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# Application Call Document 2022



Research Based Education for the Development of  
Hydropower Professionals (Hydro-Himalaya)



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## 1 PROJECT BACKGROUND

Norwegian Program for Capacity Development in Higher Education and Research for Development (NORHED), aims to strengthen the capacity of higher education institutions in developing countries to produce high-quality graduates, high-quality research, and more inclusive higher education.

The NORHED-II program has funded the project, “**Research Based Education for Development of Hydropower Professionals for the Himalayan Region (Hydro-Himalaya)**”. The Hydro-Himalaya project has three thematic areas: Effective Production of Hydro Energy, Effective Transmission of Hydro Energy and Effective End-use of Hydro Energy.

### 1.1 Objectives

- i. Strengthen the research-based education within hydropower engineering at Kathmandu University by producing a better-qualified workforce in the Himalayan region.
- ii. Transfer of academic and research competence from Kathmandu University to the Nepalese and Himalayan region universities in the field of hydropower engineering.
- iii. Bridge academia and industry for sustainable solutions and practices.

### 1.2 Expected results of the project

- **Overarching goal** – The Himalaya region has increased access to sustainable and resilient energy infrastructure, educated nationals able to maintain and further develop the energy sector and industry by utilizing and promoting sustainable solutions.
- **Education** - The Himalaya region has increased access to local personnel with relevant education and skills to maintain and further develop the energy infrastructure in a sustainable matter.
- **Technology Development** - The Himalaya region has increased access to sustainable and resilient technology specifically developed or adapted for the technical challenges in the region.
- **Industry development** – Domestic and regional industries are mature and ready to implement new innovations.

### 1.3 Partners

**Applicant Institution:** Norwegian University of Science and Technology, Trondheim, Norway ([www.ntnu.edu](http://www.ntnu.edu))

**Local University Partner:** Kathmandu University, Dhulikhel, Nepal ([www.ku.edu.np](http://www.ku.edu.np))

**Partner at North:** University of South-Eastern Norway, Norway ([www.usn.no](http://www.usn.no))

**Partner at South:** Wuhan University, Wuhan, China ([en.whu.edu.cn/](http://en.whu.edu.cn/))

**Regional supporting partner:** Himalayan University Consortium, Kathmandu, Nepal (<https://www.icimod.org/initiative/huc/>)

## 2 ACADEMIC BACKGROUND

The holistic approach for the research is to have ‘*Effective Production of Hydro Energy*’, ‘*Effective Transmission of Hydro Energy*’, and ‘*Effective End-use of Hydro Energy*’ in the Himalayan region. The academic focus is on the innovations and solutions to the regional challenge induced by high sediment flows and the effective use of spilled energy.

**Table 1** Academic Details for 2021-2026

Thematic Area	Specific Area	Research Domain	Degrees	Total
Effective Production of Hydroelectricity	Sediment Erosion in hydro turbine	Basic research, Design, Production, Operation and Maintenance	Post Doc	1
			PhD	3
			MS	10
			Double Degree PhD	2
Effective Transmission of Hydroelectricity	Electrical Control, and Effective Transmission	Quality and reliability of power, Surveillance, VFD Control and grid stability	PhD	1
			Double Degree PhD	2
			MS	6
Effective End-use of Hydroelectricity	Green Hydrogen	H2H: Feasibility, Design cases, develop research facilities, prototype, safety, process control	Post Doc	1
			PhD	1
			Double Degree PhD	1
			MS	4
<b>Total</b>				<b>32</b>

\* *The research domain and number of degrees are subject to changes*

### **MS Degree**

The program is distributed for two years in which the students engage in finding solutions to research questions under the guidance of designated supervisors from KU and partner institutions. The MS degree is offered by KU upon successful completion of MS by Research.

### **PhD Degree (Single and Double degree)**

The program is distributed over three years period in which the students engage in finding solutions to PhD research questions. KU provides the PhD degree upon the completion of the study program for those having a single degree and for those with double degrees, the program will award PhD degrees from both KU and the partner university jointly after fulfilling the requirements at both universities. The PhD degree is three years long.

### **Post-Doc**

The Post-doc position has been planned to train the faculty members and researchers for strengthening research competence at KU.

