exit from a typing program.</li><li>3. Use basic level typing that is letters from same middle row.</li><li>4. Use high level typing that is letters/words from all the three rows.</li><li>5. Play typing game to score.</li><li>6. Use all the 10 fingers.</li><li>7. Use advanced level typing that is letters/words and symbols from all four rows.</li></ol>	<p><b>Condition (Given):</b> A pc with typing program installed.</p> <p><b>Tasks (What):</b> Perform typing work.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"><li>• Loaded &amp; quit the program.</li><li>• Used basic, high &amp; advanced level typing.</li><li>• Using all fingers.</li></ul>	<ol style="list-style-type: none"><li>1. Commands to load &amp; quit the typing program.</li><li>2. Use of menu bar.</li><li>3. Use tool bar.</li><li>4. Switching among basic, high &amp; advanced level typing.</li><li>5. Methods of using fingers &amp; hand placement.</li></ol>

**Tools and Materials:-****Safety:-**



**Task 3. Operate MS Office word.**

Time:- 45 hrs  
 Theory:- 5 hrs  
 Practical:-40 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Load MS-Word program.</li> <li>2. Exit MS-Word program.</li> <li>3. Create word document.</li> <li>4. Save word document.</li> <li>5. Perform cursor movement.</li> <li>6. Apply all menu bars.</li> <li>7. Apply templates.</li> <li>8. Protect document with password.</li> <li>9. Perform page setup.                             <ol style="list-style-type: none"> <li>a. Change margins.</li> <li>b. Change page orientation.</li> <li>c. Format document.</li> <li>d. Format alignment.</li> <li>e. Format selling</li> <li>f. Paragraph selling</li> <li>g. Edit document.</li> <li>h. Apply tool menu (cut, copy, pest)</li> </ol> </li> <li>10. Review document                             <ol style="list-style-type: none"> <li>a. Check spelling</li> <li>b. Check grammar</li> <li>c. Count word</li> </ol> </li> <li>11. Create table</li> <li>12. Create picture, shapes</li> <li>13. Create chart</li> <li>14. Apply equation tool</li> <li>15. Insert header, footer, page number, date &amp; time, end note.</li> <li>16. Create a page border.</li> <li>17. Perform scaling</li> <li>18. Perform section break.</li> <li>19. Print a document.</li> </ol>	<p><b>Condition (Given):</b>                      A PC with latest version MS-Office installed.</p> <p><b>Tasks (What):</b>                      Operate MS-Office word</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Created word document.</li> <li>• Used templates.</li> <li>• Protected document with password.</li> <li>• Printed a document according to given layout.</li> <li>• Created a table, picture, and chart.</li> <li>• Created equations</li> <li>• Inserted header, footer, page number, date, time.</li> <li>• Created a page border.</li> </ul>	<ol style="list-style-type: none"> <li>1. MS-Word.                             <ul style="list-style-type: none"> <li>▪ What does it do?</li> <li>▪ Menu bar</li> <li>▪ Tool bar</li> <li>▪ Screen</li> </ul> </li> <li>2. Concept of templates.</li> <li>3. Asking the office assistant for help.</li> <li>4. Rows &amp; column in table creation.</li> <li>5. Inserting picture and shapes</li> <li>6. Defining chart</li> <li>7. Concept of header, footer, page</li> <li>8. Defining mathematical equations and standard symbols ( Summation, different brackets, trigonometric symbols )</li> <li>9. Printer setting concept</li> </ol>

**Tools and Materials:-**

**Safety:-**

**Task 4. Operate MS Excel.**

Time:- 25 hrs  
 Theory:- 5 hrs  
 Practical:- 20 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Load excel program.</li> <li>2. Exit excel program.</li> <li>3. Create worksheet.</li> <li>4. Layout (design) worksheet.</li> <li>5. Move through a worksheet.</li> <li>6. Scroll through a worksheet.</li> <li>7. Enter data in worksheet cells.</li> <li>8. Copy data in worksheet.</li> <li>9. Edit cell contents:                             <ol style="list-style-type: none"> <li>a) Merge cell</li> <li>b) Warp text</li> <li>c) Format cell (number, currency, row height, width and so on)</li> <li>d) cell styles</li> </ol> </li> <li>10. Sort cell contents or data.                             <ol style="list-style-type: none"> <li>a) ascending</li> <li>b) descending</li> </ol> </li> <li>12. Enter formula or equations                             <ol style="list-style-type: none"> <li>a) Trigonometric functions</li> <li>b) Sum, Average</li> <li>c) Count numbers</li> <li>d) Maximum and minimum</li> </ol> </li> <li>13. Draw charts:                             <ol style="list-style-type: none"> <li>a) Bar</li> <li>b) Pie</li> <li>c) Line</li> </ol> </li> <li>14. Print layout</li> </ol>	<p><b>Condition (Given):</b>                      Computer with latest MS-Office package installed.</p> <p><b>Tasks (What):</b>                      Operate excel.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Created worksheet, work book, chart sheet</li> <li>• Entered data, formula, numbers.</li> <li>• Saved the entered data.</li> <li>• Printed layout.</li> </ul>	<ol style="list-style-type: none"> <li>1. Feature of excel.</li> <li>2. Components of excel worksheet &amp; work book.                             <ul style="list-style-type: none"> <li>▪ Menu bar</li> <li>▪ Tool bar</li> <li>▪ Font</li> <li>▪ Name box</li> <li>▪ Formula box.</li> <li>▪ Tab scrolling button</li> <li>▪ Active sheet tab.</li> <li>▪ Inactive sheet tab.</li> <li>▪ Split box.</li> </ul> </li> <li>3. Sorting data</li> <li>4. Mathematical equations</li> <li>5. Excel defined functions</li> <li>6. Defining charts : Bar, Pie, line</li> </ol>

**Tools and Materials:** - Latest version computer, printer, photocopy papers.

**Safety:-**

**Task 5. Operate MS Power Point.**

Time:- 15 hrs  
 Theory:- 2 hrs  
 Practical:- 13 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Load Power point program.</li> <li>2. Exit Power point program.</li> <li>3. Creat Power point slide                             <ol style="list-style-type: none"> <li>a. Add title, sub title.</li> <li>b. Add new slide for Presentation.</li> <li>c. Layout slide:                                     <ul style="list-style-type: none"> <li>• Title and content</li> <li>• Two contents</li> <li>• Content with caption</li> <li>• Picture with caption</li> </ul> </li> </ol> </li> <li>4. Set font for title and content</li> <li>5. Design slides:                             <ol style="list-style-type: none"> <li>a) Set slide orientation</li> <li>b) Set background, color</li> <li>c) Set slide themes</li> </ol> </li> <li>6. Insert audio and video clips in the presentation slides</li> <li>7. Apply transition effect</li> <li>8. Apply animation effect</li> <li>9. Present slide</li> <li>10. Print slide</li> </ol>	<p><b>Condition (Given):</b>                      Computer with MS-Office package installed.</p> <p><b>Tasks (What):</b>                      Operate Power point.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Created Power point slides</li> <li>• Entered title, sub title, contents.</li> <li>• Saved the presentation slides.</li> <li>• Presented slides.</li> <li>• Printed slides.</li> </ul>	<ol style="list-style-type: none"> <li>1. Feature of MS Power point.</li> <li>2. Components of MS power point.                             <ol style="list-style-type: none"> <li>i. Menu bar</li> <li>ii. Tool bar</li> <li>iii. Font, color , background styles</li> <li>iv. Design template</li> <li>v. Text box.</li> <li>vi. Slide transition effect</li> <li>vii. Slide animation.</li> <li>viii. Slide show features.</li> </ol> </li> <li>3. Audio and video files</li> <li>4.</li> </ol>

**Tools and Materials:** - Latest version computer, printer, photocopy papers.

**Safety:-**

**Task 6. Use Multimedia (Media player in PC)**

Time:- 15 hrs  
 Theory:- 2 hrs  
 Practical:- 13 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
1. Load media player. 2. Exit from media player. 3. Store Audio/Video files in media library. 4. Identify play lists for Audio /Video. 5. Play media files. 6. Identify media files from list of all files. 7. Adjust volume, bass treble of the media player. 8. Copy media files from CD, DVD etc. 9. Save media files.	<b>Condition (Given):</b> A PC with media player.  <b>Tasks (What):</b> Use multimedia  <b>Standard (How well):</b> <ul style="list-style-type: none"> <li>• Stored music in media library.</li> <li>• Played media files.</li> <li>• Adjusted volume, bass, treble.</li> <li>• Copied media files from CD, DVD.</li> </ul>	1. What is multimedia? 2. What does it do? 3. Music folders. 4. Media library. 5. Menu bars. 6. Tool bars. 7. Drag & drop operation. 8. Copying procedure. 9. Saving techniques from CD, DVD while playing.

**Tools and Materials:-** PC, Media player software

**Safety:-**

**Task 7. Perform e-mail, internet, and virus cleaning.**

Time:-45 hrs  
 Theory:- 5 hrs  
 Practical:- 40 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Load Internet browser.                             <ol style="list-style-type: none"> <li>a) Google chrome</li> <li>b) Internet explorer</li> <li>c) Mozilla Firefox</li> </ol> </li> <li>2. Create new internet based E-mail account (G-mail, yahoo mail).</li> <li>3. Sign in E-mail account.</li> <li>4. Send E-mail message.</li> <li>5. Receive E-mail message.</li> <li>6. Attach files to messages.</li> <li>7. Sign out E-mail account.</li> <li>8. Create new E-mail account in MS Outlook.</li> <li>9. Send message via Outlook.</li> <li>10. Receive message via Outlook.</li> <li>11. Open search engines (Google, Yahoo)</li> <li>12. Browse electronics related web sites.</li> <li>13. Book mark useful web sites</li> <li>14. Save files from internet, websites.</li> <li>15. Exit from internet browser.</li> <li>16. Check Computer virus for websites, internet based files.</li> <li>17. Clean virus, if found.</li> <li>18. Run real time virus protection software.</li> </ol>	<p><b>Condition (Given):</b>                      A PC with internet connected, Computer virus cleaning software.</p> <p><b>Tasks (What):</b>                      Perform e-mail, internet, and virus checking.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Signed up a new account.</li> <li>• Sent &amp; received e-mails.</li> <li>• Attached files.</li> <li>• Browsed internet</li> <li>• Saved files form internet.</li> <li>• Checked computer virus for internet files</li> </ul>	<ol style="list-style-type: none"> <li>1. Definition of Internet browser                      Search engines                      Internet based e-mail system (G-mail, Yahoo mail)                      Websites</li> <li>2. Outlook express                      Creating New account/adding a mail.                      Working with address book.</li> <li>3. Computer virus:                      Types of virus.                      Effects caused by virus.                      The preventive measures from virus.</li> <li>4. Concept of Networking                      LAN                      MAN                      WAN</li> </ol>

**Tools and Materials:-** PC having internet connection

**Safety:-**

# **Second Year**

# Applied Math II

<b>Total:</b>	<b>2 hrs/wk</b>
<b>Theory:</b>	<b>2 hrs/wk</b>
<b>Practical:</b>	<b>0 hrs/wk</b>

## Course Description:

This course is designed to help the students to calculate and apply the mathematical knowledge in a standard applied manner. It mainly focuses on electronics and digital mathematics.

## Course Objectives:

After completion of this course students will be able to:

1. Understand logarithms and antilogarithms
2. Develop skill of mathematics calculus
3. Develop the skill needed for the calculation of electronic engineering mathematics

## Contents

<b>1. Matrix and Determination</b>	<b>16</b>
• Matrix addition up to 3 by 3 matrix	
• Matrix multiplication up to 3 by 3 matrix	
• Determination of matrix up to 3 by 3 matrix	
• Solve system of linear equations – 2 equations, 3 equations by using Cramer's Rule	
<b>2. Logarithms &amp; Antilogarithms</b>	<b>16</b>
• Definition logarithms	
• Properties of logarithms	
• Characteristics and Mantissa	
• Method of finding Characteristics and Mantissa	
• Definition Antilogarithms	
• Method of finding Antilog of logarithm number	
• Uses of logarithms & Antilogarithms table	
• Solve some simple exercise	
<b>3. The limits</b>	<b>14</b>
• Definition	
• Types	
• Properties	
• Solve some simple exercise	
<b>4. Derivative</b>	<b>16</b>
• Definition	
• Derivative of simple algebraic functions from First principle or definition.	
• Techniques of differentiation (Derivations are not required)	
• The sum rule	
• The product rule	
• The power rule	

- The quotient rule
- Solve some simple exercise of Derivatives using formula

## **5. Integration & Anti-derivatives**

**16**

- Definition
- Indefinite integrals of simple algebraic functions
- Some simple exercise

### **References:**

- GD Panta, **Basic calculus**,
- D R Bajracharya, **Basic Mathematics**,



# Electronics Trade Technology

<b>Total:</b>	<b>2 hrs/wk</b>
<b>Theory:</b>	<b>2 hrs/wk</b>
<b>Practical:</b>	<b>0 hrs/wk</b>

## Course Description:

This course deals the characteristics and applications of semiconductor devices, analog, digital circuits and basic electronics with on analysis, selection, biasing, and applications. It also imparts knowledge to construct, analyze, verify, and troubleshoot analog circuits and digital circuits using appropriate techniques and test equipment.

## Course Objectives:

After completion of the course students will be able to:

1. Understand the basic principle of electronics of analog and digital circuit, calculation of voltage and current,
2. Troubleshoot electronics engineering problems in the fields of electronics and communication engineering,
3. Employ necessary techniques, hardware, and communication tools for modern engineering applications,
4. Solve problems through analytical thinking in their own or related fields.

