Savitribai Phule Shikshan Prasarak Mandal's

SKN SINHGAD COLLEGE OF ENGINEERING, PANDHARPUR

(Approved by AICTE,New Delhi,Recognized by D.T.E .(M.S)& Affiliated to the Solapur University, Solapur)

Gat.No.6643,Korti, Tal.Pandharpur, Dist.Solapur-413304Office Ph.No.02186-250146

Accredited by NAAC with A+ Grade

Innovation in Teaching & Learning

Subject:

Power Plant & Energy Engineering

(Design and Development of Parabolic Trough Collector)

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Linking of Subject Syllabus

Syllabus of course

Section I

Unit-1: Introduction **No. of lectures- 5**

Classification of energy sources Organization of Power Sector in India, NTPC, NHPC, NPCIL and their role in Power development in India, Role of private sector in energy management, Power distribution, Power Grid Corporation of India (PGCIL)

Unit-2: Loads on Power Plant **No. of lectures- 8**

Introduction, classification of loads on power plant, Different load curves and load factors, Effect of variable load on power plant, design & operation, comparison of the thermal, hydroelectric, nuclear and diesel power plants. (Numerical treatment) Classification of plants, Requirements of peak load plant, Pumped storage plants, Compressed air storage plants, Load sharing between base load & peak load power stations.

Unit-3: Economic Analysis of Power Plants **No. of lectures- 7**

Introduction, Cost of electric energy, Fixed and operating cost, Methods of determining depreciation, Selection of site for Power station (thermal, hydro, nuclear), Tariff methods. (Numerical treatment) Selection of Boilers, Selection of Prime movers, selection of size and number of generating units.

Section-II

Unit-4: Solar Energy **No. of lectures-8**

a) Solar radiation outside the earth's atmosphere & at the earth's surface, Solar radiation measurement – Pyranometer & Pyrheliometer, solar radiation geometry. LAT & SCT, Solar Concentrators-Method and classification, Types of concentrators.

b) Liquid flat plate collector – General, Performance analysis, Effects of various parameters. (Numerical treatment) Solar Power Plant: Introduction, components, **Types of Collectors** & Solar Ponds, Low & High Temperature Solar Power Plant. Photovoltaic Power System, Heliostat

Unit-5: Other Non-Conventional Power Plants **No. of lectures-7**

Wind Power plant: Introduction, Power of wind, Basic components of 'WECS', Classification of WEC systems. Horizontal axis machines, Vertical axis machines, Advantages & Disadvantages of WECS, Application of wind energy. Tidal energy, wave energy, OTEC, geothermal, magneto hydrodynamics, hybrid power plants, Challenges in commercialization of Non-Conventional Power Plants.

Unit-6: Energy conservation and Energy Audit **No. of lectures- 5**

Energy Conservation- Introduction, energy conservation act 2001 & its feature, energy conservation in industries Energy Audit- Introduction, need of energy audit, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Role of Bureau of Energy Efficiency (BEE)

b. List of Experiments/Tutorial/Assignments:

EXP. NO.	TITLE	CO NO.	BL	MAPPING WITH PO	MAPPING WITH PSO
1	Solar Radiation & its measurement	CO2	L4	PO1, PO2, PO3, PO4, PO12	PSO1
2	Test on Solar P-V Module	CO2	L4	PO1, PO2, PO3, PO4, PO12	PSO1
3	Assignment 1- Study of typical load curve (Residential/Commercial/Industrial)	CO1, CO2	L2	PO1, PO2, PO3	PSO1
4	Assignment 2- Study of solar collectors	CO2	L2	PO1	PSO1,
5	Assignment 3- Study of solar thermal applications	CO4	L3	PO1, PO2, PO3	PSO1
6	Assignment 4- Study of biogas plants	CO4	L3	PO1, PO2, PO3	PSO1
7	Assignment 5- Study of various energy storage devices	CO5	L2	PO1	PSO1
8	Assignment 6- Industrial visit	CO1, CO2, CO3, CO4, CO5	L4	PO1, PO2, PO3, PO4, PO11, PO12	PSO1, PSO2
9	Design and development of any type of solar collector (Parabolic trough collector)	CO4	L6	PO1, PO2, PO3, PO4, PO11, PO12	PSO1, PSO2

As per syllabus there is nothing about designing of any solar type of collector so, in this project under types of collector, we have design and fabricate of parabolic trough collector for water heating purpose.

