

Visvesvaraya Technological University



BRMK557

Research Methodology  
and Intellectual Property

Rights  
Questions (Indicating RBTL) and  
Answers

Module 1 Part 1

Mr. Harish M

## Syllabus Module 1:

Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

### Course Outcomes

At the end of the course the student will be able to:

C O 1: To know the meaning of engineering research.

C O 2: To know the procedure of Literature Review and Technical Reading. C O 3: To know the fundamentals of patent laws and drafting procedure.

C O 4: Understanding the copyright laws and subject matters of copyrights and designs

C O 5: Understanding the basic principles of design rights.

RM & IPR[BRMK557]

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Balas

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## **1.1 Meaning of Research**

Explain the fundamental principles of engineering research and how it involves systematically exploring and learning to solve real-world problems.

CO1, RBTL 3, 10  
Marks

Answer Key:

What is Research?

Engineering

Research The

Research Cycle

Building Background

Knowledge Making a

Contribution

Types of Knowledge (Observation, Models,  
Processes)

# What is Research?

Research is a way of finding out things or solving problems by following a careful and systematic method.

# What is Research?

It's like being curious and looking for answers to things we don't know yet.

# **Engineering Research**

**It is about improving our  
knowledge to solve  
skills orreatdeosnd things  
problems  
better.**

# **Engineering Research**

**It begins with recognizing a problem or something we want to achieve but can't yet.**

# **Engineering Research**

**It's all about exploring and  
learning to make the world  
better.**

# **Engineering Research**

**Good research collects information systematically and going beyond what we already know.**

# **Engineering Research**

**In engineering, it often starts from a broad area, then narrows down to a topic, and finally focuses on a specific problem.**

# Engineering Research

Finding a good problem to  
solve is a big part of research.

# The Research Cycle

Imagine  
research  
process.

like a cyclic

# The Research Cycle

**First, there's a real problem we want to solve.**

# The Research Cycle

This problem leads to a question.

# The Research Cycle

We then do research to find an answer or solution.

# The Research Cycle

Finally, that answer helps us solve the original problem.

# The Research Cycle

Meantime we will find a problem and new new arise. questions may

# **Building Background Knowledge**

**Before doing research, we need to learn and connect different ideas.**

# Building Background Knowledge

This helps our minds get ready to work on new things.

# **Building Background Knowledge**

**It's not about memorizing lots of facts; it's about preparing to create new knowledge.**

# Making a Contribution:

**Research isn't just about reading books or collecting information that already exists.**

# Making a Contribution:

**It's about adding something new, even if it's small, to what we know.**

# Making a Contribution:

It's like bringing a puzzle piece  
to complete a bigger picture.

# **Types of**

**Knowledge.** There are three main ways we access knowledge:

we develop  
and

## **(i) Observation:**

**This is when we watch and learn from what's happening around us.**

# **Types of**

**Knowledge.** There are three main ways we access knowledge:

we develop  
and

## **(i) Observation:**

It can be as simple as measuring things in a lab or studying how something works.

# Types of

~~Knowledge.~~ There are three main ways we access knowledge:

we develop  
and

## (ii) Models:

Sometimes, we use models or simplified ways to describe complex things.

## Types of

There are three main ways access knowledge:

we develop and

### (ii) Models:

It's like making  
understand a big  
area.

a map to

## **Types of**

**Knowledge.** There are three main ways we access knowledge: we develop and

### **(iii) Processes:**

**We use specific methods or steps to get a certain result.**

## **Types of**

**Knowledge.** There are three main ways we access knowledge:

we develop  
and

### **(iii) Processes:**

**It's like following a recipe to cook something delicious.**

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## **1.2 OBJECTIVES OF ENGINEERING RESEARCH**

Explain the significance of framing research objectives in engineering, emphasizing their role in the research process and the potential outcomes even when the desired result isn't achieved.

CO1, RBTL 3, 10  
Marks

Answer

Key:

Introduction

n

Type Staff of Research (Exploratory or Formulative Research,  
Research Classify Guess Research Hypothesis-Testi  
Tricky Objectives Diagnostic h, ng  
Research)

# Introduction

The primary objective of engineering research is to apply scientific methods to address unanswered questions and solve real-world problems.

