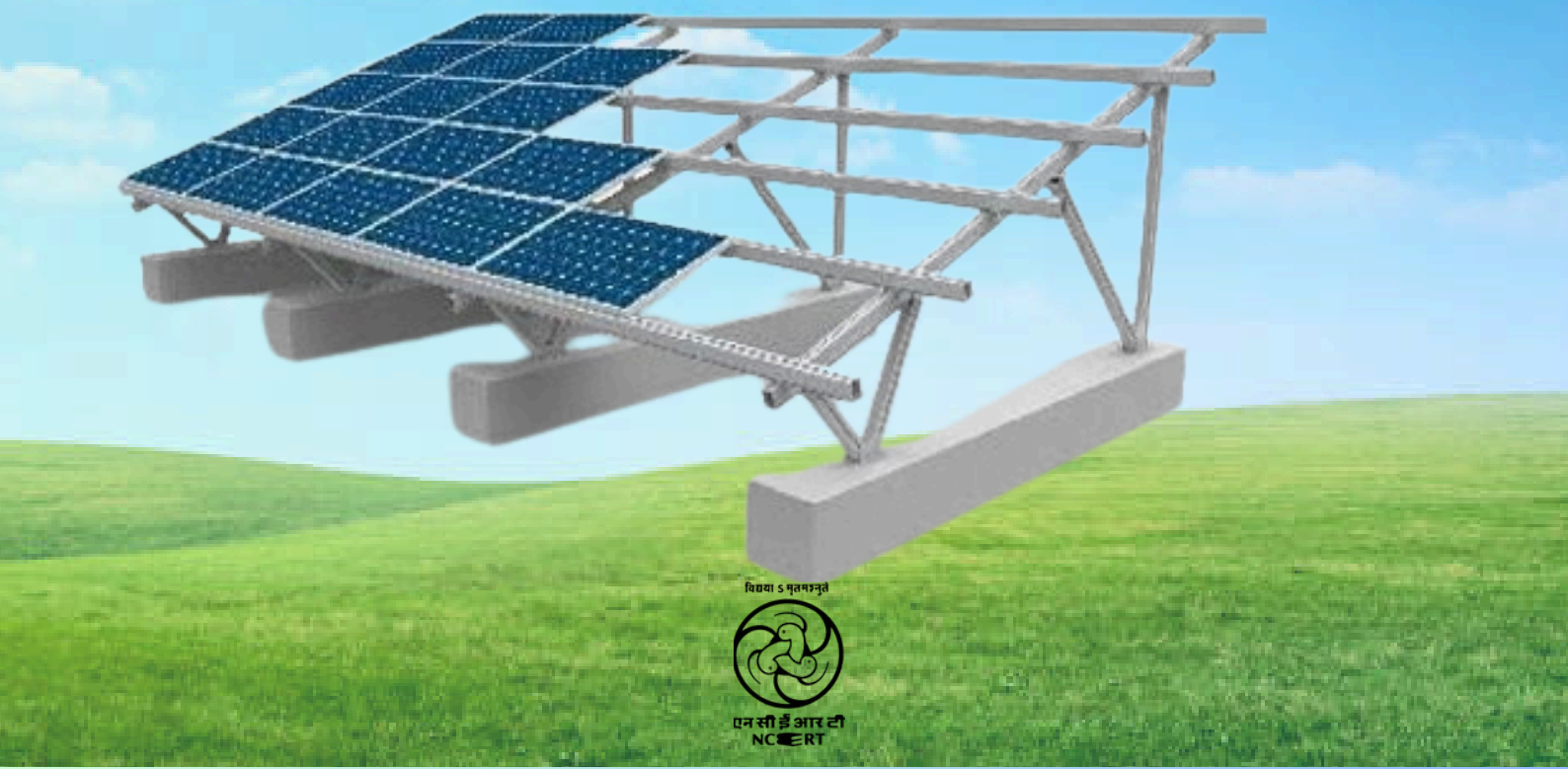
LEARNING OUTCOME BASED VOCATIONAL CURRICULUM

Job Role: Solar PV Installer - Civil

(QUALIFICATION PACK: SGJ/Q0103)

SECTOR: GREEN JOBS

Grades XI and XII



PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION

(a constituent unit of NCERT, under Ministry of Education, Government of India)

Shyamla Hills, Bhopal- 462 002, M.P., India

http://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.

LEARNING OUTCOME BASED VOCATIONAL CURRICULUM

JOB ROLE: SOLAR PV INSTALLER (CIVIL)

(QUALIFICATION PACK: Ref. Id. SGJ/Q0103)

SECTOR: GREEN JOBS

Grades 11 and 12

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विद्यया ऽमृतमश्नुते

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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 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 Qualification 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 education and training package for the job role/vocational subject of "Solar PV Installer – Civil". 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.