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Alumni Suggestions

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Accredited with 'A+' Grade by NAAC
DTE Code : EN-6643

Prof. M. H. Navale — PRESIDENT
Dr. Rohit M. Navale — GENERAL SECRETARY
Dr. K. J. Karande — PRINCIPAL

Outward No. : SKNSCOE /

Date : 16/Sep/2022

Alumni Feedback Form

We are glad that you have spent valuable years pursuing courses of your choice at SKN Sinhgad College of Engineering Korti, Pandharpur. We shall be thankful if you can spare some of your valuable time to fill up this feedback form and give valuable suggestions for further improvement of the institute. Your valuable inputs will be of great use to improve the quality of our academic programs and enhance the credibility of our Institute.

Please Tick √

Sr. No.	Statement		Excellent	Average	Poor
01	During graduation period acquired technical language is useful for higher study & in technical proficiency.	Preparation	✓		
02	Fundamental, scientific & Mathematical engg. Knowledge is useful for solving industrial problem & in career	Core Competence	✓		
03	During graduation VAP, Software courses is useful for career	Breadth		✓	
04	Various STP program, Social & Cultural activities are useful in career profession	Professionalism	✓		
05	During graduation various sessions like EDP, GATE, Competitive exam, seminars, project activities are useful in your career proficiency	Learning Environment	✓		

Suggestions for Improvement:
There is bright future in the renewable energy. many companies are working on making of solar equipment. need to focus on solar application designing.

Name: Pushpali Bansode.
Year of Passing: 2021-2022
Qualification: B.E. Mechanical.
Department: Mechanical.
E-mail ID: bansode.pushpalitai@gmail.com.
WhatsApp Contact No. : 9545590177.
Current Position & Company / Institute / Business name: Umeu India Pvt. Ltd. (Jr. Engg.).

SKNSCOE Dept. of Mechanical Engineering Korti Pandharpur 413304

Savitribai Phule Shikshan Prasarak Mandal's
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DTE Code : EN-6643

Prof. M. N. Navale, M. E. (Elect.), MBA, PRESIDENT | Dr. Rohit M. Navale, M.E. (Mech.), GENERAL SECRETARY | Dr. K. J. Karande, M. Tech, Ph. D. (Elect.), PRINCIPAL

Outward No. : SKNSCOE /

Date : 13/01/2023.

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01	During graduation period acquired technical language is useful for higher study & in technical proficiency.	Preparation	Yes		
02	Fundamental, scientific & Mathematical engg. Knowledge is useful for solving industrial problem & in career	Core Competence		Yes	
03	During graduation VAP, Software courses is useful for career	Breadth	Yes		
04	Various STP program, Social & Cultural activities are useful in career profession	Professionalism	Yes		
05	During graduation various sessions like EDP, GATE, Competitive exam, seminars, project activities are useful in your career proficiency	Learning Environment	Yes		

Suggestions for Improvement:

1] As students are from rural area need to focus on communication.

2] As a trading field in the solar application need to have more depth in solar or energy utilization equipments.

Name: Shinde Rushikesh Prakash.

Year of Passing: 2021-2022.

Qualification: B.E. Mech.

Department: Mech.

E-mail ID: rushikesh.shinde44@gmail.com

WhatsApp Contact No. : 7767877240.

Current Position & Company / Institute / Business name: GET. TE connectivity, Shirwal Pune.

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Project Design

1. **Design Objectives**

1.1. Purpose

- To concentrate solar energy onto a receiver (absorber) to heat a fluid or generate steam.

1.2. Application

- Identify the specific application (e.g., residential hot water, industrial processes, electricity generation).

