Program Profile		
Program	Program name	Experimental Procedure: Investigation of Thermal Conductivity Change in a Metal Rod under Tensile Stress
	Category	Industrial application

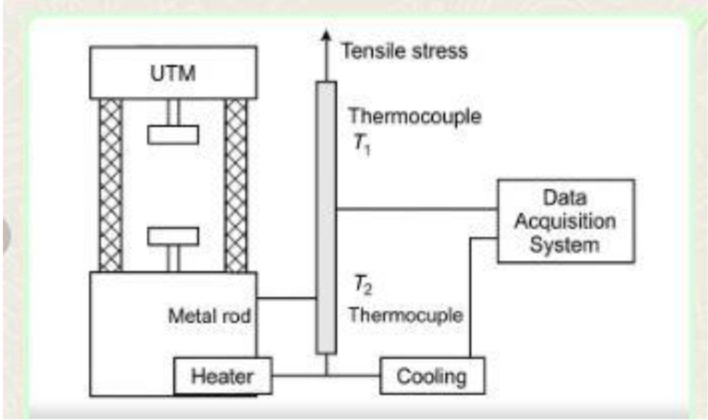
Summary of Program	
Program Name	Experimental Procedure: Investigation of Thermal Conductivity Change in a Metal Rod under Tensile Stress
Category	Industrial application
Abstract of Program	The goal of this experiment is to study how the thermal conductivity of a metal changes when subjected to tensile stress using a Universal Testing Machine (UTM). The experimental setup will allow us to apply tensile stress to a metal rod while simultaneously measuring its temperature distribution along the metal rod. The relationship between tensile stress and thermal conductivity will be analyzed. **Applications in Engineering Design** Understanding stress effects on thermal conductivity is vital for: - Heat-sensitive components (e.g., turbines) - MEMS/NEMS devices - Flexible electronics - Aerospace structures Strain-engineered thermal management is an emerging area of research.

Details of Program		
Planning		
Objectives	Long-term Goals	(Describe the program's long-term objectives over several years.)
	Short-term Targets	(Outline the program's planned outcomes for the upcoming year.)
	Rationale	(Explain the reasons for initiating the program.)
Subject (Leader)	Initiator(s)	Subrata Saha
	Champion(s)	(Enter the champion’s last name first, in capital letters.)
	Major team member(s)	1. Masud Rana

		2. Md. Sohel Rana 3. Mustafizur Rahman
Environment	Nature/Society	(Discuss how nature and society affect or limit the program.)
	Industry/Market	(Discuss how the industry and market influence or restrict the program.)
	Citizen/Government	(Discuss how citizens and government support or impose on the program.)
Resources	Human resources	4 faculty members of the Department of Mechatronics Engineering, World University of Bangladesh to conduct the experimental project and analyze the results.
	Financial resources	The total financial support required to complete this project is approximately BDT 5,00,000 (five lac only). A proposal for funding to this project is submitted to The World University of Bangladesh
	Technological resources	**Apparatus and Materials:** • Universal Testing Machine (UTM) • Metal rod specimen (e.g., copper or aluminum) • Thermal conductivity measurement system (e.g., steady-state or transient heat flow method) • Thermocouples or Infrared thermometer • Heater (e.g., electrical resistance heater) • Heat sink or cooling mechanism • Insulation material • Data acquisition system • Micrometer or calipers • Power supply • Clamp or fixture to hold the rod in the UTM • Ruler or displacement sensor (optional) **Specimen Preparation:** 1. **Material Selection**: Choose a metal rod with known baseline thermal conductivity (e.g., Copper, Aluminum). 2. **Dimensions**: Machine the rod to uniform dimensions (length ~300 mm, diameter ~10 mm). 3. **Surface Prep**: Polish the surface to remove oxidation for better thermal contact and accurate temperature measurement. 4. **Marking**: Mark locations along the rod where thermocouples will be attached (e.g., at 50 mm intervals).
Mechanism	Strategy (Weight/Sequence)	An experimental research on the **“Effect of Tensile Stress on Thermal Conductivity of Metals”** has the potential to make significant contributions to both the **industrial** and **scientific** sectors in a developing country like **Bangladesh**, where modernization of