DINESH PRASAD SAKLANI
Director
National Council of Education Research and Training

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, Government of India, introduced the revised Centrally Sponsored Scheme of Vocationalisation of School Education under Samagra Shiksha. 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 materials for the job roles in various sectors.

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. In order to honour its commitment to the nation, the PSSCIVE 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 and foster a conducive learning environment 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

ACKNOLEDGEMENTS

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 Skill Council for Green Jobs (SCGJ) for their academic support and cooperation.

We are grateful to Dr. Saurabh Prakash, Head, Department of Engineering and Technology, PSS Central Institute of Vocational Education, Bhopal, for his consistent support. We are also thankful to Dr. Vinod Kumar Yadav, Associate Professor and Course Coordinator, for his untiring efforts and contribution to the development of this learning outcome-based curriculum.

The contributions of the experts and the editorial support provided by Mr. Neeraj Bhandari, Assistant Professor in Civil Engineering (Contractual) and Mr. Manoj Darwai, Assistant Professor in Solar (Contractual) at PSSCIVE, are appreciated and acknowledged.

CONTENTS

1. COURSE OVERVIEW

COURSE TITLE: SOLAR PV INSTALLER – CIVIL

Solar energy is a rapidly growing renewable energy source with wide applications, offering sustainable solutions for power generation, reducing carbon emissions, and supporting global clean energy goals. The Solar PV Installer (Civil) is responsible for site analysis, layout preparation, installation of support structures, and ensuring proper alignment of solar panels. The role demands a good understanding of solar PV systems, structural integrity, and safety protocols. Individuals in this role should possess logical thinking, attention to detail, problem-solving skills, and effective communication abilities. This course provides in-depth knowledge of solar PV systems, tools, and installation techniques, ensuring adherence to industry standards and safety norms. Students will learn to manage resources, prioritize tasks, and handle on-site challenges, preparing them for a career in the expanding field of renewable energy.

COURSE OBJECTIVES:

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

- Understand the role of a Solar PV Installer.
- Identify key components of a Solar Photovoltaic System.
- Demonstrate knowledge of installation tools.
- Conduct a site survey for Solar PV installation, focusing on civil aspects.
- Understand the importance of civil works in Solar PV installation.
- Apply basic Civil engineering principles to Solar PV projects.
- Assess soil conditions and perform site preparation for Solar PV installation.
- Design and construct foundations for Solar PV mounting systems.
- Install and maintain mounting structures for Solar PV panels.
- Ensure structural integrity of supporting frameworks for Solar PV installations.
- Analyze and address issues related to roof or ground-mounted Solar PV systems.
- Ensure proper drainage and prevent erosion around Solar PV installations.
- Comply with building codes and Civil Engineering standards for Solar PV installations.
- Perform civil works related to trenching and cable laying for Solar PV systems.
- Implement safety measures in civil works during Solar PV system installation.

COURSE REQUIREMENTS: The learner should be holding a 10th Grade pass certificate.

COURSE DURATION: 600 hrs

Grade 11	: 300 hrs
Grade 12	: 300 hrs
TOTAL	**: 600 hrs**

2. SCHEME OF UNITS AND ASSESMENT

The unit-wise distribution of hours and marks for Grade 11 is as follows:

GRADE 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	
	Total	**110**	**10**
Part B	**Vocational Skills**		
	Unit 1: Introduction to Solar PV Installer - Civil	25	**40**
	Unit 2: Basics of Solar Photovoltaic System	55	
	Unit 3: Tools and Tackles used in solar PV Installation	25	
	Unit 4: Fundamentals of Civil Engineering for Solar PV Installer	60	
	Total	**165**	**40**
Part C	**Practical Work**		
	Practical Examination	06	15
	Written Test	01	10
	Viva Voce	03	10
	Total	**10**	**35**
Part D	**Project Work/Field Visit**		
	Practical File/Student Portfolio	10	10
	Viva Voce	05	05
	Total	**15**	**15**
	Grand Total	**300**	**100**

The unit-wise distribution of hours and marks for Grade12 is as follows:

GRADE 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	
	Total	**75**	**10**
Part B	**Vocational Skills**		
	Unit 1: Site Survey for Solar PV Installation	40	40
	Unit 2: Civil works required for Solar PV Installation	95	
	Unit 3: Health and Safety	25	
	Total	**165**	**40**
Part C	**Practical Work**		
	Practical Examination	06	15
	Written Test	01	10
	Viva Voce	03	10
	Total	**10**	**35**
Part D	**Project Work/Field Visit**		
	Practical File/Student Portfolio	10	10
	Viva Voce	05	05
	Total	**15**	**15**
	Grand 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 aides, 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.

