

LEARNING OUTCOME BASED VOCATIONAL CURRICULUM

JOB ROLE:

Field Technician – Wireman Control Panel

(QUALIFICATION PACK: Ref. Id. ELE/Q7302)

SECTOR: Electronics

Classes 11 and 12



PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION
Shyamla Hills, Bhopal – 462 002, M.P., India

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Field Technician – Wireman Control Panel
Electronics Sector

June, 2017

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Joint Director

PSS Central Institute of Vocational Education, NCERT, Shyamla Hills, Bhopal

FOREWORD

The Pandit Sunderlal Sharma Central Institute of Vocational Education (PSSCIVE) a constituent of the National Council of Educational Research and Training (NCERT) is spearheading the efforts of developing learning outcome based curricula and courseware aimed at integrating both vocational and general qualifications to open pathways of career progression for students. It is a part of Centrally Sponsored Scheme of Vocationalisation of Secondary and Higher Secondary Education (CSSVSHSE) launched by the Ministry of Human Resource Development, Government of India in 2012. The PSS Central Institute of Vocational Education (PSSCIVE) is developing curricula under the project approved by the Project Approval Board (PAB) of *Rashtriya Madhyamik Shiksha Abhiyan* (RMSA). The main purpose of the competency based curricula is to bring about the improvement in teaching-learning process and working competences through learning outcomes embedded in the vocational subject.

It is a matter of great pleasure to introduce this learning outcome based curriculum as part of the vocational training packages for the job role of **Field Technician – Wireman Control Panel**. The curriculum has been developed for the secondary students of vocational education and is aligned to the National Occupation Standards (NOSs) of a job role identified and approved under the National Skill Qualification Framework (NSQF).

The curriculum aims to provide children with employability and vocational skills to support occupational mobility and lifelong learning. It will help them to acquire specific occupational skills that meet employers' immediate needs. The teaching process is to be performed through the interactive sessions in classrooms, practical activities in laboratories and workshops, projects, field visits, and professional experiences.

The curriculum has been developed and reviewed by a group of experts and their contributions are greatly acknowledged. The utility of the curriculum will be adjudged by the qualitative improvement that it brings about in teaching-learning. The feedback and suggestions on the content by the teachers and other stakeholders will be of immense value to us in bringing about further improvement in this document.

Hrushikesh Senapaty
Director
National Council of Educational Research & Training

PREFACE

India today stands poised at a very exciting juncture in its saga. The potential for achieving inclusive growth are immense and the possibilities are equally exciting. The world is looking at us to deliver sustainable growth and progress. To meet the growing expectations, India will largely depend upon its young workforce. The much-discussed demographic dividend will bring sustaining benefits only if this young workforce is skilled and its potential is channelized in the right direction.

In order to fulfil the growing aspirations of our youth and the demand of skilled human resource, the Ministry of Human Resource Development (MHRD), Government of India introduced the revised Centrally Sponsored Scheme of Vocationalisation of Secondary and Higher Secondary Education that aims to provide for the diversification of educational opportunities so as to enhance individual employability, reduce the mismatch between demand and supply of skilled manpower and provide an alternative for those pursuing higher education. For spearheading the scheme, the PSS Central Institute of Vocational Education (PSSCIVE) was entrusted the responsibility to develop learning outcome based curricula, student workbooks, teacher handbooks and e-learning materials for the job roles in various sectors, with growth potential for employment.

The PSSCIVE firmly believes that the vocationalisation of education in the nation need to be established on a strong footing of philosophical, cultural and sociological traditions and it should aptly address the needs and aspirations of the students besides meeting the skill demands of the industry. The curriculum, therefore, aims at developing the desired professional, managerial and communication skills to fulfill the needs of the society and the world of work. In order to honour its commitment to the nation, the PSSCIVE has initiated the work on developing learning outcome based curricula with the involvement of faculty members and leading experts in respective fields. It is being done through the concerted efforts of leading academicians, professionals, policy makers, partner institutions, Vocational Education and Training experts, industry representatives, and teachers. The expert group through a series of consultations, working group meetings and use of reference materials develops a National Curriculum. Currently, the Institute is working on developing curricula and courseware for over 100 job roles in various sectors.

We extend our gratitude to all the contributors for selflessly sharing their precious knowledge, acclaimed expertise, and valuable time and positively responding to our request for development of curriculum. We are grateful to MHRD and NCERT for the financial support and cooperation in realising the objective of providing learning outcome based modular curricula and courseware to the States and other stakeholders under the PAB (Project Approval Board) approved project of *Rashtriya Madhyamik Shiksha Abhiyan* (RMSA) of MHRD.

Finally, for transforming the proposed curriculum design into a vibrant reality of implementation, all the institutions involved in the delivery system shall have to come together with a firm commitment and they should secure optimal community support. The success of this curriculum depends upon its effective implementation and it is expected that the managers of vocational education and training system, including subject teachers will make efforts to create better facilities, develop linkages with the world of work and foster a conducive environment as per the content of the curriculum document.

The PSSCIVE, Bhopal remains committed in bringing about reforms in the vocational education and training system through the learner-centric curricula and courseware. We hope that this document will prove useful in turning out more competent Indian workforce for the 21st Century.

RAJESH P. KHAMBAYAT
Joint Director
PSS Central Institute of Vocational Education

ACKNOWLEDGEMENT

On behalf of the team at the PSS Central Institute of Vocational Education (PSSCIVE) we are grateful to the members of the Project Approval Board (PAB) of Rashtriya Madhyamik Shiksha Abhiyan (RMSA) and the officials of the Ministry of Human Resource Development (MHRD), Government of India for the financial support to the project for development of curricula.

We are grateful to the Director, NCERT for his support and guidance. We also acknowledge the contributions of our colleagues at the Technical Support Group of RMSA, MHRD, RMSA Cell at the National Council of Educational Research and Training (NCERT), National Skill Development Agency (NSDA) and National Skill Development Corporation (NSDC) and Electronics Sector Skill Council of India (ESSCI) for their academic support and cooperation.

We are grateful to the expert contributors and Dipak D. Shudhalwar, Associate Professor (CSE), PSSCIVE, for their earnest effort and contributions in the development of this learning outcome based curriculum. Their contributions are dully acknowledged.