## Contents

### 1. Voltage & Current Sources (5 hrs)

- Introduction
- Battery
- Regulated DC Supplies
- Concept of voltage sources
- Ideal voltage sources
- Ideal current sources
- Conversion of Voltage sources in to Current Sources
- Conversion of current sources in to voltage Sources

### 2. Semiconductors Materials & Properties (5 hrs)

- Introduction
- Atomic Structure of few elements
- Energy Bonds
- Forbidden Energy Gap
- Energy Band gap of Conductors, Insulators & Semiconductors
- Classification of Semiconductors
- N-type semiconductors
- P-type semiconductors
- Doping of semiconductor

- 3. Magnetism & Electro Magnetism (4 hrs)**
  - Definition of magnetic field, magnetic flux, flux density, magnetic field intensity
  - Permanent magnets & Electromagnets
  - Explanation of electro magnetism and relays
  - Production of induced emf & current
  - Faradays laws of electromagnetic induction
  - Explanation of Lenz's Law
- 4. Electrolysis & its Application (5 hrs)**
  - Faradays law of Electrolysis & its applications
  - Primary & Secondary Cell, definition & examples
  - Internal resistance of cells
  - Series & parallel connection of cells
  - Explanation & demonstration of different types of battery
- 5. Transistors Characteristics (6 hrs)**
  - Common Base Configuration
  - Common Emitter Configuration
  - Common Collector Configuration
  - D.C load line Analysis
  - Importance of D.C load line
  - Relation between current gain  $\alpha$  &  $\beta$
- 6. Amplifiers & oscillators (8 hrs)**
  - Introduction
  - Classification of amplifiers
  - Transistor amplifiers circuits
  - Multi stage amplifiers circuits
  - RC coupled amplifiers
  - Compare between amplifiers & oscillators
  - Classification of Oscillators
- 7. Working principle of BJT, JFET, MOSFET, SCR, DIAC & TRIAC (6 hrs)**
- 8. Explanation of different types of memory (3hrs)**
  - RAM, ROM, PROM, EPROM & EEPROM
- 9. Explain the concept of generators & motors (3 hrs)**
- 10. Explain Digital logic gate families (4 hrs)**
  - RTL family
  - DTL family
  - TTL family
  - CMOS family
  - Comparison of above mentioned families
- 11. Explain the concept of communication system (6 hrs)**
  - Read & interpret block diagram
  - Explain radio communication system ( Block diagram)

- Explain FM & AM modulation

**12. Introduce different communication system (8 hrs)**

- Define digital communication system & explain its functions & uses
- Define optical fiber communication system & explain its functions & uses
- Define satellite communication system & explain its functions & uses
- Define wireless system (GSM,CDMA) & explain its functions & uses
- Define PSTN & explain its functions & uses

**13. Describe microphone and its types (6 hrs)**

- Define dynamic micro phone & explain its working principles
- Define condenser micro phone & explain its functions & uses
- Define carbon micro phone & explain its functions & uses
- Define crystal micro phone & explain its functions & uses

**14. Describe speaker (3 hrs)**

- Explain principle of operation
- Identify the different parts of speaker
- Sound box
- Ear piece and head phone

**15. Describe different control systems (3 hrs)**

- Equilizer
- Tone control
- Bass control
- Volume control

**16. Describe recording system (3 hrs)**

- Magnetic recording system
- Optical recording system

**References:**

- B.L. Therjan, **Textbook of electrical Technology Volume I & II**, S. Chand Technical
- J.B. Gupta, **Basic electrical engineering**, S.K. Kataria and sons
- P.S. Dhogal, **Basic Electronics engineering Volume I&II**, Mc Graw Hill education, Pvt. Ltd, India
- Morris Mano, **Digital fundamental**, Pearson

# Computer Aided Circuit Design

<b>Total:</b>	<b>2 hrs/wk</b>
<b>Theory:</b>	<b>0 hrs/wk</b>
<b>Practical:</b>	<b>2 hrs/wk</b>

## ***Course Description:***

This course provides comprehensive knowledge and skills on designing electrical and electronic circuits. It also deals with drawing circuits manually, with the help of AutoCAD®Electrical and simulation of drawn circuits.

## **Course Objectives:**

After completion of this course students will be able to:

1. Explain drawing of Electrical and Electronic circuit (Block diagram).
2. Explain assembling and /or manufacturing drawing.
3. Be familiar with AutoCAD®Electrical.
4. Explain Electrical and Electronic circuit simulation.

## **List of Tasks**

1. Interpret assembling and manufacturing drawing
2. Draw block diagram of different Electrical/Electronic circuits
3. Draw circuit with computer aided simulation software.

## Task Analysis

### Task: 1 Interpret assembling and manufacturing drawing

Time:- 18 hrs  
Theory:- 2 hrs  
Practical:- 16 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect assembling and/or manufacturing drawing.</li> <li>2. Study assembling and/or manufacturing drawing.</li> <li>3. Flow instructions provided in assembling and/or manufacturing drawing.</li> <li>4. Identify /distinguish and /or explain the meaning of common Electrical and Electronic symbols</li> <li>5. Assemble the Electronic unit /object according to assembling drawing.</li> </ol> <p style="text-align: center;">Or</p> <ol style="list-style-type: none"> <li>6. Explain the assembling line according to assembling drawing.</li> <li>7. Compare / verify manufacturing drawing (diagram) with PCB Board.</li> <li>8. Identify defects of installed PCB Board of unit by verifying manufacturing drawing</li> <li>9. Prepare block drawing/ Sketches according to the manufacturing drawing.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• <b>Assembling and manufacturing drawing</b></li> <li>• Tool/Equipment and materials.</li> <li>• Required Component</li> <li>• PCB board</li> <li>• List of electrical and electronic symbols</li> <li>• Symbolic representation of electrical and electronic symbols</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Interpret assembling and/or manufacturing drawing.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Various electrical and electronic symbols identified, distinguish and interpreted correctly</li> <li>• Electronic unit /object assembled or explain assembling process according to assembling drawing.</li> <li>• Manufacturing drawing compared /verified with PCB board correctly</li> </ul>	<p><b>Assembling and manufacturing drawing</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance, advantages and application</li> <li>• Importance, advantages and application of Electrical and Electronic symbols</li> </ul>

**Tools and Materials:-**

**Safety:-**

**Task: 2 Draw block diagram of different Electrical/Electronic circuits**

Time:- 30 hrs  
Theory:- 8 hrs  
Practical:- 22 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Create basic boarder.</li> <li>2. Insert attributes:               <ol style="list-style-type: none"> <li>a) Sheet name</li> <li>b) Text height</li> <li>c) width factor</li> <li>d) Title</li> <li>e) drawing value</li> </ol> </li> <li>3. Save file.</li> <li>4. Create drawing</li> <li>5. Insert wire and Electrical / Electronic components</li> <li>6. Print circuit drawn.</li> </ol>	<p><b>Condition (Given):</b> A PC with AutoCAD®Electrical software installed.</p> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Draw block diagram of different Electronic circuits.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Number of section determined</li> <li>• Blocks connected according to the signal flow from one to another stage as per the given Electrical/Electronic circuit.</li> <li>• Printed the circuit diagram.</li> </ul>	<ul style="list-style-type: none"> <li>• What is AutoCAD®Electrical software?</li> <li>• How to draw circuit using AutoCAD®Electrical.</li> <li>• Menu bars.</li> <li>• Tool bars.</li> <li>• Symbols of different Electrical and Electronic circuit components.</li> <li>• Function commands of AutoCAD®Electrical.</li> </ul>

**Task: 3 Draw circuit with computer aided simulation software.**

Time:- 30 hrs  
Theory:- 4 hrs  
Practical:- 26 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Load Electrical/ Electronic circuit simulation program.</li> <li>2. Exit from circuit simulation program.</li> <li>3. Plan to draw circuits:               <ol style="list-style-type: none"> <li>a) Basic Electronics</li> <li>b) Digital Electronics</li> <li>c) Basic Electrical Installation</li> </ol> </li> <li>4. Select Electrical/ Electronic components from drop down list.</li> <li>5. Connect terminals of components.</li> <li>6. Connect voltmeter, Ammeter, Oscilloscope across the components where appropriate</li> <li>7. Add Power supply &amp; ground to circuit.</li> <li>8. Simulate drawn circuit.</li> <li>9. Measure voltage, current, frequency</li> <li>10. Convert circuit into PCB compatible.</li> <li>11. Justify the simulated circuit.</li> <li>12. Print circuit &amp; PCB layout.</li> </ol>	<p><b>Condition (Given):</b> A PC with circuit simulation software installed. (Preferred software: 1. Electronic workbench circuit simulator 2. SPICE (Simulation Program with Integrated Circuit Emphasis)</p> <p><b>Tasks (What):</b> Draw circuit with computer aided simulation software.</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Draw circuit.</li> <li>• Simulated the circuit.</li> <li>• Justified simulated result.</li> <li>• Converted circuit into PCB compatible.</li> <li>• Printed circuit &amp; PCB layout.</li> </ul>	<ul style="list-style-type: none"> <li>• What is Electrical /Electronic circuit simulation software?</li> <li>• How it works?</li> <li>• Menu bars.</li> <li>• Tool bars.</li> <li>• Symbols.</li> <li>• Defining basic Electronic circuits.</li> <li>• Defining Digital Electronic Circuits.</li> <li>• Defining Basic Electrical Installation circuits.</li> </ul>

**Tools and Materials:-** PC, CKT maker software

**Safety:-**

# Repair and Maintenance of Electronics Appliances

<b>Total:</b>	<b>8 hrs/wk</b>
<b>Theory:</b>	<b>2 hrs/wk</b>
<b>Practical:</b>	<b>6 hrs/wk</b>

## Course Description:

This course intends to provide comprehensive knowledge and skills on repairing and maintenance of electronics appliances. It also deals with operation, installation and troubleshooting of electronic appliances.

## Course Objectives:

After completion of this course students will be able to:

1. Familiar with circuit diagram of electronic appliance
2. Installation of electronic appliances
3. Install solar home system
4. Troubleshooting of electronic appliances

## List of Tasks

1. Interpret manufacturing and troubleshooting manuals
2. Repair and maintain multi meter (analog/ digital)
3. Repair and maintain regulated DC power supply
4. Connect load with solar system
5. Install Solar panels
6. Install Charge controller
7. Install Solar battery
8. Repair and maintain solar charge controller
9. Repair DC light
10. Design PCB
11. Lay circuit diagram in plain PCB
12. Perform computer aided PCB design
13. Prepare solution for etching
14. Immerse PCB in solution
15. Drill holes in PCB
16. Install PCB components
17. Assemble basic electronic goods
18. Assemble water level controller with indicator
19. Assemble/ Repair fridge guard
20. Assemble/ Repair volt guard
21. Assemble/ Repair voltage stabilizer
22. Repair and Maintain battery charger
23. Installation and Troubleshoot of Inverter system
24. Repair and maintain inverter
25. Installation and troubleshoot of CCTV system
26. Install photocopy machine
27. Disconnect and assemble common electronic devices
28. Repair and maintain emergency light
29. Repair and maintain amplifier devices



### 30. Repair and maintain calculator

#### Task Analysis

#### Task: 1 Interpret manufacturing and troubleshooting manuals

Time:- 10 hrs

Theory:- 2 hrs

Practical:- 8 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect manufacturing manual.</li> <li>2. Study manufacturing manual.</li> <li>3. Follow instructions.</li> <li>4. Compare manufacturing diagram with PCB Board.</li> <li>5. Identify defects of installed PCB Board of unit by verifying with manufacturing circuit diagram.</li> <li>6. Replace/ repair components according to manufacturing diagram.</li> <li>7. Perform the final test of unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• A faulty Unit</li> <li>• Manufacturing manual.</li> <li>• Tool/equipment and materials.</li> <li>• Required Component</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Interpret manufacturing manuals.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Identified and diagnosed the faults defects consulting manufacturing manual.</li> <li>• Components replaced/ repaired as specified in manufacturing manual.</li> <li>• Unit repaired correctly and gain normal function by interpreting manufacturing manual.</li> </ul>	<p><b>Manufacturing manual</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Definition</li> <li>• Importance, uses and advantages of Manufacturing manual</li> <li>• Electrical and electronic symbols</li> <li>• Importance, uses and advantages of circuit diagram</li> <li>• Importance, uses and advantages of Layout diagram</li> <li>• Importance, uses and advantages of Installation diagram</li> <li>• Working principle of unit</li> <li>• Importance, uses and advantages of Block diagram</li> <li>• Manual handling procedures</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, AC mains socket, soldering lead, soldering flux, wire cutter, screw driver set nose plier and tweezers

**Safety:-**

**Task: 2 Repair and maintain multi meter (analog/digital)**

Time:- 10 hrs

Theory:- 2 hrs

Practical:- 8 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Check battery of unit</li> <li>4. Identify faulty card</li> <li>5. Identify faulty components.</li> <li>6. Replace faulty card / components by right one.</li> <li>7. Test unit for normal operation.</li> <li>8. Assemble unit in the enclosure.</li> <li>9. Perform final test of particular unit.</li> <li>10. Perform required adjustment</li> <li>11. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty multi meter (analog/ digital</li> <li>2. Circuit diagram</li> <li>3. Assortment of the component used in multi meter (analog/ digital</li> </ol> <ul style="list-style-type: none"> <li>• Tool set</li> <li>• Fully equipped electronic workshop with power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain multi meter (analog/ digital</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Multi meter repaired correctly and functioned properly indicating readings</li> </ul>	<p><b>Multi meter</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Types of meter</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:- :-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper nose pliers, screw driver set, tweezers and AC mains socket with power supply

**Safety:-** Select corresponding range correctly with selector switch to prevent damage of multi meter

**Task: 3 Repair and maintain regulated DC power supply**

Time:- 11 hrs  
Theory:- 2 hrs  
Practical:- 9 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test power supply unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Measure test pin voltage of unit</li> <li>4. Identify faulty components</li> <li>5. Replace faulty components</li> <li>6. Test unit for normal operation.</li> <li>7. Measure and record output voltages</li> <li>8. Assemble unit in the enclosure.</li> <li>9. Perform final test of particular unit.</li> <li>10. Perform required adjustment</li> <li>11. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty regulated DC power supply</li> <li>2. Circuit diagram</li> <li>3. Assortment of the component used in regulated DC power supply</li> <li>4. Ac cord</li> <li>5. Tool set</li> <li>6. Fully equipped electronic with power supply workshop.</li> </ol> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain regulated DC power supply</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Dismantle the unit without further damage</li> <li>• Replaced components correctly</li> <li>• Regulated DC power supply repaired correctly and functioned normally</li> </ul>	<p><b>Regulated DC power supply</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

**Task 4 Connect load with solar system**

Time:- 14 hrs  
 Theory:- 2 hrs  
 Practical:- 12 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select the appropriate location for the load.</li> <li>2. Collect materials for solar cabling with accessories.</li> <li>3. Install proper required color cabling with socket.</li> <li>4. Install required load in the proper socket.</li> <li>5. Connect the system with charge controller.</li> <li>6. Check the operational function of unit</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Cable (7/22, 3/20, 3/22) ( 1, 1.5, 2 &amp; 2.5mm)</li> <li>• Load</li> <li>• Holder</li> <li>• Switch</li> <li>• 3 pin socket</li> <li>• PVC tape</li> <li>• Junction with connector</li> <li>• Screws</li> <li>• Tool set.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Connect load with solar system</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Load allocated in appropriate location and connected properly with solar system and function normally.</li> </ul>	<ul style="list-style-type: none"> <li>• Wiring concept</li> <li>• SHS Design and</li> <li>• Calculation</li> <li>• Differences in normal solar wiring.</li> <li>• Types and uses of cables</li> <li>• Colored code of cable</li> <li>• Load calculation</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precautions.</li> </ul>

**Tools and Materials:-** Nose pliers, Flat pliers, Screw driver set, wire cutter and Multi meter.

**Safety:-**

**Task 5. Install Solar panels**

Time:- 10 hrs  
 Theory:- 2 hrs  
 Practical:- 8 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select the appropriate location for the unit</li> <li>2. Collect element of solar panel.</li> <li>3. Select the appropriate location for unit.</li> <li>4. Install main supporting stand in proper location.</li> <li>5. Install and fasten the unit to supporting stand.</li> <li>6. Adjust solar panel the right direction and correct angle.</li> <li>7. Check the operational function of unit.</li> <li>8. Connect element of solar panel.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Solar panel and installation manual</li> <li>• Clamps and supporting stand</li> <li>• Screws, Nut and bolts</li> <li>• Adjustable wrench and</li> <li>• Screw driver set.</li> <li>• UV cable (1.5-2.5mm)</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install Solar panels</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Solar panels installed and fastened in proper location facing south in appropriate angle illuminating shadow area and accruing standard DC output voltage</li> </ul>	<ul style="list-style-type: none"> <li>• Definition of photovoltaic effect</li> <li>• Function of PV</li> <li>• Concept of solar cell</li> <li>• Panel specification and its standard output voltage.</li> <li>• Importance and use of installation diagram</li> <li>• Procedure and technique of Panel installation</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precautions.</li> </ul>

