

# Research Methodology - Introduction

by

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# Objectives of this FDP

- To motivate faculty to take up research and inculcate the research attitude in them
- To train faculty to carry out research in scientific and systematic manner
- To expose the faculty to the finer details of research methodology tools

# Topics

- Research Motivation and Planning
- Literature Survey and defining the problem
- Technical Writing skills
- Research Ethics

# Why a Faculty should take up Research

- Opportunity to widen the knowledge base
- Sharpening of learning skills
- Opportunity to publish research papers
- Opportunity to take financial grant for research projects
- Earn more through consultancy projects

# Research

*“ Research is a structured systematic study carried out through acceptable Scientific Methodology to solve problems that results in verifiable, valuable and valid proposals”*

Research may lead to new Theory, Proposal, Correlation, Design or Method or even a new Product

# What is the Research Methodology

*Research Methodology is a process of defining means and ways of carrying out research by following scientific methods*

Research **may lead to** new Theory, Proposal, Correlation, Design or Method or even a new Product

# Why follow Research Methodology?

- Research does not begin with the results!!!
- Identification of needs
- Creation of ideas
- Formalization of ideas
- Testing
- Dissemination
- Refinement

# Classification of Research in Engineering Field

Based on Application: 1. Pure (Basic) Research,  
2. Applied Research

**Pure Research** involves developing and/or testing new theories, models, designs and correlation that may or may not have immediate application but of immense importance from the point of view of development of knowledge base in fundamental aspects.

## Examples:

- New theory annex added to electromagnetic wave theory,
- Development of analytical procedure to solve a highly complex mathematical model,
- Contribution to number theory etc.,



# Classification of Research in Engineering Field

**Applied Research** refers to research carried out to derive a methodology, model, design or analysis for problems that have immediate application.

In case of applied research, the the immediate application of anticipated solution dictates the problem for the research.

## Examples:

- 1.Improvising the atomizer performance for application in a combustor,
- 2.Developing a new efficient and compact instrumentation / model for wireless communication.
3. Developing a new methodology for a manufacturing process, Inventing new tools of management,
4. Analysing a process or event in the light of physics to explain the phenomena reported etc.,

# Classification of Research in Engineering Field

## Based on Methodology:

1. Experimental,
2. Analytical
3. Numerical

**Experimental Research** is associated with experimental investigation of a process or theme using appropriate tools.

## Examples:

1. Investigation of flow behaviour of a magnetic fluid in a magnetically resonated duct using appropriate instrumentation,
2. The performance evaluation of an internal combustion engine with different catalytic converters using required instrumentation,
3. Evolution and testing of a new strategy for product design as applied to specific class of products using the current trends in the market, etc.,

# Classification of Research in Engineering Field

**Analytical Research** is associated with the developments of models or solution to the problems using analytical tools.

## Examples:

1. Solution to a set of partial differential equations using error functions or any such new methods.
2. Development of an analytical tool to collect and analyse data during adoption of a new management strategy.
3. Evolution of new standards and practices for efficient product design procedure.

# Classification of Research in Engineering Field

**Numerical Research** is associated with the solution obtained for a practical problem using numerical tools. New numerical tools and procedures may be evolved during this process or the available commercial numerical analysis based software may be used to solve the problem.

Examples:

1. Numerical investigation of flow of a non-newtonian fluid through a pin-hole orifice using a commercial software.
2. Development of a numerical tool to predict the fluid flow behaviour in a hypersonic flow regime.
3. Evolution of a new tool for grading the customer satisfaction using mathematical, statistical and numerical methods.