2. **Geometric Design**

2.1. Parabolic Shape

- **Equation**: The parabola's shape is given by y2=4fxy^2 = 4fxy2=4fx, where:
  - yyy is the vertical distance from the focal line.
  - xxx is the horizontal distance from the vertex of the parabola.
  - fff is the focal length.
- **Dimensions**:
  - **Aperture Width (W)**: The width of the trough opening. Typically ranges from 1 to 5 meters.
  - **Focal Length (f)**: Distance from the vertex of the parabola to the focal point. The focal length should be designed based on the desired concentration ratio and collector dimensions.

2.2. Parabola Depth

- The depth of the trough affects the concentration ratio. Use the formula f=W216df = \frac{W^2}{16d}f=16dW2, where ddd is the depth of the trough.
- **Example**: If W=2W = 2W=2 meters and f=1f = 1f=1 meter, then d=2216×1=0.25d = \frac{2^2}{16 \times 1} = 0.25d=16×122=0.25 meters.

3. **Material Selection**

3.1. Reflector Surface

- **Material**: High-reflectivity materials such as aluminum sheets or glass with a reflective coating.
- **Reflectivity**: Aim for a reflectivity of over 90% for optimal performance.
- **Durability**: Ensure the material can withstand environmental conditions (e.g., UV radiation, rain).

3.2. Absorber Tube

- **Material**: Typically copper or aluminum for high thermal conductivity.
- **Coating**: Apply a selective coating to enhance solar absorption and reduce thermal radiation losses (e.g., black chrome).

3.3. Support Structure

- **Material**: Corrosion-resistant materials like galvanized steel or aluminum.
- **Design**: Ensure the structure is robust and can support the trough and tracking system.

4. Thermal Performance

4.1. Concentration Ratio

- **Formula**: C=AcollectorAabsorberC = \frac{A_{collector}}{A_{absorber}}C=AabsorberAcollector, where AcollectorA_{collector}Acollector is the area of the reflective surface and AabsorberA_{absorber}Aabsorber is the cross-sectional area of the absorber tube.

4.2. Efficiency

- **Optical Efficiency**: Efficiency of how well the trough collects and directs sunlight onto the absorber.
- **Thermal Efficiency**: Efficiency of converting collected solar energy into useful thermal energy, considering losses due to heat dissipation and thermal radiation.

5. Tracking System

5.1. Type

- **Single-Axis Tracking**: Adjusts the angle of the trough around one axis, typically North-South.
- **Dual-Axis Tracking**: Adjusts both tilt (East-West) and azimuth (North-South) angles to follow the sun's movement more accurately.

5.2. Mechanism

- **Actuators and Motors**: Use linear actuators or rotary motors to adjust the trough position.
- **Sensors and Controllers**: Use solar position sensors and controllers to automate the tracking process.

6. Prototype Development

6.1. Fabrication

- **Reflector Surface**: Form the parabolic shape using the chosen reflective material and ensure it is precisely shaped.
- **Absorber Tube**: Mount the absorber tube along the focal line of the parabola.
- **Support Structure**: Assemble the support frame and mount the trough securely.

6.2. Assembly

- **Tracking System**: Integrate the tracking mechanism with the trough.
- **Connections**: Ensure proper connections to any fluid or steam generation systems.

7. Testing and Evaluation

7.1. Performance Testing

- **Efficiency Measurement**: Test the system under various solar conditions to measure efficiency and performance.
- **Heat Transfer**: Assess how well the system transfers heat to the fluid or steam.

7.2. Durability Testing

- **Structural Integrity**: Test the system's ability to withstand wind, rain, and other environmental factors.

7.3. Optimization

- **Adjustments**: Refine the design based on test results to improve performance and efficiency.

8. Deployment and Maintenance

8.1. Installation

- **Site Preparation**: Choose a location with optimal solar exposure and secure the trough.
- **Connection**: Connect the system to the water or steam heating system.

8.2. Maintenance

- **Cleaning**: Regularly clean the reflector surfaces to maintain efficiency.
- **Inspection**: Periodically inspect the tracking system and structural components for wear and tear.

9. Cost Analysis

9.1. Initial Costs

- **Materials**: Cost of reflective materials, absorber tube, and support structure.
- **Fabrication and Installation**: Costs associated with constructing and setting up the system.