4. ASSESSMENT AND CERTIFICATION

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: 40 marks**

S.No.	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 the meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase, or interpret information)	**2**	**3**	**2**	**14**
3.	Application – (Use abstract information in a 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 and 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**

SKILL ASSESSMENT (PRACTICAL)

Assessment of skills should be done by the assessors/examiners on the basis of practical demonstration of skills by students, 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 effective training in assessment principles and practices. The Sector Skill Councils should ensure that the assessors are provided with training on the assessment of competencies.

Practical Examination: Practical examination allows candidates to demonstrate the knowledge and understanding of performing a task. This will include the performance of tasks and viva voce. Teachers/Examiner will clearly define the tasks that candidates are required to perform during the practical examination. These tasks should align with the learning objectives of the course. Students are to be evaluated based on their skills, technique, accuracy, and overall performance.

For the practical exam, 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. They will assess the candidates' skills, adherence to industry standards, and efficiency in task execution. Special emphasis should be on assessment of the candidate's ability to troubleshoot and solve problems related to the tasks. During the viva voce, focus should be on assessment of candidate's communication skills and understanding of the subject.

Project Work: Project work is a great way to assess the practical skills on a certain period or timeline. Projects should simulate real-world scenarios, allowing students to solve problems or create something tangible using the skills and knowledge they've acquired. Projects should align with the curriculum's learning objectives, ensuring that students are applying relevant concepts and skills. Clear and detailed guidelines, including project objectives, evaluation criteria, and deadlines should be provided by the teachers/assessors. Rubrics, which would include aspects like content, creativity, organization, presentation, and adherence to deadlines, should be used by the Assessors to establish specific criteria for marking or grading.

Field visits can be followed by the submission of reports by the students, based on checklist. Teachers will develop a detailed checklist of items or questions students need to address during the visit. This could include specific observations, data collection, interviews, etc. Teachers will assess the reports based on the completeness of checklist items, depth of observations, analysis, and overall presentation. After the visit, teachers will also encourage students to reflect on their field experience, for example what students learned, how will they apply the knowledge gained through the field visit, etc.

Student Portfolio is a compilation of documents that supports the students' claim of competence. Documents may include reports, articles, and photos of products prepared by students in relation to the unit of competency. Copies of certificates and awards received for academic achievements, extracurricular activities, or competitions may also be included in the portfolio. Student's portfolio may also include personal reflections of the students on their learning journey, challenges faced, and lessons learned.

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.

5. UNIT CONTENTS

GRADE 11

Part A: Employability Skills

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

UNIT 1: COMMUNICATION SKILLS – III			
Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 hrs)**
1. Demonstrate the knowledge of communication.	1. Introduction to the communication process. 2. Importance of communication. 3. Elements of communication. 4. Perspectives in communication. 5. Effective communication.	1. Role-play on the communication process. 2. Group discussion on the importance of communication and factors affecting perspectives in communication. 3. Charts preparation on elements of communication. 4. Classroom discussion on the 7Cs (i.e. Clear, Concise, Concrete, Correct, Coherent, Courteous and Complete) for effective communication.	03
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
5. 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

6. Demonstrate the knowledge of saying no.	1. Steps for saying 'No' Connecting words.	1. Group discussion on how to say 'No'?	02
7. Identify and use parts of speech in writing.	1. Capitalization. 2. Punctuation. 3. Basic parts of speech Supporting parts ofspeech.	1. Group activity on identifying 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
8. Write correct sentences and paragraphs.	1. Parts of a sentence. 2. Types of object. 3. Types of sentences Paragraph.	1. Activity on framing sentences. 2. Activity on active and passive voice. 3. Assignment on writing different types of sentences.	02
9. Communicate with people.	1. Greetings 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
10. Introduce yourself to others and write about oneself.	1. Talking about self Filling a form.	1. Practicing self-introduction and filling up forms. 2. Practicing self-introduction to others.	01
11. 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
12. Communicate information about family to others.	1. Names of relatives Relations.	1. Practice talking aboutfamily. 2. Role-play on talking about family members.	01

13. Describe habits and routines.	1.Concept of habits and routines.	1. Group discussion on habits and routines. 2. Group activity on describing routines.	01
14. Ask or give directions to others.	1. Asking for directions 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 analyze own strengths and weaknesses.	1. Understanding self. 2. Techniques for identifying strengths and weaknesses. 3. Difference between interests and abilities.	1. Activity on writing aimsin life. 2. Preparing a worksheet on interests and abilities.	03
2. Demonstrate personal grooming skills.	1. Guidelines fordressing 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 team work.	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 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 Setting SMART goals.	1. Assignment on setting SMART goals. 2. Activity on developinglong-term and short- term goals using SMART method.	03
8. Apply time management strategies and techniques.	1. Meaning and importance of time management Steps for effective time management.	1. Preparing a checklist ofdaily activities.	03
		Total	**25**