		materials, energy efficiency, and mechanical innovation are crucial for growth. A study of thermal conductivity of metals under tensile stress can significantly enhance the design and technological efficiency of the industrial sector in any country. In factories, metals are extensively used in machinery, heat exchangers, pipelines, molds, and structural components. When these components undergo tensile stress during operation—such as in stretching, vibration, or thermal expansion—their internal atomic lattice alters, affecting phonon movement and thus thermal conductivity. If this change is not accounted for, heat dissipation efficiency may drop, leading to overheating, thermal fatigue, or early failure of parts. By understanding how tensile stress modifies thermal conductivity, engineers can design components with better **thermal stability** under mechanical load. For example, in power plants or metal forming industries, this knowledge helps optimize **cooling systems** and **material selection**. It can also inform **predictive maintenance** strategies by monitoring thermal behavior as an indicator of mechanical stress accumulation. Moreover, this research enables the creation of **smart materials** that adapt their thermal properties under load, contributing to energy-efficient manufacturing. Industries that rely on high-precision processes, such as electronics, automotive, or aerospace, can also benefit from improved thermal control. Thus, such a study is crucial for innovation, safety, and longevity of industrial equipment in a technology-driven economy.
	Organization	(Evaluate if the university's organizational structure aligns with the program's strategies.)
	Culture	(Assess whether the university's culture supports or hinders the program's execution.)
Doing		
Launch date		(Provide the launch date of the program.)
Responsible organization		(Specify the organization responsible for executing the program, whether internal or external to the university.)
Program content and process		(Describe the program's content and implementation process in 300 words.)
Key highlights of the content/process		(Identify up to three key highlights for content and for process, respectively.)
Differences from traditional approaches		(Highlight the differences before and after the program implementation.)

Progress as of today	(Evaluate the extent of the required work that has been completed.)
Problems in implementation	(Identify any issues or challenges that have hindered the program's smooth progression.)
Approaches to solve the problems	(If you have identified solutions to the aforementioned problems, explain how you discovered and applied them.)
Completion date, if completed	(State whether the program was completed and if its objectives were met; if not, estimate when you expect them to be achieved.)
Seeing	
Impacts on students	(Describe student satisfaction with the program's outcomes.)
Impacts on professors	(Describe professor satisfaction with the program's outcomes.)
Impacts on university administration	(Indicate whether the university president and administrators are satisfied with the program's outcomes.)
Responses from industry/market	(Assess industry satisfaction in your country/region regarding the program's outcomes.)
Responses from citizen/government	The government would benefit from this experiment by gaining valuable data to improve national industrial standards, energy efficiency policies, and infrastructure design. With insights into how tensile stress affects thermal conductivity, public sectors like power generation, railway, and defense can design safer, more durable components. It supports the formulation of updated **engineering codes**, promotes **local R&D**, and reduces dependence on foreign technology. Additionally, it can attract investment in **advanced manufacturing** and **material science**, boosting economic growth. Enhanced reliability and lifespan of public assets also lower maintenance costs, contributing to sustainable development and efficient use of national resources
Measurable output (revenues)	(If possible, provide specific program outcomes in monetary terms.)
Measurable input (expenses)	(If possible, provide specific inputs to the program in monetary terms.)
Cost-benefit analysis for effectiveness	(If possible, compare revenues and expenses, and analyze the program's effectiveness numerically.)
Future Planning	
Where does the project go from here?	(Write an epilogue for the program.)
Addendum	

Exhibits, pictures, diagrams, etc.	 Experimental setup
Reports, mimeos, monographs, books, etc.	(Describe the specific documents that validate the program, and list them here.)
Others which may help explain the program (including website links)	The project has two parts. The first part of the project is to conduct experimental testing on metal rods in UTM to find out the effect of tensile stress on the thermal conductivity of metals, while the second part is to run simulations to validate the experimental result for metal rod samples. Therefore, the following technological support is needed to complete this work: • ANSYS software with modern computer facilities and a laboratory • 3D printing facilities UTM machine