9.2. Operating Costs

- **Maintenance**: Ongoing costs for cleaning and servicing the system.

9.3. Benefits

- **Energy Savings**: Calculate savings from reduced energy bills or increased efficiency.
- **Environmental Impact**: Evaluate reductions in greenhouse gas emissions and other environmental benefits

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Use of ICT

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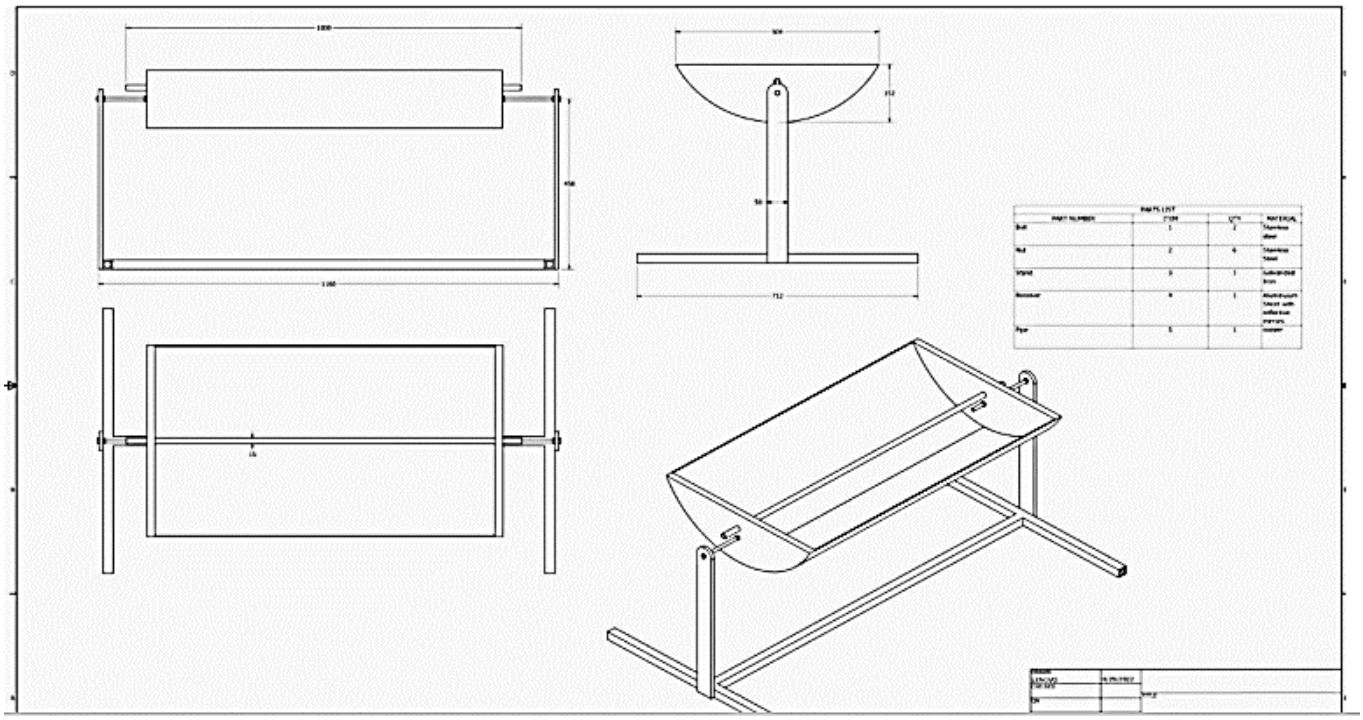
By using Auto CAD software, students have drafted 2D drawings of parabolic trough collector.



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Outcome

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Project Name: Design and development of parabolic trough collector.