### 3 KNOWLEDGE EXCHANGE AND MOBILITY

What sets Hydro-Himalaya apart is its unique partnership model – involving two Norwegian universities, one university in Nepal, and one in China. A time-tested partnership with NTNU in developing education and research capacity at KU will be the major foundation for the collaboration in this project. The strength of Wuhan University for fundamental research on sediment erosion of hydro turbines will add a new dimension to the existing competence. The expertise of the University of South-Eastern Norway in electrical and control aspects of hydropower systems will expand the project horizon to effective transmission of power. The collaboration between four academic institutions along with HUC has made Hydro-Himalaya possible with the aim to develop the academic and research activities coming out of the university and transfer to industrial adaptation. The regional network of the Himalayan University Consortium will ensure better representation of project stakeholders and dissemination of project outcomes with impactful visibility.

*All of HHP’s MS, doctoral and post-doctoral programs are coupled within one of three institutions: the Norwegian University of Science and Technology (NTNU), Wuhan University (WHU), and the University of South-Eastern Norway (USN).*

**Table 2** Yearly Recruitment Plan

Year	MS	PhD	Double PhD	Post-Doc
2021	7	2	2	
2022	8	1	3	
2023	5	2	-	2
<b>Total</b>	<b>20</b>	<b>5</b>	<b>5</b>	<b>2</b>

All the applicants enrolled under this application framework will have an opportunity to have an exchange program with at least one partner university during the academic program period. The mobility of the student to the partner university will depend on the domain of the specific research. The students enrolled under the domain of ‘*Design and Operation of Sediment Resistant Turbines*’ and ‘*Green Hydrogen*’ will have an exchange program with **NTNU**. Similarly, students enrolled under the domain of ‘*Fundamental Study on Sediment Erosion*’ will have the exchange program with **Wuhan University**, and the students enrolled under the domain ‘*Quality and Reliability of Power and Effective Transmission*’ will have the exchange program with **USN**. The duration of stay at the partner university for a double degree PhD will be of 3 semesters (50% of the academic time) and will award PhD degrees from both KU and the partner university after fulfilling the requirements at both universities. The duration of stay at the partner university for a normal PhD will be of 2 semesters (33% of the academic time) and the duration of stay at the partner university for an MS degree will be of 1 semester (25% of the academic time).

## 4 APPLICATION CALL FOR 2022

Hydro-Himalaya project welcomes applications from individuals interested to further their academic careers as hydropower professionals in the fall term of 2022. A summary of the available positions is provided in **Table 3**.

**Table 3** Details of available positions for 2022

Research Degree	Code	Research Domain	No	Study Period*	Mobility	
					Location	Period
PhD (KU)	<b>P1-22</b>	Fundamental study on sediment erosion	1	Aug 2022-Jul 2025	WHU, China	12 months
PhD Double degree (KU-NTNU)	<b>P2-22</b>	Design of sediment resistant turbines	1	Aug 2022-Jul 2025	NTNU, Norway	18 months
PhD Double degree (KU-USN)	<b>P4-22</b>	Quality and reliability of power and effective transmission	1	Aug 2022-Jul 2025	USN, Norway	18 months
MS by Research (KU)	<b>M1.1-22 and M1.2-22</b>	Fundamental study on sediment erosion	2	Aug 2022-Jun 2024	WHU, China	6 months
MS by Research (KU)	<b>M2.1-22 and M2.2-22</b>	Operation, maintenance of sediment resistant turbines	2	Aug 2022-Jun 2024	NTNU, Norway	6 months
MS by Research (KU)	<b>M3.1-22 and M3.2-22</b>	Green Hydrogen: Feasibility, Design cases for H2H	2	Aug 2022-Jun 2024	NTNU, Norway	6 months
MS by Research (KU)	<b>M4.1-22 and M4.2-22</b>	Quality and reliability of power and grid management	2	Aug 2022-Jun 2024	USN, Norway	6 months

*\*Dates are subject to change*

*\*Follow the Program code in Annexes for more details of each position.*

Applicants who are interested in more than one research topic/position can apply for a maximum of two positions. Both applications will be treated individually.

## 5 APPLICATION PROCESS

### 5.1 General eligibility criteria

The applicant must be a Nepali citizen.

#### **For MS Degree**

The candidate must have a minimum CGPA of 2.5 or equivalent in his/her four-year bachelor's degree in engineering from a reputed university in the relevant field and must have completed 16 years of education (10+2+4).

