

BRMK557 - Research Methodology and IPR

Credits :03

BRMK557 - Research Methodology and IPR

- **Course outcomes:**
- **CO1.** To know the meaning of engineering research.
- **CO2.** To know the procedure of Literature Review and Technical Reading.
- **CO3.** To know the fundamentals of patent laws and drafting procedure
- **CO 4.** Understanding the copyright laws and subject matters of copyrights and designs
- **CO5.** Understanding the basic principles of design rights

BRMK557 - Research Methodology and IPR

- **Course Objectives:**

- **CO1.** To Understand the knowledge on basics of research and its types.
- **CO2.** To Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
- **CO3.** To learn Ethics in Engineering Research.
- **CO4.** To Discuss the concepts of Intellectual Property Rights in engineering.

BRMK557 - Research Methodology and IPR

Textbook:

Dr. Santosh M Nejakar, Dr. Harish Bendigeri “Research Methodology and Intellectual Property Rights”, ISBN 978-93-5987-928-4, Edition: 2023-24.

Reference Book:

- **Dipankar Deb Rajeeb Dey, Valentina E. Balas “Engineering Research Methodology”,**
- **Intellectual Property A Primer for Academia by Prof. Rupinder Tewari Ms. Mamta Bhardwa**

Assessment Details (both CIE and SEE)

- The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.
- The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50).
- if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of 40 Marks (duration 1.5 hour)
- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

- Two assignments each of 15 Marks
- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Semester End Examination:

- Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)
- The question paper will be set for 100 marks. Marks scored shall be proportionally reduced to 50 marks
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions is under a module (with a maximum of 2 sub-questions).
- The students have to answer 5 full questions, selecting one full question from each module.

Module-1

- Introduction:
 - Meaning of Research
 - Objectives of Engineering Research
 - Motivation in Engineering Research
 - Types of Engineering Research
 - Finding and Solving a Worthwhile Problem.

Module-1

- Ethics in Engineering Research
- Ethics in Engineering Research Practice
- Types of Research Misconduct
- Ethical Issues Related to Authorship.

Module-1

- Ethics in Engineering Research
- Ethics in Engineering Research Practice
- Types of Research Misconduct
- Ethical Issues Related to Authorship.

Why We have to Learn Research Methodology?

- **Critical Thinking Skills**
- **Problem Solving**
- **Evidence-Based Decision Making**
- **Academic and Professional Development**
- **Continuous Learning**
- **Communication Skills**
- **Preparation for Advanced Studies**
- **Global Perspective**



1590

In summary

- Learning research methodology is not just about conducting research; it's about developing a set of skills and a mindset that are valuable across various personal, academic, and professional contexts. It empowers individuals to think critically, solve problems, and contribute meaningfully to their chosen fields.

