

SOLAR PANEL INSTALLATION TECHNICIAN

CLASS – XI

PAPER – I					
(Theory & Practical)					
Full Marks : 50					
Part	Unit & Topic		No. of Theory Classes	No. of Practical Classes	Maximum Marks
Part - A	Employability Skills				
	Unit - 1	Communication Skills - III	10	3	10
	Unit - 2	Self-management Skills - III	10	3	
	Unit - 3	Information & Communication Technology Skills - III	10	4	
Part – B	Vocational Skills				
	Unit - 1	Introduction to Solar Energy	15	10	40
	Unit - 2	Major Components of Solar Power System	15	10	
		Total	60	30	50
Part - C	Practical Work				
		Practical Examination			20
		Written Test			15
		Viva Voce			10
		Record			05
		Total			50
		Grand Total			100

PAPER – II					
(Theory & Practical)					
Full Marks : 50					
Part	Unit & Topic		No. of Theory Classes	No. of Practical Classes	Maximum Marks
Part - A	Employability Skills				
	Unit - 1	Entrepreneurship Development Skills - III	10	9	10
	Unit - 2	Green Skills - III	10	9	
Part – B	Vocational Skills				
	Unit - 1	Tools for Solar PV systems Installations	24	15	40
	Unit - 2	Work and Health Safety	16	12	
		Total	60	30	50

Part - C		Practical Work			
		Practical Examination			20
		Written Test			15
		Viva Voce			10
		Record			05
		Total			50
		Grand Total			100

PAPER – I(Theory)

PART A: EMPLOYABILITY SKILLS

Unit – I: Communication Skills - III

- ☞ Introduction to communication process, Importance of communication, Elements of communication, Perspectives in communication, Effective communication.
- ☞ Verbal communication, Public Speaking.
- ☞ Importance of non- verbal communication, Types of non-verbal communication, Visual communication.
- ☞ Pronunciation basics, Speaking properly, Phonetics, Types of sounds.
- ☞ Important communication styles, Assertive communication, Advantages of assertive communication, Practicing assertive communication.
- ☞ Steps for saying 'No', Connecting words.
- ☞ Capitalization, Punctuation, Basic parts of speech, Supporting parts of speech.
- ☞ Parts of a sentence, Types of object, Types of sentences, Paragraph.
- ☞ Greetings, Introducing self and others.
- ☞ Talking about self, Filling a form.
- ☞ Main types of questions, Forming closed and open-ended questions.
- ☞ Names of relatives, Relations.
- ☞ Concept of habits and routines.
- ☞ Asking for directions, Using landmarks.

Unit - 2: Self-management Skills - III

- ☞ Understanding self, Techniques for identifying strengths and weaknesses, Difference between Interests and abilities.
- ☞ Guidelines for dressing and grooming, Preparing a personal grooming checklist.
- ☞ Importance of personal hygiene, Three steps to personal hygiene, Essential steps of hand washing.
- ☞ Describe the benefits of teamwork, Working in a team.
- ☞ Benefits of networking skills, Steps to build networking skills.
- ☞ Meaning of self-motivation, Types of motivation, Steps to building self- motivation.
- ☞ Meaning of goals and purpose of goal- setting, Setting SMART goals.
- ☞ Meaning and importance of time management, Steps for effective time management.

Unit – 3: Information & Communication Technology Skills – III

- ☞ Introduction to ICT, Advantages of using a word processor, Work with LibreOffice Writer.

- ☞ Status bar, Menu bar, Icons on the Menu bar, Multiple ways to perform a function.
- ☞ Save a word document, Close a word document, Open an existing document, Print.
- ☞ Change style and size of text, Align text, Cut, Copy, Paste, Find and replace.
- ☞ Use of spellchecker, Autocorrect.
- ☞ Insert bullet list, Number list, Tables, Pictures, Shapes.
- ☞ Insert header, Insert footer, Insert page number, Page count.
- ☞ Tracking option, Manage option, Compare documents.

PART B: VOCATIONAL SKILLS

Unit – 1: Introduction to Solar Energy

- ☞ Introduction of energy (Renewable energy and non-renewable energy), Various types of Renewable energy, Advantages of solar energy and other Renewable energy sources, Fundamental of electricity.
- ☞ Solar energy, Various applications of solar energy (thermal and PV energy), Differentiate between energy coming from the sun – thermal and PV energy, Solar geometry and radiations.
- ☞ History and evolution of Solar PV technology, Identify the future scope of solar PV, Need for training in the solar energy sector.
- ☞ 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.

