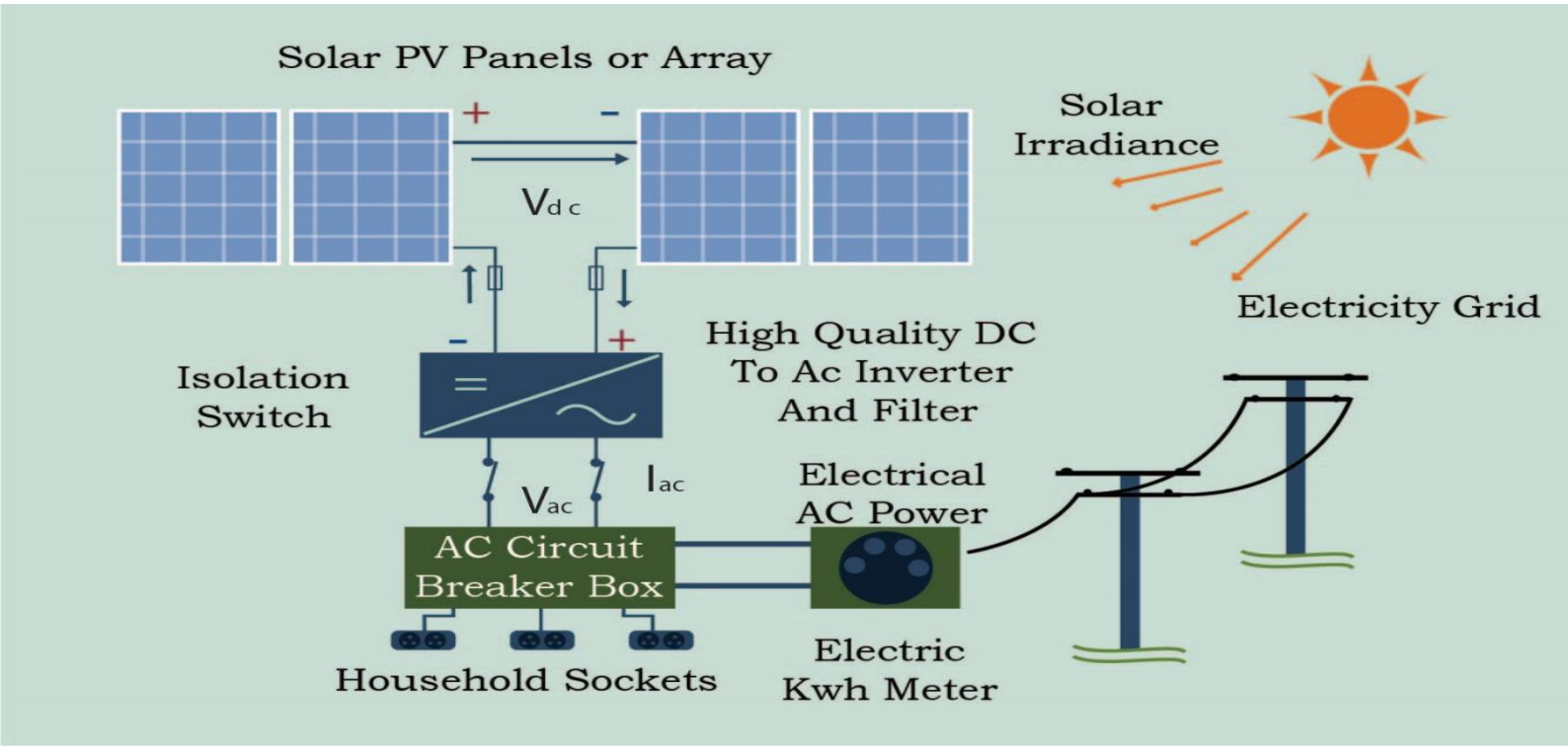
LEARNING OUTCOME BASED VOCATIONAL CURRICULUM

JOB ROLE: Solar Panel Installation Technician

(QUALIFICATION PACK: Ref. Id. SGJ/Q0101
and Ref. Id ELEQ590)

SECTOR: SKILL COUNCIL FOR GREEN JOBS (SCGJ) AND ELECTRONICS SECTOR SKILLS COUNCIL OF INDIA (ESSCI)

Classes 11 and 12



PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION
(a constituent unit of NCERT, under MoE, Government of India)
Shyamla Hills, Bhopal- 462 002, Madhya Pradesh, India
https://www.psscive.ac.in

Gandhiji's Talisman

I will give you a talisman. Whenever you are in doubt or when the self becomes too much with you, apply the following test:

Recall the face of the poorest and the weakest man whom you may have seen and ask yourself if the step you contemplate is going to be of any use to him. Will he gain anything by it? Will it restore him to a control over his own life and destiny? In other words, will it lead to Swaraj for the hungry and spiritually starving millions?

Then you will find your doubts and your self melting away.

M K Gandhi

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JOB ROLE: Solar Panel Installation Technician

(QUALIFICATION PACK: Ref. Id. SGJ/Q0101 And Ref. Id ELEQ5901)

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Classes 11 and 12

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FOREWORD

The Pandit Sundarlal 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 education to open pathways of career progression for students. The curriculum has been developed for the vocational education programme introduced under the Centrally Sponsored Scheme of Samagra Shiksha of the Ministry of Education (erstwhile, Ministry of Human Resource Development) and is aligned to the National Skill Qualifications Framework (NSQF). The curricula for vocational courses are being developed under the project approved by the Project Approval Board (PAB) of 'Samagra Shiksha', which is an overarching programme for the school education sector extending from pre-school to Grade 12.

It is a matter of great pleasure to introduce this learning outcome-based curriculum as part of the vocational training package for the job role of **Solar Panel Installation Technician (SGJ/Q0101), ELE/Q5901.** The curriculum has been developed for the secondary students of Grades 11 and 12 and is aligned to the National Occupation Standards (NOSs) for the job role. 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 skill needs. The teaching-learning is to be done through interactive sessions in classrooms, practical activities in laboratories or workshops, projects, field visits, etc. and professional experience is to be provided through on-the-job training.

The curriculum has been developed and reviewed by a group of experts and their contributions are duly 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.