The contributions made by Vinay Swarup Mehrotra, Professor and Head, Curriculum Development and Evaluation Centre (CDEC), Vipin Kumar Jain, Associate Professor and Head, Programme Planning and Monitoring Cell (PPMC) and Dipak Shudhalwar, Associate Professor (CSE) and Head, Computer Centre, PSSCIVE in development of the curriculum for the employability skills are duly acknowledged.

We are also grateful to the Course Coordinator Dipak D. Shudhalwar, Associate Professor (CSE), Head, Department of Engineering and Technology, PSSCIVE, for bringing out this curriculum in the final form.

PSSCIVE Team

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1. COURSE OVERVIEW

COURSE TITLE: Field Technician – Wireman Control Panel

Wireman Control Panel is aimed at training candidates for the job of a “Field Technician – Wireman Control Panel”, in the “Electronics” Sector, “Industrial Electronics” Sub-Sector and aims at building the key competencies in Wireman Control Panel.

COURSE OUTCOME : On completion of the course, students should be able to:

1. Apply effective oral and written communication skills to interact with people and customers;
2. Identify the principal components of a computer system;
3. Demonstrate the basic skills of using computer;
4. Demonstrate self-management skills;
5. Demonstrate the ability to provide a self-analysis in context of entrepreneurial skills and abilities;
6. Demonstrate the knowledge of the importance of green skills in meeting the challenges of sustainable development and environment protection;
7. Identify the different types of control panels in residential and commercial power systems
8. Demonstrate the wiring of simple control panels
9. Identify and rectify/repair the faults in house wiring connection with grid
10. Ensure system functioning and perform a demo
11. Handle customer queries
12. Identify and control hazards in the workplace that pose a danger or threat to their safety or health, or that of others.

COURSE REQUIREMENTS: The learner should have the basic reading and writing skills in English and Hindi.

COURSE LEVEL: This is a beginner level course meant for class 9 and 10.

COURSE DURATION: 600 Hours
Class 11 : 300 hrs
Class 12 : 300 hrs

2. SCHEME OF UNITS AND ASSESSMENT

This course is a planned sequence of instructions consisting of Units meant for developing employability and vocational competencies of students of Class 11 and 12 opting for vocational subject along with general education subjects. The unit-wise distribution of hours and marks for **Class 11** is as follows :

CLASS 11			
	Units	No. of Hours for Theory and Practical 300	Max. Marks for Theory and Practical 100
Part A	Employability Skills		
Unit 1	Communication Skills – III	25	10
Unit 2	Self-management Skills – III	25	
Unit 3	Basic ICT Skills – III	20	
Unit 4	Entrepreneurial Skills – III	25	
Unit 5	Green Skills – III	15	
	Total	110	10
Part B	Vocational Skills		
Unit 1	Basics of Electrical and Electronics	45	40
Unit 2	Electrical Safety and Hazards	40	
Unit 3	Tools and Equipment	20	
Unit 4	Cabling and Wire Preparation	40	
Unit 5	Electromechanical Assembly	20	
	Total	165	40
Part C	Practical Work		
	Practical Examination	6	15
	Written Test	1	10
	Viva Voce	3	10
	Total	10	35
Part D	Project Work/Field Visit		
	Practical File/ Student Portfolio	10	10
	Viva Voce	5	5
	Total	15	15
	Total	300	100

The unit-wise distribution of hours and marks for **Class 12** is as follows:

CLASS 12			
	Units	No. of Hours for Theory and Practical 300	Max. Marks for Theory and Practical 100
Part A	Employability Skills		
Unit 1	Communication Skills – IV	25	10
Unit 2	Self-management Skills – IV	25	
Unit 3	Basic ICT Skills – IV	20	
Unit 4	Entrepreneurial Skills – IV	25	
Unit 5	Green Skills – IV	15	
	Total	110	10
Part B	Vocational Skills		
Unit 1	Generation, Transmission and Distribution of Electrical Power	35	40
Unit 2	Installation and Troubleshooting Electrical Control Panel	50	
Unit 3	AC Drive, PLC and Switchboard in Control Panel	40	
Unit 4	Testing and Measurement in Electrical Panel	30	
Unit 5	Safety Measures and Hazard	10	
	Total	165	40
Part C	Practical Work		
	Practical Examination	6	15
	Written Test	1	10
	Viva Voce	3	10
	Total	10	35
Part D	Project Work/Field Visit		
	Practical File/ Student Portfolio	10	10
	Viva Voce	5	5
	Total	15	15
	Total	300	100

3. TEACHING/TRAINING ACTIVITIES

The teaching and training activities have to be conducted in classroom, laboratory/ workshops and field visits. Students should be taken to field visits for interaction with experts and to expose them to the various tools, equipment, materials, procedures and operations in the workplace.

Special emphasis should be laid on the occupational safety, health and hygiene during the training and field visits.

CLASSROOM ACTIVITIES

Classroom activities are an integral part of this course and interactive lecture sessions, followed by discussions should be conducted by trained vocational teachers. Vocational teachers should make effective use of a variety of instructional aids, such as audio-video materials, colour slides, charts, diagrams, models, exhibits, hand-outs, online teaching materials, etc. to transmit knowledge and impart training to the students.

PRACTICAL WORK IN LABORATORY/WORKSHOP

Practical work may include but not limited to hands-on-training, simulated training, role play, case based studies, exercises, etc. Equipment and supplies should be provided to enhance hands-on learning experience of students. Only trained personnel should teach specialized techniques. A training plan that reflects tools, equipment, materials, skills and activities to be performed by the students should be submitted by the vocational teacher to the Head of the Institution.

FIELD VISITS/ EDUCATIONAL TOUR

In field visits, children will go outside the classroom to obtain specific information from experts or to make observations of the activities. A checklist of observations to be made by the students during the field visits should be developed by the Vocational Teachers for systematic collection of information by the students on the various aspects. Principals and Teachers should identify the different opportunities for field visits within a short distance from the school and make necessary arrangements for the visits. At least three field visits should be conducted in a year.

4. ASSESSMENT AND CERTIFICATION

Upon successful completion of the course by the candidate, the Central/ State Examination Board for Secondary Education and the respective Sector Skill Council will certify the competencies.