**Tools and Materials:-** Nose pliers, Cutter pliers, Screw driver set, Slide wrench and Multi meter.

**Safety:-**

**Task 6 Install Charge controller**

Time:- 12 hrs  
 Theory:- 2 hrs  
 Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select appropriate location for unit</li> <li>2. Mount and fasten the unit to eye sight stable base.</li> <li>3. Connect the unit with battery with proper cable.</li> <li>4. Connect the unit and panel with UV cable.</li> <li>5. Connect the unit and load with proper cable.</li> <li>6. Check the operational function of unit</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Charger controller</li> <li>• Connecting wires</li> <li>• Connecting diagram</li> <li>• Tools and equipment.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install Charge controller</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Charger controller mounted and fastens to eye sight stable base at appropriate location, battery panel and load connected correctly in right sequence indicating best performance by blinking /lighting bulb.</li> </ul>	<p><b>Charge controller</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Function</li> <li>• Working principle</li> <li>• Circuit diagram</li> <li>• Procedure and techniques of installation</li> <li>• Procedure of voltage measurement</li> <li>• Types of cable use in solar system</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precautions.</li> </ul>

**Tools and Materials:-** Multi meter, screw driver set, and wire cutter.

**Safety:-**

**Task 7 Install Solar battery**

Time:- 10 hrs  
 Theory:- 2 hrs  
 Practical:- 8 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select the appropriate location for the load.</li> <li>2. Place battery to appropriate location on stable flat base.</li> <li>3. Connect cable according to polarity / color code of battery.</li> <li>4. Check the operational function of unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• New deep cycle battery</li> <li>• Hydrometer</li> <li>• Distilled water</li> <li>• Battery cable and</li> <li>• Cable shoe</li> <li>• Electrolyte</li> <li>• Tools and equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install battery</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Battery installed in stable base at appropriate and safe location, cable connected in correct polarity and regulate standard DC voltage</li> </ul>	<p><b>Battery</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• types</li> <li>• Specific gravity</li> <li>• Chemical reaction</li> <li>• Color code and battery polarity</li> <li>• Principle of operation</li> <li>• Introduction, uses and method of using hydrometer</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:** - Multi meter, Hydrometer, screw driver set, Nose pliers and wire cutter

**Safety:** - Hazard involved in handling acid

**Task: 8 Repair and maintain solar charge controller**

Time:- 14 hrs  
 Theory:- 2 hrs  
 Practical:- 12 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Identify faulty components.</li> <li>4. Check battery</li> <li>5. Measure test pin voltage of unit</li> <li>6. Replace faulty components by right one.</li> <li>7. Test unit for normal operation.</li> <li>8. Assemble unit in the enclosure.</li> <li>9. Perform final test of particular unit.</li> <li>10. Perform required adjustment</li> <li>11. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Faulty solar charge controller</li> <li>• Circuit diagram</li> <li>• Assortment of the component used in solar charge controller</li> <li>• Tool set</li> <li>• Fully equipped electronic workshop.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain solar charge controller</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Dismantle the unit without further damage</li> <li>• Replaced components correctly</li> <li>• Solar charge controller repaired correctly and functioned normally</li> <li>• Supply received from panels and charger indicator indicated charging</li> </ul>	<p><b>Solar charge controller</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Concept of sensor</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**



**Task: 9 Repair DC light**

Time:- 11 hrs  
 Theory:- 2 hrs  
 Practical:- 9 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
1. Collect the electronic components 2. Collect the appropriate Repairing Tools 3. Collect DC LED , TUBE and CFL lights 4. Check the function of DC lights	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• DC LED, TUBE and CFL lights</li> <li>• Required electronic components</li> <li>• Circuit Diagram</li> <li>• Table lamp</li> <li>• Multi meter</li> <li>• Tools and equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair different DC lights types</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Repair properly and check the function of DC lights</li> </ul>	<p><b>Battery</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Operating principle of driver circuit</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precautions</li> <li>•</li> </ul>

**Tools and Materials:** - Multi meter, screw driver set, Nose pliers and wire cutter  
 Soldering Iron, De-soldering pump, Variable power supply etc.

**Safety:-**

Time:- 12 hrs  
 Theory:- 2 hrs  
 Practical:- 10 hrs

**Task: 10 Construct Printed Circuit Board (PCB)**

Time:- 12 hrs  
 Theory:- 2 hrs  
 Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtained tested circuit diagram and white paper</li> <li>2. Reduce tested circuit and PCB layout</li> <li>3. Reduce crossing by rerouting connecting lines / relocating components</li> <li>4. Provide jumper where crossing cannot be avoided</li> <li>5. Minimize jumper where possible</li> <li>6. Draw PCB configuration of components and connect as per circuit diagram</li> <li>7. Increase thickness of supply line track</li> <li>8. Check final PCB with tested circuit diagram for operation/ function</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Fully equipped workshop with related tools, equipment and materials</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Resize size of PCB</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Tested circuit and PCB layout resized correctly without varying operational function of tested circuit diagram with no jumper or minimum jumper</li> </ul>	<p><b>PCB</b></p> <ul style="list-style-type: none"> <li>• Designing concept</li> <li>• Types</li> <li>• Importance</li> <li>• Function</li> <li>• Circuit diagram</li> <li>• Application</li> <li>• Advantages</li> </ul> <p><b>Complex circuitry</b></p> <ul style="list-style-type: none"> <li>• Application</li> <li>• Advantages</li> </ul> <p><b>Defects of many jumpers</b></p>

**Tools and Materials:-** Hacksaw frame with blade, white paper and drawing tools / equipment

**Safety:-**

**Task: 11 Lay circuit diagram in plain PCB**

Time:- 10 hrs  
 Theory:- 2 hrs  
 Practical:- 8 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Obtained plain PCB and PCB diagram</li> <li>2. Cut plain PCB to required size and clean its surface</li> <li>3. Copy tracks of PCB diagram to copper side of plain PCB with pencil</li> <li>4. Cover tracks with permanent marker (enamel, Nail polish etc.)</li> <li>5. Remove unwanted excess enamel from the track</li> <li>6. Check for short circuit between enamel paint of the adjacent track</li> <li>7. Verify interconnection with PCB diagram</li> <li>8. Leave PCB for at least 3 hrs in dry place</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Fully equipped workshop with related tools, equipment and materials</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Lay circuit diagram in plain PCB</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Copied PCB diagram in plain PCB clearly and neatly without short circuit and excess part in plain PCB</li> </ul>	<ol style="list-style-type: none"> <li>1. <b>Enamel paintings</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Functions</li> <li>• Importance</li> <li>• Application</li> <li>• Advantages</li> </ul> </li> <li>2. Disadvantages of running paints in PCB Board</li> <li>3. Importance of Plain PCB board making</li> </ol>

**Tools and Materials:-** Plain PCB, White paper, Drawing tools, Permanent marker (enamel / nail polish etc.) Hacksaw frame with blade and file

**Safety:-**

**Task: 12 Perform computer added PCB design**

Time:- 10 hrs  
Theory:- 2 hrs  
Practical:- 8 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"><li>1. Obtained PCB software</li><li>2. Install the software</li><li>3. Run the computer</li><li>4. Design circuit diagram</li><li>5. save the diagram</li><li>6. Print the diagram</li><li>7. Check the diagram.</li></ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"><li>• PCB Design software</li><li>• Computer and printer</li></ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"><li>• Perform computer added PCB design.</li></ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"><li>• Printed well using tracing paper.</li></ul>	<p><b>PCB software design</b></p> <ul style="list-style-type: none"><li>• Definition</li><li>• Types</li><li>• Functions</li><li>• Importance</li><li>• Application</li><li>• Advantages</li></ul>

**Tools and Materials:-** computer, software, printer, tracing paper

**Safety:-**

**Task: 13 Prepare solution for etching**

Time:- 8 hrs

Theory:- 1 hr

Practical:- 7 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
1. Take required chemicals 2. Prepare ferric chloride solution in Luke warm water in non-corrosive flatbed vassal 3. Apply liquid ready to use solution 4. Stir solution vigorously	<b>Condition (Given):</b> <ul style="list-style-type: none"> <li>• Fully equipped workshop with related tools, equipment and materials</li> </ul> <b>Tasks (What):</b> <ul style="list-style-type: none"> <li>• Prepare solution for etching.</li> </ul> <b>Standard (How well):</b> <ul style="list-style-type: none"> <li>• Solution prepared with correct method and proportion</li> </ul>	<b>1. Chemicals</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Functions</li> <li>• Importance</li> </ul> <b>2. ACID</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Functions</li> <li>• Importance</li> <li>• Application</li> <li>• Advantages</li> </ul> <b>3. Safety precautions</b>

**Tools and Materials:-** Ferric chloride, Luck warm water, Flat bed vassal, plastic tweezers and glove

**Safety:-**

**Task: 14 Immerse PCB in solution**

Time:- 17 hrs  
 Theory:- 2 hrs  
 Practical:- 15 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Prepare required chemicals tools as per requirement</li> <li>2. Immerse PCB in solution</li> <li>3. Wait for 30 minute</li> <li>4. Remove PCB from solution using tweezers</li> <li>5. Wash PCB with fresh water thrice</li> <li>6. Dry PCB for one hour</li> <li>7. Gently wash enamel from the track</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Fully equipped workshop with related tools, equipment and materials</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Immerse laid PCB in solution.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• PCB etched with right solution to appropriate time without damaging any copper track</li> </ul>	<ol style="list-style-type: none"> <li><b>1. Baric chloride</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Functions</li> <li>• Importance</li> <li>• Application</li> <li>• Advantages</li> <li>• Experiments</li> </ul> </li> <li><b>2. Etching process of PCB</b></li> </ol>

**Tools and Materials:-** Plastic twizzer, PCB cleaner

**Safety:-**

**Task: 15 Drill holes in PCB**

Time:- 8 hrs  
 Theory:- 1 hr  
 Practical:- 7 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select and collect appropriate drilling machine</li> <li>2. Select and collect required size drill bit.</li> <li>3. Install required size drill bit into drill machine.</li> <li>4. Drill all holes for small resister, capacitor and transistor</li> <li>5. Replace drill bits as required</li> <li>6. Drill large size holes as per requirement</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Fully equipped workshop with related tools, equipment and materials</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Drill holes in PCB</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Required size and number of holes drilled in PCB with correct procedures without breaking drill bits and damaging PCB</li> </ul>	<p><b>Drilling machine</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Functions</li> <li>• Importance</li> <li>• Application</li> <li>• Advantages</li> <li>• Experiments</li> <li>• Operation</li> </ul> <p><b>Drill bits</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Size</li> <li>• Functions</li> <li>• Importance</li> <li>• Application</li> <li>• Advantages</li> <li>• Experiments</li> <li>• Operation</li> <li>• Process and techniques of drilling hole</li> <li>• Size of component</li> </ul>

**Tools and Materials:-** Portable drilling machine and drill bit set

**Safety:-**

**Task: 16 Install PCB components**

Time:- 10 hrs  
 Theory:- 2 hrs  
 Practical:- 8 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Take designed require PCB with components</li> <li>2. Clean PCB with PCB cleaner</li> <li>3. Place components in proper location</li> <li>4. Solder the components</li> <li>5. Check for short circuits between soldered joints</li> <li>6. Assemble PCB in suitable place</li> <li>7. Test set for normal operational function</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Fully equipped workshop with related tools, equipment and materials</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install PCB components</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Components installed correctly and neatly with required outputs</li> </ul>	<p><b>Soldering/ de-soldering</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Functions</li> <li>• Importance</li> <li>• Application</li> <li>• Advantages</li> <li>• Experiments</li> <li>• Operation</li> </ul> <p><b>PCB Layout</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Importance</li> <li>• Application</li> <li>• Advantages</li> <li>• Operation</li> </ul>

**Tools and Materials:-** Soldering iron, soldering lead, de-soldering pump, twizzer, wire cutter and required components

**Safety:-**



**Task: 17 Assemble basic electronic goods/devices**

Time:- 7 hrs  
 Theory:- 1 hr  
 Practical:- 6 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect electronics components and soldering iron and rod</li> <li>2. Plug soldering iron in the A.C. main socket (35 watts)</li> <li>3. Assemble the electronic components according to the circuit diagram /manufacture diagram</li> <li>4. Plug A.C. main cord of the given electronics project/goods</li> <li>5. Switch on power check the normal operation/function of electronic project/good</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• PCB</li> <li>• Required electronics components</li> <li>• Circuit diagram</li> <li>• Well-equipped electronics work shop</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Assemble board electronics goods.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• In components neatly soldering</li> <li>• PBC</li> <li>• The connectors plugged into the socket</li> <li>• Components assembled as per circuit diagram and checked for normal operational function</li> </ul>	<p><b>Electronics components.</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Functions</li> <li>• Advantages</li> <li>• Assembling procedure steps of given electronics project</li> </ul>

**Tools and Materials:** - Multi-meter, soldering iron with stand, soldering lead, soldering paste / flux, Nose plier, wire cutter, wire slipper and tweezers.

**Safety:** - Proper use of tools and components

**Task: 18 Assemble water level controller with indicator**

Time: 12 hrs  
 Practical: 2 hrs  
 Theory: 10 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required PCB components as per circuit diagram</li> <li>2. Collect tools equipment</li> <li>3. Check all the components</li> <li>4. Clean the required PCB Spider components for leads</li> <li>5. Solder the components in PCB</li> <li>6. Check for short circuits of soldering, polarity of component and open circuit in PCB track.</li> <li>7. Check operational function of the circuit by taking measurement at the test points.</li> <li>8. Assemble the complete circuit in the enclosure</li> <li>9. Check tearing water level controller with indicator.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• PCB</li> <li>• Circuit diagram</li> <li>• Basic tools</li> <li>• Well-equipped electronics work shop /lab</li> </ul> <p><b>Task(What):</b></p> <p>Assemble water level controller with indicator.</p> <p><b>Standard(How well):</b></p> <ul style="list-style-type: none"> <li>• Water level controller with Indicator set assembled neatly and safety. And receive normal function</li> </ul>	<p><b><u>Safety belt :</u></b></p> <ul style="list-style-type: none"> <li>• Operating principle</li> <li>• Basic concept of water level controller with indicator</li> <li>• Exploitation of water level controller with indicator</li> <li>• Definition</li> <li>• Type</li> <li>• Functions</li> <li>• Advantages</li> </ul>

**Tools/Equipment:** : Multi-meter, soldering iron with stand, soldering lead, de-soldering pump, soldering paste / flux, Nose-pliers, Tweezers, screw driver set, wire cutter and wire snipers

**Safety:**

**Task: 19 Assemble/ Repair volt guard**

Time:- 12 hrs  
 Theory:- 2 hrs  
 Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Take inventory of the components requires as per circuit diagram</li> <li>2. Check all the components</li> <li>3. Clean the required PCB and the leads of all components</li> <li>4. Solder the components in PCB</li> <li>5. Check for short circuit, dry soldering, polarity of components and open circuit in PVB track</li> <li>6. Check the function by taking measurement at the test points</li> <li>7. Fix the high &amp; low voltage cut off using variable AC power supply</li> <li>8. Assemble the complete circuit in the enclosure</li> <li>9. Perform the final testing of volt guard unit</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• PCB ,components enclosure,</li> <li>• circuit diagram</li> <li>• basic tools</li> <li>• Well-equipped electronics work shop</li> <li>• Variable AC power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Assemble volt guard</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Fridge guard set assembled neatly and the function of set as expected</li> <li>• Cut-off high and low voltage accurately</li> </ul>	<ul style="list-style-type: none"> <li>• Operating principle</li> <li>• Basic concept of AC control device and its application</li> <li>• Explanation of volt guard</li> <li>• Circuit diagram</li> <li>• Definition</li> <li>• Type</li> <li>• Function</li> <li>• Advantage</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-**Multi-meter, soldering iron with stand, soldering lead, de-soldering pump, soldering paste / flux, Nose-pliers, cutter pliers, Tweezers, screw driver set wire cutter and wire snipers

**Safety: -** Proper use of tools and components

**Task: 20 Assemble/ Repair fridge guard**

Time:- 12 hrs  
 Theory:- 2 hrs  
 Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. collected required components as per circuit diagram</li> <li>2. Collect required tools &amp; equipment</li> <li>3. Check all the components</li> <li>4. Clean the surface of required PCB and the leads of all components</li> <li>5. Solder the components on the PCB</li> <li>6. Check for short circuit diagram solder polarity of components and open circuit in PCB track</li> <li>7. Check for operational functioning of the circuit by taking measurement at the test points</li> <li>8. Check the trimming function of fridge guard</li> <li>9. Fix the high and low voltage cut off with timer by variable AC power supply</li> <li>10. Assemble the PCB board in the enclosure</li> <li>11. Check/ test fridge guard unit for operational and functional</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• PCB , component enclosure</li> <li>• circuit diagram</li> <li>• Tools set</li> <li>• Well-equipped electronics work shop</li> <li>• Variable AC power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Assemble fridge guard</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Fridge guard security assembled neatly with accurate timing function</li> <li>• Checked and replace defective components without damaging other parts</li> <li>• Cut-off high and low voltage accurately with timer.</li> </ul>	<ul style="list-style-type: none"> <li>• Operating principle</li> <li>• Basic concept of fridge guard and its application</li> <li>• Circuit diagram and it's explanation</li> <li>• Definition</li> <li>• Type</li> <li>• Function</li> <li>• Advantages</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-**Multi-meter, soldering iron with stand, soldering lead, de-soldering pump, soldering paste / flux, Nose-pliers, cutter pliers, Tweezers and screw driver set.