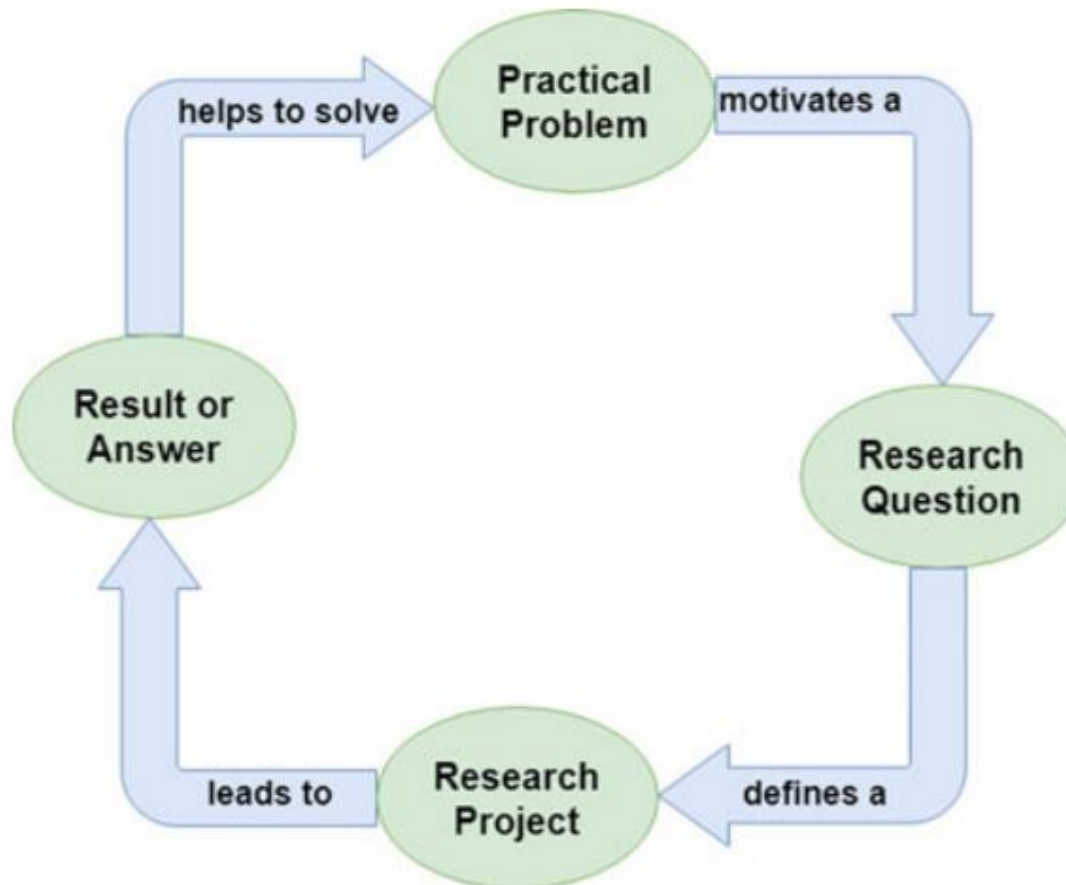
Meaning of Research

- Research refers to a careful, well-defined (or redefined), objective, and systematic method of search for knowledge, or formulation of a theory that is driven by curiousness for that which is unknown and useful on a particular aspect so as to make an original contribution to expand the existing knowledge base-**Textbook**

Meaning of Research

- Research involves formulation of hypothesis or proposition of solutions, data analysis, and deductions; and ascertaining whether the conclusions fit the hypothesis. Research is a process of creating, or formulating knowledge that does not yet exist-**Textbook**

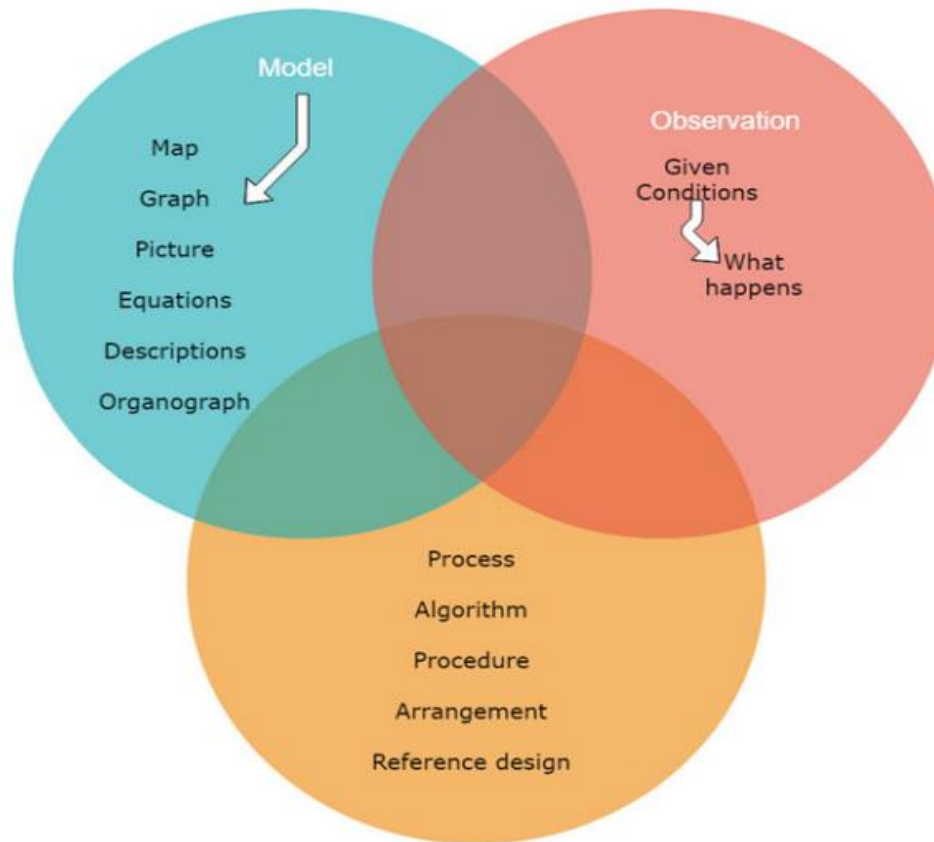
Research Flow Diagram



The ways of developing and accessing knowledge come in three, somewhat overlapping, broad categories:

- **Observation:** is the most fundamental way of obtaining information from a source, Observation takes different forms from something like measurements in a laboratory to a survey among a group of subjects to the time it takes for a firmware routine to run. The observational data often needs to be processed in some form and this leads to the second category of knowledge, the model
- **Models :** Models are approximated often simplified ways of describing sometimes very complex interactions in the form of a statistical relationship, a figure, or a set of mathematical equations
- **The final category is a way of arranging :** or doing things through processes, algorithms, procedures, arrangements, or reference designs, to get a certain desired result.