# Introduction

However, it's important to understand that research goals extend beyond merely achieving a desired result.

# Introduction

Research objectives should be framed so that, even if the outcome isn't achieved, insights are gained.

# Introduction

Understanding why a particular objective couldn't be met contributes to ongoing research efforts.

# Introduction

In some cases, a different approach or perspective may eventually lead to the desired outcome.

# The Start of Engineering Research

When engineers begin their research, they are faced with a unique challenge. They don't have all the answers from the start.

# The Start of Engineering Research

In fact, the conclusion they seek is often completely unknown. So, how do they even begin?

# The Start of Engineering Research

To kickstart the research journey, engineers rely on a mix of "circumstantial evidence," intuition, and imagination.

# The Start of Engineering Research

It's like taking an educated guess about what the final answer might look like.

# The Start of Engineering Research

This initial guess serves as a target, something to aim for.

# The Start of Engineering Research

However, it's important to note that this guess isn't always accurate.

# Chasing the Guess

The guess, though not always right, provides a direction to work towards.

# Chasing the Guess

Engineers embark on experiments and investigations based on their initial guess.

# Chasing the Guess

Sometimes, they discover that their guess was indeed incorrect.

# Chasing the Guess

However, this isn't a failure. Instead, it can lead to valuable insights, new avenues of exploration, or even unexpected discoveries.

# Chasing the Guess

In essence, engineering research is a dynamic process where the journey itself can reveal exciting opportunities and solutions that weren't apparent at the beginning.

# Chasing the Guess

This element of unpredictability keeps the process engaging and full of potential.

# Tricky Objectives

Research objectives in engineering can sometimes appear complex and challenging to follow.

# Tricky Objectives

Engineers need to navigate through a maze of information to solve problems effectively.

# Tricky Objectives

Failing to thoroughly investigate engineering guidelines, standards, and best practices can have serious consequences, leading to failures with far-reaching impacts.

# Tricky Objectives

As engineers, the ability to conduct meticulous and accurate research while effectively communicating the results is crucial.

# Tricky Objectives

It directly influences decision-making and ensures that projects meet the highest standards of quality and safety.

# Types of Research

In engineering, there are various types of research studies, each serving a specific purpose: Each type of research serves a unique role in advancing knowledge and addressing engineering challenges.

# Types of Research

## Exploratory or Formulative Research:

This type of research is conducted to explore new ideas, concepts, or areas of interest within engineering.

# Types of Research

## Exploratory or Formulative Research:

It focuses on generating initial hypotheses and theories rather than testing existing ones.

# Types of Research

## Exploratory or Formulative

Research:

Example: An engineer may conduct to research for ~~sustainable~~ ~~innovation~~ without having a specific hypothesis in mind.

# Types of Research

## Descriptive Research:

It aims to provide a comprehensive detailed account of a specific or existing phenomenon, subject, or problem.

# Types of Research

## Descriptive

Research:

It involves collecting data information to describe characteristics, features, or attributes of the subject under study.

# Types of Research

## Descriptive

### Research:

**Example:** An engineer might use descriptive research to compile detailed reports on the structural components and design of historical bridges in a particular region.

# Types of Research

## Diagnostic Research:

Diagnostic research is carried out to investigate and identify the causes and underlying factors contributing to specific engineering issues or problems.

# Types of Research

## Diagnostic Research:

It seeks to understand why a particular problem exists by analyzing its root causes and variables involved.

# Types of Research

## Diagnostic Research:

Example: An engineer could conduct diagnostic research to determine why a certain electronic component in a device is malfunctioning and identify the contributing factors.

# Types of Research

## Hypothesis-Testing Research:

This type of research involves testing educated guesses or hypotheses to ascertain their validity and whether they hold true.

# Types of Research

## Hypothesis-Testing Research:

It relies on empirical data and experimentation to either confirm or reject the proposed hypotheses.

# Types of Research

## Hypothesis-Testing Research:

Example: An engineer may use hypothesis-testing research to investigate whether altering the composition of a particular alloy enhances its tensile strength as hypothesized.

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Module 1 Part 3

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## **1.3 MOTIVATION IN ENGINEERING RESEARCH**

Explain the various motivations that drive engineers to engage in research, highlighting their diverse reasons and how these motivations influence their research pursuits.