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DINESH PRASHAD SAKLANI
Director
National Council of Education Research and Training
New Delhi

PREFACE

India today stands poised at a very exciting juncture in its saga. The potential for achieving inclusive growth is 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. In order to fulfil the growing aspirations of our youth and the demand for a skilled human resource, the Ministry of Education (erstwhile, Ministry of Human Resource Development (MHRD), Government of India introduced the revised Centrally Sponsored Scheme of Vocationalisation of School 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 with the responsibility to develop learning outcome- based curricula, student textbooks and e-learning material for job roles in various sector.

The PSSCIVE firmly believes that the vocationalisation of education in the nation needs 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 fulfil the needs of society and the world of work. In order to honour its commitment to the nation, the PSSSCIVE is developing learning outcome-based curricula with the involvement of faculty members and leading experts in the field. It is being done through the concerted efforts of leading academicians, professionals, policymakers, partner institutions, Vocational Education and Training (VET) 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. 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.

The success of this curriculum depends upon its effective implementation, and it is expected that the managers of vocational education programme, vocational educators, vocational teachers/trainers, and other stakeholders will make earnest efforts to provide better facilities, develop linkages with the industry or world of work and foster a conducive learning environment for the students for effectively transacting the curriculum and to achieve the learning outcomes as per the content of the curriculum document.

DEEPAK PALIWAL
Joint Director
PSS Central Institute of Vocational Education

ACKNOWLEDGEMENTS

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 Samagra Shiksha and the officials of the Ministry of Education (MoE), Government of India for the financial support to the project for development of learning outcome-based curricula.

We are grateful to the Director, National Council of Educational Research and Training (NCERT) for his support and guidance. We also acknowledge the contributions of our colleagues at the NCERT, National Council for Vocational Education and Training (NCVET), National Skill Development Corporation (NSDC) and Sector Skill Council for Management and Entrepreneurship and Professional Skills for their academic support and cooperation in the development of Qualification file and curriculum.

We are grateful to Prof. Saurabh Prakash, Course Coordinator for his untiring efforts and contribution to the development of this learning outcome-based curriculum. The contribution made by Dr. J.L. Bhagoriya, Dr. Manoj Arya, Prem Prakash Bharti, Mr. Prakash Khade, Mr. Anindya Basu Kashyap, Mr. Krishna kant Choudhary, Er. Kuber Singh, Dr. Satyendra Thakur and his team, Industry Partner in the development of the curriculum for domain and non-domain skills is duly acknowledged.

The suggestions and editorial support provided by Manoj Darwai, Assistant Professor (Solar Energy), Department of Engineering and Technology, Consultant on contractual basis at PSSCIVE, Bhopal are duly appreciated and acknowledged.

PSSCIVE Team

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1. COURSE OVERVIEW

COURSE TITLE: Solar Panel Installation Technician SGJ/Q0101 and ELEQ5901

The current course Solar Panel Installation Technician Job Role caters to the needs of the students who want to learn activities related to the Solar Panel Installation Technician Job Role. Any student/entrepreneur who wants to start a Solar Panel System Service Center can acquire the desired competencies with the help of this course. A solar panel installation technician connects the solar PV module to the inverter and various components such as batteries, and the grid, a technician's job is to install solar panels, maintain, do electrical wiring, operate equipment, and test systems that are described in this course.

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

- Identify the principal components of a solar power system
- Identify and control hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
- Demonstrate self-management skills.
- Demonstrate the ability to provide a self-analysis in the context of entrepreneurial skills and abilities.
- Demonstrate the knowledge of the importance of green skills in meeting the challenges of sustainable development and environment protection.
- Communicate effectively with the customers
- Understand the work requirement of Solar Power Systems
- Check out and assess the Solar System
- Understand the installation requirement of Solar Power Systems
- Do the designing of the Solar Panel System
- Collect materials required for installation of Solar Power System
- Do the installation of Solar Panel Systems in the field of solar
- Ensure quality material usage and appropriate handling mechanism
- Repair and maintain the minor and major devices of the Solar Panel System.

COURSE REQUIREMENTS: The learner should have a basic knowledge of science.

COURSE LEVEL: This is a course for class XI and XII. On completion of this course, a student can take up a higher-level course in the area of the Solar Sector.

COURSE DURATION: **600 hrs**

Class 11:	300 hrs
Class 12:	300 hrs
Total :	**600 hrs**

2. SCHEME OF UNITS

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 the vocational subject along with general education subjects. The unit-wise distribution of hours and marks for Class11 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: Information and Communication Technology Skills-III	20	
	Unit 4: Entrepreneurial Skills-III	25	
	Unit 5: Green Skills-III	15	
		110	**10**
Part B	**Vocational Skills**		
	Unit 1: Introduction to Solar Energy	30	**40**
	Unit 2: Major components of Solar Power System	60	
	Unit 3: Tools for Solar PV systems Installations	50	
	Unit 4: Work and health safety	25	
		165	**40**
Part C	**Practical Work**		
	Practical Examination	06	15
	Written Test	01	10
	Viva Voce	03	10
		10	**35**
Part D	**Project Work/Field Visit**		
	Practical File/Student Portfolio	10	10
	Viva Voce	05	05
		15	**15**
	Grand 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	20	10
	Unit 2: Self-management Skills-IV	10	
	Unit 3: Information and Communication Technology Skills-IV	20	
	Unit 4: Entrepreneurial Skills-IV	15	

	Unit 5: Green Skills-IV	10	
		110	**10**
Part B	**Vocational Skills**		
	Unit 1: Installation and Commissioning	80	40
	Unit 2: Repair and Maintenance	30	
	Unit 3: Cost Economics of Solar PV Systems and Opportunities	30	
	Unit 4: Innovation and development in solar energy	25	
		165	**40**
Part C	Practical Examination	06	15
	Written Test	01	10
	Viva Voce	03	10
		10	**35**
Part D	**Project Work/Field Visit**		
	Practical File/Student Portfolio	10	10
	Viva Voce	05	05
		15	**15**
	Grand Total	**300**	**100**

3. TEACHING/TRAINING ACTIVITIES

The teaching and training activities have to be conducted in classrooms, 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 or teaching 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 is 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, and 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

		No. of Questions			
S.No.	**Typology of Question**	**Very Short Answer (1 mark)**	**Short Answer (2 Marks)**	**Long Answer (3 Marks)**	**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,	**2**	**3**	**2**	**14**

	explain, paraphrase, or interpret information)				
3.	Application – (Use abstract information in concrete situation, to apply knowledge to new situations: Use given content to interpret a situation, private 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 questions)**