# Research Methodology - Mandatory Steps

- Finding a topic
- Problem specification
- State-of-the-art (literature review)
- Proposed approaches and their justification
- Tools and methods used
- Expected results and their significance
- Plan of activities, time table

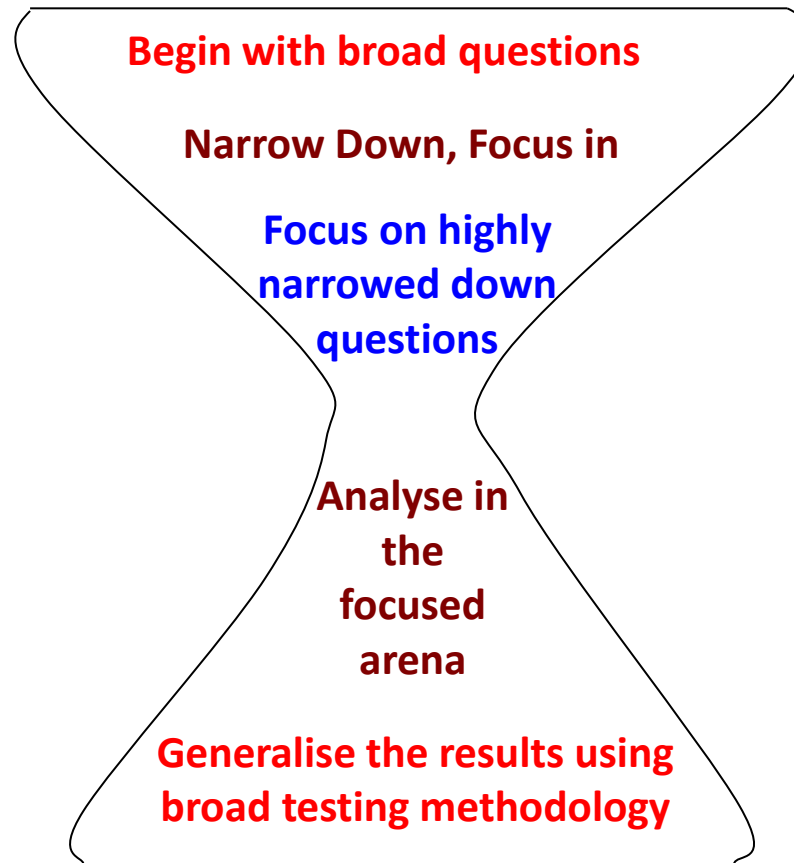
# Research methodology – mandatory steps

- Finding a topic
  - Worthwhile problem/question still unsolved
  - Be able to solve it
  - Not a toy problem, but not too big to finish
- Problem specification (literature review)
- State-of-the-art
- Proposed approaches and their justification
- Tools and methods used
- Expected results and their significance
- Plan of activities, time table

# Research methodology – mandatory steps

- Finding a topic
- Problem specification
  - Concise & unambiguous description of the problem to solve
  - Requirements specification
- State-of-the-art (literature review)
- Proposed approaches and their justification
- Tools and methods used
- Expected results and their significance
- Plan of activities, time table

# Research Methodology





# Research methodology – mandatory steps

- Finding a topic
- Problem specification
- State-of-the-art (literature review)
  - A MUST for proving the originality and value of your work
  - Know what's already done
  - Know who you should talk to
- Proposed approaches and their justification
- Tools and methods used
- Expected results and their significance
- Plan of activities, time table

# Research methodology – mandatory steps

- Finding a topic
- Problem specification
- State-of-the-art (literature review)
- Proposed approaches and their justification
  - How do you solve the problem
  - Design phase: modeling, architecture, interfaces...
- Tools and methods used
- Expected results and their significance
- Plan of activities, time table

# Research methodology – mandatory steps

- Finding a topic
- Problem specification
- State-of-the-art (literature review)
- Proposed approaches and their justification
- Tools and methods used
  - What are you using for solving the problem
  - Implementation phase: algorithms, data structure...
- Expected results and their significance
- Plan of activities, time table

# Research methodology – mandatory steps

- Finding a topic
- Problem specification
- State-of-the-art (literature review)
- Proposed approaches and their justification
- Tools and methods used
- **Expected results and their significance**
  - Addressed in the context of already existing work
  - Evaluate your results (functional and non-functional points of view)
  - Indicate the criteria
- Plan of activities, time table

# Research methodology – mandatory steps

- Finding a topic
- Problem specification
- State-of-the-art (literature review)
- Proposed approaches and their justification
- Tools and methods used
- Expected results and their significance
- Plan of activities, time table



WHICH STEP HAVE YOU REACHED TODAY?

# Become a Champion



# Thank You