UNIT 3: INFORMATION AND COMMUNICATION TECHNOLOGY-III			
Learning Outcome	**Theory (08 hrs)**	**Practical (12 hrs)**	**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 afile 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 functionsfor saving, closing and printing documents in LibreOffice Writer. 2. Group activity on performing the functions 3. 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, and Paste, 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 Autocorrect.	1. Group activity on checking spellings andgrammar using LibreOffice Writer. 2. Group activity on checking spellings and grammar 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 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 pagenumber Page count.	1. Practical exercise of inserting header, footerand page numbers in LibreOffice Writer. 2. Practical exercise of inserting header, footerand page numbers in Microsoft Word.	03

8. Make changes by using the track change option in aword document.	1. Tracking option. 2. Manage option Compare documents.	1. Group activity on performing track changes in LibreOfficeWriter. 2. Group activity on performing track changes in Microsoft Word.	04
		Total	**25**

4: ENTREPRENEURSHIP SKILLS – 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 ofvalue. 2. Values of an Entrepreneur. 3. Case study on qualities of an entrepreneur.	1. Role-play on qualities of an entrepreneur.	03
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 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 businessideas.	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 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 Skills

No.	Units	Duration(Hrs.)
1.	Unit 1: Introduction to Solar PV Installer -Civil	20
2.	Unit 2: Basics of Solar Photovoltaic System	55
3.	Unit 3: Tools and Tackles used in solar PV Installation	25
4.	Unit 4: Fundamentals of Civil Engineering for Solar PV Installer	65
	Total	**165 hrs**

UNIT 1: INTRODUCTION TO SOLAR PV INSTALLER -CIVIL			
Learning Outcome	**Theory** *(20 Hrs.)*	**Practical** *(40 Hrs.)*	**Duration** *(60 Hrs)*
1. Explain the classification of energy and its sources.	1. Introduction of energy (Renewable energy and non-renewable energy). 2. Various types of Renewable energy and Non-renewable energy sources 3. Advantages and Disadvantages of Renewable energy and Non-renewable energy.	1. Observe and enlist the sources of energy around yourself. 2.Classify the above enlisted sources of energy into renewable and non-renewable energy. 3. Collect and paste pictures of different renewable and non-renewable energy sources.	05
2. Explain the significance of solar energy as a sustainable energy source.	1. Introduction to Solar Energy as a renewable energy source. 2. Environmental and economic benefits of solar energy. 3. Relevance of solar energy in addressing global energy demands. 4. Advantages of solar energy over other renewable energy sources.	1. Conduct a group discussion on significance of solar energy as a renewable resource. 2. Enlist various applications of solar energy in different sectors.	05
3. Understand the history and future scope of Solar PV in energy sector.	1. Introduction to Solar PV system. 2. History and evolution of Solar PV technology. 3. Identify the future scope of Solar PV	1. Group Discussion on the chronological development of Solar PV technology. 2. Visit to Solar PV system on site and observe it carefully.	05

	system. 4. Need for training in the Solar energy sector.	3. Enlist the components and discuss about the same.	
4. Discuss the role of Solar PV Installer- Civil.	1. Role and Responsibilities of a Solar PV Installer- Civil.	1. Visit the Solar PV installation site, observe the ongoing work, and engage in a conversation with the workers to understand the different job roles and their respective responsibilities.	02
5. Discuss the job opportunities for a Solar PV Installer - Civil.	1. Career opportunities for a Solar PV Installer Civil.		03
		Total	**20**
UNIT 2: BASICS OF SOLAR PHOTOVOLTAIC SYSTEM			
1. Understand the movement of the sun and its effect on the performance of the solar plant.	1. Understanding the movement of the sun. 2. Analyzing the impact of the sun's daily movement on electricity generation in solar panels. 3. Various Instrument used for tracking movement of the sun.	1. Conduct a group discussion on use of various instruments for tracking movement of sun.	02
2. Explain basic terminologies used in Solar Industry.	1. Basic terminologies used in Solar Industry. 2. Various terms used in Solar PV system - Direct Normal Irradiance (DNI), Diffuse Horizontal Irradiance (DHI), Global Horizontal Irradiance (GHI), Solar Altitude Angle etc.	1. Use a flashlight to simulate the sun and measure how the light intensity changes as it moves closer or farther from a surface, relating to Direct Normal Irradiance (DNI). 2. Take students outside the classroom to measure the length of shadows at different times of the day, helping them understand solar altitude and its effect on sunlight. 3. Create a chart showing how sunlight changes during the day and explain how it affects solar panels' energy generation.	06