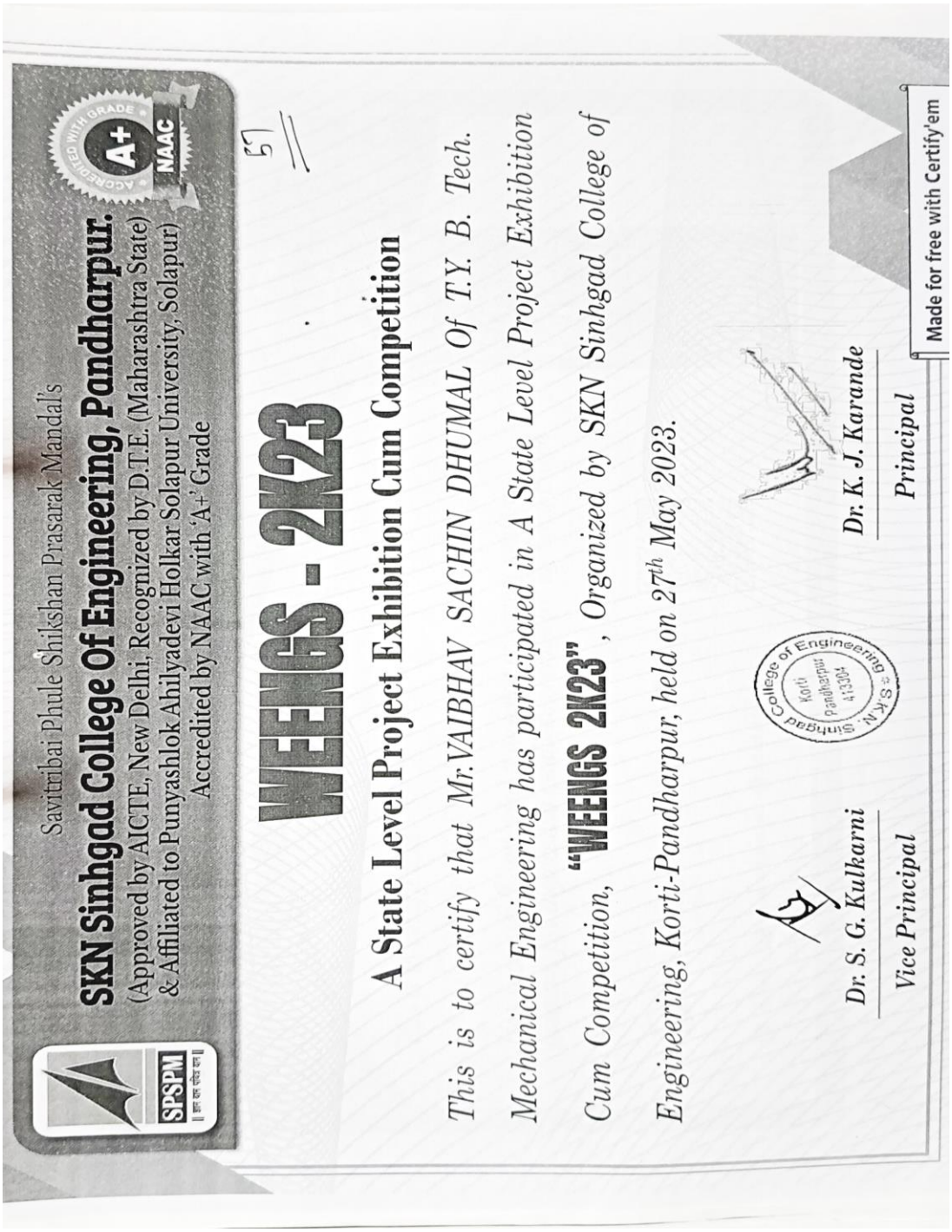
Project Group: Vaibhav Dhumal, Shubham Pawar.

Academic Year: 2022-23.