The Categories of Knowledge in Research



Objectives of Engineering Research

- The objective of engineering research is to solve new and important problems
- Knowing where and how to find different types of information helps one solve engineering problems, in both academic and professional career.
- The main aim of the research is to apply scientific approaches to seek answers to open questions, and although each research study is particularly suited for a certain approach, in general.
- The objectives of engineering research should be to develop new theoretical or applied knowledge and not necessarily limited to obtaining abilities to obtain the desired result.

Motivation in Engineering Research

- **The following desires:**
- **Studies have shown** that intrinsic motivations like interest, challenge, learning, meaning, purpose, are linked to strong creative performance;
- **Extrinsic motivating factors** like rewards for good work include money, fame, awards, praise, and status are very strong motivators, but may block creativity. For example: Research outcome may enable obtaining a patent which is a good way to become rich and famous
- **Influences from others like** competition, collaboration, commitment, and encouragement are also motivating factors in research. For example: my friends are all doing research and so should I, or, a person that I dislike is doing well and I want to do better.
- **Personal motivation** in solving unsolved problems, intellectual joy, service to community, and respectability are all driving factors

Types of Engineering Research

- **Descriptive versus Analytical:** Descriptive research includes comparative and correlational methods, and fact-finding inquiries, to effectively describe the present state of art ; Analytical-Logical approach
- **Applied versus Fundamental:** Research can either be applied research or fundamental (basic or pure) research. Applied research seeks to solve an immediate problem facing the organization, whereas fundamental research is concerned with generalizations and formulation of a theory
- **Quantitative versus Qualitative:** Quantitative research uses statistical observations of a sufficiently large number of representative cases to draw any conclusions, while qualitative researchers rely on a few non representative cases or verbal narrative in behavioral studies

Examples on Descriptive Research

- **Population Census:**
- **Survey on Consumer Preferences:**
- **Observational Study of Classroom Behavior:**
- **Analysis of Historical Trends in Stock Prices:**

Examples on Analytical Research

- **Study on the Causes of Disease Outbreaks:**
- **Comparative Analysis of Educational Methods:**
- **Crime statistics analysis:**

Applied Research Examples:

- Medical Trials for a New Drug:
- Environmental Impact Assessment:
- Market Research for a New Product:
- Cybersecurity Vulnerability Analysis:

Fundamental Research Examples

- **Mathematical Proof in Number Theory:**
- **Climate change modeling:**

Examples on Quantitative Research

- **Survey on Customer Satisfaction:**
- **Economic Data Analysis:**
- **Educational Achievement Test Scores:**

Examples on Qualitative Research

- **In-depth Interviews with Cancer Patients:**
- **Case Study of a Business Merger:**

Finding and Solving a Worthwhile Problem.

- A researcher may start out with the research problems stated by the Supervisor or posed by others that are yet to be solved.
- Research scholars are faced with the task of finding an appropriate problem on which to begin their research.
- Skills needed to accomplish such a task at the outset, while taking care of possible implications are critically important but often not taught
- **Initial spark** is ideally required before the process of literature survey may duly begin

Steps to solve a Research problem are

- **Understand the problem**, restate it as if it's your own, visualize the problem by drawing figures, and determine if something more is needed.
- One must start somewhere and **systematically explore** possible strategies to solve the problem or a simpler version of it while looking for patterns.
- **Execute the plan** to see if it works, and if it does not then start over with another approach.
- **Looking back and reflecting helps** in understanding and assimilating the strategy, and is a sort of investment into the future.

Great Problems and solutions ;Examples of Recent Times

- Addressing water scarcity through sustainable water management - Rainwater harvesting
- Exploring clean energy solutions - Solar energy, E-Vehicle
- Healthcare through biomedical solutions
- Space exploration - Chandrayana
- Covid -Vaccination
- Neuro Science - Brain Machine-Interface
- Cyber security - encryption techniques

Ethics in Engineering Research

- Ethics generally refers to a set of rules distinguishing acceptable and unacceptable conduct, distinguishing right from wrong, or wise aphorisms like the sayings of Chanakya
- Most people learn such norms in their formative years
- Ethics are not laws, but laws often follow ethics because ethics are our shared values.

- International norms for the ethical conduct of research have a deep-rooted history, dating back to the adoption of the Nuremberg Code in 1947.
- According to Whitbeck, the issues related with research credit find their roots in the seventeenth-century establishment of the British Royal Society (BRS), which aimed at refining the methods and practices of modern science.
- According to this, priority for publication was given to whoever first submitted findings, rather than focusing on determining who had first made the discovery.