Unit 2: Major Components of Solar PV System

- ☞ Solar panels, types and their capacity, size, specification, Differentiate between different types of solar panel.
- ☞ Discuss the fabrication structure of the solar module(components).
- ☞ Mounting structure and its different types, material, and accessories, system tracking-daily and seasonal, automatic and manual, Different types of fastening accessories are used in the mounting structure.
- ☞ Power conditioning units and their components
 - MPPT
 - Charge controller
- ☞ Inverters – its different types, advantages of inverters, Circuit diagram of inverter connection.
- ☞ Types of battery, Battery energy storage and its condition, DOD(depth of discharge), SOC(state of charge), Rating of the battery according to hours.
- ☞ Describe the various types of cable and wire
 - DC cable,
 - AC cable.
- ☞ Importance of earthing systems and their types,
 - maintenance-free/ chemical earthing system,
 - earthing electrode,
 - earthing back-fill compound,Lightning arrester and its uses and importance.
- ☞ Conduit and its types, cable dressing accessories - cable and conduit gland, cable tie and

its types, cable and conduit clips, lugs - aluminium and copper.

PAPER – I(Practical)

PART A: EMPLOYABILITY SKILLS

Unit – I: Communication Skills - III

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.
5. Role-play of a phone conversation.
6. Group activity on delivering a speech and practicing public speaking.
7. Role-play on non- verbal communication.
8. Group exercise and discussion on Do's and Don'ts to avoid body language mistakes.
9. Group activity on methods of communication.
10. Group activities on practicing pronunciation.
11. Group discussion on communication styles.
12. Group discussion on observing and sharing communication styles.
13. Group discussion on how to say 'No'.
14. Group activity on identifying parts of speech.
15. Writing a paragraph with punctuation marks.
16. Group activity on constructing sentences.
17. Group activity on identifying parts of speech.
18. Activity on framing sentences.
19. Activity on active and passive voice.
20. Assignment on writing different types of sentences.
21. Role-play on formal and informal greetings.
22. Role-play on introducing someone.
23. Practice and group discussion on how to greet different people.
24. Practicing self- introduction and filling up forms.
25. Practicing self- introduction to others.
26. Practice exercise on forming questions.
27. Group activity on framing questions.
28. Practice talking about family.
29. Role-play on talking about family members.
30. Group discussion on habits and routines.
31. Group activity on describing routines.
32. Role-play on asking and giving directions.
33. Identifying symbols used for giving directions.

Unit - 2: Self-management Skills - III

1. Activity on writing aims in life.

2. Preparing a worksheet on interests and abilities.
3. Role-play on dressing and grooming standards.
4. Self-reflection activity on various aspects of personal grooming
5. Role-play on personal hygiene.
6. Assignment on personal hygiene.
7. Assignment on working in a team.
8. Self-reflection on team work.
9. Group activity on networking in action.
10. Assignment on networking skills.
11. Activity on staying motivated.
12. Assignment on reasons hindering motivation.
13. Assignment on setting SMART goals.
14. Activity on developing long - term and short-term goals using SMART method.
15. Preparing a checklist of daily activities.

Unit – 3: Information & Communication Technology Skills – III

1. Demonstration and practice of the following:
 - Creating a new document
 - Typing text
 - Saving the text
 - Opening and saving file on Microsoft Word/LibreOffice Writer.
2. Group activity on using basic user interface of LibreOffice writer.
3. Group activity on working with Microsoft Word.
4. Group activity on performing the functions for saving, closing and printing documents in LibreOffice Writer.
5. Group activity on performing the functions for saving, closing and printing documents in Microsoft Word.
6. Group activity on formatting text in LibreOffice Writer.
7. Group activity on formatting text in Microsoft Word.
8. Group activity on checking spellings and grammar using LibreOffice Writer.
9. Group activity on checking spellings and grammar using Microsoft Word.
10. Practical exercise of inserting lists and tables using LibreOffice Writer.
11. Practical exercise of inserting header, footer and page numbers in LibreOffice Writer.
12. Practical exercise of inserting header, footer and page numbers in Microsoft Word.
13. Group activity on performing track changes in LibreOffice Writer.
14. Group activity on performing track changes in Microsoft Word.