CO1, RBTL 3, 10  
Marks

Answer

Key:

Introduction

Because It's

Interesting For the

Rewards Because of

Others Personal

Fulfillment Making the

World Better Some

Extra Push External

# Introduction

Motivation in engineering research is like a bunch of different reasons that drive engineers to explore, discover, and create.

# Introduction

When engineers decide to do research, they push them to explore new things.

**Because It's**

**Interesting**

Some engineers just  
research topics  
fascinating.

find

# Because It's Interesting

They're curious and love a good challenge.

# Because It's Interesting

Learning new stuff and finding meaning in their work drives them.

# Because It's Interesting

It's like solving a puzzle or  
involving in an exciting  
adventure.

.

# For the Rewards

Others are motivated by rewards like money, fame, awards, praise, or getting a high-status job.

# For the Rewards

Imagine inventing something cool and getting a patent for it. That could make you rich and famous.

# Because of Others

Sometimes, your friends or even people you don't like can push you. If your friends are into research, you might want to join in.

# Because of Others

Or maybe someone you don't really get along with is doing well, and you want to prove you can do better.

# Personal Fulfillment

Some engineers are driven by personal reasons.

# Personal Fulfillment

They want to solve tough problems, enjoy brains, help their community, and earn respect from others.

# Personal Fulfillment

It's about feeling good  
what they do.

about

# Making the World Better

There are engineers who want  
to do more than just okay.

# Making the World Better

They aim to beat what's already out there, make technology better, and contribute to making society a nicer place.

# Making the World Better

They want to honor their cultural background and make their mark in history.

# Some Extra Push

A mix of reasons can also motivate engineers.

# Some Extra Push

Like wanting to outdo what' already been done, improv in technology, making better, and carrying on the cultural heritage.

# External Influences

Sometimes, outside things  
can also motivate people.

# External Influences

Like when the government says, "Hey, we need research in this area" !

# External Influences

or when there's money and good job opportunities. That can get people excited about engineering research.

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## **1.4 Types of Engineering Research**

Compare and contrast types of engineering research, and explain their respective roles in shaping discoveries and solving problems in the field.

CO1, RBTL 4, 10  
Marks

**Answer Key:**

Introduction

Descriptive Research

Analytical Research

Applied Research

Fundamental

Research

Quantitative

Research Qualitative

Research

# Introduction

In engineering research, different types of research approaches play a pivotal role in shaping the path to discovery and innovation.

# Introduction

These approaches, include descriptive, analytical, fundamental, quantitative and qualitative research.

# Descriptive Research

Imagine you're a  
photographer in a  
forest, capturing images  
of animals without disturbing  
them.

# Descriptive Research

Your goal is to document and show the different species and their behaviors as they naturally occur in their habitat.

# Analytical Research

Imagine you're a forensic investigator examining a crime scene.

# Analytical Research

You're not just documenting evidence; you're piecing together clues to understand why the crime happened and who might be responsible.

# Analytical Research

You're like a problem solver  
unraveling the mysteries ,  
behind the incident.

# Analytical Research

In engineering, this could involve investigating a product failure to determine the root cause and prevent future issues.

# Applied Research

Think of a car manufacturer facing a problem with their vehicles suddenly stalling.

# Applied Research

They conduct research to identify and fix the immediate issue, ensuring that the cars run smoothly and safely on the road.

# Applied Research

It's like providing a quick  
solution to keep things running.

# Fundamental Research

This is like astronomers studying the origins of galaxies and the fundamental laws of the universe.

# Fundamental Research

They delve into the question about deepest the aiming to expand our understanding of the universe's structure and evolution.

# Fundamental Research

It's not about solving an immediate problem but gaining profound knowledge.

# Quantitative

## Research

Imagine you're a market researcher analyzing survey responses from thousands of people to determine which smartphone features are most popular.

# Quantitative

## Research

You use statistical data to draw conclusions, making it clear what a certain percentage prefers larger screens or better battery life.

## Qualitative

## Research

This is like conducting in-depth interviews with a few individuals to understand their personal experiences with a new technology.

## Qualitative

## Research

You explore their unique stories and insights, diving deep into their perspectives on how the technology has impacted their lives.