The National Skills Qualifications Framework (NSQF) is based on outcomes referenced to the National Occupation Standards (NOSs), rather than inputs. The NSQF level descriptors, which are the learning outcomes for each level, include the process, professional knowledge, professional skills, core skills and responsibility. The assessment is to be undertaken to verify that individuals have the knowledge and skills needed to perform a particular job and that the learning programme undertaken has delivered education at a given standard. It should be closely linked to certification so that the individual and the employer could come to know the competencies acquired through the vocational subject or course. The assessment should be reliable, valid, flexible, convenient, cost effective and above all it should be fair and transparent. Standardized assessment tools should be used for assessment of knowledge of students. Necessary arrangements should be made for using technology in assessment of students.

KNOWLEDGE ASSESSMENT (THEORY)

Knowledge Assessment should include two components: one comprising of internal assessment and second an external examination, including theory examination to be conducted by the Board. The assessment tools shall contain components for testing the knowledge and application of

knowledge. The knowledge test can be objective paper based test or short structured questions based on the content of the curriculum.

WRITTEN TEST

It allows candidates to demonstrate that they have the knowledge and understanding of a given topic. Theory question paper for the vocational subject should be prepared by the subject experts comprising group of experts of academicians, experts from existing vocational subject experts/teachers, and subject experts from university/colleges or industry. The respective Sector Skill Council should be consulted by the Central/State Board for preparing the panel of experts for question paper setting and conducting the examinations.

The blue print for the question paper may be as follows:

Duration: 3 hrs

Max. Mark: 30

	Typology of Question	No. of Questions			Marks
		Very Short Answer (1 mark)	Short Answer (2 Marks)	Long Answer (3 Marks)	
1.	Remembering – (Knowledge based simple recall questions, to know specific facts, terms, concepts, principles, or theories; identify, define or recite, information)	3	2	2	13
2.	Understanding – (Comprehension – to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase, or interpret information)	2	3	2	14
3.	Application – (Use abstract information in concrete situation, to apply knowledge to new situations: Use given content to interpret a situation, provide an example, or solve a problem)	0	2	1	07
4.	High Order Thinking Skills – (Analysis & Synthesis – Classify, compare, contrast, or differentiate between different pieces of information; Organize and/ or integrate unique pieces of information from a variety of sources)	0	2	0	04
5.	Evaluation – (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)	0	1	0	02
	Total	5x1=5	10x2=20	5x3=15	40 (20 Ques.)

SKILL ASSESSMENT (PRACTICAL)

Assessment of skills by the students should be done by the assessors/examiners on the basis of practical demonstration of skills by the candidate, using a competency checklist. The competency checklist should be developed as per the National Occupation Standards (NOSs) given in the Qualification Pack for the Job Role to bring about necessary consistency in the quality of assessment across different sectors and Institutions. The student has to demonstrate competency against the performance criteria defined in the National Occupation Standards and the assessment will indicate that they are 'competent', or are 'not yet competent'. The assessors assessing the skills of the students should possess a current experience in the industry and should have undergone an effective training in assessment principles and practices. The Sector Skill

Councils should ensure that the assessors are provided with the training on the assessment of competencies.

Practical examination allows candidates to demonstrate that they have the knowledge and understanding of performing a task. This will include hands-on practical exam and viva voce. For practical, there should be a team of two evaluators – the subject teacher and the expert from the relevant industry certified by the Board or concerned Sector Skill Council. The same team of examiners will conduct the viva voce.

Project Work (individual or group project) is a great way to assess the practical skills on a certain time period or timeline. Project work should be given on the basis of the capability of the individual to perform the tasks or activities involved in the project. Projects should be discussed in the class and the teacher should periodically monitor the progress of the project and provide feedback for improvement and innovation. Field visits should be organised as part of the project work. Field visits can be followed by a small-group work/project work. When the class returns from the field visit, each group might be asked to use the information that they have gathered to prepare presentations or reports of their observations. Project work should be assessed on the basis of practical file or student portfolio.

Student Portfolio is a compilation of documents that supports the candidate's claim of competence. Documents may include reports, articles, photos of products prepared by students in relation to the unit of competency.

Viva voce allows candidates to demonstrate communication skills and content knowledge. Audio or video recording can be done at the time of viva voce. The number of external examiners would be decided as per the existing norms of the Board and these norms should be suitably adopted/adapted as per the specific requirements of the vocational subject. Viva voce should also be conducted to obtain feedback on the student's experiences and learning during the project work/field visits.

CONTINUOUS AND COMPREHENSIVE EVALUATION

Continuous and Comprehensive Evaluation (CCE) refers to a system of school-based evaluation of students that covers all aspects of student's development. In this scheme, the term 'continuous' is meant to emphasize that evaluation of identified aspects of students 'growth and development' is a continuous process rather than an event, built into the total teaching-learning process and spread over the entire span of academic session. The second term 'comprehensive' means that the scheme attempts to cover both the scholastic and the co-scholastic aspects of students' growth and development. For details, the CCE manual of Central Board of Secondary Education (CBSE) or the guidelines issued by the State Boards on the procedure for CCE should be followed by the Institutions.

5. UNIT CONTENTS

CLASS 11

Part A: Employability Skills

Unit No.	Unit Name	Duration in Hours
Unit 1	Communication Skills – III	25
Unit 2	Self-management Skills – III	25
Unit 3	Basic ICT Skills – III	20
Unit 4	Entrepreneurial Skills – III	25
Unit 5	Green Skills – III	15
Total		110

Unit 1: Communication Skills – III				
Sn	Learning Outcome	Theory (10 Hours)	Practical (15 Hours)	25 Hrs
1.	Demonstrate knowledge of various methods of communication	<ul style="list-style-type: none"> • Methods of communication • Verbal • Non-verbal • Visual 	<ul style="list-style-type: none"> • Writing pros and cons of written, verbal and non-verbal communication • Listing do's and don'ts for avoiding common body language mistakes 	5
2.	Identify specific communication styles	<ul style="list-style-type: none"> • Communication styles- assertive, aggressive, passive-aggressive, submissive, etc. 	<ul style="list-style-type: none"> • Observing and sharing communication styles of friends, teachers and family members and adapting the best practices • Role plays on communication styles. 	10
3.	Demonstrate basic writing skills	<ul style="list-style-type: none"> • Writing skills to the following: • Sentence • Phrase • Kinds of Sentences • Parts of Sentence • Parts of Speech • Articles • Construction of a Paragraph 	<ul style="list-style-type: none"> • Demonstration and practice of writing sentences and paragraphs on topics related to the subject 	5
Total Duration in Hours				25