PART B: VOCATIONAL SKILLS

Unit – 1: Introduction to Solar Energy

1. List the various types of renewable energy and non-renewable energy source.
2. Preparing chart and poster.
3. Sketch different energy sources.
4. Measurements of electrical quantities.
5. Identification and use of basic electrical tools.

6. Make a list of various applications and solar radiation instruments.
7. Collect the solar radiation data in your location.
8. Use of pyranometer.
9. List the chronological development of solar PV technology.
10. Make a chart or poster/ block diagram of solar energy generation.
11. Make a presentation on the Current status of energy generation in India.

Unit 2: Major Components of Solar PV System

1. Make a chart of different types of solar panels according to
 - efficiency,
 - size,
 - capacity,
 - specification.
2. Identify the types solar panel.
3. Identify the various layers of solar panel and draw it.
4. Identify the different types of mounting structures and accessories.
5. Make a list of daily, seasonal, automatic, and manual tracking system.
6. Identify the different types of fastening accessories.
7. Sketch different types of fastening accessories.
8. Identify the power conditioning unit and its components.
9. Identify the various types of inverter.
10. Operate the inverter as per the instruction manual.
11. Identify the operating function of the inverter.
12. Identify the component of the battery
 - terminals,
 - Cells,
 - electrolyte,
 - packing
13. Reading of specification sticker paste on the battery body.
14. Identification of single and multi-core cable.
15. Make a chart of different types of cables according to gauge and their material.
16. Visit the solar PV site and check the earthing system.
17. Measure earthing resistance with an earth tester.
18. Identify the components of the lightning arrestor.
19. Draw the line diagram of earthing.
20. Identify the different types of conduit cable.
21. Make a list of different types of conduit cable.

PAPER – II (Theory)

PART A: EMPLOYABILITY SKILLS

Unit – I: Entrepreneurship Development Skills - III

- ☞ Introduction to entrepreneurship, Types of business activities.
- ☞ Meaning of value, Values of an Entrepreneur, Case study on qualities of an entrepreneur.

- ☞ Difference between the attitude of entrepreneur and employee.
- ☞ Problems of entrepreneurs, Problem-solving, Ways to think like an entrepreneur.
- ☞ The business cycles, Principles of idea creation, Generating a business idea, Case studies.
- ☞ Understanding customer needs, Conducting a customer survey.
- ☞ Importance of business planning, Preparing a business plan, Principles to follow for growing a business, Case studies.

Unit – 2: Green Skills – III

- ☞ Meaning of eco-system, food chain and sustainable development, Main sectors of the green economy- E- waste management, green transportation, renewal energy, green construction, and water management.
- ☞ Policies for a green economy.
- ☞ Stakeholders in the green economy.
- ☞ Role of the government in promoting a green economy, Role of private agencies in promoting green economy.

PART B: VOCATIONAL SKILLS

Unit - 1: Tools for Solar PV systems installations

- ☞ Mechanical tools used in the solar PV system installation - spanner, drill machine, hammer, chisel, grinder, torque wrench, LN keys, saw, power drill, scrapers, screwdriver.
- ☞ Electrical tools used in the solar system – multimeter, clamp meter earth tester/megger, Wire stripper, tester electrical insulator, pliers, crimper.
- ☞ Safety tools used in the solar system – personnel protective equipment kit (PPEKIT).
- ☞ Marking tools used in the solar system - compass, measurement level, marking thread, angle finder tape, spirit level.
- ☞ Civil tools used in the solar system – linedori, pickaxe, spud, mortar pan, spade, water level pipe, crowbar, pliers.
- ☞ Electrical parameters- voltage, AC and DC, earthing, power factor, frequency, resistance.
- ☞ 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.

Unit - 2: Work and health safety

- ☞ 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.
- ☞ Importance of PPE kit,
 - demonstration of gathering points and different safety measures
 - CPR,
 - First-aid, practice
 - Evacuation plantSafety regulation - industrial and construction safety act and practice.
- ☞ 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 sign board,
- 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

PAPER – II (Practical)

PART A: EMPLOYABILITY SKILLS

Unit – I: Entrepreneurship Development Skills - III

1. Role-play on different kinds of businesses around us.
2. Role-play on qualities of an entrepreneur.
3. Interviewing employees and entrepreneurs.
4. Group activity on identifying and solving problems.
5. Brainstorming on generating a business ideas.
6. Group activity to conduct a customer survey.
7. Group activity on developing a business plan.