# Qualitative

## Research

It's about quality over quantity  
focusing on rich narratives and  
human  
experiences.

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**Module 1 Part 5**

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## **1.6 ETHICS IN ENGINEERING RESEARCH**

Describe the significance of ethics in engineering research, providing examples of how ethical principles guide researchers, and explain the historical development of international rules for research ethics, including their impact on the conduct of research.

CO1, RBTL 4, 10  
Marks

**Answer Key:**

**What Are Ethics?**

**International Rules for Research**

**Ethics Tricky Questions About**

**Authorship Rules and Codes**

**Why It Matters**

# What Are Ethics?

Ethics is like a set of rules that help us know what's okay and what's not.

# What Are Ethics?

It helps us figure out what's right and what's wrong.

# What Are Ethics?

It's a bit like wise sayings or teachings, similar to the sayings of Chanakya.

# What Are Ethics?

These rules guide our behavior and help us make good choices in life.

# International Rules for Research Ethics

There have been international rules about doing research ethically since 1947 when the Nuremberg Code was adopted. People have cared about ethical issues in research for a long time.

# International Rules for Research Ethics

For example, in the 1600s, the British Royal Society changed how research results were shared.

They started giving credit to whoever shared their findings first, instead of who discovered something first.

# International Rules for Research Ethics

For example, in the 1600s, the British Royal Society changed how research results were shared.

They started giving credit to whoever shared their findings first, instead of who discovered something first.

# Tricky Questions About Authorship

Sometimes, it's tricky to decide who should be called an author and in what order they should be listed.

This is especially important today when researchers from all over the world work together.

# Questions About Tricky Authorship

ip

Some people might help a lot with the research but not write the paper, so who gets credit?

Some Universities even have rules about coauthorship to prevent cheating.

# Rules and

## Codes

Different countries and Universities have their own codes for research ethics.

# Rules and

## Codes

Some people confuse research ethics with the ‘responsible conduct of research’, but they're a bit different.

# Rules and

## Codes

Research ethics is about making sure research is used in the right way, while responsible conduct of research is about how research is done.

# Why It Matters

So, why do ethics in engineering  
research matter?

# Why It Matters

Well, they help us do good research  
and make sure it's used for the right  
reasons.

# Why It

# Matters

They also make sure everyone gets the credit they deserve for their hard work.

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Questions (including RBTL) and  
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Module 1 Part 7

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# 1.7 Ethics in Engineering Research

**Practical** the significance of engineering ethics in research, particularly in the context of data-related technologies, and how engineering researchers can proactively address ethical concerns during the development of technology.

CO1, RBTL 3, 10 Marks

Answer Key:

Real-Life Impact of Engineering  
Research Data and Its Ethical  
Dimensions Balancing Possibilities and  
Ethics

The Role of Engineering Researchers (1. Setting Ethical Requirements, 2. Ethical Considerations in Design, 3. Choosing Ethical Alternatives)

Mitigating Unintended Consequences

# Real-Life Impact of Engineering Research

When engineers conduct research, they often deal with data and technology that can affect individuals and society as a whole.

# Real-Life Impact of Engineering Research

For example, think about systems that collect surveillance data for purposes. How this data ~~as seen by~~ raise ethical concerns, especially regarding people's privacy.

# Data and Its Ethical Dimensions

One key reason ethics matter in engineering research, especially when dealing with data, is because this data often involves humans. Different situations and people may have varying views on what is acceptable or not.

# Data and Its Ethical Dimensions

It's essential to consider these ethical aspects, as they can significantly impact how data is used and the consequences that follow.

# Balancing Possibilities and Ethics

Today, we have access to vast amounts of data and advanced tools to analyze it.

# Balancing Possibilities and Ethics

This raises an important question:  
Just because we can do something  
with data, should we do it?

# Balancing Possibilities and Ethics

Engineering ethics provides guidelines on how to determine what actions are morally acceptable and what are not.

# The Role of Engineering Researchers

Engineering researchers are not separate from the broader technological developments happening in society.

# The Role of Engineering Researchers

They make choices that have ethical implications and can influence technology's effects.

# The Role of Engineering Researchers

They make choices that have ethical implications and can influence technology's effects.