3. Discuss the types of solar modules (panel) and its types.	1. Types of Solar Panels such as Monocrystalline Solar Panels, Polycrystalline Solar Panels, Thin-Film Solar Panels, Bifacial Solar Panels, Concentrated Photovoltaic (CPV) Panels and Building-Integrated Photovoltaics (BIPV). 2. Application of different types of solar panels.	1. Identify different types of Solar Panels. 2. Collect reading from various sites having different types of solar panels and analyze the data obtained. 3.Compare the efficiency of various types of solar panels.	08
4. Describe the components used in Solar PV system.	1. Components of a Solar PV System - Solar Panels, Inverter, Mounting Structures, Battery Storage, Charge Controller Cables, Wiring Junction Box and Monitoring System.	1. Identify various Components of a Solar PV System. 2. Visit to a Solar PV station and draw a block diagram of the connection made between the components of solar PV system.	10
5. Explain the Module Mounting Structure (MMS) and its types.	1. Introduction to Module Mounting Structures (MMS). 2. Types of Module Mounting Structures (MMS). 3. Materials Used in MMS. 4. Effect of wind on various Module Mounting structures (MMS).	1. Identify different types of Modules Mounting Structures (MMS). 2. Conduct a group discussion on the comparison of different MMS and make a list of pros and cons of each.	08
6. Understand and interpret the manufacturing data specification sheets.	1. Key sections of a specification sheet which includes electrical parameters, mechanical parameters, and environmental specifications. 2. Key Terms and Parameters such as Nominal Power, Open	1. Collect manufacturing data specification sheets from two different Solar PV station and analyze the data of both the stations. 2. Conduct a group discussion and compare the key parameters of both the stations.	04

	Circuit Voltage (Voc), Short Circuit Current (Isc), Temperature Coefficient etc.		
7. Explain role and types of inverter, cables and conduits, earthing system and lighting arrester used in the setup for Solar PV setup.	1. Role and Types of Inverters in Solar PV Systems. 2. Cables and Conduits used in Solar PV Systems with its types. 3.Earthing System in Solar PV Setup. 4. Lighting Arresters in Solar PV Systems.	1. Identify different types of Inverters. 2. Visit to a Solar PV site and note down the specifications of each of the components such as Cables (diameter, type), lighting arresters etc.	07
8. Describe various types of solar PV systems.	1. Introduction to various Solar PV systems such as On-grid, Off-grid, and Hybrid systems. 2. Advantages and disadvantages of a solar PV system: On-grid, Off-grid and Hybrid system. 3. Conversion of the Off-grid system into the On-grid system.	1. Visit a Site with On-Grid, Off-Grid, and Hybrid Solar PV Systems. 2. Conduct a Group Discussion on the differences Between On-Grid, Off-Grid, and Hybrid Solar PV Systems 3. Compare the Advantages and Disadvantages of On-Grid, Off-Grid, and Hybrid Systems.	10
		Total	**55**
UNIT 3: TOOLS AND TACKLES USED IN SOLAR PV INSTALLATION			
1. Discuss various mechanical and electrical tools used for solar PV installation.	1. Mechanical tools used in the solar PV system installation - spanner, drill machine, hammer, chisel, grinder, torque wrench, Allen keys, saw, power drill, scrapers, screwdriver etc. 2. Electrical tools used in Solar PV System such as Multimeter, Clamp meter, Irradiance meter,	1. List and identify the various mechanical and electrical tools. 2. Handling of the different mechanical and electrical tools. 3. Do the operations like cutting, spanning, drilling, hammering etc.	10

	Insulation tester, Battery Operated drills, cables, wires, pliers, Mager etc.		
2. Discuss the basic tools and tackles required for civil works in Solar PV Installation.	1. Civil tools used in the solar system – line Dori, pickaxe, spud, mortar pan, spade, water level pipe, crowbar, pliers etc. 2. Use of different marking tools such as measuring steel tape, compass, measurement level, marking thread, angle finder tape and spirit level.	1. Marking of a right-angle triangle using 3-4-5 technique. 2. Using a Line Dori for Marking Solar Panel Layouts. 3. Demonstrate the Use of a Spade and Pickaxe for Ground Preparation. 4. Show students how to use a compass to orient solar panels correctly according to the sun's path. 5. Students practice marking straight lines for panel placement using marking thread, then check the level using a spirit level to ensure accuracy.	10
3. Explain the safety procedure to be followed while handing various tools used in civil works.	1. Handling specific tools safely. 2. Maintenance and Storage of tools. 3. Worksite Safety Protocols	1. Practice Safe Tool Storage and Maintenance in your laboratory.	05
		Total	**25**
UNIT 4: Fundamentals of Civil Engineering for Solar PV Installer			
1. Explain concrete and its types.	1. Introduction to concrete and its components. 2. Types of concrete and its application.	1. Identify different components of a concrete.	05
2. Describe various grades of concrete.	1. Introduction to concrete grades. 2. Properties and applications of different grades of concrete.	1. Identification of various concrete grades. 2. Mixing and testing of grade-specific strength. 3. Group discussion on selecting appropriate grades for projects.	06