Unit – 2: Green Skills – III

1. Group discussion on sectors of green economy.
2. Poster making on various sectors for promoting green economy.
3. Group discussion on initiatives for promoting the green economy.
4. Writing an essay or a short note on the important initiatives for promoting green economy.
5. Group discussion on the role of stake holders in the green economy.
6. Making solar bulbs.
7. Group discussion on the role of Government and Private Agencies in promoting a green economy.
8. Poster making on green sectors.

PART B: VOCATIONAL SKILLS

Unit - 1: Tools for Solar PV systems installations

1. List and Identify the various mechanical tool.
2. Draw the image of the mechanical tool and label it.
3. Handling of the different mechanical tools (spanner, drill machine, hammer, chisel, grinder, torque wrench, LN keys, saw, power drill, scrapers, screw driver).
4. Do the operations like cutting, spanner, drill machine, hammer, chisel, grinder, wrench, LN keys, saw, power drill, scrapers, screwdriver.

5. Identify the various electrical tools for the specific task.
6. Sketch the electrical tool and label it.
7. Handling and operate the different electrical tools (clamp meter, multimeter, earth tester/megger, Wire stripper, tester electrical insulator, pliers, crimper).
8. Do the all electrical tool operations(multimeter, earth tester/megger, tester electrical insulator, pliers, crimper).
9. Identify the various safety tools for the specific task.
10. Demonstrate the different safety tool.
11. Perform practical of all safety tool operations.
12. Use of Measuring tools compass, measurement level, marking thread, angle finder tape, spirit level.
13. Identify the various Civil tools for the specific task.
14. Sketch the Civil tool and label it.
15. Demonstrate the different Civil tools (pick axe, spud, mortar pan, spade, water level pipe, crowbar, pliers).
16. Perform practically all Civil tool operations(like a pick axe, spud, mortar pan, spade, crowbar, and pliers).
17. Make a list of different electrical parameter.
18. Draw the symbols of electrical parameters.
19. Make a chart or poster of on-grid and off-grid system.
20. Draw the line diagram of the on-grid and off-grid system.

Unit - 2: Work and health safety

1. Perform the role play on the toolbox talk.
2. Make a list of hazards and precautions to be taken during installations.
3. Demonstrate how to use a PPE kit and its importance.
4. Demonstration of First aid box.
5. Demonstration of CPR.
6. Identify different types of PPE kit.
7. Mock Practice of using first aid.
8. Make a chart and poster of different hazard sign and emergency sign.
9. Identification of different components of fire extinguisher.
10. Operate and handling of fire extinguisher.
11. Operate the safety harness during work at a height.

CLASS – XII

PAPER – III					
(Theory & Practical)					
Full Marks : 50					
Part	Unit & Topic		No. of Theory Classes	No. of Practical Classes	Maximum Marks
Part - A	Employability Skills				
	Unit - 1	Communication Skills - IV	9	4	10
	Unit - 2	Self-management Skills - IV	9	4	
	Unit - 3	Information & Communication Technology Skills - IV	10	4	
Part – B	Vocational Skills				
	Unit - 1	Installation and Commissioning	16	9	40
	Unit - 2	Repair and Maintenance	16	9	
		Total	60	30	50
Part - C	Practical Work				
		Practical Examination			20
		Written Test			15
		Viva Voce			10
		Record			05
		Total			50
		Grand Total			100

PAPER – IV					
(Theory & Practical)					
Full Marks : 50					
Part	Unit & Topic		No. of Theory Classes	No. of Practical Classes	Maximum Marks
Part - A	Employability Skills				
	Unit - 1	Entrepreneurial Skills - IV	12	4	10
	Unit - 2	Green Skills - IV	12	5	
Part – B	Vocational Skills				
	Unit - 1	Cost Economics of Solar PV Systems and Opportunities	18	10	40
	Unit - 2	Innovation and Development in Solar Energy	18	11	
		Total	60	30	50
Part - C	Practical Work				

		Practical Examination			20
		Written Test			15
		Viva Voce			10
		Record			05
		Total			50
		Grand Total			100

PAPER – III(Theory)

PART – A: EMPLOYABILITY SKILLS

Unit – 1: Communication Skills – IV

- ☞ Active listening -listening skill, stages of active listening, Overcoming barriers to active listening.
- ☞ Parts of speech – using capitals, punctuation, basic parts of speech, Supporting parts of speech.
- ☞ Writing skills to practice the following:
 - Simple sentence
 - Complex sentence
 - Types of object,
 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.