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, and 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

S.No.	Units	Duration (Hrs)
1.	Communication Skills - III	25
2.	Self-management Skills - IIII	25
3.	Information and Communication Technology Skills- III	20
4.	Entrepreneurial Skills - III	25
5.	Green Skills - III	15
	Total	**110**

UNIT 1: COMMUNICATION SKILL - III			
Learning Outcome	**Theory (10 Hrs)**	**Practical (15 Hrs)**	**Duration (25 Hrs)**
1. Demonstrate knowledge of communication	1. Introduction to communication process 2. Importance of communication 3. Elements of communication 4. Perspectives in communication 5. Effective	1. Role play on the communication process 2. Group discussion on the importance of communication and factors affecting perspectives in communication 3. Charts preparation	03

	communication	on elements of communication 4. Classroom discussion on the 7Cs (i.e. Clear, Concise, Concrete, Correct, Coherent, Courteous and Complete) for effective communication	
2. Demonstrate verbal communication	1. Verbal communication 2. Public Speaking	1. Role-play of a phone conversation. 2. Group activity on delivering a speech and practicing public speaking	02
3. Demonstrate non-verbal communication	1. Importance of non-verbal communication 2. Types of non-verbal communication 3. Visual communication	1. Role-play on non-verbal communication 2. Group exercise and discussion on Do's and Don'ts to avoid body language mistakes 3. Group activity on methods of communication	02
4. Demonstrate speech using correct pronunciation	1. Pronunciation basics 2. Speaking properly 3. Phonetics 4. Types of sounds	1. Group activities on practicing pronunciation	01
1. Apply an assertive communication style	1. Important communication styles 2. Assertive communication 3. Advantages of assertive communication 4. Practicing assertive communication	1. Group discussion on communication styles 2. Group discussion on observing and sharing communication styles	03
2. Demonstrate the knowledge of saying no	1. Steps for saying 'No' 2. Connecting words	1. Group discussion on how to say 'No'	02
3. Identify and use parts of speech in writing	1. Capitalisation 2. Punctuation 3. Basic parts of	1. Group activity on identifying parts of speech	

	speech 4. Supporting parts of speech	2. Writing a paragraph with punctuation marks 3. Group activity on constructing sentences 4. Group activity on identifying parts of speech	03
4. Write correct sentences and paragraphs	1. Parts of a sentence 2. Types of object 3. Types of sentences 4. Paragraph	1. Activity on framing sentences 2. Activity on active and passive voice 3. Assignment on writing different types of sentences	02
5. Communicate with people	1. Greetings 2. Introducing self and others	1. Role-play on formal and informal greetings 2. Role-play on introducing someone 3. Practice and group discussion on how to greet different people?	02
6. Introduce yourself to others and write about oneself	1. Talking about self 2. Filling a form	1. Practicing self-introduction and filling up forms 2. Practicing self-introduction to others	01
7. Develop questioning skill	1.Main types of questions 2.Forming closed and open-ended questions	1. Practice exercise on forming questions 2. Group activity on framing questions	01
8. Communicate information about family to others	1.Names of relatives 2.Relations	1. Practice talking about family 2. Role-play on talking about family members.	01
9. Describe habits and routines	1.Concept of habits and routines	1. Group discussion on habits and routines 2. Group activity on describing routines	01
10. Ask or give directions to others	1.Asking for directions 2.Using landmarks	1. Role-play on asking and giving directions 2. Identifying symbols	

		used for giving directions	01
Total			**25**

UNIT 2: SELF-MANAGEMENT - III			
Learning Outcome	**Theory (10 Hrs)**	**Practical (15 Hrs)**	**Duration (25 Hrs)**
1. Identify and analyse own strengths and weaknesses	1. Understanding self 2. Techniques for identifying strengths and weaknesses 3. Difference between interests and abilities	1. Activity on writing aims in life 2. Preparing a worksheet on interests and abilities	03
2. Demonstrate personal grooming skills	1. Guidelines for dressing and grooming 2. Preparing a personal grooming checklist	1. Role-play on dressing and grooming standards 2. Self-reflection activity on various aspects of personal grooming	04
3. Maintaining personal hygiene	1. Importance of personal hygiene 2. Three steps to personal hygiene 3. Essential steps of hand washing	1. Role-play on personal hygiene 2. Assignment on personal hygiene	03
4. Demonstrate the knowledge of working in a team and participating in group activities	1. Describe the benefits of teamwork 2. Working in a team	1. Assignment on working in a team 2. Self-reflection on teamwork	03
5. Develop networking skills	1. Benefits of networking skills 2. Steps to build networking skills	1. Group activity on networking in action 2. Assignment on networking skills	03
6. Describe the meaning and importance of self-motivation	1. Meaning of self-motivation 2. Types of motivation 3. Steps to building self-motivation	1. Activity on staying motivated 2. Assignment on reasons hindering motivation	03
7. Set goals	1. Meaning of goals and purpose of goal-setting 2. Setting SMART goals	1. Assignment on setting SMART goals 2. Activity on developing long-term and short-term goals using SMART method	03

8. Apply time management strategies and techniques	1. Meaning and importance of time management 2. Steps for effective time management	1. Preparing a checklist of daily activities	03
Total			**25**

UNIT 3: INFORMATION & COMMUNICATION TECHNOLOGY - III			
Learning Outcome	**Theory (08hrs)**	**Practical (12hrs)**	**Duration (20 Hrs)**
1.Create a document on the word processor	1. Introduction to ICT 2. Advantages of using a word processor. 3. Work with Libre Office Writer	1. Demonstration and practice of the following: • Creating a new document • Typing text • Saving the text • Opening and saving file on Microsoft Word/Libre Office Writer.	02
2.Identify icons on the toolbar	1. Status bar 2. Menu bar 3. Icons on the Menu bar 4. Multiple ways to perform a function	1. Group activity on using basic user interface of LibreOffice writer 2. Group activity on working with Microsoft Word	02
3.Save, close, open and print document	1. Save a word document 2. Close a word document 3. Open an existing document 4. Print	1. Group activity on performing the functions for saving, closing and printing documents in LibreOffice Writer 2. Group activity on performing the functions for saving, closing and printing documents in Microsoft Word	02
4.Format text in a word document	1. Change style and size of text 2. Align text 3. Cut, Copy, Paste 4. Find and replace	1. Group activity on formatting text in LibreOffice Writer 2. Group activity on formatting text in Microsoft Word	02