**Safety: -** Paper use of tools & components

**Task: 21 Assemble/Repair voltage stabilizer**

Time:- 12 hrs  
 Theory:- 2 hrs  
 Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Take Inventory of the components required as per circuit diagram</li> <li>2. Check all the components</li> <li>3. Clean the required PCB and the lead of all components</li> <li>4. Solder the components in proper terminals or joints</li> <li>5. Check for short circuit dry soldering, polarity of components and open circuit in PCB track</li> <li>6. Check the functioning of the circuit by taking measurement at the test point.</li> <li>7. Fix high voltages cut off using variable Ac power supply</li> <li>8. Assemble the components circuit in the enclosure</li> <li>9. Perform the final testing of voltage stabilizer unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• PCB, required components</li> <li>• Cabinet</li> <li>• Circuit diagram</li> <li>• Basic tools</li> <li>• Well-equipped electronics work shop</li> <li>• Variable AC power supply</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Assemble voltage stabilizer</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Voltage stabilizer set assembled neatly and function as expected.</li> <li>• Stabilizer function with 220 V output and cut off high voltage.</li> </ul>	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Function</li> <li>• Advantage</li> <li>• application</li> <li>• Operating principle</li> <li>• Basic components of voltage stabilizer</li> <li>• Circuit diagram and it's explanation</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi-meter, soldering iron with stand, soldering lead, de-soldering pump, soldering paste / flux, Nose-pliers, Tweezers, screw driver set wire cutter and wire snipers

**Safety:-**

**Task: 22 Repair and Maintain battery charger**

Time: 12 hrs  
 Practical: 2 hrs  
 Theory: 10 hrs

Task Steps	Training Performance Objective	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Take Inventory of the component as per circuit diagram</li> <li>2. Check all the components</li> <li>3. Clean the surface of required PCB and the leads of all components</li> <li>4. Solder the components on the PCB</li> <li>5. Check for short circuit dry solder polarity of components and open circuit. in PCB track</li> <li>6. Check the functioning of the circuit by taking measurement at the test points</li> <li>7. Assemble the component circuit in the enclosure</li> <li>8. Perform the final testing</li> </ol>	<p><b>Condition(Given):</b></p> <ul style="list-style-type: none"> <li>• PCB, components, enclosure,</li> <li>• Circuit diagram</li> <li>• Battery</li> <li>• basic tools</li> <li>• Well-equipped electronics work shop / lab</li> </ul> <p><b>Task (What):</b>                      Assemble battery charger</p> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Battery charger set assembled neatly and functioned as expected</li> </ul>	<p><b><u>Safety belt :</u></b></p> <ul style="list-style-type: none"> <li>• Basic concept of Battery charger</li> <li>• Operating principle</li> <li>• Circuit diagram and it's explanation</li> <li>• Types</li> <li>• Advantages</li> <li>• Application</li> </ul>

**Tools/Equipment:** Multi-meter, soldering iron with stand, soldering lead, de-soldering pump, soldering paste / flux, Nose-pliers, Tweezers, screw driver set, wire cutter and wire snipers

**Safety:**

**Task: 23 Install and troubleshoot inverter system**

Time:- 7 hrs  
Theory:- 1 hrs  
Practical:- 6 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select the appropriate location for the unit</li> <li>2. Collect element of inverter system</li> <li>3. Install the proper cabling for inverter system.</li> <li>4. Install main Inverter System in safe place.</li> <li>5. Install the Backup Battery appropriate location.</li> <li>6. Connect each element to main system.</li> <li>7. Set normal function for main system</li> <li>8. Adjust the Inverter main system if necessary.</li> <li>9. Check the operational function of unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Inverter System</li> <li>• Battery.</li> <li>• Layout diagram</li> <li>• Operational manual of Inverter</li> <li>• Electric cables.</li> <li>• Tool set</li> <li>• Fully equipped electronic workshop with power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Installation and troubleshooting of Inverter system</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Installed system works properly and gained normal &amp; backup power supply.</li> <li>• Passed test of backup as well as normal supply with minimum time delay.</li> </ul>	<p><b>Inverter System</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Layout diagram</li> <li>• Trouble shooting procedure</li> <li>• Advantages</li> <li>• Application</li> </ul>

**Tools and Materials:-** Normal tool set, coaxial cable, AC / DC power cable, drill machine, multimeter etc.

**Safety:-** Connect battery safely without damaging circuit.

**Task: 24 Repair and maintain inverter**

Time:- 12 hrs  
Theory:- 2 hrs  
Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical condition of component.</li> <li>4. Check voltage of test pins</li> <li>5. Identify faulty components of unit</li> <li>6. Replace faulty components by right one.</li> <li>7. Test set for normal operation.</li> <li>8. Assemble unit in the enclosure.</li> <li>9. Perform final test of particular unit.</li> <li>10. Perform required adjustment</li> <li>11. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Faulty inverter</li> <li>• Circuit diagram</li> <li>• Assortment of the component used in inverter</li> <li>• Tool set</li> <li>• Fully equipped electronic workshop with power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain inverter</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit repaired correctly and gained normal AC output Voltage of unit</li> <li>• Passed test of backup system</li> </ul>	<p><b>Inverter</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper nose pliers, screw driver set, tweezers and AC mains socket with power supply

**Safety:-** Connect battery safely without damaging circuit



**Task: 25 Install and troubleshoot CCTV system**

Time:- 7 hrs  
Theory:- 1 hrs  
Practical:- 6 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select the appropriate location for the unit</li> <li>2. Collect element of CCTV system.</li> <li>3. Select the appropriate location for unit.</li> <li>4. Install the proper cabling for video and power supply.</li> <li>5. Install main CCTV camera in each location.</li> <li>6. Install and fasten the main in appropriate location.</li> <li>7. Connect each element to main system.</li> <li>8. Set normal function for main system</li> <li>9. Adjust the CCTV camera and main system if necessary.</li> <li>10. Check the operational function of unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. CCTV camera</li> <li>2. Hub/ DVR</li> <li>3. Layout diagram</li> <li>4. Operational manual of DVR</li> <li>5. BNC connector</li> </ol> <ul style="list-style-type: none"> <li>• Tool set</li> <li>• Fully equipped electronic workshop with power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Installation and troubleshooting of CCTV system</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Installed system works properly and gained normal video display</li> <li>• Passed test of recording and playback system of obtained video</li> </ul>	<p><b>CCTV System</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> </ul>

**Tools and Materials:-** Normal tool set, coaxial cable, AC / DC power cable, drill machine, multimeter etc.

**Safety:-** Connect CCTV system safely without damaging each element

**Task: 26 Install and repair photocopier machine**

Time:- 7 hrs  
 Theory:- 1 hr  
 Practical:- 6 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Select appropriate location for the unit.</li> <li>2. Install devices on flat stable base in proper location.</li> <li>3. Install AC power cable with socket.</li> <li>4. Feed proper tray with paper</li> <li>5. Connect AC cord of Photocopy cord with AC mains socket.</li> <li>6. Plug AC power in AC socket</li> <li>7. Check operational function of unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Photocopy machine</li> <li>• Line</li> <li>• Remote control</li> <li>• Ac main socket with power</li> <li>• Connection diagram</li> <li>• Tool and equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install Photocopy machine.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Installed photocopy machine correctly and gain normal operational function with best reception.</li> </ul>	<p><b>Photocopy machine</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Principle of operation</li> <li>• Types</li> <li>• Installation procedures</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-****Safety:-**

**Task: 27 Disconnect and assemble common electronic devices**

Time:- 7 hrs  
 Theory:- 1 hrs  
 Practical:- 6 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the assemble unit and diagnose the faulty section.</li> <li>2. Observe physical condition of the unit.</li> <li>3. Disconnect parts of assemble unit.</li> <li>4. Identify the faulty components.</li> <li>5. Replace the faulty components by right one.</li> <li>6. Reassemble the unit.</li> <li>7. Test the unit for normal operation.</li> <li>8. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Faulty common electronic devices</li> <li>• Circuit diagram,</li> <li>• Assortment of the component used in common electronic devices</li> <li>• Tool set</li> <li>• Fully equipped electronics workshop with power supply</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Disconnect and assemble common electronic devices</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Disconnected parts safely without damaging adjacent part.</li> <li>• Unit repaired correctly with proper connection and gained normal operational function</li> </ul>	<p><b>Common electronic devices</b></p> <ul style="list-style-type: none"> <li>• Concept</li> <li>• Block diagram</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Working principle</li> <li>• Connection diagram</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, nose plier, screw driver set, AC mains socket and tweezers

**Safety:-**

**Task: 28 Repair and maintain emergency light**

Time:- 12 hrs  
Theory:- 2 hrs  
Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Measure battery voltages</li> <li>4. Measure test pin voltage</li> <li>5. Identify faulty components.</li> <li>6. Check battery</li> <li>7. Replace faulty components</li> <li>8. Test unit for normal operation.</li> <li>9. Assemble unit in the enclosure.</li> <li>10. Perform final test of particular unit.               <ol style="list-style-type: none"> <li>i. Perform required adjustment</li> <li>ii. Store tools and equipment in proper place</li> </ol> </li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Faulty emergency light</li> <li>• Circuit diagram</li> <li>• Assortment of the component used in emergency light</li> <li>• Tool set</li> <li>• Fully equipped electronic workshop with power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain emergency light</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Dismantle the unit without further damage</li> <li>• Replaced components correctly</li> <li>• Emergency light repaired correctly and functioned normally with glaring lamp</li> </ul>	<p><b>Emergency light</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Types of meter</li> <li>• Concept of sensor</li> <li>• Battery voltage</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** :- Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers and tweezers

**Safety:-**

**Task: 29 Repair and maintain amplifier devices**

Time:- 12 hrs  
Theory:- 2 hrs  
Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Measure test pin voltage of unit</li> <li>4. Identify faulty components</li> <li>5. Replace faulty components by right one.</li> <li>6. Test unit for normal operation.</li> <li>7. Assemble unit in the enclosure.</li> <li>8. Perform final test of particular unit.</li> <li>9. Perform required adjustment</li> <li>10. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Faulty amplifier devices</li> <li>• Circuit diagram</li> <li>• Assortment of the component used in amplifier devices</li> <li>• Tool set</li> <li>• Oscilloscope</li> <li>• Signal generator</li> <li>• Fully equipped electronic workshop.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain amplifier devices</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Dismantle the unit without further damage</li> <li>• Replaced components correctly</li> <li>• Amplifier devices repaired correctly and functioned normally</li> </ul>	<p><b>Amplifier</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• block diagram</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Alignment procedure</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Types of meter</li> <li>• Concept of sensor</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

**Task: 30 Repair calculator**

Time:- 4 hrs  
Theory:- 1 hr  
Practical:- 3 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Check battery</li> <li>3. Replace battery</li> <li>4. Dismantle the unit</li> <li>5. Identify faulty card</li> <li>6. Measure test pin voltage of unit</li> <li>7. Identify faulty components.</li> <li>8. Replace faulty card /components by right one.</li> <li>9. Test unit for normal operation.</li> <li>10. Assemble unit in the enclosure.</li> <li>11. Perform final test of particular unit.</li> <li>12. Perform required adjustment</li> <li>13. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Faulty calculator</li> <li>• Circuit diagram</li> <li>• Assortment of the component used in Calculator</li> <li>• Tool set</li> <li>• Fully equipped electronic workshop.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain calculator</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit dismantled without further damage</li> <li>• Components replaced correctly</li> <li>• Calculator repaired correctly with normal function</li> </ul>	<p><b>Calculator</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

**References:**

- Lab manual
- Circuit diagrams
- Internet explore

# Repair and Maintenance of Television

<b>Total:</b>	<b>10 hrs/wk</b>
<b>Theory:</b>	<b>2 hrs/wk</b>
<b>Practical:</b>	<b>8 hrs/wk</b>

## Course Description:

This course is designed to provide knowledge and skills on repairing and maintenance of B/W TV, SMPS, Antenna, color, LCD, LED TV.

## Course Objectives:

After completion of this course students will be able to:

1. Connect Cable TV Network
2. Assemble and repair black and white TV
3. Repair SMPS power supply
4. Install yagi antenna
5. Install Dish antenna
6. Assemble and repair and assemble color TV
7. Assemble and repair and assemble LCD TV
8. Assemble and repair and assemble LED TV
9. Repair TV remote control.
10. Apply safety precautions.