# The Role of Engineering Researchers

Here are some ways they do this:

## 1. Setting Ethical Requirements

Right from the beginning, researchers can define ethical requirements for their projects.

# The Role of Engineering Researchers

Here are some ways they do this:

## 1. Setting Ethical Requirements

These requirements guide the development of technology, ensuring it aligns with ethical principles.

# The Role of Engineering Researchers

Here are some ways they do this:

## 2. Ethical Considerations in Design

During the design phase, researchers make decisions about how to fulfill project requirements.

# The Role of Engineering Researchers

Here are some ways they do this:

## 2. Ethical Considerations in Design

Ethical aspects, such as safety and fairness, should be part of this decision-making process.

# The Role of Engineering Researchers

Here are some ways they do this:

## 3. Choosing Ethical Alternatives

Researchers often face choices between different alternatives that achieve similar goals.

# The Role of Engineering Researchers

Here are some ways they do this:

## 3. Choosing Ethical Alternatives

They must weigh these options from an ethical standpoint and select the one that aligns with moral principles.

# Mitigating Unintended Consequences

Engineering research can lead to unintended side effects.

It's the ethical duty of researchers to minimize these risks and consider safer alternatives.

# Mitigating Unintended Consequences

This may involve designing technologies with built-in safety measures or backup systems to prevent harm.

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Module 1 Part 8

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## 1.8 TYPES OF RESEARCH

**MISCONDUCT** Importance of research integrity, while also highlighting other forms of research misconduct and their implications.

CO1, RBTL 4, 10  
Marks

Answer Key:

The Essence of Research Integrity  
Preventing Mistakes Through Peer  
Review

Common Types of Research Misconduct [1. Fabrication  
(Creating Fake Data), 2. Falsification (Altering Data  
Inappropriately), 3. Plagiarism (Using Others' Work Without  
Credit)]

Detecting Plagiarism

Ethical Avoidance of Plagiarism  
Other Forms of Research

Misconduct

# The Essence of Research Integrity

Integrity in research involves conducting studies honestly, treating others fairly, ensuring the safety of research subjects, and accurately representing methods and results. It's a vital aspect of responsible research.

# Preventing Mistakes Through Review Peer

Before research findings are published, peer reviews should occur. These reviews help spot errors and ensure the credibility of the research output.

# Common Types of Research Misconduct

Research misconduct can take different forms:

1. Fabrication (Creating Fake Data)
2. Falsification (Altering Data Inappropriately)
3. Plagiarism (Using Others' Work Without Credit)

# Common Types of Research Misconduct

## 1. Fabrication (Creating Fake Data)

Fabrication involves making up data or experiments because of time constraints or pressure.

It undermines the integrity of research and can lead to false information circulating in scientific literature.

# Common Types of Research Misconduct

## 2. Falsification (Altering Data Inappropriately)

Falsification occurs when data or experiments are misrepresented, altered, or misinterpreted to support a particular hypothesis, even if the actual results suggest otherwise.

It can harm research progress and trust.

# Common Types of Research Misconduct

## 3. Plagiarism (Using Others' Work Without Credit)

Plagiarism is copying someone else's work , including text, data, or ideas, without giving proper credit.

This unethical practice extends to self-plagiarism, where one reuses their own work without acknowledgment.

# Detecting Plagiarism

can be identified through various means:

- Original authors may discover it.
- Reviewers might uncover it during the review process.
- Readers who come across the plagiarized content can report it.

## Detecting

### Plagiarism

Automated software can detect similarities between texts, human judgment is often needed to determine if plagiarism has occurred.

A low similarity score doesn't guarantee plagiarism-free content.

# Ethical Avoidance of Plagiarism

When high similarity scores in manuscripts, researchers can ethically use existing content:

- Paraphrase the content in their own words.
- Summarize relevant material.
- Always cite the original source.

## Ethical Avoidance of

**Plagiarism** citing, researchers should avoid doing copying sentences or paragraphs exactly.

They should aim to differentiate their ideas and writing from existing sources.

## Other Forms of Research

**Misconduct** Serious deviations from ethical conduct can also be considered research misconduct. Researchers should refrain from submitting the same article to multiple journals simultaneously, as it violates publication policies.

Additionally, mistakes in published content are often not openly acknowledged and corrected.

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