#### **For PhD Degree**

The candidate must have a minimum CGPA of 3.0 or B grade or equivalent in his/her MS degree in Engineering and must have completed a minimum of 17.5 years of education (10+2+4+2).

#### **For a Double PhD Degree**

The candidate must meet all the requirements separately of both KU and the partner university to be eligible to apply. The candidate must have a minimum CGPA of 3.0 or B grade or equivalent in his/her MS degree in Engineering. MS degree must have at least 1 semester of independent thesis load.

*The applicant must have gained the required qualification within the start date of the position, so applicants in the last semester of their MS degree are also eligible to apply for PhD. In such case, instead of a transcript and degree certificate, students must submit a letter from their current University/College with the expected completion date.*

### 5.2 Expected qualifications

A higher CGPA, experience in paper publication and relevant work experience are advantages. Proof of excellent written and oral English language skills is required. The application will be further strengthened if documentation of publications and thesis in the relevant area of study is provided by the candidate.

A candidate with an ability to work independently and having the motivation to share knowledge and take part in teamwork is preferred. Cooperation between staff members is an integrated part of the working atmosphere at Kathmandu University and the partner university. The candidate should be motivated and demonstrate a proven ability to work effectively within a team to formulate and realize common objectives. Personal suitability for the post will be emphasized.

*Please refer to the specific program document in the Annex for more details about the specific program of study.*

### 5.3 Related information

The Department has fewer women in scientific positions; therefore, women are particularly encouraged to apply. The project aims that the students to reflect the diversity of the general population. An expert assessment of applicants will be carried out and the candidates deemed best qualified will be invited to

an interview. The person appointed must comply with the laws, regulations, and agreements that apply at any given time to the post.

#### 5.4 Personal characteristics

- Strongly motivated and determined
- Be structured, targeted and solution-oriented
- Have the motivation to work in interdisciplinary
- The candidate should be creative and actively contribute to the team he/she will be a part of
- Have good communication and dissemination skills
- Personal skills such as a positive and friendly attitude, a strong appreciation for diversity, and contributing to a sustainable social environment will also be valued

In the evaluation of which candidate is best qualified, emphasis will be placed on education, experience, and personal suitability, in terms of the qualification requirements specified in the advertisement.

#### 5.5 What to expect

The candidate enrolled in MS and PhD can expect the following:

**Tuition Fee Scholarship:** The tuition fees and expenses incurred during research activities will be covered by the project.

**Monthly Salary/Payment:** All the students enrolled in this program will be provided with a monthly salary as per the regulations at Kathmandu University while in Nepal. During mobility at the partner institution, a monthly payment will be provided as per the regulations of the partner university to cover living costs.

**Visa Fees and International Travel:** Students enrolled in each degree has the provision of exchange with one of the partner university. For the same, securing visas is important and the project will fund the visa expenses along with two-way flight charges. The candidate should prepare all the relevant documentation in accordance with the visa awarding nation's regulations; which is also the case for his/her families and spouses if the candidates are willing to take them as well. Personal insurance and other liabilities should be covered by respective candidates.

**Leadership Mentoring:** Himalayan University Consortium, a partnering institution, conducts a wide range of practical support training for students in order to build their leadership and confidence throughout the program aiming to achieve all-rounded readiness for their future careers.

#### 5.6 What we offer

- A stimulating and growing research environment, with good opportunities to develop your career and your academic skills
- An open and inclusive work environment with dedicated colleagues
- A healthy social environment where diversity is celebrated
- Team and individual mentoring support to build communication and leadership skills and achieve all-rounded readiness for future career
- Exposure to extra curriculum and associated skill activities

## 5.7 How to apply

Students should submit the complete application with the attached documentation through the project address and the detailed information can be found [here](#).