Unit 2: Self-management Skills – III				
Sn	Learning Outcome	Theory (10 Hours)	Practical (15 Hours)	25 Hrs
1.	Demonstrate impressive	<ul style="list-style-type: none"> • Describe the importance of dressing appropriately, looking 	<ul style="list-style-type: none"> • Demonstration of impressive appearance and groomed 	07

	appearance and grooming	<p>decent and positive body language.</p> <ul style="list-style-type: none"> Describe the term grooming Prepare a personal grooming checklist. Describe the techniques of self-exploration. 	<p>personality.</p> <ul style="list-style-type: none"> Demonstration of the ability to self- explore. 	
2.	Demonstrate team work skills	<ul style="list-style-type: none"> Describe the important factors that influence in team building. Describe factors influencing team work. 	<ul style="list-style-type: none"> Group discussion on qualities of a good team. Group discussion on strategies that are adopted for team building and team work. 	08
3.	Apply time management strategies and techniques	<ul style="list-style-type: none"> Meaning and importance of time management – setting and prioritizing goals, creating a schedule, making lists of tasks, balancing work and leisure, using different optimization tools to break large tasks into smaller tasks. 	<ul style="list-style-type: none"> Game on time management. Checklist preparation. To-do-list preparation. 	10
Total Duration in Hours				25

Unit 3: Basic ICT Skills – III				
Sn	Learning Outcome	Theory (08 Hours)	Practical (12 Hours)	20 Hrs
1.	Create a document on word processor	<ul style="list-style-type: none"> Introduction to word processing. Software packages for word processing. Opening and exiting the word processor. Creating a document 	<ul style="list-style-type: none"> Demonstration and practice of the following: Listing the features of word processing, Listing the software packages for word processing, Opening and exit the word processor, Creating a document 	10
2.	Edit, save and print a document in word processor	<ul style="list-style-type: none"> Editing text Wrapping and aligning the text Font size, type and face. Header and Footer Auto correct Numbering and bullet Creating table Find and replace Page numbering. Printing document. Saving a document in various formats 	<ul style="list-style-type: none"> Demonstration and practicing the following: Editing the text Word wrapping and alignment, Changing font type, size and face, Inserting header and footer, Removing header and footer, Using autocorrect option, Insert page numbers and bullet, Save and print a document. 	10
Total Duration in Hours				20

Unit 4: Entrepreneurial Skills – III				
Sn	Learning Outcome	Theory (10 Hours)	Practical (15 Hours)	25 Hrs
1.	Describe the significance of entrepreneurial values and attitude.	<ul style="list-style-type: none"> Values in general and entrepreneurial values. Entrepreneurial value orientation with respect to inattentiveness, independence, outstanding performance and respect for work. 	<ul style="list-style-type: none"> Listing of entrepreneurial values by the students. Group work on identification of entrepreneurial values and their roles after listing or reading 2-3 stories of successful entrepreneur. Exhibiting entrepreneurial values in Ice breaking, rapport building, group work and home assignments. 	10
2.	Demonstrate the knowledge of attitudinal changes required to become an entrepreneur.	<ul style="list-style-type: none"> Attitudes in general and entrepreneurial attitudes Using imagination/ intuition Tendency to take moderate risk Enjoying freedom of expression and action Looking for economic opportunities Believing that we can change the environment Analyzing situation and planning action Involving in activity 	<ul style="list-style-type: none"> Preparing a list of factors that influence attitude in general and entrepreneurial attitude. Demonstrating and identifying own entrepreneurial attitudes during the following micro lab activities like thematic appreciation test. Preparing a short write-up on "who am I". Take up a product and suggest how its features can be improved. Group activity for suggesting brand names, names of enterprises, etc. 	15
			Total Duration in Hours	25

Unit 5: Green Skills – III				
Sn	Learning Outcome	Theory (07 Hours)	Practical (08 Hours)	15 Hrs
1.	Describe importance of main sector of green economy	<ul style="list-style-type: none"> Main sectors of green economy- E-waste management, green transportation, renewal energy, green construction, water management. Policy initiatives for greening economy in India. 	<ul style="list-style-type: none"> Preparing a poster on any one of the sectors of green economy. Writing a two-page essay on important initiatives taken in India for promoting green economy. 	08
2.	Describe the major green Sectors/ Areas and the role of various stakeholder in green economy	<ul style="list-style-type: none"> Stakeholders in green economy. Role of government and private agencies in greening cities, buildings, tourism, industry, transport, renewable energy, waste management, 	<ul style="list-style-type: none"> Preparing posters on green Sectors/Areas: cities, buildings, tourism, industry, transport, renewable energy, waste management, agriculture, water, forests and fisheries. 	07

		agriculture, water, forests and fisheries.		
			Total Duration in Hours	15

Class XI, Part B: Vocational Skills

Unit No.	Unit Name	Duration in Hours
Unit 1	Basics of Electrical and Electronics	45
Unit 2	Electrical Safety and Hazards	40
Unit 3	Tools and Equipment	20
Unit 4	Cabling and Wire Preparation	40
Unit 5	Electromechanical Assembly	20
	Total Duration	165