Unit 2: Self-management Skills – IV

- ☞ Motivation and positive attitude, Intrinsic and extrinsic motivation, Positive attitude – ways to maintain positive attitude, Stress and stress management – ways to manage stress.
- ☞ How to become result oriented?, Goal setting – examples of result-oriented goals.
- ☞ Steps towards self – awareness, Personality and basic personality traits, Common personality disorders-
 - Suspicious
 - Emotional and impulsive
 - Anxious,
 Steps to overcome personality disorders.

Unit 3: Information and Communication Technology Skills – IV

- ☞ Getting started with spreadsheet - types of a spreadsheet, steps to start LibreOffice Calc., components of a worksheet.
- ☞ Opening workbook and entering data – types of data, steps to enter data, editing and

deleting data in a cell, Selecting multiple cells, Saving the spreadsheet in various formats, Closing the spreadsheet, Opening the spreadsheet, Printing the spreadsheet.

- ☞ 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, Need to format cell and content, Changing text style and font size, Align text in a cell, Highlight text.
- ☞ Sorting data, Filtering data, Protecting spreadsheet with password.
- ☞ Presentation software available, Steps to start LibreOffice Impress, Adding text to a presentation.
- ☞ Open, Close, Save and Print a slide presentation.
- ☞ 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.
- ☞ Advanced features used in a presentation, Inserting shapes in the presentation, Inserting clipart and images in a presentation, Changing slide layout.

PART – B: VOCATIONAL SKILLS

Unit 1: Installation and Commissioning

- ☞ 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.
- ☞ 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.
- ☞ Design and evaluation of various parameter: Load calculation, number of module series and parallel connections, dc/ac cable size calculation.
- ☞ Material procurement and handling, transportation and storage-loading and unloading material, Handling procedure.
- ☞ Civil work, RCC piling, mounting structure and Installation Procedure, Identify the concrete mix for the casting of the civil foundation.
- ☞ AC & DC cabling and interconnection, Physical connection, String connection
 - electrical,
 - use of MC4 connector
 - use of ferruling(label)
- ☞ Installation of various parts of MMS, Mounting of solar panel on structure, features, and procedure.
- ☞ Quality assurance parameters.

Unit 2: Repair and Maintenance

- ☞ Cleaning and testing of solar panels, procedures, and schedule, Routine checkups of Solar PV Systems.
- ☞ 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.

PAPER – III(Practical)

PART – A: EMPLOYABILITY SKILLS

Unit – 1: Communication Skills – IV

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.
4. Group practice on identifying parts of speech.
5. Group practice on constructing sentences.
6. Group activity on writing sentences and paragraphs.
7. Group activity on practicing writing sentences in active or passive voice.
8. Group activity on writing different types of sentences (i.e. declarative, exclamatory, interrogative and imperative)

Unit 2: Self-management Skills – IV

1. Role-play on avoiding stressful situations.
2. Activity on listing negative situations and ways to turn it positive.
3. Group activity on listing aim in life.
4. Group discussion on self-awareness.
5. Group discussion on common personality disorders.
6. Brainstorming steps to overcome personality disorder.

Unit 3: Information and Communication Technology Skills – IV

1. Group activity on identifying components of spreadsheet in LibreOffice Calc.
2. Group activity on working with data on LibreOffice Calc.
3. Group activity on formatting a spreadsheet in LibreOffice Calc.
4. Group activity on performing basic calculations in LibreOffice Calc.
5. Group activity on sorting data in LibreOffice Calc.
6. Group practice on working with LibreOffice Impress tools.
7. Group activity on saving, closing and opening a presentation in LibreOffice Impress.
8. Group activity on working with font styles in LibreOffice Impress.
9. Group activity on changing slide layout on LibreOffice Impress.