The following documents shall be attached to the application while applying for the **PhD position**:

- Transcripts and degree certificates of Bachelor's and MS Degrees. The transcript should clearly show the grades obtained for different courses taken for the Bachelor's and MS Degree. Must have a minimum 3 CGPA on a 4-point scale or equivalent.
- Research Statement (three pages at most)
- A copy of citizenship document
- Two Recommendations
- Curriculum Vitae
- Other relevant work and academic certificates (*Optional*)

The following documents shall be attached to the application while applying for the **MS position**:

- Transcript and degree certificate of Bachelor's Degree. The transcript should clearly show the grades obtained for different courses taken for the Bachelor's Degree. Must have a minimum 2.5 CGPA on a 4-point scale or equivalent.
- Research Statement (three pages at most)
- A copy of citizenship document
- Two Recommendations
- Curriculum Vitae
- Other relevant work and academic certificates (*Optional*)

## 5.8 Special initiatives to ensure social inclusion

Initiatives that will ensure equal opportunities for higher education, research, professional development, and leadership for underrepresented or disadvantaged students are encouraged. This could include, but is not limited to:

- Small grants to cover personal expenses enable disadvantaged students/students with disabilities to attend and complete studies at the graduate/post-graduate level.
- Personal assistance during the program where required.
- Special interest groups at university.

## 5.9 Gender mainstreaming initiative

Any initiatives that will ensure equitable opportunities for higher education, research, professional development, and leadership for females can be supported. This could include, but is not limited to:

- Compensation for up to 3 months of maternity leave for those receiving full scholarships and fellowships.
- Assistance in a visa application for spouses and children if required.

- Small grants could be provided to cover personal expenses like hygiene articles, local transport, stationaries, etc. to ensure that female students in need can attend and complete their studies at the graduate/post-graduate level within project thematic areas and in countries where women's underrepresentation is clear.
- Leadership training and mentoring group.

### **5.10 Selection process**

The complete application will only be assessed based on the attached document as requested through the application call. The application received shall be reviewed firstly by the project management team, KU, and then, by an external evaluator. After the completion of a thorough assessment of the application, at most 3 candidates per position shall be shortlisted and called upon for an interview.

The interview shall be conducted in presence of the project management team, the WP leads, and supervisors. An evaluation shall be done by the team and then, the final result shall be announced via the KU website.

The selected candidate is required to submit all the original documents for the fulfillment of the admission process as requested. A cotutelle agreement has to be signed with both the home and partner institution universities by the double degree PhD candidate and fulfill all the requirements as listed.

### **5.11 Deadline**

Each applicant is responsible for ensuring that the required documentation has been uploaded within the application deadline. The deadline to appeal is 1 week from the decision that was sent to you. You will receive a reply to your appeal approximately within 3 weeks.

## **6 RIGHT TO APPEAL AND OUR RESERVATIONS**

You have a right to appeal if you believe you have been wrongfully rejected for admission or if there has been a mistake in the processing of your application. The individual himself/herself has to appeal to the Hydro-Himalaya Project Admissions committee via email to register their appeal.

Not all applications that meet the minimum requirements will be selected. Admission to the program is highly competitive with many strong applicants. If you have received the rejection 'not admitted due to competition', you cannot appeal on the basis that you meet the requirements.

## ANNEX 1

Admission call for positions as a PhD (single degree) and 2 MS by Research at:  
**Kathmandu University (KU)/ Wuhan University (WHU)**

<b>Academic Supervision</b>	KU: Department of Mechanical Engineering, School of Engineering WHU: School of Water Resources and Hydropower Engineering		
<b>Thematic Area</b>	Effective <b>Production</b> of Hydroelectricity		
<b>Research Domain</b>	Fundamental study on sediment erosion	<b>Degree awarded by</b>	
<b>PhD Topic (P1-22)</b>	<i>Erosion modeling in Pelton turbines</i>		DoME, KU
<b>MS Topic (M1.1-22)</b>	<i>Numerical investigation of erosion in Pelton turbines (using OpenFOAM)</i>		DoME, KU
<b>MS Topic (M1.2-22)</b>	<i>Numerical investigation of erosion in Francis turbines (using OpenFOAM)</i>		DoME, KU
<b>Application deadline</b>	2022.06.20	<b>Expected Decision Date</b>	2022.07.20

### About the Positions

The selected candidates for a PhD and 2 MS by Research shall have a full-time position as Research Fellow and Research Assistant respectively. The academic and research work will be jointly carried out at TTL, KU and, Hydropower Research Centre for Himalaya Region (HRCHR) WHU. The MS and PhD candidates will have the provision of one and two semesters exchange with WHU respectively.