## Theory

### Course Contents:

- 1. Cable Network –introduction-12 hrs**
- 2. Television –introduction-8 hrs**
  - a. History, concept, latest development trend
  - b. Applications and advantages of TV
  - c. Image formation, pixel, scanning
- 3. Black /White CRT TV- 20 hrs**
  - a. Picture to video signal conversion basic concept
  - b. Simple TV modulation and demodulation
  - c. Block diagram of simple TV and functions of each blocks
  - d. Circuit diagram of TV and it's working principle
  - e. Basic faults symptoms and diagnosis methods
  - f. Safety precautions and technique for TV repairing
- 4. Antenna - 9 hrs**
  - a. Simple dipole, yagi, dish antenna concept
  - b. Method of installation of dish antenna, yagi antenna
  - c. Basic faults symptoms and diagnosis methods
- 5. SMPS power supply - 4 hrs**
  - a. Concept of SMPS and advantages, application
  - b. Block diagram of simple SMPS and functions of each blocks
  - c. Basic circuit diagram of simple SMPS and simple working principle
  - d. Basic faults symptoms and diagnosis methods

- 6. Color TV (CRT Type) - 15 hrs**
  - a. Simple color combination concept
  - b. Color video signal concept
  - c. Color encoder/decoder systems, concepts of PAL,SECAM,NTSC
  - d. Block diagram color TV and explanation of each blocks
  - e. Circuit diagram and it's working principle
  - f. Faults symptoms and diagnosis methods
- 7. LCD TV - 4 hrs**
  - a. CCD concept
  - b. LCD concept
  - c. Block diagram of LCD TV and it's explanation
  - d. Circuit diagram and working principle
  - e. Faults symptoms and diagnosis methods
- 8. LED TV - 4 hrs**
  - a. Concept, application and advantage
  - b. Block diagram of LED TV and it's explanation
  - c. Circuit diagram and working principle
  - d. Faults symptoms and diagnosis methods
- 9. Remote controls - 2 hrs**
  - a. Concept, application, advantage of remote control
  - b. Block diagram and it's explanation
  - c. Circuit diagram and working principle
  - d. Faults symptoms and diagnosis methods

### Practical

#### **List of Tasks:**

1. Install Cable TV Network - 35 hrs
2. Assemble black and white television - 40 hrs
3. Repair black and white television - 60 hrs
4. Repair SMPS power supply - 20 hrs
5. Install Yagi antenna - 10 hrs
6. Install dish antenna - 20 hrs
7. Assemble and repair color TV - 60 hrs
8. Assemble and repair LCD TV - 30 hrs
9. Assemble and repair LED TV - 30 hrs
10. Repair TV remote controls - 7 hrs



## Task Analysis

### Task: 1 Install cable TV network

Time:- 35 hrs

Theory:- hrs

Practical:- 35 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect different items of cable television system</li> <li>2. Select appropriate location and install dish antenna.</li> <li>3. Select appropriate location and install receiver unit.</li> <li>4. Install power driver mixer and amplifier on appropriate location</li> <li>5. Install and distribute proper station cable with F connector and connect to different TVs.</li> <li>6. Test operational function of the system.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Cable networking materials</li> <li>• Dish antenna, receivers, mixer and amplifier</li> <li>• Connection and layout diagrams</li> <li>• Tool and equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install TV cable network system.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit installed correctly and gain normal operational function with best reception.</li> </ul>	<p><b>Cable network</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Principle of operation</li> <li>• Principle of installation</li> <li>• Types</li> <li>• Installation techniques</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-** :- Flat pliers, Adjustable slide wrench, Nose pliers, wire cutter and screw driver set, signal strength meter, pattern generator, multimeter

**Safety:-**

**Task: 2 Assemble black and white (BW) Television**

Time:- 40 hrs

Theory:- hrs

Practical:- 40 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required materials, tools &amp; components</li> <li>2. Mount main TV kit in the cabinet and fix with screws</li> <li>3. Mount and test the picture tube assembly in cabinet with screws</li> <li>4. Install transformer, V-hold, contrast, and transformer, volume control in T.V. kit</li> <li>5. Install EHT (extra high-tension transformer) in kit and picture tube.</li> <li>6. Fix back side cabinet and fasten screws.</li> <li>7. Plug in A.C. main cord of the set/power and switch to ON position.</li> <li>8. Check the normal operation of Black &amp; white television</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• BW TV kit, picture tube ,V hold, contrast, volume control</li> <li>• Cabinet,</li> <li>• Step down transformer</li> <li>• circuit diagram</li> <li>• Pattern generator</li> <li>• Basic tools</li> <li>• Well-equipped electronics work shop</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Assemble black &amp; white Television.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• The wire cables components of BW/TV solder neatly and safety in the TV kit</li> <li>• The connectors plugged in to power socket safely</li> <li>• The set assembled correctly and checked for normal operation mode.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of BWTV</li> <li>• Advantage</li> <li>• Assembling procedure of BWTV Set</li> <li>• Block diagram of black and white television</li> <li>• Function of each block</li> <li>• Importance of black &amp; white Television.</li> <li>• Circuit diagram</li> <li>• Working principle of circuit diagram</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 3 Repair and maintain black and white (BW) Television**

Time:- 60 hrs  
Theory:- hrs  
Practical:- 60 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical condition of the unit.</li> <li>4. Check voltage of the test pins of unit.</li> <li>5. Identify the faulty components.</li> <li>6. Replace the faulty components by right one.</li> <li>7. Test the unit for normal operation.</li> <li>8. Assemble the unit in the enclosure.</li> <li>9. Perform the final test of unit.</li> <li>10. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• BW TV kit, picture tube, V hold, contrast, volume control</li> <li>• Cabinet,</li> <li>• Step down transformer</li> <li>• circuit diagram and service manual</li> <li>• Pattern generator</li> <li>• Basic tools</li> <li>• Well-equipped electronics work shop</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair black &amp; white Television.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• The wire cables components of BW/TV solder neatly and safety in the TV kit</li> <li>• The connectors plugged in to power socket safely</li> <li>• The set assembled correctly and checked for normal operation mode.</li> </ul>	<ul style="list-style-type: none"> <li>• Symptoms and faults</li> <li>• Fault finding method for TV</li> <li>• Block diagram and circuit diagram</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 4 Repair and maintain SMPS power supply**

Time:- 20 hrs  
 Theory:- hrs  
 Practical:- 20 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the SMPS</li> <li>2. Dismantle SMPS</li> <li>3. Identify faulty components.</li> <li>4. Check voltage of test pins</li> <li>5. Replace faulty components</li> <li>6. Test SMPS for normal operation.</li> <li>7. Measure and record different output voltage</li> <li>8. Assemble unit in the enclosure.</li> <li>9. Perform final test of particular unit.</li> <li>10. Perform required adjustment</li> <li>11. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty SMPS unit</li> <li>2. Circuit diagram and service manual</li> <li>3. Assortment of the component used in SMPS</li> </ol> <ul style="list-style-type: none"> <li>• Tool set</li> <li>• Fully equipped electronic workshop with power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain SMPS power supply</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit repaired correctly and functioned normally with multiple output voltage correctly</li> </ul>	<p><b>SMPS</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Disadvantages</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 5 Install Yagi Antenna**

Time:- 10 hrs  
 Theory:- hrs  
 Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect different element of Yagi Antenna.</li> <li>2. Assemble the given (Primary) element of unit.</li> <li>3. Select appropriate location for the unit.</li> <li>4. Connect the Antenna cable to the dipole element.</li> <li>5. Install and fasten the antenna at the top of top of the building.</li> <li>6. Adjust the direction and angle of Antenna for better reception.</li> <li>7. Check operational function of unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Antenna</li> <li>• G I rod</li> <li>• Supporting clamp</li> <li>• Antenna</li> <li>• Connection diagram</li> <li>• Tool and equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install VHF Yagi Antenna</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit installed and fastened securely with correct method and gain normal operational function with best reception.</li> </ul>	<p><b>Antenna</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Parts</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Importance and use of connection diagram</li> <li>• Installation procedures</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket, mechanical tool set

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 6 Install Disc antenna**

Time:- 20 hrs  
 Theory:- hrs  
 Practical:- 20 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select appropriate location for the unit.</li> <li>2. Collect element of disc Antenna with accessories.</li> <li>3. Place the unit on stable and flat base.</li> <li>4. Install the Main supporting stand of disc Antenna on stable, flat base.</li> <li>5. Install and fasten element of the unit on supporting stand.</li> <li>6. Install LNB /LNC with tripod unit</li> <li>7. Connect required cable to its LNB/LNC unit.</li> <li>8. Adjust the direction and angle of Antenna for better reception.</li> <li>9. Check operational function of unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Disc Antenna with accessories set.</li> <li>• Satellite receiver</li> <li>• Coaxial cable and F connector</li> <li>• Connection diagram</li> <li>• Tool and equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install Disc antenna</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit installed and fastened securely at appropriate location with correct method and gained normal operational function with best reception.</li> </ul>	<p><b>Disc Antenna</b></p> <ul style="list-style-type: none"> <li>• Definition (Satellite communication)</li> <li>• Parts</li> <li>• Coaxial cable</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Importance and use of connection diagram</li> <li>• Installation procedures and techniques</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket, mechanical tool set

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 7 Assemble and repair Color TV**

Time:- 60 hrs  
 Theory:- hrs  
 Practical:- 60 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical condition of the unit.</li> <li>4. Check voltage of the test pins of unit.</li> <li>5. Identify the faulty components.</li> <li>6. Replace the faulty components by right one.</li> <li>7. Test the unit for normal operation.</li> <li>8. Assemble the unit in the enclosure.</li> <li>9. Perform the final test of unit.</li> <li>10. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty Color TV                             <ul style="list-style-type: none"> <li>• Assortment components used in C TV set,</li> <li>• circuit diagram,</li> <li>• Service manual</li> <li>• Pattern generator</li> <li>• Fully equipped electronics workshop.</li> </ul> </li> </ol> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain Color TV</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Replaced Faulty component with proper value and rating component without damaging adjacent part.</li> <li>• Unit repaired correctly with proper connection and gained normal operational functions</li> </ul>	<p><b>Television</b></p> <ul style="list-style-type: none"> <li>• Concept</li> <li>• CTV signal Transmission</li> <li>• Block diagram</li> <li>• Function of each block</li> <li>• Circuit diagram</li> <li>• Working principle of circuit</li> <li>• Types</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket, pattern generators, oscilloscope, signal generator

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 8 Assemble and repair LCD TV**

Time:- 30 hrs  
 Theory:- hrs  
 Practical:- 30 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical condition of the unit.</li> <li>4. Check voltage of the test pins of unit.</li> <li>5. Identify the faulty components.</li> <li>6. Replace the faulty components by right one.</li> <li>7. Test the unit for normal operation.</li> <li>8. Assemble the unit in the enclosure.</li> <li>9. Perform the final test of unit.</li> <li>10. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty LCD TV</li> </ol> <ul style="list-style-type: none"> <li>• Assortment components used in LCD TV set,</li> <li>• circuit diagram,</li> <li>• Service manual</li> <li>• Pattern generator</li> <li>• Fully equipped electronics workshop.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain LCD TV</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Replaced Faulty component with proper value and rating component without damaging adjacent part.</li> <li>• Unit repaired correctly with proper connection and gained normal operational functions</li> </ul>	<p><b>Television</b></p> <ul style="list-style-type: none"> <li>• Concept</li> <li>• Block diagram</li> <li>• Function of each block</li> <li>• Circuit diagram</li> <li>• Working principle of circuit</li> <li>• Types</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket, pattern generator, signal generator and oscilloscope

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work



**Task: 9 Assemble and repair LED TV**

Time:- 30 hrs  
 Theory:- hrs  
 Practical:- 30 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical condition of the unit.</li> <li>4. Check voltage of the test pins of unit.</li> <li>5. Identify the faulty components.</li> <li>6. Replace the faulty components by right one.</li> <li>7. Test the unit for normal operation.</li> <li>8. Assemble the unit in the enclosure.</li> <li>9. Perform the final test of unit.</li> <li>10. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty LED TV                             <ul style="list-style-type: none"> <li>• Assortment components used in LED TV set,</li> <li>• circuit diagram,</li> <li>• AC power supply</li> <li>• Pattern generator</li> <li>• Fully equipped electronics workshop.</li> </ul> </li> </ol> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain LED TV</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Replaced Faulty component with proper value and rating component without damaging adjacent part.</li> <li>• Unit repaired correctly with proper connection and gained normal operational functions</li> </ul>	<p><b>Television</b></p> <ul style="list-style-type: none"> <li>• Concept</li> <li>• Block diagram</li> <li>• Function of each block</li> <li>• Circuit diagram</li> <li>• Working principle of circuit</li> <li>• Types</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 10 Repair TV remote controls.**

Time:- 7 hrs  
 Theory:- hrs  
 Practical:- 7 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Check battery</li> <li>3. Dismantle the unit.</li> <li>4. Identify faulty card</li> <li>5. Identify faulty components.</li> <li>6. Replace faulty card / components by right one.</li> <li>7. Test unit for normal operation.</li> <li>8. Assemble unit in enclosure</li> <li>9. Perform final test of particular unit.</li> <li>10. Perform required adjustment</li> <li>11. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty remote control set</li> <li>2. Circuit diagram</li> <li>3. Assortment of the component used in remote control</li> <li>4. Tool set</li> <li>5. Service manual</li> <li>6. Fully equipped electronic workshop.</li> </ol> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain remote control system</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit repaired correctly and functioned normally</li> </ul>	<p><b>Remote control</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Types of meter</li> <li>• Concept of sensor</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket, pattern generator, signal generator, oscilloscope

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

# Computer Hardware and Networking

<b>Total:</b>	<b>4 hrs/wk</b>
<b>Theory:</b>	<b>1 hr/wk</b>
<b>Practical:</b>	<b>3 hrs/wk</b>

## Course Description:

This intends to impart knowledge and skills on computer hardware components and networking system. It also deals with installation of operating system, applications and utility software. Moreover, computer hardware components repairing and maintenance are included.

## Course Objectives:

After the completion of this course students will be able to:

1. Familiar with safety precautions and applying the same in practice
2. Develop computer system configuration
3. Conduct diagnostics - testing and inspection
4. Acquire knowledge of hardware components and latest development in the field
5. Conduct repair and maintenance of computer.
6. Carry out installation of operating system, applications and utility software
7. Perform computer networking and system connectivity.

## Contents:

### 1. Introduction and Concepts:: 10 hrs

- Block diagram of computer, Hardware and Software, System Software, Application Software,
- Utility Software, Firmware, CMOS/BIOS setup, Partitioning, Formatting, Operating Systems,
- Program, Flow Charts, Loader, assembler, Compiler, Linker, Editor, Simulator, Emulator,
- Debugger, Device Drivers, Software Packages and Introduction to Programming Language,
- Computer virus.

### 2. Operating System: Types and Functions – 8 hrs

- DOS – Introduction, Versions, DOS Commands, Internal, External, Root Directory.
- Windows Operating System – Introduction, Working with desktop, Control Panel settings.
- Introduction to System tools.

### 3. Microprocessor Study: 6 hrs

8086 – Architecture, Instruction set, 80286, 80386, 80486. Introduction to advanced Processors - i series.

### 4. Interfaces & Drives: 6 hrs

- Type of interface, HDC, CRT Controller, Serial and Parallel Interface, USB,
- Introduction to Bluetooth and IR device, Wifi, Port, Slot, Mini USB, Micro USB. Drives- Floppy Disk Drive, Hard Disk Drive, Optical Disk Drive: Types (ROM, R/W, DVDRROM, DVD Drive Components ( Connectors, Motors, Back up Drive: Pen Drive U3 format, Zip Drive, Tape Drive,

**5. Multimedia, Networking and Internet: 9 hrs**

- Networking: Concepts, Need, Types, Topologies, Protocols, Introduction to Network
- Interface Card and Network Operating Systems, Thick and Thin PC's, Virtual PC.
- Multimedia: Medium concept, Types, Multimedia Computer Systems.
- Internet: Concept, Different Connection types, Applications.