5. Check spelling and grammar in a word document	1. Use of spell checker 2. Autocorrect	1. Group activity on checking spellings and grammer using LibreOffice Writer 2. Group activity on checking spellings and grammer using Microsoft Word	02
6. Insert lists, tables, pictures, and shapes in a word document	1. Insert bullet list 2. Number list 3. Tables 4. Pictures 5. Shapes	1. Practical exercise of inserting lists and tables using LibreOffice Writer	03
7. Insert header, footer and page number in a word document	1. Insert header 2. Insert footer 3. Insert page number 4. Page count	1. Practical exercise of inserting header, footer and page numbers in LibreOffice Writer 2. Practical exercise of inserting header, footer and page numbers in Microsoft Word	03
8. Make changes by using the track change option in a word document	1. Tracking option 2. Manage option 3. Compare documents	1. Group activity on performing track changes in LibreOffice Writer 2. Group activity on performing track changes in Microsoft Word	04
Total			**20**

UNIT 4: ENTREPRENEURSHIP DEVELOPMENT - III			
Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 Hrs)**
1. Differentiate between different kinds of businesses	1. Introduction to entrepreneurship 2. Types of business activities	1. Role-play on different kinds of businesses around us	03
2. Describe the significance of entrepreneurial values	1. Meaning of value 2. Values of an Entrepreneur 3. Case study on	1. Role-play on qualities of an entrepreneur	03

	qualities of an entrepreneur		
3. Demonstrate the attitudinal changes required to become an entrepreneur	1. Difference between the attitude of entrepreneur and employee	1. Interviewing employees and entrepreneurs	03
4. Develop thinking skills like an entrepreneur	1. Problems of entrepreneurs 2. Problem-solving 3. Ways to think like an entrepreneur	1. Group activity on identifying and solving problems	04
5. Generate business ideas	1. The business cycles 2. Principles of idea creation 3. Generating a business idea 4. Case studies	1. Brainstorming on generating a business ideas	04
6. Describe customer needs and the importance of conducting a customer survey	1. Understanding customer needs 2. Conducting a customer survey	1. Group activity to conduct a customer survey	04
7. Create a business plan	1. Importance of business planning 2. Preparing a business plan 3. Principles to follow for growing a business 4. Case studies	1. Group activity on developing a business plan	04
Total			**25**

UNIT 5: GREEN SKILLS - III			
Learning Outcome	**Theory (07 hrs)**	**Practical (08 hrs)**	**Duration (15 Hrs)**
1. Describe the importance of the main sector of the green economy	1. Meaning of ecosystem, food chain and sustainable development 2. Main sectors of the green economy- E-waste management, green transportation, renewal energy, green construction, and water management	1. Group discussion on sectors of green economy 2. Poster making on various sectors for promoting green economy	06

2. Describe the main recommendations of policies for the green economy	1. Policies for a green economy	1. Group discussion on initiatives for promoting the green economy 2. Writing an essay or a short note on the important initiatives for promoting green economy.	03
3. Describe the major green sectors/ areas and the role of various stakeholders in the green economy	1. Stakeholders in the green economy	1. Group discussion on the role of stakeholders in the green economy 2. Making solar bulbs.	03
4. Identify the role of government and private agencies in the green economy	1. Role of the government in promoting a green economy 2. Role of private agencies in promoting green economy	1. Group discussion on the role of Government and Private Agencies in promoting a green economy. 2. Poster making on green sectors.	03
Total			**15**

Part B: Vocational Skill

S. No.	Units	Duration (Hrs.)
1	Unit 1: Introduction to Solar Energy	30
2	Unit 2: Major components of Solar PV System	60
3	Unit 3: Tools for Solar PV systems installations	50
4	Unit 4: Work and health safety	25
	Total	**165**

UNIT 1: INTRODUCTION OF SOLAR ENERGY

Learning Outcome	Theory (30 Hrs)	Practical (12 Hrs)	Duration (30 Hrs)
1. Describe the basic concept of energy, photovoltaic energy, and the basics of electricity.	• Introduction of energy (Renewable energy and non-renewable energy) • Various types of Renewable energy • Advantages of solar energy and other Renewable energy sources	• List the various types of renewable energy and non-renewable energy source • Preparing chart and poster • Sketch different energy sources • Measurements of electrical quantities	09

	• Fundamental of electricity	• Identification and use of basic electrical tools	
2. Describe the use of solar energy and its application	• Solar energy • Various applications of solar energy (thermal and PV energy) • Differentiate between energy coming from the sun – thermal and PV energy • Solar radiation and its types	• Make a list of various applications and solar radiation instruments • Collect the solar radiation data in your location • Use of pyranometer	09
3. Explain the Solar PV Technology	• History and evolution of Solar PV technology • Identify the future scope of solar PV • Need for training in the solar energy sector	• List the chronological development of solar PV technology	04
4. Discuss the principles of Solar energy generation and current trends	• Solar energy generation - Basic conversion and control of the electrical system and its functions (use of storage - battery), • Current status of energy generation in India.	• Make a chart or poster/ block diagram of solar energy generation • Make a presentation on the Current status of energy generation in India.	08
Total			**30**