**P1-22:** The PhD position, **P1-22** deals with the study to conduct the experimental/numerical investigation to determine the fundamentals behind erosion in the turbines. A suitable erosion model will be proposed that is based on properties of the flow, sediment, turbine geometry etc. through experiments in laboratory conditions.

**M1.1-22 and M1.2-22:** The MS by Research **M1.1-22** deals with numerical investigation of erosion in the injectors and runner bucket in Pelton turbines using an open source CFD tool. The results from CFD will be compared with experimental or power plant data. The MS by Research **M1.2-22** deals with numerical investigation of erosion in Francis turbines using an open source CFD tool. A suitable numerical model from the available data of the power plant will be developed and analyzed numerically using a proper erosion model and the results will be compared with experimental or power plant data.

### Expected Knowledge:

**P1-22:** Fundamental knowledge within i) Machine learning tools such as OpenFOAM, LabVIEW, MATLAB, Python, etc. ii) Basic Chinese language (preferred)

**M1.1-22 and M1.2-22:** Fundamental knowledge within i) OpenFOAM ii) Basic Chinese language (preferred)

## ANNEX 2

Admission call for positions as a PhD (double degree) and 2 MS by Research at:  
**Kathmandu University (KU)/ Norwegian University of Science and Technology (NTNU)**

<b>Academic Supervision</b>	KU: Department of Mechanical Engineering, School of Engineering NTNU: Department of Energy and Process Engineering		
<b>Thematic Area</b>	Effective <b>Production</b> of Hydroelectricity		
<b>Research Domain</b>	Design of sediment resistant turbines	<b>Degree awarded by</b>	
<b>PhD Topic (P2-22)</b>	<i>Condition monitoring of Pelton turbines in sediment affected power plants</i>	DoME, KU and NTNU jointly	
<b>MS Topic (M2.1-22)</b>	<i>Image processing techniques for estimating erosion in Pelton turbines</i>	DoME, KU	
<b>MS Topic (M2.2-22)</b>	<i>Fault analysis of Pelton turbines in sediment affected power plants</i>	DoME, KU	
<b>Application deadline</b>	2022.06.20	<b>Expected Decision Date</b>	2022.07.20

### About the Positions

The selected candidates for a PhD and 2 MS by Research shall have a full-time position as Research Fellow and Research Assistant respectively. The academic and research work will be jointly carried out at Turbine Testing Lab at KU and Waterpower Laboratory at NTNU. The MS and PhD candidates will have the provision of one and three semesters exchange with NTNU respectively.

**P2-22:** The PhD position, **P2-22** focuses on the development of condition monitoring methods for the application in Pelton turbines. The scope of the work includes both numerical and experimental studies of erosion induced faults in such turbines, as well as integration in machine learning algorithms for estimating their conditions in real-time to carry out preventive maintenances in turbines, minimizing the extent of damage and maximizing their life-span.

**M2.1-22 and M2.2-22:** The MS by Research **M2.1-22** deals with investigation of visual images from eroded surfaces in Pelton turbine, such that the images taken during the course of operation of such turbines can estimate the condition and remaining time for the failure using machine learning algorithms. The MS by Research **M2.2-22** focuses on conducting a trend analysis of the fault signals in Pelton turbines using experimental and numerical studies. Typical faults in these turbines along with their signature impacts on the output signals from different sensors will be analyzed.

### Expected Knowledge:

Fundamental knowledge within machine learning tools such as LabVIEW, MATLAB, Python, etc.

## ANNEX 3

Admission call for positions as 2 MS by Research at:

**Kathmandu University (KU)/ Norwegian University of Science and Technology (NTNU)**

<b>Academic Supervision</b>	KU: Department of Mechanical Engineering, School of Engineering NTNU: Department of Energy and Process Engineering		
<b>Thematic Area</b>	Effective <b>End-use</b> of Hydroelectricity		
<b>Research Domain</b>	Green Hydrogen	<b>Degree Awarded by</b>	
<b>MS Topic (M3.1-22)</b>	“Hydrogen Applications in Industry Sector”		DoME, KU
<b>MS Topic (M3.2-22)</b>	“Assessment of Green Hydrogen as an Alternative Fuel in Nepalese Context”		DoME, KU
<b>Application deadline</b>	2022.06.20	<b>Expected Decision Date</b>	2022.07.20

### About the Positions

The selected candidates for 2 MS by Research shall have a full-time position as Research Assistant. The academic and research work will be jointly carried out at Green Hydrogen Lab, DoME, KU, and NTNU Energy Team Hydrogen, NTNU. The MS candidates will have the provision of one semester exchange with NTNU.