**List of Tasks:**

1. Install Computer
2. Identify and dismantle the computer
3. Assemble the computer
4. Install the Software
5. Repair and maintain of computer.
6. Repair and maintain SMPS power supply
7. Install the router
8. Perform networking
9. Install Printer
10. Repair printer
11. Repair and maintain UPS

## Task Analysis

### Task: 1 Install Computer

Time:- 6 hrs

Theory:- 1 hr

Practical:- 5 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select appropriate location for the unit to be installed</li> <li>2. Place the computer on Computer table.</li> <li>3. Install the AC power cable with socket.</li> <li>4. Plug AC power cord of UPS to the mains AC outlets.</li> <li>5. Connect AC power cord of the computer to the outlets of UPS.</li> <li>6. Connect Input and output device of computer system to corresponding CPU port.</li> <li>7. Check operational function of unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• CPU</li> <li>• Monitor</li> <li>• Keyboard</li> <li>• Mouse</li> <li>• UPS</li> <li>• Computer table</li> <li>• Connection diagram</li> <li>• Ac main Socket with power</li> <li>• Tools and Equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install Computer</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Installed computer as per the specification without damaging and loosening the parts</li> <li>• Tasted installed computer for 24 hours</li> <li>• Computer functioned normally.</li> </ul>	<p><b>Computer</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Block diagram of computer</li> <li>• Connection diagram</li> <li>• Types</li> <li>• Parts</li> <li>• Function</li> <li>• Installation procedures</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-** Screw driver set, Computer set.

**Safety:-**

**Task: 2 Dismantle Computer**

Time:- 6 hrs  
 Theory:- 1 hr  
 Practical:- 5 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Select appropriate tools for dismantle the PC</li> <li>2. Place the computer on Computer table.</li> <li>3. Unplug AC power cord of UPS to the mains AC outlets.</li> <li>4. Unscrew the casing of CPU</li> <li>5. Dismantle UPS unit.</li> <li>6. Dismantle memory unit.</li> <li>7. Dismantle hard disk, CD-ROM,</li> <li>8. Disconnect front panel connector.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• CPU</li> <li>• Monitor</li> <li>• Keyboard</li> <li>• Mouse</li> <li>• UPS</li> <li>• Computer table</li> <li>• Connection diagram</li> <li>• Ac main Socket with power</li> <li>• Tools and Equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Dismantle Computer</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Dismantled computer as per the normal requirement without damaging computer parts</li> </ul>	<p><b>Computer</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Block diagram of computer</li> <li>• Connection diagram</li> <li>• Types</li> <li>• Parts</li> <li>• Function</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-** Screw driver set.

**Safety:-**

**Task: 3 Assemble Computer**

Time:- 20 hrs  
 Theory:- 2 hrs  
 Practical:- 18 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required materials, tools &amp; components</li> <li>2. Fix motherboard in computer casing with proper screw</li> <li>3. Install CD-ROM, Hard disk, SMPS, memory in computer casing</li> <li>4. Connect proper cable in proper place</li> <li>5. Fix back side cabinet and fasten screws.</li> <li>6. Install input and output devices</li> <li>7. Plug in A.C. main cord of the set/power and switch to ON position.</li> <li>8. Check the normal operation of computer</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Motherboard, RAM, CD-ROM, Hard disk</li> <li>• casing</li> <li>• SMPS power supply</li> <li>• User manual</li> <li>• Input and output devices</li> <li>• Well-equipped computer workshop</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Assemble computer.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• The wire cables components of computer connected neatly and safely</li> <li>• The connectors plugged in to power socket safely</li> <li>• The set assembled correctly and checked for normal operation mode.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of computer</li> <li>• Advantage</li> <li>• Assembling procedure of computer</li> <li>• Layout diagram of computer</li> <li>• Importance of computer hardware</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, screw driver set, AC cord, monitor, keyboard, mouse, computer parts and its accessories

**Safety:-**

1. Use safety rubber shoe
2. Check electric lines and possible hazards before starting to work
3. Jumper setting for mother board

**Task: 4 Install Software**

Time:- 14 hrs  
 Theory:- 4 hrs  
 Practical:- 10 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Collect main bootable operating and application software CD</li> <li>2. Place the computer on Computer table.</li> <li>3. Install the AC power cable with socket.</li> <li>4. Adjust bios setup for booting CD</li> <li>5. Insert the main CD in CD ROM trolley.</li> <li>6. Follow the instructions and readjust if necessary</li> <li>7. Install application software</li> <li>8. Install driver software</li> <li>9. Check for normal operation</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• CPU</li> <li>• Monitor</li> <li>• Keyboard</li> <li>• Mouse</li> <li>• UPS</li> <li>• Computer table</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install Software</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Installed software as per requirement without error</li> <li>• Installed software work function properly</li> <li>• Computer functioned normally.</li> </ul>	<p><b>Software</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Function</li> <li>• Installation procedures</li> <li>• Advantage</li> <li>• Application</li> </ul>

**Tools and Materials:-** Main Operating CD, application software CD, driver CD

**Safety:-**



**Task: 5 Repair and maintain computer**

Time:- 14 hrs  
 Theory:- 4 hrs  
 Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Check the fault symptoms</li> <li>3. Open the casing</li> <li>4. Identify the faulty parts/ software</li> <li>5. Reinstall the required software</li> <li>6. Replace the faulty parts by right one.</li> <li>7. Test the unit for normal operation</li> <li>8. Assemble the unit in the enclosure.</li> <li>9. Perform the final test of unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• CPU</li> <li>• Monitor</li> <li>• Keyboard</li> <li>• Mouse</li> <li>• UPS</li> <li>• Computer table</li> <li>• Connection diagram</li> <li>• Tools and Equipment</li> <li>• Software CDs</li> <li>• Assortment of the parts used in computer</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain personal Computer</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Repaired computer function properly.</li> <li>• Tested repaired computer for normal condition</li> </ul>	<p><b>Repair and maintain personal Computer</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Repairing procedures</li> <li>• Advantage</li> <li>• Application</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-** Main Operating CD, application software CD, driver CD, Screw driver set.

**Safety:-**

**Task: 6 Repair and maintain ATX (SMPS) power supply**

Time:- 12 hrs

Theory: 2 hrs

Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the SMPS</li> <li>2. Dismantle SMPS</li> <li>3. Identify faulty components.</li> <li>4. Check voltage of test pins</li> <li>5. Replace faulty components</li> <li>6. Test SMPS for normal operation.</li> <li>7. Measure and record different output voltage</li> <li>8. Assemble unit in the enclosure.</li> <li>9. Perform final test of particular unit.</li> <li>10. Perform required adjustment</li> <li>11. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty</li> <li>2. Circuit diagram</li> <li>3. Assortment of the component used in SMPS</li> </ol> <ul style="list-style-type: none"> <li>• Tool set</li> <li>• Fully equipped electronic workshop with power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain SMPS power supply</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit repaired correctly and functioned normally with multiple output voltage correctly</li> </ul>	<p><b>SMPS</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Disadvantages</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazard

**Task: 7 Install and configure internet**

Time:- 7 hrs  
 Theory:- 2 hrs  
 Practical:- 5 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
1. Install appropriate hardware to the computer. 2. Install appropriate driver to the computer 3. Configure appropriate internet setting of the computer. 4. Manage appropriate Dial up or DSL setting 5. Configure minimum security setting.	<b>Condition (Given):</b> <ul style="list-style-type: none"> <li>•</li> <li>• AC cord</li> <li>• Ac main socket with power</li> <li>• Connection diagram</li> <li>• Data cable</li> <li>• Tool and equipment</li> </ul> <b>Tasks (What):</b> <ul style="list-style-type: none"> <li>• Install printer</li> </ul> <b>Standard (How well):</b> <ul style="list-style-type: none"> <li>• Installed internet works properly.</li> <li>• Internet functioned normal operational.</li> </ul>	<b>Internet</b> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Function</li> <li>• Connection diagram</li> <li>• Advantage</li> <li>• Application</li> </ul>

**Tools and Materials:-** Main Operating CD, application software CD, driver CD, Screw driver set.

**Safety:-**

**Task: 8 Install DSL/ADSL Router**

Time:- 5 hrs  
 Theory:- 2 hrs  
 Practical:- 3 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select appropriate location for the unit.</li> <li>2. Mount and fasten the unit to the stable and solid concrete wall.</li> <li>3. Install proper RJ-45 cable to the computer and router socket.</li> <li>4. Connect the system with AC supply system.</li> <li>5. Power on the system</li> <li>6. Setup the normal required Parameter of router.</li> <li>7. Follow the instruction and readjust if necessary.</li> <li>8. Check operational function</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Router</li> <li>• Telephone line</li> <li>• Wiring pair cable</li> <li>• AC cord</li> <li>• Protection module</li> <li>• Layout diagram</li> <li>• Tools and equipment.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install Router.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit including router must be installed at appropriate and safe location with proper connection using proper cable.</li> </ul>	<p><b>Router</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Function</li> <li>• Importance</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Importance and use of connection diagram</li> <li>• Installation procedures and techniques</li> <li>• Application</li> <li>• Advantage</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Screw driver set, router, RJ-45 cable, computer, ADSL line etc,

**Safety:-**

**Task: 9 Perform computer networking.**

Time:- 15 hrs  
 Theory:- 5 hrs  
 Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select appropriate location for HUB.</li> <li>2. Collect element of computer networking with accessories.</li> <li>3. Mount the unit on wall or place on stable with flat base.</li> <li>4. Install the proper cable for required computer</li> <li>5. Install Rj-45 cable on each point</li> <li>6. Connect required cable to its HUB/Computer unit.</li> <li>7. Configure the computer with proper networking protocol and readjust if necessary.</li> <li>8. Check operational function of unit.</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Computer</li> <li>• HUB</li> <li>• Ac main socket with power</li> <li>• Layout diagram</li> <li>• Data cable</li> <li>• Tool and equipment</li> <li>• Well-equipped computer lab</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install printer</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Installed Networking system works properly without error</li> <li>• Computer functioned sharing data properly.</li> </ul>	<p><b>Computer Networking</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Function</li> <li>• Layout diagram</li> <li>• Networking procedures</li> <li>• Advantage</li> <li>• Application</li> </ul>

**Tools and Materials:-**HUB, computer, crimping tools, RJ-45 connector, tools set etc

**Safety:-** Networking cable of HUB removes and fix safely without damaging

**Task: 10 Install printer**

Time:- 5 hrs  
 Theory:- 2 hrs  
 Practical:- 3 hrs

<b>Steps</b>	<b>Terminal performance objectives</b>	<b>Related Technical Knowledge</b>
<ol style="list-style-type: none"> <li>1. Select appropriate location for the unit.</li> <li>2. Install device on stable and flat base near CPU.</li> <li>3. Install paper tray with paper.</li> <li>4. Connect data cable to CPU and printer.</li> <li>5. Plug AC power cord into AC outlets.</li> <li>6. Check normal operational function of unit.</li> <li>7. Search for correct driver until detecting PNP device</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Printer</li> <li>• AC cord</li> <li>• Ac main socket with power</li> <li>• Connection diagram</li> <li>• Data cable</li> <li>• Tool and equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install printer</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Installed printer properly without damaging</li> <li>• Printer functioned normal operational.</li> </ul>	<p><b>Printer</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Function</li> <li>• Connection diagram</li> <li>• Installation procedures</li> <li>• Advantage</li> <li>• Application</li> </ul>

**Tools and Materials:-**Printer, computer, AC cord, paper etc.

**Safety:-** Data cable and paper of printer removes and fix safely without damaging

**Task: 11 Repair printer**

Time:- 10 hrs  
 Theory:- 2 hrs  
 Practical:- 8 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section</li> <li>2. Dismantle the unit.</li> <li>3. Readjust the printer driver if necessary.</li> <li>4. Observe physical condition of the unit.</li> <li>5. Check voltage of the test pins of unit.</li> <li>6. Identify the faulty components.</li> <li>7. Replace the faulty components by right one.</li> <li>8. Test the unit for normal operation.</li> <li>9. Assemble the unit in the enclosure.</li> <li>10. Perform the final test of unit.</li> <li>11. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Printer</li> <li>• AC cord</li> <li>• Assortment of electronic component used in printer</li> <li>• Circuit diagram</li> <li>• Sensor</li> <li>• Cartridge</li> <li>• Power supply module</li> <li>• Tool and equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair printer</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Repaired printer works properly.</li> <li>• Printer functioned normal operational.</li> </ul>	<p><b>Printer</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Function</li> <li>• Connection diagram</li> <li>• Installation procedures</li> <li>• Advantage</li> <li>• Application</li> <li>• Sensor</li> <li>• Cartridge</li> </ul>

**Tools and Materials:- :-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper nose pliers, screw driver set, tweezers and AC mains socket with power supply

**Safety:-**

- Sensor and cartridge of printer removes and fix safely without damaging.

**Task: 12 Repair and maintain UPS**

Time:- 10 hrs  
Theory:- 3 hrs  
Practical:- 7 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical condition of component.</li> <li>4. Check voltage of test pins</li> <li>5. Identify faulty components of unit</li> <li>6. Replace faulty components by right one.</li> <li>7. Test set for normal operation.</li> <li>8. Assemble unit in the enclosure.</li> <li>9. Perform final test of particular unit.</li> <li>10. Perform required adjustment</li> <li>11. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Faulty inverter /UPS</li> <li>• Circuit diagram</li> <li>• Assortment of the component used in UPS</li> <li>• Tool set</li> <li>• Fully equipped electronic workshop with power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain UPS</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit repaired correctly and gained normal AC output Voltage of unit</li> <li>• Passed test of backup system</li> </ul>	<p><b>UPS</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precaution</li> <li>• Difference between inventor and UPS Measurement</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper nose pliers, screw driver set, tweezers and AC mains socket with power supply

**Safety:-** Connect battery safely without damaging circuit



# Repair and Maintenance of Audio Video and Multimedia System

<b>Total:</b>	<b>4 hrs/wk</b>
<b>Theory:</b>	<b>1 hr/wk</b>
<b>Practical:</b>	<b>3 hrs/wk</b>

## Course Description:

This course is designed to help students to impart knowledge and skills on repairing and maintenance of audio video and multimedia system devices and equipments.

## Course Objectives:

After the completion of this course the student will be able to:

1. Understand application and principle of operation of audio video equipment and devices.
2. Repair CD, DVD and VCR.
3. Repair and maintain speaker and mike.
4. Install PA system.
5. Repair and maintain camera.

## List of Tasks

1. Repair and maintain CD player
2. Repair and maintain DVD player
3. Repair and maintain VCR
4. Repair and maintain speaker and mike
5. Install PA System
6. Repair and maintain digital cameras.
7. Repair and maintenance of multimedia projector.