PART – B: VOCATIONAL SKILLS

Unit 1: Installation and Commissioning

1. Make a list of criteria for site selection.
2. Check the soil characteristics at the installation site.
3. Visit the solar Panel System site and see the effect of the shadow of a tree or building, electric poll, etc.
4. Locate and Identify the place of the Solar Panel System at the site.
5. Make a feasibility report of the site.
6. Identification of different types of Solar Panel Systems.
7. Make a single-line diagram of a system.
8. Identify different components of the Solar Panel System.

9. List of various parameters used for the design of Solar PV Systems.
10. Calculate load-volt, amp.
11. Calculate voltage in series and parallel connection.
12. Calculate the required cable size.
13. Collect the information on weather condition.
14. Checklist of different parameters of the solar PV system.
15. Identify the viability of the grid.
16. List the specifications of the material and equipment.
17. Make a list of suppliers or companies related to the solar unit.
18. Write the procedure for making a foundation.
19. Visit the solar site.
20. Construction of civil block.
21. Marking and layout of the civil block on the ground/roof.
22. Prepare concrete mixer for RCC.
23. Identify the AC & DC cabling and interconnection.
24. Check the AC & DC cabling and interconnection.
25. Check physical connection
 - Rusting in electrical
 - Loose and break the connection
26. Check the panel connection like electrical and structure.
27. Identify and draw the mounting structure for solar panel.
28. Visit the Solar Panel System site and note the all features.
29. List the step to check quality assurance parameter.

Unit 2: Repair and Maintenance

1. Write cleaning procedure of Solar Panel.
2. Check the wire and terminal connection.
3. Check the solar panel position.
4. Generation report.
5. Visit the Solar PV Plant site to check the tilt angle and mounting structure condition.
6. Check the nut and bolt for loose connection and tighten it.
7. Identify the direction by using a compass.
8. Identify the basic function and features of the battery.
9. Check leakage and blockage in the water supply pipe line.
10. Check all electrical terminal connection.
11. Write the maintenance procedure.
12. Identify defective components and their replacement like wire cuts, burned, carbon supply, twist, etc.

PAPER – IV(Theory)

PART – A: EMPLOYABILITY SKILLS

Unit – 1: Entrepreneurial Skills – IV

- ☞ Entrepreneurship and entrepreneur, Characteristics of entrepreneurship, Entrepreneurship-

art and science, Qualities of a successful entrepreneur, Types of entrepreneurs, Roles and functions of an entrepreneur, What motivates an entrepreneur, Identifying opportunities and risk-taking, Startups.

- ☞ Barriers to entrepreneurship, Environmental barriers, No or faulty business plan, Personal barriers.
- ☞ Entrepreneurial attitude,
- ☞ Entrepreneurial competencies, Decisiveness, Initiative, Interpersonal skills - positive attitude, stress management, Perseverance, Organizational skills – time management, goal setting, efficiency, managing quality.

Unit – 2: Green Skills – IV

- ☞ Green jobs, Benefits of green jobs, Green jobs in different sectors:
 - Agriculture
 - Transportation
 - Water conservation
 - Solar and wind energy
 - Eco-tourism
 - Building and construction
 - Solid waste management
 - Appropriate technology
- ☞ Importance of green jobs in
 - Limiting green house gas emissions
 - Minimizing waste and pollution
 - Protecting and restoring ecosystems
 - Adapting to the effects of climate change
- ☞ Green jobs, Benefits of green jobs, Green jobs in different sectors:
 - Agriculture
 - Transportation
 - Water conservation
 - Solar and wind energy
 - Eco-tourism
 - Building and construction
 - Solid waste management
 - Appropriate technology

PART – B: VOCATIONAL SKILLS

Unit – 1: Cost economics of Solar PV Systems and opportunities

- ☞ Cost calculation for Solar Panel System, solar panel as per capacity, Prepare a project plan.
- ☞ Business opportunities and market trend, Govt. Project and Policy, Metering concept, Net metering, Gross metering.
- ☞ Different marketing strategies-add on, Solar Panel System spare parts.
- ☞ Work effectively with others(as a team or individual), Importance of annual maintenance, Follow-up and Annual Maintenance,

Unit – 2: Innovation and Development in Solar Energy

☞ 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

☞ New solar technology

- Solar bifacial,
- BIPV (Building-integrated photovoltaic),

The standard for solar system-BIS, IEC code, The flexible solar panel (thin film), Solar dryer, Solar desalination plant, Solar fencing, Solar cold storage.