3. Discuss the importance of water cement ratio in concrete.	1. Definition of water-cement ratio. 2. Effect of improper ratios on the strength of concrete.	1. Demonstrating mix designs with different water-cement ratios. 2. Group discussion on the role of water-cement ratio in durability of concrete.	05
4. Explain the workability of concrete and tests used to check the workability.	1. Definition and factors affecting workability. 2. Different test to determine the workability.	1. Conducting slump test, compaction factor test, and Vee-Bee test. 2. Site visit to observe workability in practice.	10
5. Explain the basics of concrete mix design.	1. Principles of mix design. 2. IS code provisions and steps in mix design.	1. Making of different mixes of concrete using different proportions of Cement, Sand and Aggregate (Nominal Mixes).	05
6. Describe the importance of curing of concrete.	1. Definition and methods of curing. 2. Impact of improper curing on strength of concrete.	1. Demonstrating curing methods like water curing, steam curing, etc. 2. Site visit to observe curing practices.	05
7. Understand the importance of Basic Indian Standard Codes used for structural design.	1. Importance of Basic Indian Standard Codes Used for Structural Design.	1.Enlist various codes of structural design and its usage in civil engineering work. 2. Conduct a Group discussion on the code relevant to the design of concrete structures.	03
8. Explain the types of reinforcing steel with its grade.	1. Types of steel (mild, HYSD, TMT) 2. Properties of various grades of steel.	1. Identifying steel grades by visual inspection and testing. 2. Measuring properties like yield strength etc. 3. Site visit to study reinforcement placement.	05
9. Discuss the anchoring in structures.	1. Introduction to anchoring and its Importance. 2. Types and methods of anchoring. 3. Need of anchoring of structures in Solar PV system installation.	1. Demonstrating mechanical and chemical anchoring techniques. 2. Group discussion on various methods used for anchoring the structures.	08

10. Understand about prefabricated structures.	1. Definition and benefits of prefabrication. 2. Types of prefabricated elements.	1. Assembling prefabricated components. 2. On-site visit for a prefabricated structured Solar PV system.	07
11. Discuss the civil work required for different types of mounting structures.	1. Civil work required for the different types of mounting structures.	1. Visit the Solar PV installation site and observe the civil works ongoing for different types of mounting structures.	06
		Total	**65**

GRADE XII

Part A: Employability Skills

S.No.	Units	Duration (hrs)
1.	Communication Skills- IV	25
2.	Self-management Skills - IV	25
3.	Information and Communication Technology Skills - IV	20
4.	Entrepreneurial Skills – IV	25
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	1. Group practice on identifying parts of speech. 2. Group practice	10

	speech.	on constructing sentences.	
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. • 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	1. Steps towards self-awareness. 2. Personality and	1. Group discussion on self-awareness. 2. Group discussion on	10

basic personality traits, types and disorders.	basic personality traits. 3. Common personality disorders- • Suspicious • Emotional and impulsive • Anxious. 4. Steps to overcome personality disorders.	common personality disorders. 3. Brainstorming steps to overcome personality disorder.	
		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. 2. Selecting multiple cells. 3. Saving the spreadsheet in various formats. 4. Closing the spreadsheet. 5. Opening the spreadsheet. 6. Printing the spreadsheet.	1. Group activity on working with data on LibreOffice Calc.	03
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 text colour.	1. Group activity on working with font styles in LibreOffice Impress.	04
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.	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	10

	6. Roles and functions of an entrepreneur. 7. What motivates an entrepreneur. 8. Identifying opportunities and risk-taking. 9. Startups.	types of entrepreneurs. 4. Brainstorming activity on what motivates an entrepreneur.	
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- positive attitude, stress management. 5. Perseverance. 6. Organizational skills- time management, goal setting, efficiency, managing quality.	1. Playing games, such as "Who am I". 2. Brainstorming a business idea. 3. Group practice on "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.	05
		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	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.		
3. State the importance of green jobs.	1. Importance of green jobs in • Limiting greenhouse gas emissions • Minimizing 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 minimizing waste and pollution.	07
		Total	**15**

Part B: Vocational Skills

S.No.	Units	Duration
1	Unit 1: Site Survey for Solar PV Installation	45
2	Unit 2: Civil works required for Solar PV Installation	95
3	Unit 3: Health and Safety	25
	Total	**165**