## Task Analysis

### Task: 1 Repair and maintain CD player

Time:- 5 hrs

Theory:-1 hr

Practical:- 4 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Inspect input output jacks/sockets/ports and extension cables.</li> <li>4. Inspect physical condition, symptom of damage due to falling at the ground as for example.</li> <li>5. Identify faulty cord</li> <li>6. Identify faulty components.</li> <li>7. Replace faulty cord / components by right one.</li> <li>8. Test unit for normal operation.</li> <li>9. Assemble unit in the enclosure.</li> <li>10. Perform final test of particular unit.</li> <li>11. Perform required adjustment</li> <li>12. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty CD player</li> <li>2. Circuit diagram</li> <li>3. Assortment of the component used in CD player</li> <li>4. Tool set</li> <li>5. Service manual of CD player</li> <li>6. Hot blower iron</li> <li>7. Air blower</li> </ol> <ul style="list-style-type: none"> <li>• Fully equipped workshop with power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain CD player</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Parts disconnected safely.</li> <li>• Unit repaired correctly with proper connections.</li> <li>• Gained normal operation functions</li> </ul>	<p><b>CD</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, nose pliers, screw driver set and AC mains socket, signal generator, oscilloscope

**Safety: -** Lens of CD player removes and fix safely without damaging

**Task: 2 Repair and maintain DVD player**

Time:- 8 hrs  
 Theory:- 2 hrs  
 Practical:- 6 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Identify faulty cord</li> <li>4. Identify faulty components.</li> <li>5. Replace faulty cord / components by right one.</li> <li>6. Test unit for normal operation.</li> <li>7. Assemble unit in the enclosure.</li> <li>8. Perform final test of particular unit.</li> <li>9. Perform required adjustment</li> <li>10. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty DVD player</li> <li>2. Circuit diagram</li> <li>3. Assortment of the component used in DVD player</li> <li>4. Tool set</li> <li>5. Hot blower iron</li> <li>6. Fully equipped workshop with power supply.</li> <li>7. Service manual</li> </ol> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain CD player</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Parts disconnected safety, unit repaired correctly with proper connection and gained normal operational functions</li> </ul>	<p><b>DVD</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:** - Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, nose pliers, screw driver set hot air blower iron and AC mains socket, signal generator, oscilloscope

**Safety:-**

**Task: 3 Repair and maintain VCR**

Time:- 10 hrs  
 Theory:- 2 hrs  
 Practical:- 8 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical conditions of components</li> <li>4. Measure test pin voltage of unit</li> <li>5. Identify faulty component</li> <li>6. Replace faulty components by right one.</li> <li>7. Test unit for normal operation.</li> <li>8. Assemble unit in the enclosure.</li> <li>9. Perform final test of particular unit.</li> <li>10. Perform required adjustment</li> <li>11. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty VCR unit</li> <li>2. Circuit diagram</li> <li>3. Assortment of the component used in VCR</li> </ol> <ul style="list-style-type: none"> <li>• Tool set.</li> <li>• Fully equipped electronic workshop.</li> <li>• Service manual of the VCR unit</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain VCR</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Dismantle unit without further damage</li> <li>• Defective components of VCR replaced with good one correctly without damaging other parts and VCR repaired with normal function</li> </ul>	<p><b>VCR</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Application</li> <li>• Concept of sensor</li> <li>• Components value and rating</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** :- Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket, signal generator and oscilloscope

**Safety:-**

**Task: 4 Repair and maintain speaker and mike**

Time:- 8 hrs  
 Theory:- 2 hrs  
 Practical:- 6 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required materials.</li> <li>2. Test the units to be repaired and diagnose the faulty unit.</li> <li>3. Disassemble the speaker box and microphone.</li> <li>4. Test the continuity of wiring leads up to voice coil of the speaker and microphone.</li> <li>5. Check the voice coil loop lead wires for breaks and dry soldering of speaker.</li> <li>6. Replace faulty or damaged voice coil with good one.</li> <li>7. Replace torn or damaged paper cone with good one.</li> <li>8. Replace damaged mike capsule with good ne.</li> <li>9. Assemble the whole unit.</li> <li>10. Test the function of repaired gadget.</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty connecting lead wires and plugs</li> <li>2. Faulty switches (in case of mikes)</li> <li>3. Faulty or damaged cross over networks.</li> <li>4. Faulty voice coil: shorted or open circuit voice coils</li> <li>5. Tools and equipment</li> <li>6. Fully equipped electronic workshop.</li> </ol> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain speaker and mike.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Repaired speaker and mike functioning.</li> <li>• Volume of sound at speakers appropriate and adequate.</li> </ul>	<p><b>Speaker and mike</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Principle of operation</li> <li>• Types</li> <li>• Trouble shooting technique</li> <li>• Repairing technique</li> <li>• Safety precautions</li> <li>•</li> </ul>

**Tools and Materials:-** :- Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-** It is precision skill work more than knowledge.

**Task: 5 Install PA System**

Time:- 16 hrs  
 Theory:- 4 hrs  
 Practical:- 12 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required materials.</li> <li>2. Select appropriate location for sound mixer and amplifier units.</li> <li>3. Select appropriate location for speakers and microphones.</li> <li>4. Install speakers and microphones with stand.</li> <li>5. Install mixer unit on a stable table with sufficient illuminated light.</li> <li>6. Wire all the audio gadgets eg: mixer, amplifier, mikes, speakers, sound effect gadgets, recording and playback units.</li> <li>7. Install a\AC extension power to AC mains sockets.</li> <li>8. Check operational functions of all units with the help of built in signal generator or playback unit.</li> <li>9. Finally check again using microphones and sound effect units.</li> <li>10. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. PA system gadgets</li> <li>2. AC mains power and extension units.</li> <li>3. Connection or wiring diagram</li> <li>4. Tools and equipment</li> <li>5. Fully equipped electronic workshop.</li> </ol> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install PA System</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Installed PA system functioning alright with mikes and playback units and volume of sound at speakers appropriate and adequate.</li> </ul>	<p><b>PA System</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Principle of operation</li> <li>• Components</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Application</li> <li>• Components value and rating</li> <li>• Safety precautions</li> <li>• Instruction or operation manuals of the gadgets and their specifications, especially of mixer, main power amplifier units and speakers.</li> <li>• Principles of power amplifier units and speakers</li> <li>• Proper handling of AC mains power line: Proper functioning and safety precautions</li> <li>• Repairing techniques: replacements of fuses and non-functioning gadgets with good ones.</li> </ul>

**Tools and Materials:-** :- Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

**Task: 6 Disassemble and Assemble of Digital video camera**

Time:- 20 hrs  
 Theory:- 4 hrs  
 Practical:- 16 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required materials, tools &amp; components</li> <li>2. Disassemble of camera carefully with remarking the all screws carefully</li> <li>3. Fix the main kit in cabinet</li> <li>4. Fix the monitor in cabinet</li> <li>5. Fix and check the all users control for free flexible</li> <li>6. Put the memory chip correctly</li> <li>7. Fix power supply correctly</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Digital camera complete kit-set</li> <li>• Cabinet,</li> <li>• Charger set with battery</li> <li>• circuit diagram</li> <li>• Basic tools</li> <li>• Well-equipped electronics work shop</li> <li>• Service manual</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Disassemble and Assemble digital video camera</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• The wire cables components are correctly fixed</li> <li>• The connectors plugged in to power socket safely</li> <li>• The set assembled correctly and checked for normal operation mode.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of Digital Video camera</li> <li>• Advantage</li> <li>• Assembling procedure of digital camera Set</li> <li>• Block diagram of digital camera</li> <li>• Function of each block</li> <li>• Circuit diagram</li> <li>• Working principle of circuit diagram</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket, special and precision screw driver/nut drivers

**Safety:-** 1. Use safety spectacle, rubber shoe, fitted working dress, globe  
 2. Check electric lines and possible hazards before starting to work

**Task: 7 Repair and maintain Digital camera.**

Time:- 8 hrs.  
Theory:- 2 hrs.  
Practical:- 6 hrs.

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required materials.</li> <li>2. Test the unit to be repaired.</li> <li>3. Observe physical condition of the unit.</li> <li>4. Dismantle the unit.</li> <li>5. Diagnose the faulty section.</li> <li>6. Readjust the mechanism if necessary.</li> <li>7. Check normal component of the t of unit.</li> <li>8. Identify the faulty components.</li> <li>9. Replace the faulty components by right one.</li> <li>10. Test the unit for normal operation.</li> <li>11. Assemble the unit in the enclosure.</li> <li>12. Perform the final test of unit.</li> <li>13. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Faulty set</li> <li>• camera tools set</li> <li>• Battery</li> <li>• sensor, lens</li> <li>• Gear</li> <li>• Service manual</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain camera.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Repaired camera functioning well.</li> </ul>	<p><b>Digital Camera</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Principle of operation</li> <li>• Types</li> <li>• Trouble shooting technique</li> <li>• Repairing technique</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** :- Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket, special and precision screw and nut drivers

**Safety:-** It is precision skill work more than knowledge.



**Task: 8 Familiarize the users control**

Time: 5 hrs  
 Theory: 1 hrs  
 Practical: 4 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
1. Read the instruction manual 2. Power on 3. See the display on monitor screen 4. Use one by one function and notice the changed video features 5. Make a video and test its quality	<b>Condition (Given):</b> 1. Faulty set  2. Manual of video camera  <b>Tasks (What):</b> <ul style="list-style-type: none"> <li>• Familiarize the users control of video camera</li> </ul> <b>Standard (How well):</b> <ul style="list-style-type: none"> <li>• Video recording replay with good visualization.</li> </ul>	<ul style="list-style-type: none"> <li>• Types, and features</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Disadvantages</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket, precision screw/nut drivers

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to works

**Task: 9** Repair and maintain power supply of multimedia projector

Time:- 15 hrs  
Theory:- 3 hrs  
Practical:- 12 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the power supply</li> <li>2. Identify faulty components.</li> <li>3. Check voltage of test pins</li> <li>4. Replace faulty components</li> <li>5. Measure and record different output voltage</li> <li>6. Assemble unit in the enclosure.</li> <li>7. Perform final test of particular unit.</li> <li>8. Perform required adjustment</li> <li>9. Store tools and equipment in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty set</li> <li>2. Circuit diagram</li> <li>3. Assortment of the component used in power supply</li> </ol> <ul style="list-style-type: none"> <li>• Tool set</li> <li>• Service manual</li> <li>• Fully equipped electronic workshop with power supply.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain battery charger</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit repaired correctly and functioned normally with multiple output voltage correctly</li> </ul>	<p><b>SMPS</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Trouble shooting procedure</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Disadvantages</li> <li>• Application</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket, precision screw and nut drivers

**Safety:-** 1. Use safety spectacle, rubber shoe, fitted working dress, globe  
2. Check electric lines and possible hazards before starting to works

**Task: 10 Disassemble and assemble of multimedia projector**

Time:- 15 hrs  
Theory:- 03 hrs  
Practical:- 12 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required materials, tools &amp; components</li> <li>2. Disassemble of multimedia projector carefully with remarking the all screws carefully</li> <li>3. Fix the main kit in cabinet</li> <li>4. Fix the monitor in cabinet</li> <li>5. Fix and check the all users control for free flexible</li> <li>6. Put the memory chip correctly</li> <li>7. Fix power supply correctly</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Multimedia projector complete kit-set with attached documents</li> <li>• Cabinet,</li> <li>• Charger set with battery</li> <li>• circuit diagram</li> <li>• Basic tools</li> <li>• Well-equipped electronics work shop</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Disassemble and Assemble Multimedia projector</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• The wire cables components are correctly fixed</li> <li>• The connectors plugged in to power socket safely</li> <li>• The set assembled correctly and checked for normal operation mode.</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of Multimedia projector</li> <li>• Advantage</li> <li>• Assembling procedure of Multimedia projector Set</li> <li>• Block diagram of Multimedia projector</li> <li>• Function of each bloc</li> <li>• Circuit diagram</li> <li>• Working principle of circuit diagram</li> <li>• Safety precautions</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

**Task: 11** Repair and maintain Multimedia projector

Time:- 12 hrs

Theory:- 2 hrs

Practical:- 10 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Test the unit to be repaired and diagnose the faulty section.</li> <li>2. Dismantle the unit.</li> <li>3. Observe physical condition of the unit.</li> <li>4. Check voltage of the test pins of unit.</li> <li>5. Identify the faulty components.</li> <li>6. Replace the faulty components by right one.</li> <li>7. Test the unit for normal operation.</li> <li>8. Assemble the unit in the enclosure.</li> <li>9. Perform the final test of unit.</li> <li>10. Perform required adjustment</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Multimedia projector kit-set, picture tube</li> <li>• Cabinet,</li> <li>• circuit diagram</li> <li>• Pattern generator</li> <li>• Basic tools</li> <li>• Well-equipped electronics workshop</li> <li>• Service manual</li> <li>•</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair of Multimedia projector</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• The wire cables components of solder neatly and safety in the multimedia projector kit</li> <li>• The connectors plugged in to power socket safely</li> <li>• The set assembled correctly and checked for normal operation mode.</li> </ul>	<ul style="list-style-type: none"> <li>• Symptoms and faults</li> <li>• Fault finding method for Multimedia projector</li> <li>• Block diagram and circuit diagram</li> </ul>

**Tools and Materials:-** Multi meter, soldering iron with stand, de-soldering pump, soldering leads, soldering paste /flux, wire cutter, wire stripper, screw driver set, nose pliers, tweezers and AC mains socket

**Safety:-**

1. Use safety spectacle, rubber shoe, fitted working dress, globe
2. Check electric lines and possible hazards before starting to work

# Repair and Maintenance of Telecommunication Devices

<b>Total:</b>	<b>6 hrs/wk</b>
<b>Theory:</b>	<b>1 hr/wk</b>
<b>Practical:</b>	<b>5 hrs/wk</b>

## **Course Description:**

This course intends to provide knowledge and skills on operating as well as repairing and maintenance of telecommunication devices such as telephone sets, fax machines and mobile phones.

## **Course Objectives:**

After completion of this course students will be able to:

1. Understand application and principle of operation of telecommunication devices.
2. Install telecommunication devices.
3. Operate telecommunication devices.
4. Repair and maintain telecommunication devices.