Photo1: Top view of Parabolic trough collector

Photo2: Side view of Parabolic trough collector

Participation in WEENGS event: 1. Vaibhav Dhumal



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WEENGS - 2K23

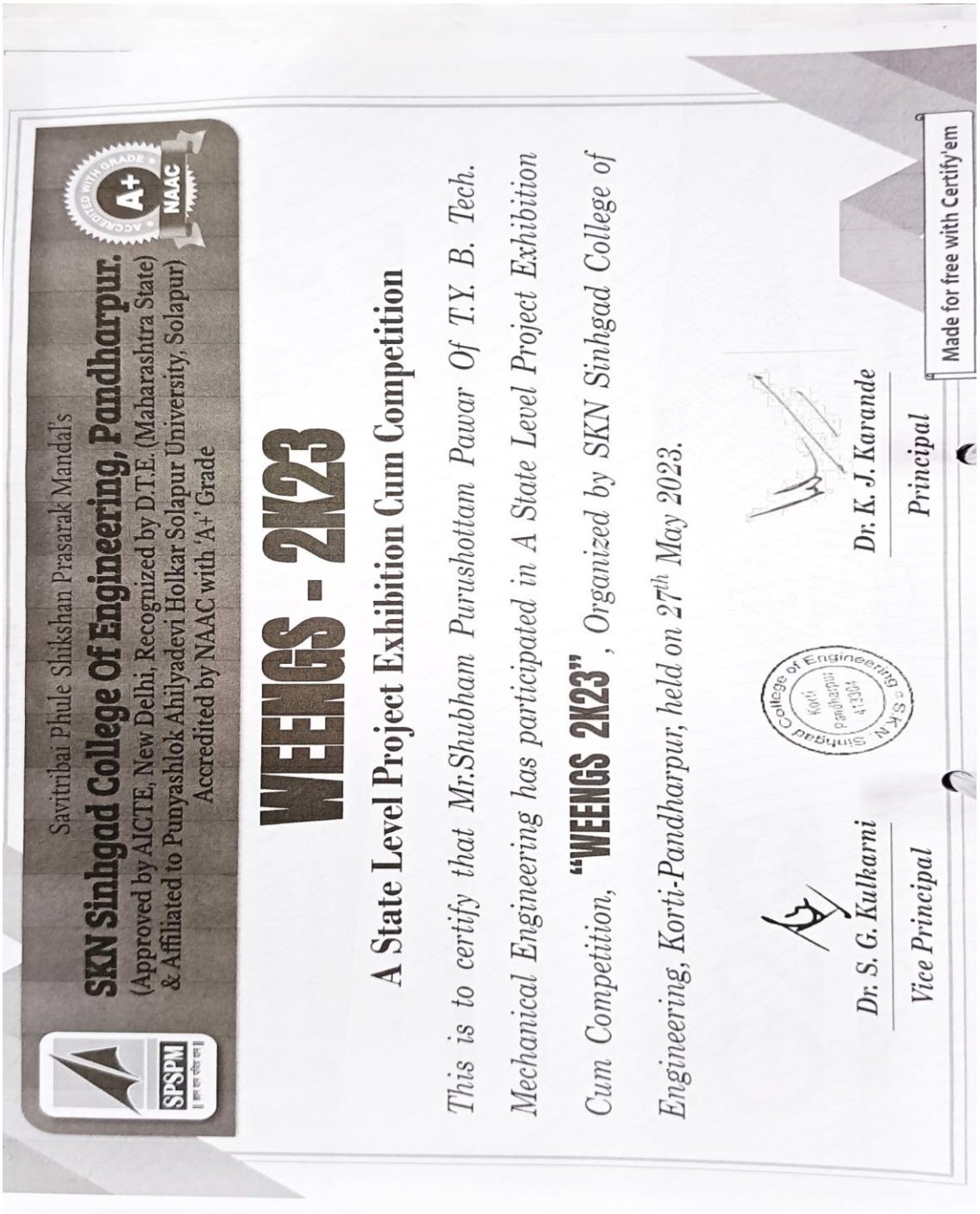
A State Level Project Exhibition Cum Competition

This is to certify that Mr.VAIBHAV SACHIN DHUMAL Of T.Y. B. Tech. Mechanical Engineering has participated in A State Level Project Exhibition Cum Competition, "WEENGS 2K23", Organized by SKN Sinhgad College of Engineering, Korti-Pandharpur, held on 27th May 2023.

Dr. S. G. Kulkarni
Vice Principal

Dr. K. J. Karande
Principal

Participation in WEENGS event: 1. Shubham Pawar



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Dr. S. G. Kulkarni
Vice Principal

Dr. K. J. Karande
Principal

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