PAPER – IV(Practical)

PART – A: EMPLOYABILITY SKILLS

Unit – 1: Entrepreneurial Skills – IV

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.
5. Group discussion about “What we fear about entrepreneurship”.
6. Activity on taking an interview of an entrepreneur.
7. Group activity on identifying entrepreneurial attitude.
8. Playing games, such as “Who am I”.
9. Brain storming a business ideas.
10. Group practice on “Best out of Waste”.
11. Group discussion on the topic of “Let’s grow together”.
12. Group activity on listing stress and methods to deal with it like Yoga, deep breathing exercises, etc.
13. Group activity on time management.

Unit – 2: Green Skills - IV

1. Group discussion on the importance of green job.
2. Chart preparation on green jobs in different sectors.
3. Preparing posters on green jobs.
4. Group activity on tree plantation.
5. Brainstorming different ways of minimizing waste and pollution.
6. Group discussion on the importance of green job.
7. Chart preparation on green jobs in different sectors.

PART – B: VOCATIONAL SKILLS**Unit – 1: Cost economics of Solar PV Systems and opportunities**

1. Calculate the cost of solar power plant.
2. Read and note down the specification of solar panel.
3. Identify the different business opportunities and market trend.
4. Make a list of govt. project and policy.
5. Check the net metering and Gross metering policy of your state/ central govt. scheme.
6. Collect the information from the vendor about Solar Panel Systems.
7. Identifying different marketing strategies-add on, Solar Panel System spare parts.
8. Make a chart or poster of different marketing strategies-add on, Solar Panel System spare parts.
9. Make a list of company or vendor.
10. Role-play and group discussion on work.
11. Reading the annual maintenance report of the Solar Panel System according specification.

Unit – 2: Innovation and Development in Solar Energy

1. Identification of new solar products.
2. Reading of specifications for all solar products.
3. Make a list of solar product and its price.
4. Identify the solar product in your area.
5. Visit the solar panel to check the power outputs.
6. Identify the features of solar panel.
7. Collect the information from the websites and make a project report.
8. Make a chart or poster of BIS, IEC Code.
9. Identify different types of Solar Panel film.
10. Identify different types of solar dryers.
11. Make a chart of solar dryer.
12. Visit the solar desalination plant.
13. Visit the site to check the solar fencing.

Question Pattern(For Theory Papers)

1. Multiple Choice Questions (ALL questions to be answered)	1 mark X 14	= 14
2. Short Answer Type Questions Answer within 40 to 50 words each (Answer 7 out of 12 questions)	3 marks X 7	= 21
3. Long Answer Type Questions (Answer 3 out of 6 questions)	5 marks X 3	= 15
TOTAL MARKS		50

Links for Reference Books/ Study Materials:

1. https://bharatskills.gov.in/pdf/E_Books/SolarTechnician_Vol1_TP.pdf
2. [https://bharatskills.gov.in/pdf/E_Books/CTS/76/English/TT/Solar%20Technician%20\(Electrical\)%20-%20TT%20\(NSQF%202022\).pdf](https://bharatskills.gov.in/pdf/E_Books/CTS/76/English/TT/Solar%20Technician%20(Electrical)%20-%20TT%20(NSQF%202022).pdf)
3. [https://bharatskills.gov.in/pdf/E_Books/CTS/76/English/TP/Solar%20Technician%20\(Electrical\)%20-%20TP%20\(NSQF%202022\).pdf](https://bharatskills.gov.in/pdf/E_Books/CTS/76/English/TP/Solar%20Technician%20(Electrical)%20-%20TP%20(NSQF%202022).pdf)
4. <https://www.psscive.ac.in/storage/uploads/textbooks/pdf/english/solar-panel-installation-technician-english-class-11.pdf>
5. <https://www.psscive.ac.in/storage/uploads/textbooks/pdf/english/solar-panel-installation-technician-english-class-%2012.pdf>
6. <https://essc-india.org/participant-handook/English/Solar%20Panel%20Installation%20Technician.pdf>
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