UNIT 1: SITE SURVEY FOR SOLAR PV INSTALLATION			
Learning Outcome	**Theory** ***(30Hrs)***	**Practical** ***(30Hrs)***	**Duration(60 Hrs)**
1. Explain the purpose and importance of site investigation in solar panel installation.	1. Purpose of site investigation 2. Importance of site investigation in solar PV installation. 3. Important Parameters to be calculated or checked such as orientation, angle of tilt of panels etc. while site investigation for Solar PV	1. Case study on site investigation reports of different Solar PV stations. 2. Group discussion on common challenges in site investigation. 3. Visit to a solar PV	10

	system installation. 3. Factors affecting site suitability.	site to observe site conditions.	
2. Identify the load to be connected to the Solar PV system.	1. Types of loads (residential, commercial, industrial). 2. Load calculation methods. 3. Peak and off-peak load management.	1. Load calculation for a sample solar PV system. 2. Group activity to design load distribution for different scenarios. 3. Field visit to observe load management in operational systems.	20
3. Discuss site investigation procedures.	1. Steps of site investigation. 2. Importance of Soil testing, shading and role of wind load. 3. Use of tools and equipment for site assessment.	1. Site Survey on various Solar PV stations to observe shading at peak and off-peak time. 2. Group discussion on improving site investigation techniques. 3. Practical site visit to conduct a basic site investigation.	15
		Total	**45**
UNIT 2: CIVIL WORKS REQUIRED FOR SOLAR PV INSTALLATION			
1. Understand different types, sizes and specifications of foundations/footings.	1. Introduction to Foundation. 2. Types of foundation. 3. Selection of foundation for a suitable structure required for Solar PV system.	1. Identifying types of foundations on-site. 2. Measuring and inspecting foundation dimensions.	10
2. Select the right footing/foundation as per site location including suitability of roof condition or suitability of soil.	1. Site assessment for the roof conditions. 2. Site assessment for foundation selection. - Soil conditions and load-bearing capacity.	1. Group activity on foundation selection for specific site scenarios. 2. Field visit to observe footing construction.	15
3. Discuss the civil foundation works required as per the mounting structures.	1. Types of mounting structures. 2. Foundation design for solar PV mounting systems. 3. Connections required between the mounting structures and foundation.	1. Preparing a sample foundation layout for a mounting structure. 2. Group discussion on challenges in foundation preparation.	15
4. Interpret the Single Line diagram, Layout Diagrams, required for civil works.	1. Understanding Single Line Diagrams (SLD). 2. Layout diagram elements and	1. Reading and interpreting SLD and layout diagrams.	15

	their significance.	2. Creating a sample SLD for a solar installation.	
5. Discuss about Structural supports and material handling.	1. Types of structural supports and their importance. 2. Basics of material handling.	1. Demonstration of structural support installation. 2. Hands-on practice in material handling techniques.	20
6. Understand the DO's and Don'ts of material handling.	1. Guidelines for material handling. 2. Common errors and their consequences.	1. Role-play exercises to demonstrate proper material handling. 2. Site visit to observe material handling in practice.	10
7. Describe the quality check procedure for the foundation and mounting structures.	1. Steps in quality control for foundations. 2. Checklist for inspecting mounting structures.	1. Conducting a quality inspection for a sample foundation. 2. Field exercise to evaluate mounting structure quality.	10
8. Cost Economics of installation of Solar PV system of a particular load.	1. Cost analysis for the installation of Solar PV system of a particular load. 2. Various new models (RESCO, COPEX etc.) involved in the Solar PV installation.	1. Cost estimation for installation of 3 kW solar power plant.	
		Total	**95**
UNIT 3: HEALTH AND SAFETY			
1. Explain the toolbox and different types of hazards in the civil installation.	1. Tools box talk- talking about safety at work, identifying the hazards of 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 different safety practices.	1. Importance of PPE kit, - demonstration of gathering points and different safety measures - CPR, - first aid, practice - evacuation plant 2. Safety regulation industrial and construction safety act	1. Demonstrate how to use a PPE kit and its Importance. 2. Demonstration of First aid box. 3. Demonstration of CPR.	08

	and practice.		
3. Describe different types of safety tools	1. Head Protection (helmet) and its types, gloves, shoe, apron, harness etc. 2. First aid and its usage. 3. Hazard sign boards: • Electrical hazard sign boards • Precaution signboard • Safety measures Signboard • Emergency signboard 4. Hazard identification a. Fire hazard (Types and use of fire extinguishers) b. fire exit plan. 5. Work at height hazard - use of safety harness.	1. Mock Practice of using first aid. 2. Make a chart and poster of different hazard sign and emergency sign 3. Identification of different components of fire extinguisher. 4. Operate and handling of fire extinguisher. 5. Operate the safety harness during work at a height.	08
4. Understand Occupational health & Safety standards and regulations for installation of Solar PV system.	1. Overview of Occupational Health & Safety (OHS) standards. 2. Safety regulations specific to solar PV installations.	1. Demonstration of proper use of PPE kit during installation. 2. Role-playing safety scenarios and emergency procedures. 3. Site visit to observe OHS practices in action.	04
		Total	**25**