UNIT 2: MAJOR COMPONENTS OF SOLAR PV SYSTEM			
Learning Outcome	**Theory (30 Hrs)**	**Practical (30 Hrs)**	**Duration (60Hrs)**
1. Identify the solar panel and its types	• Solar panels, • types and their capacity, • size, • specification • Differentiate between different types of solar panel	• Make a chart of different types of solar panels according to - efficiency, - size, - capacity, - specification • Identify the types solar panel	05
2. Describe the components of solar panel	• Discuss the fabrication structure of the solar module. (components)	• Identify the of various layers of solar panel and draw it.	5
3. Explain the module mounting structure (MMS) and types	• Mounting structure and its different types, material, and accessories, system tracking- daily and seasonal, automatic and manual • Different types of	• Identify the different types of mounting structures and accessories • Make a list of daily, seasonal, automatic, and manual tracking system	12

	fastening accessories are used in the mounting structure	• Identify the different types of fastening accessories • Sketch different types of fastening accessories	
4. Describe the power conditioning unit (PCU)	• Power conditioning units and their components - MPPT - Charge controller	• Identify the power conditioning unit and its components	10
5. Describe the Inverter and its types	• Inverters - its different types advantages of inverters • Circuit diagram of inverter connection	• Identify the various types of inverter • Operate the inverter as per the instruction manual • Identify the operating function of the inverter	08
6. Able to explain features of battery energy storage unit	• Types of battery • Battery energy storage and its condition - DOD (depth of discharge) - SOC (state of charge) • Rating of the battery according to hours	• Identify the component of the battery - terminals, - Cells, - electrolyte, - packing • Reading of specification sticker paste on the battery body	05
7. Identify the different cables	Describe the various types of cable and wire - DC cable, - AC cable,	• Identification of single and multicore-cable • Make a chart of different types of cables according to gauge and their material	05
8. Explain the importance of earthing systems and lighting arrester	• Importance of earthing systems and their types, - maintenance-free/ chemical earthing system, - earthing electrode, - earthing backfill compound, • Lighting arrester and its uses and importance	• Visit the solar PV site and check the earthing system • Measure earthing resistance with an earth tester • Identify the components of the lighting arrestor • Draw the line diagram of earthing.	05
9. Explain the different types of conduit used in cable	• Conduit and its types, cable dressing accessories- cable and conduit gland, cable tie and its types, cable and conduit	• Identify the different types of conduit cable • Make a list of different types of conduit cable	05

	clips, lugs- aluminium and copper,		
Total			**60**

UNIT 3: TOOLS FOR SOLAR PV SYSTEM INSTALLATIONS			
Learning Outcome	**Theory (26 Hrs)**	**Practical (24 Hrs)**	**Duration (50 Hrs)**
1. Describe the various mechanical tool	• Mechanical tools used in the solar PV system installation- spanner, drill machine, hammer, chisel, grinder, torque wrench, LN keys, saw, power drill, scrapers, screwdriver	• List and Identify the various mechanical tool • Draw the image of the mechanical tool and label it • Handling of the different mechanical tools (spanner, drill machine, hammer, chisel, grinder, torque wrench, LN keys, saw, power drill, scrapers, screwdriver) • Do the operations like cutting, spanner, drill machine, hammer, chisel, grinder, wrench, LN keys, saw, power drill, scrapers, screwdriver	10
2. Describe the various electrical tools	• Electrical tools used in the solar system – multimeter, clamp meter earth tester/megger, Wire stripper, tester electrical insulator, pliers, crimper	• Identify the various electrical tool for the specific task • Sketch the electrical tool and label it • Handling and operate the different electrical tools (clamp meter, multimeter, earth tester/ megger, Wire stripper, tester electrical insulator, pliers, crimper) • Do the all electrical tool operations (multimeter, earth tester/megger, tester electrical insulator, pliers, crimper)	10
3. Describe the various safety tool	• Safety tools used in the solar system – personnel protective equipment kit (PPE KIT)	• Identify the various safety tool for the specific task • Demonstrate the different safety tool • Perform practical of all safety tool operations	08
4. Identify and use the different marking tool	• Marking tools used in the solar system - compass, measurement level, marking thread, angle finder tape, spirit level	• Use of Measuring tools compass, measurement level, marking thread, angle finder tape, spirit level	08

5. Identify and use the civil tool used in the solar system	• Civil tools used in the solar system – line dori, pickaxe, spud, mortar pan, spade, water level pipe, crowbar, pliers	• Identify the various Civil tools for the specific task • Sketch the Civil tool and label it • Demonstrate the different Civil tools (pickaxe, spud, mortar pan, spade, water level pipe, crowbar, pliers) • Perform practically all Civil tool operations (like a pickaxe, spud, mortar pan, spade, crowbar, and pliers)	06
6. Describe the different electrical parameters	• electrical parameters- voltage, AC and DC, earthing, power factor, frequency, resistance.	• Make a list of different electrical parameter • Draw the symbols of electrical parameters	04
7. Describe the various types of solar PV systems	• Solar PV systems: On-grid, Off-grid, and Hybrid systems. • Advantages and disadvantages of a solar PV system - on and off-grid, hybrid system • Conversion of the off-grid system into the on-grid system	• Make a chart or poster of on-grid and off-grid system • Draw the line diagram of the on-grid and off-grid system	04
Total			**50**

UNIT 4: WORK AND HEALTH SAFETY			
Learning Outcome	**Theory (15 Hrs)**	**Practical (10 Hrs)**	**Duration (25 Hrs)**
1. Explain the toolbox talk and different types of hazards in the installation	• Tools box talk- talking about safety at work, identifying the hazards of today's work and taking precautions during installation, talking about safety tools and current work	1. Perform the role play on the toolbox talk 2. Make a list of hazards and precautions to be taken during installations	05
2. Discuss and perform the different safety practices	• Importance of PPE kit, - demonstration of gathering points and different safety measures - CPR, - first aid, practice - evacuation plant • Safety regulation- industrial and construction safety act and practice	3. Demonstrate how to use a PPE kit and its importance 4. Demonstration of First aid box 5. Demonstration of CPR	08

3. Describe the different types of safety tools	Use of PPE kit - helmet and its types, gloves, shoe, apron, harness First aid – discuss about first aid material Hazard sign board - electrical hazard sign boards, - precaution signboard, - safety measures signboard, emergency, and emergency number signboard Hazard identification- A. Electrical safety - Shock prevention - First aid after electrical shock. B. Fire hazard - types and use of fire extinguishers - fire exit plan C. Work at height hazard - use of safety harness	1. Identify different types of PPE kit 2. Mock Practice of using first aid 3. Make a chart and poster of different hazard sign and emergency sign 4. Identification of different components of fire extinguisher 5. Operate and handling of fire extinguisher 6. Operate the safety harness during work at a height	12
Total			**25**

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: Information and Communication Technology Skills - IV	20
4.	Unit 4: Entrepreneurial Skills –IV	25
5.	Unit 5: Green Skills –IV	15
	Total	**110**