Unit 1: Basics of Electrical and Electronics				
Sn	Learning Outcome	Theory (15 Hours)	Practical (30 Hours)	45 Hrs
1.	Appreciate the basics of electrical and electronics	<ul style="list-style-type: none"> • Origin of electricity, • Electrical quantities, • AC and DC, • Electric circuit • Series and parallel connections, • Open circuit and closed circuit, • Ohms law, • Kirchhoff law, • Energy consumption of appliances. 	<ul style="list-style-type: none"> • Demonstrate the basics of electricity and electrical, • Identify the symbols of voltage, current, resistance, power in a circuit diagram, • Draw the circuit and show voltage, current, resistance, power, • Identify the Live, Neutral and Earth on power socket, • Prepare the circuit to glow the lamp, • Construct a test lamp and use it to mains, • Build the series and parallel connections of resistors and calculate the resistance, • Verify ohm's law in the given electrical circuit. 	15
2.	Identify the electronic components	<ul style="list-style-type: none"> • Basic electronic components – resistor, capacitor, inductor, transformer, diode, transistor, LED, ICs • Resistor – definition, types, construction, specification, • Capacitor – definition, types, construction, • Inductors – definition, types, construction, 	<ul style="list-style-type: none"> • Identify and name the discrete components used in circuit, • Identify different parts of transformers, • Setup an experiment to identify the primary and secondary winding of transformer and measure the voltage of primary and secondary winding of step 	15

		<ul style="list-style-type: none"> Transformer – working principle, specifications Diode – definition, types, construction, specification, Transistor – definition, types, construction, specification, measuring parameter, LED – definition, construction, specific use, IC – definition, construction, specific use. 	<ul style="list-style-type: none"> down transformer, Identify NPN and PNP transistor. 	
3.	Measure its parameters of electronic and electrical components	<ul style="list-style-type: none"> Types of Resistor – axial, surface mount Resistors, Colour coding of Resistors, – Specification of four band Resistor – Calculation of resistor value Alphanumerically Coded Resistors, Measuring parameters and unit of capacitor, Tolerance value of capacitor, Voltage rating of capacitor 	<ul style="list-style-type: none"> Measure the resistor values using colour code and verify the reading by measuring in multi-meter Read and list out the parameters of given resistor, capacitor, inductor, Measure the resistor value using alphanumeric code in surface mount resistor. 	15
			Total Duration in Hours	45

Unit 2: Electrical Safety and Hazards				
Sn	Learning Outcome	Theory (15 Hours)	Practical (25 Hours)	40 Hrs
1.	Demonstrate the process of electrical earthing	<ul style="list-style-type: none"> Importance of earthing, Types of earthing: pipe earthing, plate earthing and rod earthing, Importance of lightning arrester Surge protection devices and circuit breakers. 	<ul style="list-style-type: none"> Visit the site and observe the different types of earthing systems, Set up an experiment to demonstrate the complete process of electrical earthing, Identify and list different types of circuit breaker and surge protection devices 	20
2.	Observe electrical safety	<ul style="list-style-type: none"> Safety in electrical system, Work and safety standards, Protecting Yourself, Electrostatic Discharge (ESD), Safety measures to prevent electric shock, Electrical earthing for safety 	<ul style="list-style-type: none"> Demonstrate to operate MCB, Identify the safety symbols in electrical system, Practice safety measure for ESD Demonstrate to use of different electrical safety material. 	10
3.	Demonstrate the preventive measures in electrical hazard	<ul style="list-style-type: none"> Hazardous materials, Electric shock, Causes of electric shock – uninsulated conductor, lightning, unearthed electrical 	<ul style="list-style-type: none"> Demonstrate to use fire extinguisher, Demonstrate to use first aid kit for first aid treatment, Demonstrate remedies to be 	10

		<p>machines,</p> <ul style="list-style-type: none"> • Ways to prevent electric shock, • Fire Extinguisher and its use, • Basic First Aid and its use, • Artificial respiration, • Electrical Emergencies. 	<ul style="list-style-type: none"> • taken against electric shock, • Demonstrate the process of artificial respiration, • Demonstrate remedies to be taken against electrical emergencies. 	
Total Duration in Hours				40

Unit 3: Tools and Equipment

Sn	Learning Outcome	Theory (05 Hours)	Practical (15 Hours)	20 Hrs
1.	Demonstrate the use of tools and equipment	<ul style="list-style-type: none"> • Hand tools – screwdriver, pliers, wire stripper, wire cutter, hammer, ladder, phase tester, Pipe wrench, wire lugs, drill machine and drill bits. • Multi-meter, • Clamp meter, • Soldering iron and wire, • Soldering and de-soldering, 	<ul style="list-style-type: none"> • Identify and name the hand tools and its parts, • Demonstrate to use the hand tools for given task, • Demonstrate the use of multi-meter to measure the various electrical quantity for the given task, • Demonstrate the soldering and desoldering techniques, • Identify P and N terminal of diode. • Identify the terminals of PNP and NPN transistor using multi-meter, • Measure the current flowing in the wire using clamp meter, • Measurement of AC and DC voltage using multi-meter • Measurement of AC and DC current using multi-meter. 	20
Total Duration in Hours				20

Unit 4: Cabling and Wire Preparation

Sn	Learning Outcome	Theory (15 Hours)	Practical (25 Hours)	40 Hrs
1.	Identify and understand the specification of electrical cable	<ul style="list-style-type: none"> • Electrical cable and its specifications, • Different types of electrical cable, • Cable preparation methods 	<ul style="list-style-type: none"> • Demonstrate the crimping of electrical cable, • Demonstrate the crimping of 70 mm four core power cable, • Demonstrate to check the oil level of hydraulic crimping tool. 	20
2.	Demonstrate the process of wire preparation	<ul style="list-style-type: none"> • Wire preparation steps • Cable stripping, • Damage during insulation removal, 	<ul style="list-style-type: none"> • Demonstrate the stripping of electrical wire, • Demonstrate the crimping of 2.5 mm electrical wire. 	20

		<ul style="list-style-type: none"> • Wire stripping • Wire bending, • Wire joints • Crimping process, • Crimping tools, • Lugs, • Cable preparation method. 		
			Total Duration in Hours	40

Unit 5: Electromechanical Assembly

Sn	Learning Outcome	Theory (05 Hours)	Practical (15 Hours)	20 Hrs
1.	Demonstrate to use electromechanical assembly	<ul style="list-style-type: none"> • Electromechanical system, • Components of electromechanical assembly, • Types of assembly, • Wiring instruction and guidelines for assembly, • Process of panel assembly. 	<ul style="list-style-type: none"> • Identify electromechanical assembly, • Identify different types of assembly, • List the general guidelines for electromechanical wiring, • Demonstrate the panel assembly process. 	20
			Total Duration in Hours	20