6. ORGANISATION OF FIELD VISITS

In a year, at least 3 field visits/educational tours should be organized for the students to expose them to the activities in the workplace. Visit a Solar PV Station site and observe the following:

1. Location: Describe the location and accessibility of the site.
2. Site: Note the layout and size of the area designated for the Solar PV installation.
3. Construction Site: Observe and describe ongoing construction activities.
4. Foundation and Footing: Observe the type of foundation (e.g., concrete or pile) and its depth for stability.
5. Mounting Structures: Identify the type of structure supporting the panels.
6. Solar Panels: Note the type of panels (monocrystalline, polycrystalline, or thin-film) and their efficiency.
7. Panel Arrangement: Check the orientation (landscape/portrait) and spacing between rows to minimize shading.

8. Electrical Infrastructure: Look for the types of cables used (AC/DC) and how they are routed (underground/overhead).
9. Inverter System: Identify the type of inverter (string, central, or micro) and its location on-site.
10. Energy Storage: Examine the presence and capacity of battery systems for storing electricity.
11. Grounding System: Verify the grounding system used to prevent electrical hazards.
12. Site Conditions: Observe soil type and site preparation activities like leveling and clearing.

In addition to the technical and detailed observations mentioned earlier, some key additional observations to include are:

1. Type of project (Residential/Commercial)
2. Technology adopted for Solar PV installation
3. Manpower engaged (Number and roles)
4. Total expenditure of the project
5. Expected total annual income from the installation

7. LIST OF EQUIPMENTS 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. Following are the basic list of equipment and materials required:

S.No.	Equipment & Materials	Quantity	Cost
For Civil Works			
1.	Measuring Tape	2 No.	₹300
2.	Spirit Level	2 No.	₹600
3.	Adjustable Wrench	2 No.	₹250
4.	Hammer	2 No.	₹500
5.	Pliers (Combination)	2 No.	₹400
6.	Utility Knife	2 No.	₹200
7.	Tape Measure	2 No.	₹300
8.	Spanner Set	2 No.	₹800
9.	Allen Wrench Set	2 No.	₹500
10.	Shovel (Small)	2 No.	₹700
11.	Hand Trowel	2 No.	₹400
12.	Handsaw	2 No.	₹1000
13.	Crowbar	1 No.	₹1600
14.	Sledge Hammer	1 No.	₹2000
15.	Cement Bag	50 kg (1 bag)	₹ 400
16.	Coarse Aggregates (per cu. m)	Per cubic meter	₹ 900
17.	Sand	Per cu. ft.	₹800
18.	Water as required	-	-
19.	Clamp (C-Clamp)	2 No.	₹600
20.	Saw Blade (For basic cutting)	2 No.	₹800
21.	Small Bucket (For mixing)	2 No.	₹200

For Solar Works			
22.	Solar Panel Mounting System	1 Set	₹15,000
23.	Solar Panels for Demonstration	1 No.	₹8,000
24.	Solar Panel Mounting Brackets	10 No.	₹1000
25.	Solar Panel Clips	10 No.	₹500
26.	Solar Cable Connectors	10 No.	₹300
27.	Mounting Rails	10 meters	₹1000
28.	Solar Panel Support Blocks	10 No.	₹1000
29.	Fasteners (Nuts, Bolts, Washers)	10 sets	₹1000
30.	PVC Pipes (For conduits)	10 meters	₹250
31.	Cable Ties	1 pack	₹500

Note: This list provides a general idea of basic quantities required and its pricing, but actual rates can vary based on location, brand, and quality of tools.

8. VOCATIONAL TEACHER'S AND TRAINERS' 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:

Qualification	Minimum Competencies	Age Limit
Graduation in Civil Engineering from a recognized Institute /University, with at least 1-year work / teaching experience **OR** Diploma in Civil engineering with 2-year work / teaching experience **OR** B.Voc in Construction sector with at least 1 year work / teaching experience.	Effective communication skills (oral and written) Basic computing skills.	18-37 years (as on Jan. 01 (mention the year)) Age relaxation to be provided as per Govt. rules.

These guidelines have been prepared with the aim of helping and guiding the States in engaging qualified Vocational Teachers/Trainers in schools. Various parameters that need to be considered while engaging Vocational Teachers/Trainers include the mode and procedure of selection, 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 Samagra Shiksha in the following ways:

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

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 organizations 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.

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 organize 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. Following parameters may be considered during the appraisal process:

1. Participation in guidance and counseling activities conducted at Institutional, District and State level;
2. Adoption of innovative teaching and training methods;
3. Improvement in result of vocational students of Class X or Class XII;
4. Continuous up-gradation of knowledge and skills related to the vocational pedagogy, communication skills and vocational subject;
5. Membership of professional society at 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. Organization of activities for promotion of vocational subjects;
11. Involvement in placement of students/student support services.

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