UNIT 1: COMMUNICATION SKILLS – IV			
Learning Outcome	**Theory (10 Hrs)**	**Practical (15 Hrs)**	**Duration (25 Hrs)**
1. Demonstrate active listening skills	1. Active listening -listening skill, stages of active listening 2. Overcoming barriers to active listening	1. Group discussion on factors affecting active listening 2. Poster making on steps for active listening 3. Role-play on negative effects of not listening actively	10
2. Identify the parts of speech	1. Parts of speech – using capitals, punctuation, basic parts of speech, Supporting parts of speech	1. Group practice on identifying parts of speech 2. Group practice on constructing sentences	10
3. Write sentences	1. Writing skills to practice the following: • Simple sentence • Complex sentence • Types of object 2. Identify the types of sentences • Active and Passive sentences • Statement/ • Declarative sentence • Question/ • Interrogative sentence - Emotion/ Reaction or Exclamatory sentence - Order or Imperative sentence 3. Paragraph writing	1. Group activity on writing sentences and paragraphs 2. Group activity on practicing writing sentences in active or passive voice 3. Group activity on writing different types of sentences (i.e., declarative, exclamatory, interrogative and imperative)	05
Total			**25**

UNIT 2: SELF-MANAGEMENT SKILLS – IV			
Learning Outcome	**Theory (10 Hrs)**	**Practical (15 Hrs)**	**Duration (25 Hrs)**
1. Describe the various factors influencing motivation and positive attitude	1. Motivation and positive attitude 2. Intrinsic and extrinsic motivation 3. Positive attitude – ways to maintain positive attitude 4. Stress and stress management - ways to manage stress	1. Role-play on avoiding stressful situations 2. Activity on listing negative situations and ways to turn it positive	10
2. Describe how to become result oriented	1. How to become result oriented? 2. Goal setting – examples of result-oriented goals	1. Group activity on listing aim in life	05
3. Describe the importance of self-awareness and the basic personality traits, types and disorders	1. Steps towards self-awareness 2. Personality and basic personality traits 3. Common personality disorders- • Suspicious • Emotional and impulsive • Anxious 4. Steps to overcome personality disorders	1. Group discussion on self-awareness 2. Group discussion on common personality disorders 3. Brainstorming steps to overcome personality disorder	10
Total			**25**

UNIT 3: INFORMATION AND COMMUNICATION TECHNOLOGY SKILLS – IV			
Learning Outcome	**Theory (06 Hrs)**	**Practical (14 Hrs)**	**Duration (20 Hrs)**
1. Identify the components of a spreadsheet application	1. Getting started with spreadsheet - types of a spreadsheet, steps to start LibreOffice Calc., components of a worksheet.	1. Group activity on identifying components of spreadsheet in LibreOffice Calc.	02
2. Perform basic operations in a spreadsheet	1. Opening workbook and entering data – types of data, steps to enter data, editing and deleting data in a cell	1. Group activity on working with data on LibreOffice Calc.	03

	2. Selecting multiple cells 3. Saving the spreadsheet in various formats 4. Closing the spreadsheet 5. Opening the spreadsheet. 6. Printing the spreadsheet.		
3. Demonstrate the knowledge of working with data and formatting text	1. Using a spreadsheet for addition – adding value directly, adding by using cell address, using a mouse to select values in a formula, using sum function, copying and moving formula 2. Need to format cell and content 3. Changing text style and font size 4. Align text in a cell 5. Highlight text	1. Group activity on formatting a spreadsheet in LibreOffice Calc 2. Group activity on performing basic calculations in LibreOffice Calc.	02
4. Demonstrate the knowledge of using advanced features in spreadsheet	1. Sorting data 2. Filtering data 3. Protecting spreadsheet with password	1. Group activity on sorting data in LibreOffice Calc	03
5. Make use of the software used for making slide presentations	1. Presentation software available 2. Stapes to start LibreOffice Impress 3. Adding text to a presentation	1. Group practice on working with LibreOffice Impress tools	02
6. Demonstrate the knowledge to open, close and save slide presentations	1. Open, Close, Save and Print a slide presentation	1. Group activity on saving, closing and opening a presentation in LibreOffice Impress	01
7. Demonstrate the operations related to slides and texts in the presentation	1. Working with slides and text in a presentation- adding slides to a presentation, deleting slides, adding and formatting text, highlighting text, aligning text, changing	1. Group activity on working with font styles in LibreOffice Impress	04

	text colour		
8. Demonstrate the use of advanced features in a presentation	1. Advanced features used in a presentation 2. Inserting shapes in the presentation 3. Inserting clipart and images in a presentation 4. Changing slide layout	1. Group activity on changing slide layout on LibreOffice Impress	03
Total			**20**

UNIT 4: ENTREPRENEURIAL SKILLS – IV			
Learning Outcome	**Theory (10 Hrs)**	**Practical (15 Hrs)**	**Duration (25 Hrs)**
1. Describe the concept of entrepreneurship and the types and roles and functions entrepreneur	1. Entrepreneurship and entrepreneur 2. Characteristics of entrepreneurship 3. Entrepreneurship-art and science 4. Qualities of a successful entrepreneur 5. Types of entrepreneurs 6. Roles and functions of an entrepreneur 7. What motivates an entrepreneur 8. Identifying opportunities and risk-taking 9. Startups	1. Group discussion on the topic "An entrepreneur is not born but created". 2. Conducting a classroom quiz on various aspects of entrepreneurship. 3. Chart preparation on types of entrepreneurs 4. Brainstorming activity on What motivates an entrepreneur	10
2. Identify the barriers to entrepreneurship	1. Barriers to entrepreneurship 2. Environmental barriers 3. No or faulty business plan 4. Personal barriers	1. Group discussion about "What we fear about entrepreneurship" 2. Activity on taking an interview of an entrepreneur.	05
3. Identify the attitude that make an entrepreneur successful	1. Entrepreneurial attitude	1. Group activity on identifying entrepreneurial attitude.	05
4. Demonstrate the knowledge of entrepreneurial attitude and competencies	1. Entrepreneurial competencies 2. Decisiveness 3. Initiative 4. Interpersonal skills-	1. Playing games, such as "Who am I". 2. Brainstorming a business ideas 3. Group practice on	05

	positive attitude, stress management 5. Perseverance 6. Organisational skills- time management, goal setting, efficiency, managing quality.	"Best out of Waste" 4. Group discussion on the topic of "Let's grow together" 5. Group activity on listing stress and methods to deal with it like Yoga, deep breathing exercises, etc. 6. Group activity on time management	
Total			**25**