CLASS 12**Part A: Employability Skills**

S. No.	Units	Duration in Hours
1.	Unit 1: Communication Skills – IV	25
2.	Unit 2: Self-management Skills – IV	25
3.	Unit 3: Basic ICT Skills – IV	20
4.	Unit 4: Entrepreneurial Skills – IV	25
5.	Unit 5: Green Skills – IV	15
	Total	110

Unit 1: Communication Skills – IV

Sn	Learning Outcome	Theory (10 Hours)	Practical (15 Hours)	25 Hrs
1.	Describe the steps to active listening skills	<ul style="list-style-type: none"> • Importance of active listening at workplace • Steps to active listening. 	<ul style="list-style-type: none"> • Demonstration of the key aspects of becoming active listener. • Preparing posters of steps for active listening. 	10
2.	Demonstrate	<ul style="list-style-type: none"> • Writing skills to the following: 	<ul style="list-style-type: none"> • Demonstration and practice of 	15

	basic writing skills	<ul style="list-style-type: none"> • Sentence • Phrase • Kinds of Sentences • Parts of Sentence • Parts of Speech • Articles • Construction of a Paragraph 	writing sentences and paragraphs on topics related to the subject.	
			Total Duration in Hours	25

Unit 2: Self-management Skills – IV

Sn	Learning Outcome	Theory (10 Hours)	Practical (15 Hours)	25 Hrs
1.	Describe the various factors influencing self-motivation	<ul style="list-style-type: none"> • Finding and listing motives (needs and desires); • Finding sources of motivation and inspiration (music, books, activities); expansive thoughts; living fully in the present moment; dreaming big. 	<ul style="list-style-type: none"> • Group discussion on identifying needs and desire. • Discussion on sources of motivation and inspiration. 	10
2.	Describe the basic personality traits, types and disorders	<ul style="list-style-type: none"> • Describe the meaning of personality. • Describe how personality influence others. • Describe basic personality traits. • Describe common personality disorders- paranoid, antisocial, schizoid, borderline, narcissistic, avoidant, dependent and obsessive. 	<ul style="list-style-type: none"> • Demonstrate the knowledge of different personality types. 	15
			Total Duration in Hours	25

Unit 3: Basic ICT Skills – IV

Sn	Learning Outcome	Theory (06 Hours)	Practical (14 Hours)	20 Hrs
1.	Perform tabulation using spreadsheet application	<ul style="list-style-type: none"> • Introduction to spreadsheet application, • Spreadsheet applications, • Creating a new worksheet, • Opening workbook and entering text, • Resizing fonts and styles, • Copying and moving, • Filter and sorting, • Formulas and functions, • Password protection, • Printing a spreadsheet, • Saving a spreadsheet in various formats. 	<ul style="list-style-type: none"> • Demonstration and practice on the following: • Introduction to the spreadsheet application, • Listing the spreadsheet applications, • Creating a new worksheet, • Opening the workbook and enter text, • Resizing fonts and styles, • Copying and move the cell data, • Sorting and Filter the data, • Applying elementary formulas 	10

			<ul style="list-style-type: none"> and functions, Protecting the spreadsheet with password, Printing a spreadsheet, Saving the spreadsheet in various formats. 	
2.	Prepare presentation using presentation application	<ul style="list-style-type: none"> Introduction to presentation, Software packages for presentation, Creating a new presentation, Adding a slide, Deleting a slide, Entering and editing text, Formatting text, Inserting clipart and images, Slide layout, Saving a presentation, Printing a presentation document. 	<ul style="list-style-type: none"> Demonstration and practice on the following: Listing the software packages for presentation, Explaining the features of presentation, Creating a new presentation, Adding a slide to presentation, Deleting a slide, Entering and edit text, Formatting text, Inserting clipart and images, Sliding layout, Saving a presentation, Printing a presentation document. 	10
			Total Duration in Hours	20

Unit 4: Entrepreneurial Skills – IV

Sn	Learning Outcome	Theory (10 Hours)	Practical (15 Hours)	25 Hrs
1.	Identify the general and entrepreneurial behavioral competencies	<ul style="list-style-type: none"> Barriers to becoming entrepreneur. Behavioral and entrepreneurial competencies – adaptability/decisiveness, initiative/perseverance, interpersonal skills, organizational skills, stress management, valuing service and diversity. 	<ul style="list-style-type: none"> Administering self-rating questionnaire and score responses on each of the competencies. Collect small story/ anecdote of prominent successful entrepreneurs. Identify entrepreneurial competencies reflected in each story and connect it to the definition of behavioral competencies. Preparation of competency profile of students. 	10
2.	Demonstrate the knowledge of self-assessment of behavioral competencies	<ul style="list-style-type: none"> Entrepreneurial competency in particular: self-confidence, initiative, seeing and acting on opportunities, concern for quality, goal setting and risk taking, problem solving and creativity, systematic planning and efficiency, information seeking, persistence, 	<ul style="list-style-type: none"> Games and exercises on changing entrepreneurial behavior and development of competencies for enhancing self-confidence, problem solving, goal setting, information seeking, team building and creativity. 	15

		influencing and negotiating, team building.		
			Total Duration in Hours	25

Unit 5: Green Skills – IV				
Sn	Learning Outcome	Theory (05 Hours)	Practical (10 Hours)	15 Hrs
1.	Identify the role and importance of green jobs in different sectors	<ul style="list-style-type: none"> • Role of green jobs in toxin-free homes. • Green organic gardening, public transport and energy conservation, • Green jobs in water conservation. • Green jobs in solar and wind power, waste reduction, reuse and recycling of wastes, • Green jobs in green tourism • Green jobs in building and construction. • Green jobs in appropriate technology. • Role of green jobs in Improving energy and raw materials use • Role of green jobs in limiting greenhouse gas emissions • Role of green jobs minimizing waste and pollution • Role of green jobs in protecting and restoring ecosystems • Role of green jobs in support adaptation to the effects of climate change 	<ul style="list-style-type: none"> • Listing of green jobs and preparation of posters on green job profiles. • Prepare posters on green jobs. 	15
			Total Duration in Hours	15