**M3.1-22 and M3.2-22:** The MS by Research **M3.1-22** focuses on various applications of hydrogen in the industry to ensure a low-carbon economy and sustainability. This area of research provides an ample opportunity to perform a system design, supply chain design, followed by plant design to understand and evaluate the underlined advantages of replacing fossil fuels in the industrial sector with green hydrogen. It also focuses on scaling up the research study to a pilot-scale demonstration supported by the development of an efficient and highly optimized plant designed for a particular end-use of hydrogen in a specific industry. The MS by Research **M3.2-22** deals with the technical, economic, and environmental assessment of green hydrogen as a promising alternative fuel in the Nepalese context. It requires various studies such as fuel life cycle analysis (fuel LCA), techno-economic assessment (TEA), life cycle costing (LCC), etc. to highlight the pros and cons of promoting green hydrogen as an alternative fuel in various sectors such as industry, transportation, etc. In a nutshell, SWOT and PESTEL analysis are essential techniques to evaluate the strengths, weaknesses, opportunities, and threats of promoting green hydrogen in a broader spectrum considering political, economic, social, technological, environmental, and legal factors.

### Expected Knowledge:

**M3.1-22:** Fundamental knowledge within i) Hydrogen Technologies ii) Hydrogen Supply Chain iii) Chemical engineering and kinetics iv) Experimental Research v) Data process

**M3.2-22:** Fundamental knowledge within i) Hydrogen Technologies ii) Energy Modelling iii) Fuels and emissions iv) Energy economics

## ANNEX 4

Admission call for positions as a PhD (double degree) and 2 MS by Research at:  
**Kathmandu University (KU)/ University of South-Eastern Norway (USN)**

<b>Academic Supervision</b>	KU: Department of Electrical & Electronics Engineering, School of Engineering USN: Faculty of Technology, Natural Sciences and Maritime Sciences		
<b>Thematic Area</b>	Effective <b>Transmission</b> of Hydroelectricity		
<b>Research Domain</b>	Quality and reliability of power and grid management	<b>Degree Awarded by</b>	
<b>PhD Topic (P4-22)</b>	<i>Advanced control of variable speed hydropower plant for improved operation</i>	DoEE, KU and USN jointly	
<b>MS Topic (M4.1-22)</b>	<i>Modeling for control and optimization of run-of-river hydro power plants</i>	DoEE, KU	
<b>MS Topic (M4.2-22)</b>	<i>Hydro Turbine State of Health Analysis and Condition Monitoring</i>	DoEE, KU	
<b>Application deadline</b>	2022.06.20	<b>Expected Decision Date</b>	2022.07.20

### About the Positions

The selected candidates for a PhD and 2 MS by Research shall have a full-time position as Research Fellow and Research Assistant respectively. The academic and research work will be jointly carried out at the Department of Electrical and Electronics Engineering, KU, and the Department of Electrical Engineering, Information Technology, and Cybernetics at USN. The MS and PhD candidates will have the provision of one and three-semester exchange with USN respectively.

**P4-22:** The PhD position, **P4-22** focuses on the development of optimal controllers for improved operation of variable speed hydropower plant (VSHP) (preferably mechanistic models based on conservation laws such as mass, momentum, energy balances).

**M4.1-22 and M4.2-22:** The MS by Research **M4.1-22** focuses on flexible hydro powers, non-dimensional numbers for hydropower plant, efficiency relations with discharge and head, mechanistic model, OpenHPL, Kaplan turbine model, Propeller turbine mechanistic model, S-Z types Kaplan-based power plant. The MS by Research **M4.2-22** deals with the primary function of diagnosis is to determine the health of a monitored system, the subsystem of the hydro-turbine.

### Expected Knowledge:

**P4-22:** Fundamental knowledge within i) Control Engineering ii) Computer programming, with emphasis on languages such as MATLAB, Python, etc.

**M4.1-22 and M4.2-22:** Fundamental knowledge within i) Hydropower Engineering ii) Control system (PID controller and its operation) iii) Programming skills in Python or Julia language, C++