UNIT 5: GREEN SKILLS – IV			
Learning Outcome	**Theory (05 Hrs)**	**Practical (10 Hrs)**	**Duration (15 Hrs)**
1. Identify the benefits of the green jobs	1. Green jobs 2. Benefits of green jobs 3. Green jobs in different sectors: • Agriculture • Transportation • Water conservation • Solar and wind energy • Eco-tourism • Building and construction • Solid waste management • Appropriate technology	1. Group discussion on the importance of green job. 2. Chart preparation on green jobs in different sectors.	08
2. State the importance of green jobs	1. Importance of green jobs in • Limiting greenhouse gas emissions • Minimiing waste and pollution • Protecting and restoring ecosystems • Adapting to the effects of climate change	1. Preparing posters on green jobs. 2. Group activity on tree plantation. 3. Brainstorming different ways of mininmising waste and pollution	07
3. Identify the benefits of the green jobs	1. Green jobs 2. Benefits of green jobs 3. Green jobs in different sectors: • Agriculture • Transportation • Water conservation	1. Group discussion on the importance of green job. 2. Chart preparation on green jobs in different sectors.	08

	• Solar and wind energy • Eco-tourism • Building and construction • Solid waste management • Appropriate technology		
Total			**15**

Part B: Vocational Skills

S. No.	Units	Duration (Hrs.)
1	Unit 1: Installation and Commissioning	80
2	Unit 2: Repair and Maintenance	30
3	Unit 3: Cost economics of Solar PV Systems and opportunities	30
4	Unit 4: Innovation and Development in Solar Energy	25
	Total	**165**

UNIT 1: INSTALLATION AND COMMISSIONING

Learning Outcome	Theory (30 Hrs)	Practical (50 Hrs)	Duration (80 Hrs)
1. Describe the site survey and prepare the site feasibility report	• Importance of site survey • Criteria of Site Selection • Site survey- measurement of required area for a solar plant, shadow analysis, Soil characteristics, understanding of site feasibility report, and Performance criteria of solar power System	• Make a list of criteria for site selection • Check the soil characteristics at the installation site • Visit the solar Panel System site and see the effect of the shadow of a tree or building, electric poll, etc. • Locate and Identify the place of the Solar Panel System at the site • Make a feasibility report of the site	15
2. Identify the design of the Solar PV system	• Selection and design of Solar PV system, understanding of single line diagram of different types of solar PV system • Stand-alone solar PV Systems • On-grid solar PV system • Hybrid solar PV system	• Identification of different types of Solar Panel Systems • Make a single-line diagram of a system • Identify different components of the Solar Panel System	08
3. Describe the importance of design and evaluation features	• Design and evaluation of various parameter: • Load calculation • number of module series and parallel connections, • dc/ac cable size calculation	• List of various parameters used for the design of Solar PV Systems • Calculate load - volt, amp • Calculate voltage in series and parallel connection • Calculate the required cable size • Collect the information on weather condition • Checklist of different parameters of the solar	20

		PV system. • Identify the viability of the grid	
4. List the material handling procedure	• Material procurement and handling, transportation and storage - loading and unloading material, • Handling procedure	• List the specifications of the material and equipment • Make a list of suppliers or companies related to the solar unit	05
5. Construct the foundation for the solar PV system unit	• Civil work, RCC piling, mounting structure and Installation Procedure, • Identify the concrete mix for the casting of the civil foundation	• Write the procedure for making a foundation • Visit the solar site • Construction of civil block • Marking and layout of the civil block on the ground/ roof • Prepare concrete mixer for RCC	12
6. Describe the cable connection used in the solar installation	• AC & DC cabling and interconnection, • Physical connection, • String connection - electrical, - use of MC4 connector - use of ferruling (label)	• Identify the AC & DC cabling and interconnection • Check the AC & DC cabling and interconnection • Check physical connection • rusting in electrical • loose and break the connection • Check the panel connection like electrical and structure	06
7. Describe the Installation of the Mounting structure and Solar panel	• Installation of various parts of MMS • Mounting of solar panel on structure, features, and procedure	• Identify and draw the mounting structure for solar panel • Visit the Solar Panel System site and note the all features.	10
8. Discuss the quality assurance parameters	• Quality assurance parameters	• list the step to check quality assurance parameter	04
Total			**80**

UNIT 2: REPAIR AND MAINTENANCE			
Learning Outcomes	**Theory (15 Hrs)**	**Practical (15 Hrs)**	**Duration (30 Hrs)**
1. Describe the procedure of cleaning and testing solar panel	• Cleaning and testing of solar panels, procedures, and schedule • Routine checkups of	• Write cleaning procedure • Check the wire and terminal connection • Check the solar panel	15

	Solar PV Systems	position • Generation report	
2. Checking the solar panel mounting systems and identifying the different faults in the solar PV system	• Checking of solar panel mounting, nuts, bolts, and angle of tilt • Sunlight and direction assessment • Basics of battery functioning and service • Checking of conduits • Checking of electrical connection • Solar plant equipment and its functioning, maintenance procedure of equipment's	• Visit the Solar PV Plant site to check the tilt angle and mounting structure condition • Check the nut and bolt for loose connection and tighten it. • Identify the direction by using a compass • Identify the basic function and features of the battery • Check leakage and blockage in the water supply pipeline • Check all electrical terminal connection • Write the maintenance procedure • Identify defective components and their replacement like wire cuts, burned, carbon supply, twist, etc.,	15
Total			**30**

UNIT 3: COST ECONOMICS OF SOLAR PV SYSTEMS AND OPPORTUNITIES			
Learning Outcomes	**Theory (15 Hrs)**	**Practical (15 Hrs)**	**Duration (30 Hrs)**
1. Able to Calculate the cost of the solar power plant and installation cost.	• Cost calculation for Solar Panel System, solar panel as per capacity • Prepare a project plan	• Calculate the cost of solar power plant • Read and note down the specification of solar panel	10
2. Describe the business strategies, government scheme, and policy	• Business opportunities and market trend, Govt. Project and Policy, • Metering concept • Net metering • Gross metering	• Identify the different business opportunities and market trend • Make a list of govt. project and policy • Check the net metering and Gross metering policy of your state/ central govt. scheme • Collect the information from the vendor about Solar Panel Systems.	05