Class XII Part B: Vocational Skills

Unit No.	Unit Name	Duration in Hours
Unit 1	Generation, Transmission and Distribution of Electrical Power	35
Unit 2	Installation and Troubleshooting Electrical Control Panel	50
Unit 3	AC Drive, PLC and Switchboard in Control Panel	40
Unit 4	Testing and Measurement in Electrical Panel	30
Unit 5	Safety Measures and Hazard	10
	Total Duration	165

Unit 1: Generation, Transmission and Distribution of Electrical Power				
Sn	Learning Outcome	Theory (15 Hours)	Practical (20 Hours)	35 Hrs
1.	Describe the process of power generation, transmission and distribution in electrical network	<ul style="list-style-type: none"> Electrical power-generation, transmission and distribution, Three phase system concept of three phase voltage, three phase transformer in transmission and distribution, Electric power distribution, <ul style="list-style-type: none"> Residential application Commercial application Industrial application 	<ul style="list-style-type: none"> Demonstrate the generation of electricity in power generating unit, Demonstrate the distribution of electrical energy in electrical substation, Demonstrate the manufacturing steps of three phase transformer, Perform an experimental setup to generate an electricity for lightening the small bulb. 	20
2.	Analyze the working and application of electrical machines	<ul style="list-style-type: none"> Generator and its types, Motor and its types, Starter Direct online starter Star-delta starter 	<ul style="list-style-type: none"> Demonstrate the experimental setup that illustrate the working principle of electric motor, Demonstrate the fault identification of an electric motor, Demonstrate the working of star delta starter. 	15
			Total Duration in Hours	35

Unit 2: Installation and Troubleshooting Electrical Control Panel				
Sn	Learning Outcome	Theory (20 Hours)	Practical (30 Hours)	50 Hrs
1.	Demonstrate the role of circuit breaker in electrical system	<ul style="list-style-type: none"> Circuit breaker, Over current protection device, Types of overcurrent protection device <ul style="list-style-type: none"> Fuse Miniature circuit breaker 	<ul style="list-style-type: none"> Demonstrate the bending of bimetallic strip in miniature circuit breaker. Demonstrate the tripping mechanism of miniature circuit breaker. Demonstrate the different types of fuse. 	15
2.	Describe the busway in power distribution	<ul style="list-style-type: none"> Busway definition, types, construction, Busway in distribution system, Components used in busway. 	<ul style="list-style-type: none"> Perform the Identification and list down the specification of busway system components. Perform the experimental setup to route and bending of busway. 	15
3.	Describe the residential power distribution system	<ul style="list-style-type: none"> Load center – definition, construction, types, rating, Service entrance in load center. 	<ul style="list-style-type: none"> Demonstrate to identify different components mounted in the load center. Demonstrate the different type of load center. 	10
4.	Describe the commercial and	<ul style="list-style-type: none"> Panel board- definition, construction, types. 	<ul style="list-style-type: none"> Demonstrate to identify different components 	10

	industrial distribution system		mounted in the panel board, • Demonstrate the different type of panel board.	
			Total Duration in Hours	50

Unit 3: AC Drive, PLC and Switch Board in Control Panel				
Sn	Learning Outcome	Theory (15 Hours)	Practical (25 Hours)	40 Hrs
1.	Analyze the AC drives and soft starters	<ul style="list-style-type: none"> AC Drive- Definition, construction, types, Variable Frequency Drive- definition, panel function, Soft starting of electrical machine. 	<ul style="list-style-type: none"> Identify various components in AC drive. Demonstrate the functioning of VFD control terminal. Demonstrate the functioning of soft starting control terminal. 	15
2.	Demonstrate the functionality of programmable logic controller	<ul style="list-style-type: none"> Programmable Logic Controller, PLC architecture, Human machine interface, PLC and HMI wiring. 	<ul style="list-style-type: none"> Identify different type of PLC and HMI connector. Demonstrate the architecture of PLC. 	15
3.	Describe the switch board in control panel	<ul style="list-style-type: none"> Switchboard – definition, construction, types. 	<ul style="list-style-type: none"> Identify different types of switchboard. 	10
			Total Duration in Hours	40

Unit 4: Testing and Measurement in Electrical Panel				
Sn	Learning Outcome	Theory (10 Hours)	Practical (20 Hours)	30 Hrs
1.	Test the electrical system components	<ul style="list-style-type: none"> Different types of testing in control panel: Current Transformer (CT) Potential Transformer (PT), Push button, Relay and contactor, Indicator lamp, Energy meter. 	<ul style="list-style-type: none"> Demonstrate the experimental setup of CT/PT test in high-tension transmission line. Perform the functionality test of push button using test lamp. Perform the functionality test to check relay and contactor using test lamp. Perform the functionality test to check indicator lamp using test lamp. 	30
			Total Duration in Hours	30

Unit 5: Safety Measures and Hazards				
Sn	Learning Outcome	Theory (5 Hours)	Practical (5 Hours)	10 Hrs
1.	Observe the role of safety and health at	<ul style="list-style-type: none"> Various types of Hazards Electrical hazard, Chemical hazard, 	<ul style="list-style-type: none"> Demonstrate using experimental setup the safety measures while working with 	10

	workplace	<ul style="list-style-type: none"> • Fire extinguisher, • First aid for electrical emergency. 	the electrical system. <ul style="list-style-type: none"> • Demonstrate the use of fire extinguisher. • Demonstrate the use of safety helmets, ear plugs, shoes, gloves, goggles etc. 	
			Total Duration in Hours	10

6. ORGANISATION OF FIELD VISITS

In a year, at least 3 field visits/educational tours should be organised for the students to expose them to the activities in the workplace.

Visit a computer assembly and service centre and observe the following: Location, Site, Computer systems and peripheral devices. During the visit, students should obtain the following information from the owner or the supervisor of the nursery:

1. Area required for the junction box installation
2. Mounting of the control panels
3. Wiring of the control panels
4. Assembling of the control panels
5. Meter connections of the control panels
6. Procedure of fault checking
7. People and worker engaged

7. LIST OF EQUIPMENT AND MATERIALS

The list given below is suggestive and an exhaustive list should be prepared by the vocational teacher. Only basic tools, equipment and accessories should be procured by the Institution so that the routine tasks can be performed by the students regularly for practice and acquiring adequate practical experience.