## **List of Tasks**

1. Install telephone set
2. Repair and maintain telephone set
3. Repair and maintain mobile phone set
4. Repair Fax machine
5. Install EPABX

## Task Analysis

Time:- 2 hrs  
Theory:- 1 hr  
Practical:- 1hr

### Task: 1 Install telephone set

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select appropriate location</li> <li>2. Provide appropriate stable flat surface</li> <li>3. Place set on the stable flat surface</li> <li>4. Place hand set on the cradle and connect it to hand set jack</li> <li>5. Install telephone cable with socket</li> <li>6. Connect telephone line to line jack of the set</li> <li>7. Check operational function</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Telephone set</li> <li>• Telephone line</li> <li>• Telephone cable</li> <li>• Telephone cord and socket</li> <li>• PVC tape</li> <li>• Connection diagram</li> <li>• Tools and Equipment</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install telephone set.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit installed to appropriate and safe location with proper connection using proper cable and gain normal function.</li> </ul>	<p><b>Telephone</b></p> <ul style="list-style-type: none"> <li>• Definition</li> <li>• Principle of operation of telephone and communication system.</li> <li>• Transmission media.</li> <li>• Importance and use of connection diagram</li> <li>• Installation procedures and techniques</li> <li>• Types and uses of telephone cable</li> <li>• Application</li> <li>• Advantage</li> <li>• Safety precautions</li> </ul>

**Tools and Materials: -**

1. Screw driver set
2. Roset box
3. Telephone cord

**Safety:-**

**Task: 2 Repair and maintain telephone set**

Time:- 20 hrs  
 Theory:- 6 hrs  
 Practical:- 14 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required tools and materials.</li> <li>2. Dismantle the set.</li> <li>3. Test the unit to be repaired.</li> <li>4. Diagnose the faulty section.</li> <li>5. Dismantle the unit.</li> <li>6. Observe the physical condition of components.</li> <li>7. Check voltage of test pins</li> <li>8. Identify faulty components.</li> <li>9. Replace faulty components by right one.</li> <li>10. Test unit for normal operation.</li> <li>11. Assemble unit in the enclosure.</li> <li>12. Perform final test of particular unit.</li> <li>13. Perform required adjustment</li> <li>14. Store tools and materials in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty telephone set</li> <li>2. Circuit diagram</li> <li>3. Assortment of component used in telephone set</li> <li>4. Tool set</li> <li>5. Fully equipped workshop with telephone line and socket.</li> </ol> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain telephone set.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Repaired set must operate normally.</li> <li>• Safety measures must be followed.</li> </ul>	<p><b>Telephone Set</b></p> <ul style="list-style-type: none"> <li>• Explanation</li> <li>• Block diagram</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Troubleshooting procedures</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Applications</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-**

1. Multimeter
2. Soldering iron with stand
3. De-soldering pump
4. Soldering leads
5. Soldering paste /flux
6. Wire cutter
7. Wire stripper
8. Nose pliers
9. Screw driver set
10. Telephone line with socket

**Safety:-**

**Task 3: Repair and maintain mobile phone set**

Time:- 140 hrs  
 Theory:- 40 hrs  
 Practical:- 100 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required tools and materials.</li> <li>2. Dismantle the mobile phone set.</li> <li>3. Test the unit to be repaired.</li> <li>4. Diagnose the faulty section.</li> <li>5. Dismantle the unit.</li> <li>6. Observe the physical condition of components.</li> <li>7. Check voltage of test pins</li> <li>8. Identify faulty components.</li> <li>9. Replace faulty components by right one.</li> <li>10. Test unit for normal operation.</li> <li>11. Assemble unit in the enclosure.</li> <li>12. Perform final test of particular unit.</li> <li>13. Perform required adjustment</li> <li>14. Store tools and materials in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ol style="list-style-type: none"> <li>1. Faulty mobile phone set</li> <li>2. Circuit diagram</li> <li>3. Assortment of components used in mobile phone set</li> <li>4. Tool set</li> <li>5. Fully equipped workshop with mobile phone network and socket.</li> </ol> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Perform Fault Finding</li> <li>• Repair Power Supply Unit</li> <li>• Repair Charging Section</li> <li>• Repair BGA IC</li> <li>• Repair Network Section</li> <li>• Repair Connectivity Section</li> <li>• Repair Light Section</li> <li>• Troubleshoot Display Unit</li> <li>• Repair Keypad</li> <li>• Repair SIM/RUIM Card Section</li> <li>• Repair UI (audio/vibration) Unit</li> <li>• Repair Camera Section</li> <li>• Repair Radio Section</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Repaired set must operate normally.</li> <li>• Safety measures must be followed.</li> </ul>	<p><b>Telephone Set</b></p> <ul style="list-style-type: none"> <li>• Explanation</li> <li>• Block diagram</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Circuit diagram</li> <li>• Troubleshooting procedures</li> <li>• Operating procedure</li> <li>• Advantages</li> <li>• Applications</li> <li>• Safety precaution</li> </ul>

**Tools and Materials:-**

1. Multimeter, Screw driver set, Soldering iron, De-soldering pump, Frequency counter, SMD Rework Station, PCB Holder, Multivibrator, Propyl Alcohol, Computer with flashing software and other applications, Universal Flashing Devices

**Safety:-**



#### Task 4 Repair Fax machine

Time:- 10 hrs  
Theory:- 2 hrs  
Practical:- 8 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Collect required tools and materials.</li> <li>2. Observe the fax set</li> <li>3. Dismantle the fax set.</li> <li>4. Test the unit to be repaired.</li> <li>5. Diagnose the faulty section.</li> <li>6. Dismantle the unit.</li> <li>7. Observe the physical condition of components.</li> <li>8. Check voltage if required</li> <li>9. Identify faulty components.</li> <li>10. Replace faulty components by right one.</li> <li>11. Test unit for normal operation.</li> <li>12. Assemble unit in the enclosure.</li> <li>13. Perform final test of particular unit.</li> <li>14. Perform required adjustment</li> <li>15. Store tools and materials in proper place</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• Fax machine</li> <li>• Telephone line</li> <li>• AC cord and socket</li> <li>• PVC tape</li> <li>• Thermal paper</li> <li>• Connection diagram</li> <li>• Tools and Equipment.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Repair and maintain data transmitting and receiving unit of fax machine.</li> <li>• Repair and maintain mechanical unit of fax machine.</li> <li>• Repair and maintain control unit of fax machine.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Repaired fax machine must operate normally.</li> </ul>	<p><b>Fax machine</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Function</li> <li>• Importance</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Installation procedures and techniques</li> <li>• Application</li> <li>• Advantage <ul style="list-style-type: none"> <li>• Safety precaution</li> </ul> </li> </ul>

#### Tools and Materials: -

1. Screw driver set
2. Multimeter

#### Safety:-

**Task 5: Install EPABX**

Time:- 62 hrs  
 Theory:- 12 hrs  
 Practical:- 50 hrs

Steps	Terminal performance objectives	Related Technical Knowledge
<ol style="list-style-type: none"> <li>1. Select appropriate location for the unit.</li> <li>2. Mount and fasten the unit to the stable and solid concrete wall.</li> <li>3. Connect the frame of the unit to earth.</li> <li>4. Connect the trunk line to the unit.</li> <li>5. Install proper station cable and AC power cable with socket.</li> <li>6. Connect the system with surge protection.</li> <li>7. Connect output of surge protection to definite required point</li> <li>8. Connect the normal telephone set to extension points</li> <li>9. Connect the hybrid set to the operator console.</li> <li>10. Check operational function</li> </ol>	<p><b>Condition (Given):</b></p> <ul style="list-style-type: none"> <li>• EPABX</li> <li>• Telephone line</li> <li>• Wiring pair cable</li> <li>• AC cord</li> <li>• PVC tape</li> <li>• Protection module</li> <li>• Connection diagram</li> <li>• Tools and Equipment.</li> </ul> <p><b>Tasks (What):</b></p> <ul style="list-style-type: none"> <li>• Install EPABX.</li> </ul> <p><b>Standard (How well):</b></p> <ul style="list-style-type: none"> <li>• Unit including operator console must be installed at appropriate and safe location with proper connection using proper cable.</li> </ul>	<p><b>EPABX</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Function</li> <li>• Importance</li> <li>• Types</li> <li>• Principle of operation</li> <li>• Basic principle of telephone and wireless communication</li> <li>• Importance and use of connection diagram</li> <li>• Installation procedures and techniques</li> <li>• Application</li> <li>• Advantage</li> <li>• Safety precautions</li> </ul>

**Tools and Materials: -**

Multi meter, Screw driver set, Nose pliers, Wire cutter, Wire stripper, Hammer, Pair cable

**Safety:-**

# Entrepreneurship Development

**Total: 78 hrs**

**Theory: 30 hrs**

**Practical: 48 hrs**

## Course 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. Understand the concept of 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.	Task statements	Related technical knowledge	Time (hrs)		
			T	P	Total
<b>Unit 1: Introduction to Entrepreneurship</b>			5.75	4.08	9.83
1	Introduce business	<b><u>Introduction of business:</u></b> Definition of business/enterprise Types of business Classification of business Overview of MSMEs(Micro, Small and Medium Enterprises) in Nepal	1.5		1.5
2	<u>Define entrepreneur/entrepreneurship</u>	<b><u>Definition of entrepreneur:</u></b> <u>Definition of entrepreneur</u> <u>Definition of entrepreneurship</u> <u>Entrepreneurship development process</u>	0.5	0.5	1.0
3	<u>Describe entrepreneur's characteristics</u>	<b><u>Entrepreneur's characteristics:</u></b> <u>Characteristics of entrepreneurs</u> Nature of entrepreneurs	0.67	0.83	1.5
4	<u>Assess entrepreneur's characteristics</u>	<b><u>Assessment of entrepreneur's characteristics:</u></b> <u>List of human characteristics</u> <u>Assessment of entrepreneurial characteristics</u>	0.5	1.0	1.5
5	Compare entrepreneur with other occupations	<u>Entrepreneur and other occupations:</u> Comparison of entrepreneur with other occupations Types and styles of entrepreneurs	1.0		1.0
6	Differentiate between entrepreneur and employee	<u>Entrepreneur and employee:</u> Difference between entrepreneur and employee Benefit of doing own business	0.5	0.5	1.0
7	Assess "Self"	<u>"Self" assessment:</u> Understanding "self" Self-disclosure and feedback taking	0.6	0.4	1.0
8	Entrepreneurial personality test: Assess "Self" inclination to business	<u>Entrepreneurial personality test:</u> Concept of entrepreneurial personality test Assessing self-entrepreneurial inclination	0.67	0.83	1.5
Unit 2: Creativity and Assessment			6.5	4.0	10.5
9	Create viable business idea	<u>Creativity:</u> Concept of creativity Barriers to creative thinking	1.67	0.33	2.0
10	Innovate business idea	<u>Innovation:</u> Concept of innovation SCAMPER Method of innovation	0.83	0.67	1.5
11	Transfer ideas into action	<u>Transformation of idea into action:</u> Concept of transferring idea into action Self-assessment of creative style	1.0	0.5	1.5
12	Assess personal entrepreneurial competencies	<u>Personal entrepreneurial competencies:</u> Concept of entrepreneurial competencies Assessing personal entrepreneurial competencies	0.5	1.0	1.5

13	Assess personal risk taking attitude	<u>Risk taking attitude:</u> Concept of risk Personal risk taking attitude Do and don't do while taking risk	1.5	1.0	2.5
14	Make decision	<u>Decision making:</u> Concept of decision making Personal decision making attitude Do and don't do while making decision	1.0	0.5	1.5
Unit 3: Identification and Selection of Viable Business Ideas			0.83	3.42	4.25
15	Identify/ select potential business idea  Analyze strength, Weakness, Opportunity and Threat (SWOT) of business idea	<u>Identification and selection of potential business:</u> Sources of business ideas Points to be considered while selecting business idea Business selection process Potential business selection among different businesses Strength, Weakness, Opportunity and Threats (SWOT) analysis of business idea Selection of viable business idea matching to "self"	0.83	3.42	4.25
Unit 4: Business Plan			16.67	36.58	53.25
16	Assess market and marketing	<u>Market and marketing:</u> Concept of market and marketing Marketing and selling Market forces 4 Ps of marketing Marketing strategies	1.33	0.75	2.08
17	Business exercise:  Explore small business management concept	<u>Business exercise:</u> Business exercise rules Concept of small business management Elements of business management  Planning Organizing Executing Controlling	1.58	1.67	3.25
18	Prepare market plan	<u>Business plan/Market plan</u> Concept of business plan Concept of market plan Steps of market plan	2.0	2.0	4.0
19	Prepare production plan	<u>Business plan/Production plan:</u> Concept of production plan Steps of production plan	1.25	1.5	2.75
20	Prepare business operation plan	<u>Business plan/Business operation plan:</u> Concept of business operation plan Steps of business operation plan Cost price determination	2.5	2.67	5.17
21	Prepare financial plan	<u>Business pan/Financial plan:</u>	4.5	7.5	12.0

		Concept of financial plan Steps of financial plan Working capital estimation Pricing strategy Profit/loss calculation BEP and ROI analysis Cash flow calculation			
22	Collect market information /prepare business plan	<u>Information collection and preparing business plan:</u> Introduction  Market survey Precaution to be taken while collecting information Sample questions for market survey Questions to be asked to the customers Questions to be asked to the retailer Questions to be asked to the stockiest/suppliers Preparing business plan	2.0	13.0	15.0
23	Appraise business plan	<u>Business plan appraisal:</u> Return on investment Breakeven analysis Cash flow Risk factors	0.5	5.5	6.0
24	Maintain basic book keeping	<u>Basic book keeping:</u> Concept and need of book keeping Methods and types of book keeping Keeping and maintaining of day book and sales records	1.0	2.0	3.0
		Total:	30	48	78.0

**Text book:**

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

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

**Reference book:**

Entrepreneur's Handbook, Technonet Asia, 1981.

## References:

- Marivin Tepper, **Basic Radio Volume 1 to 6**, Tarapore Valla Sons, India
- Harry Miliat, **Electricity Volume 1 to 7**, Traapore Valla Sons, India
- Harry Miliat, **Electronics Volume 1 to 7**, Traapore Valla Sons, India
- G.N. Pathet, **Television Servicing Vol. 1 to 4**, Norman, London
- Paul Owes, **Stereo Troubleshooting and Repair Manual**, Prentice hall 1979, USA
- Philip Hoff, **Consumer Electronics for Engineers**, University Press, UK
- A.P. Malvino, **Electronics Principles**
- A.P. Malvino, **Digital Principles and Applications**, Donald P. Leachm Goutam Saha, SIE Special Indian Edition
- Thomas L. Floyd, **Electronic Devices**, First Indian Reprint 2001, (5<sup>th</sup> Edition, Education Inc.
- Dr. Sanjaya Sharma, **Electronics Principles**, Katson Publication, India
- Dr. Shanjay Sharma, **Digital Electronics and Logic Design**, Katson Publications, India
- J. B. Gupta, **An Integrated course in Electronics Engineering**, Katson Publication India, S.K. Kataria and sons
- M. Lotia, P.Nair and A. Chakra Borty, **Modern CD player Servicing Manual**, Lotial/BPB Publications
- AEPC, **सौर्य विद्युत प्राविधिक तह २**
- Prof. Jagarnath Shrestha, Prof. Dr. Dinesh Sharma, **Solar PV. Handbook**

## Other/some BPB publications

- Television service manual (Toshiba, Grunding, Konark and Webel, BPL, Snanyo etc.
- Tape recorders
- Amplifiers
- Satellite and Cable TV manual
- VCP/VCR service manual
- SMPS and STR servicing
- Telephone and cordless servicing
- Remote control operating system and servicing manual etc.

### **Experts involved in Curriculum revision**

- Dr. Diwakar Panta, IOE Pulchok Campus, Lalitpur
- Dr. Sanjib Prasad Pandey, IOE Pulchok Campus, Lalitpur
- Er. Arjun Devkota, Korea Nepal Institute of Technology, Butwal,
- Er. Dipak Lal Shrestha, IOE Pulchok Campus, Lalitpur
- Er. Nabin Kishor Gaire, Bheri technical School, Nepalgunj,
- Er. Shanta Maharjan, IOE Thapathali Campus
- Er. Tej Prakash Sapkota, Balaju School of Engineering & Technology, Balaju
- Er. Uttam Mali, IOE Pulchok Campus, Lalitpur
- Mr. Sagar Mani Lamsal, Former Sr. Curriculum Officer, CTEVT
- Ms. Uma Shrestha, Balaju School of Engineering & Technology, Balaju
- Mr. Anil Muni Bajracharya, Balaju School of Engineering & Technology, Balaju
- Mr. Umesh Aryal, Bheri technical School, Nepalgunj
- Mr. Mukunda Prasad Mainali, National Skill Testing Board, CTEVT
- Mr. Santosh Mahaseth, Curriculum Development Division, CTEVT
- Mr. Chandra Bhakta Nakarmi, Director, Curriculum Development Division, CTEVT
- Mr. Jeevan Chandra Dahal, Chief Sr. Curriculum Officer, Curriculum Development Division, CTEVT
- Mr. Binod Badal, curriculum officer, Curriculum Development Division, CTEVT