3. Explain the different marketing strategies- add on, Solar Panel System spare parts	• Different marketing strategies- add on, Solar Panel System spare parts	• Identifying different marketing strategies- add on, Solar Panel System spare parts • Make a chart or poster of different marketing strategies- add on, Solar Panel System spare parts	07
4. Describe about annual maintenance	• Work effectively with others (as a team or individual) • Importance of annual maintenance • Follow-up and Annual Maintenance	• Make a list of company or vendor • Role play and group discussion on work • Reading the annual maintenance report of the Solar Panel System according specification	08
Total			**30**

UNIT 4: INNOVATION AND DEVELOPMENT IN SOLAR ENERGY			
Learning Outcomes	**Theory (15 Hrs)**	**Practical (10 Hrs)**	**Duration (25 Hrs)**
1. Describe the innovations in different solar products	• Solar product - home lighting system - lantern, - solar torch, - solar water heater, - solar cooker - solar power bank, - solar street light, - solar e-rickshaw, - solar EV charging station	• Identification of new solar products • Reading of specifications for all solar products • Make a list of solar • Product and its price • Identify the solar product in your area	15
2. Explain new solar technology	• New solar technology - solar bifacial, -BIPV (Building-integrated photo voltaic) • The standard for solar system-BIS, IEC code • The flexible solar panel (thin film) • Solar dryer • Solar desalination plant • Solar fencing • Solar cold storage	• Visit the solar panel to check the power outputs • Identify the features of solar panel • Collect the information from the websites and make a project report • Make a chart or poster of BIS, IEC Code • Identify different types of Solar Panel film • Identify different types of solar dryers • Make a chart of solar dryer • Visit the solar desalination plant • Visit the site to check the solar fencing	10
Total			**25**

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 like Solar Power plant /Solar Manufacturing Company, Solar Fair, solar site Different section of show room and service centre.

Visit a Solar Power plant and service centre and observe the following: During the visit, students should obtain the following information from the owner or the supervisor of the showroom:

1. Activity of Solar Power System and service centre
2. Different section of show room and service centre
3. Service centre activities
4. Sale procedure
5. Manpower engaged
6. Total expenditure of showroom
7. Total annual income
8. Profit/Loss (Annual)
9. Any other information

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.

Tools and Equipment

A complete unit of Solar photovoltaic system model of solar photovoltaic power plant, Solar power meter (pyranometer), Solar photovoltaic inverter, energy meter, Battery, cable.

Tool kit, Electrician knife, water level indicator, PVC mallet, Fuse puller, Tong tester AC/DC, Multimeter,

Earthing rod, Soldering iron and flux, Phase sequence meter, Inclinometer. Clamp meter, earth tester, lux meter, drill machine and torque wrench, compass,

Spirit level/water level, drill machine, double-ended flat and ring spanner, combination plier, side cutting plier. Nose pliers, wire stripper, hacksaw frame with the blade, screwdriver, torque wrench, wire stripper, Measuring tape, line dori, plumb bob, Vernier calliper, Allen key set, Cable ties, Charge controller, Connecting wires, Lead solder, Load (AC/DC), Centre punch, Standard wire gauge, MC4 connectors, Mechanical fixtures required for panel installation, PUCs, Cable cutter, Screw driver set, solar chart, Solar conversion kits, Soldering flux, solar panels, soldering iron, wire stripper, safety helmet, safety belt, Nose mask, Safety goggles, ear plug, cotton hand glove,

Solar products

- Solar product
  - home lighting system
  - lantern,
  - solar torch,
  - solar water heater,
  - solar cooker,

- solar power bank,
- solar street light,
- solar e-rickshaw,
- solar charging station

Training materials and First Aid kit

- Teaching Aids: Charts, CBTs, LCD Projector, and Videos.
- Cleaning equipment and solutions
- SOP Charts on safety norms and drills
- Charts of dos and Don'ts in the work area.
- Audio/video on English, Hindi, or local language course
- Reference books
- Workbooks
- Study for Soft Skills
- CBTs on working on the computer

8. VOCATIONAL TEACHER'S/ TRAINER'S QUALIFICATION AND GUIDELINES

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.	Degree/ B.Voc. (Bachelor in Vocation) in Civil, Mechanical, Electrical and Electronics Engineering, Agricultural, from a recognized Institute /University, with at least 1-year work / teaching experience. Or Diploma in Civil, Agricultural, Mechanical and Electrical and Electronics Engineering from a recognized Institute/ University, with at least 2-year work / teaching experience	• Effective communication skills (oral and written) • Basic computing skills.	18-37 years (as on Jan. 01 (year)) Age relaxation to be provided as per Govt. rules.

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 the following ways:

(i) 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

(ii) 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:

(i) Written test for the technical/domain specific knowledge related to the sector;
(ii) Interview for assessing the knowledge, interests and aptitude of trainer through a panel of experts from the field and state representatives; and
(iii) 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:

(i) Prepare session plans and deliver sessions which have a clear and relevant purpose and which engage the students;
(ii) Deliver education and training activities to students, based on the curriculum to achieve the learning outcomes;

(iii) Make effective use of learning aids and ICT tools during the classroom sessions;
(iv) 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;
(v) 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;
(vi) Identify the weaknesses of students and assist them in up-gradation of competency;
(vii) Cater to different learning styles and level of ability of students;
(viii) Assess the learning needs and abilities, when working with students with different abilities
(ix) Identify any additional support the student may need and help to make special arrangements for that support;
(x) 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. The following parameters may be considered during the appraisal process:

1. Participation in guidance and counselling activities conducted at the Institutional, District and State level;
2. Adoption of innovative teaching and training methods;
3. Improvement in the result of vocational students of Class X or Class XII;
4. Continuous up-gradation of knowledge and skills related to vocational pedagogy, communication skills and vocational subject;
5. Membership of professional society at the District, State, Regional, National, and International level;
6. Development of teaching-learning materials in the subject area;
7. Efforts made in developing linkages with the Industry/Establishments;
8. Efforts made towards involving the local community in Vocational Education
9. Publication of papers in National and International Journals;
10. Organisation of activities for the promotion of vocational subjects;
11. Involvement in the placement of students/student support services.

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