- Pliers
- Screwdrivers and nut drivers
- Wire strippers
- Fishing tools
- Voltmeter
- Ammeter
- Labelling machines
- Power drills and drivers
- Hammer/drills
- Circuit Testers
- Knife
- Electrical Tape
- Duct Tape
- A Tool Pouch
- Ladders and Step Stools
- Allen Wrench Set (Hex Set)
- Wire Crimper
- Non-contact Voltage Detector
- Tester
- Wire gauge
- Basic tool kit

8. TEACHER'S/TRAINER'S QUALIFICATION

Qualification and other requirements for appointment of vocational teachers/trainers on contractual basis should be decided by the State/UT. The suggestive qualifications and minimum competencies for the vocational teacher should be as follows:

S.No.	Qualification	Minimum Competencies	Age Limit
1	<p>Bachelor of Engineering in Electronics/ Electrical. Additionally should have done a Diploma or certificate course in Control Panel Wiring of residential/ Industrial systems.</p> <p>The suggested qualification is the minimum criteria. However higher qualifications such as Bachelor of Engineering in Electronics.</p>	<p>The candidate should have a minimum of 1 year of work experience in the same job role. S/He should be able to communicate in English and local language. S/He should have knowledge of equipment, tools, material, Safety, Health & Hygiene.</p>	<p>18-37 years (as on Jan. 01 (year))</p> <p>Age relaxation to be provided as per Govt. rules</p>

Vocational Teachers/Trainers form the backbone of Vocational Education being imparted as an integral part of Rashtriya Madhyamik Shiksha Abhiyan (RMSA). They are directly involved in teaching of vocational subjects and also serve as a link between the industry and the schools for arranging industry visits, On-the-Job Training (OJT) and placement.

These guidelines have been prepared with an aim to help and guide the States in engaging quality Vocational Teachers/Trainers in the schools. Various parameters that need to be looked into while engaging the Vocational Teachers/Trainers are mode and procedure of selection of Vocational Teachers/Trainers, Educational Qualifications, Industry Experience, and Certification/Accreditation.

The State may engage Vocational Teachers/Trainers in schools approved under the component of Vocationalisation of Secondary and Higher Secondary Education under RMSA in following ways:

1. Directly as per the prescribed qualifications and industry experience suggested by the PSS Central Institute of Vocational Education(PSSCIVE), NCERT or the respective Sector Skill Council(SSC). **OR**
2. Through accredited Vocational Training Providers accredited under the National Quality Assurance Framework (NQAF*) approved by the National Skill Qualification Committee on 21.07.2016. If the State is engaging Vocational Teachers/Trainers through the Vocational Training Provider (VTP), it should ensure that VTP should have been accredited at NQAF Level 2 or higher.

* *The National Quality Assurance Framework (NQAF) provides the benchmarks or quality criteria which the different organisations involved in education and training must meet in order to be accredited by competent bodies to provide government-funded education and training/skills activities. This is applicable to all organizations offering NSQF-compliant qualifications.*

The educational qualifications required for being a Vocational Teacher/Trainer for a particular job role are clearly mentioned in the curriculum for the particular NSQF compliant job role. The State should ensure that teachers / trainers deployed in the schools have relevant technical competencies for the NSQF qualification being delivered. The Vocational Teachers/Trainers preferably should be certified by the concerned Sector Skill Council for the particular Qualification Pack/Job role which he will be teaching. Copies of relevant certificates and/or record of experience of the teacher/trainer in the industry should be kept as record.

To ensure the quality of the Vocational Teachers/Trainers, the State should ensure that a standardized procedure for selection of Vocational Teachers/Trainers is followed. The selection procedure should consist of the following:

1. Written test for the technical/domain specific knowledge related to the sector;
2. Interview for assessing the knowledge, interests and aptitude of trainer through a panel of experts from the field and state representatives; and
3. Practical test/mock test in classroom/workshop/laboratory.

In case of appointment through VTPs, the selection may be done based on the above procedure by a committee having representatives of both the State Government and the VTP.

The State should ensure that the Vocational Teachers/ Trainers who are recruited should undergo induction training of 20 days for understanding the scheme, NSQF framework and Vocational Pedagogy before being deployed in the schools.

The State should ensure that the existing trainers undergo in-service training of 5 days every year to make them aware of the relevant and new techniques/approaches in their sector and understand the latest trends and policy reforms in vocational education.

The Head Master/Principal of the school where the scheme is being implemented should facilitate and ensure that the Vocational Teachers/Trainers:

- Prepare session plans and deliver sessions which have a clear and relevant purpose and which engage the students;
- Deliver education and training activities to students, based on the curriculum to achieve the learning outcomes;
- Make effective use of learning aids and ICT tools during the classroom sessions;
- Engage students in learning activities, which include a mix of different methodologies, such as project based work, team work, practical and simulation based learning experiences;
- Work with the institution's management to organise skill demonstrations, site visits, on-job trainings, and presentations for students in cooperation with industry, enterprises and other workplaces;
- Identify the weaknesses of students and assist them in up-gradation of competency;
- Cater to different learning styles and level of ability of students;
- Assess the learning needs and abilities, when working with students with different abilities
- Identify any additional support the student may need and help to make special arrangements for that support;
- Provide placement assistance

Assessment and evaluation of Vocational Teachers/Trainers is very critical for making them aware of their performance and for suggesting corrective actions. The States/UTs should ensure that the performance of the Vocational Teachers/Trainers is appraised annually. Performance based appraisal in relation to certain pre-established criteria and objectives should be done periodically to ensure the quality of the Vocational Teachers/Trainers. Following parameters may be considered during the appraisal process:

- Participation in guidance and counselling activities conducted at Institutional, District and State level;
- Adoption of innovative teaching and training methods;
- Improvement in result of vocational students of Class X or Class XII;
- Continuous up-gradation of knowledge and skills related to the vocational pedagogy, communication skills and vocational subject;

- Membership of professional society at District, State, Regional, National and International level;
- Development of teaching-learning materials in the subject area;
- Efforts made in developing linkages with the Industry/Establishments;
- Efforts made towards involving the local community in Vocational Education
- Publication of papers in National and International Journals;
- Organisation of activities for promotion of vocational subjects;
- Involvement in placement of students/student support services.

9. LIST OF CONTRIBUTORS

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