- Whitbeck raised two simple but significant questions to address the tricky issue of authorship in research are :
 - (i) who should be included as an author and
 - (ii) the appropriate order of listing authors

- Government bodies, and universities worldwide have adopted certain codes for research ethics. Research ethics and the responsible conduct of research are often erroneously used interchangeably
- Research ethics examines the appropriate application of research outcomes, while responsible conduct of research deals with the way the work is undertaken

Some Examples of Unethical Practices

- Volkswagen Emissions scandal(2015)
- Facebook – Cambridge analytica Data scandal(2018)
- Googles DeepMind's NHS Patient Data
Controversy(2016)

Ethics in Engineering Research Practice

- Technological developments raise a whole range of ethical concerns such as **privacy issues** and data related to surveillance systems, and so engineering researchers need to make ethical decisions and are answerable for the repercussions borne out of their research as outcomes.
- Certain practices may be **acceptable** to certain people in certain situations, and the reasons for **unacceptability** may be perfectly valid.
- Engineering ethics gives us the **rule book**; tells us, how to decide what is okay to do and what is not.

Ethical Concerns in Technological Developments:

- **Data Collection and Privacy:** Ethics is crucial in engineering research, especially when working with data, as it directly influences human well-being. For example, Research involving data collection, especially personal or sensitive information, requires respect for individuals' privacy and obtaining informed consent.
- **Acceptability and Validity:** Certain practices may be acceptable in specific situations, but the reasons for their unacceptability can be valid. Engineering ethics serves as our rulebook, offering guidance on determining what is ethically acceptable and what is not, providing a framework for responsible data use.

Ethical Decision-Making in Technological Choices

- i. **Setting Ethical Requirements:** At the outset of a project, engineering researchers can shape the effects of the developed technology by establishing ethically sound requirements. This initial step sets the stage for the responsible technological advancements.
- ii. **Influencing Through Design:** Influence may also be applied by researchers through design, which is a process that translates the requirements into a blueprint to fulfill those requirements.
- iii. **Choosing Alternatives:** Throughout the research journey, engineering researchers have to choose between different alternatives fulfilling similar functions, considering their ethical implications.

Types of Research Misconduct

- Engineering research should be conducted to improve the state-of-the-art of technologies. Research integrity encompasses dealing fairly with others, honesty about the methods and results, replicating the results wherever possible so as to avoid errors, protecting the welfare of research subjects, ensuring laboratory safety, and so forth. In order to prevent mistakes, peer reviews should take place before the research output is published.
- Fabrication (Illegitimate creation of data)
- Falsification (Inappropriate alteration of data)
- Fabrication and falsification of data in published content can hurt honest researchers getting their work published because what they can churn out may short fall of what is already published through misconduct till the misconduct is established and subsequently retracted

Types of Research Misconduct

- **Plagiarism** (Taking other's work):Plagiarism takes place when someone uses or reuses the work (including portions) of others (text, data, tables, figures, illustrations or concepts) as if it were his/her own without explicit acknowledgement.
- The increasing availability of scientific content on the internet seems to encourage plagiarism in certain cases, but also enables detection of such practices through automated software packages.

Self-plagiarism

- Verbatim copying or reusing one's own published work is termed as self-plagiarism and is also an unacceptable practice in scientific literature.

How are supervisors, reviewers or editors alerted to Plagiarism?

- Original author comes to know and informs everyone concerned.
- Sometimes a reviewer finds out about it during the review process.
- Or, readers who come across the article or book, while doing research.

Other Aspects of Research Misconduct

- Simultaneous submission of the same article to two different journals also violates publication policy
- Another issue is that when mistakes are found in an article or any published content, they are generally not reported for public access unless a researcher is driven enough to build on that mistake and provide a correct version of the same which is not always the primary objective of the researcher.

Ethical Issues Related to Authorship.

- **Academic authorship** involves communicating scholarly work, establishing priority for their discoveries, and building peer-reputation, and comes with intrinsic burden of acceptance of the responsibility for the contents of the work. It is the primary basis of evaluation for employment, promotion, and other honors.
- **Credit for research** contributions is attributed in three major ways in research publications: by **authorship** (of the intended publication), **citation** (of previously published or formally presented work), and through a **written acknowledgment** (of some inputs to the present research).

Ethical Issues Related to Authorship.

- **Including “guest” or “gift”** (coauthorship bestowed on someone with little or no contribution to the work) authors dilutes the contribution of those who actually did the work
- **Sometimes, the primary author dubiously (ಸಂಶಯಾಸ್ಪದವಾಗಿ) bestows(ದಯಪಾಲಿಸು) co-authorship** on a junior faculty or a student to boost their chances of employment or promotion, which can be termed as Career-boost authorship
- There is also an unfortunate malpractice of co-authorship that can be described as “Career-preservation authorship” **wherein a head of the department, a dean, a provost, or other administrators are added as Coauthors** because of quid pro quo (something for something) arrangement wherein the principal author benefits from a “good relation” with the superiors and the administrator benefits from authorship without doing the required work for it

Ghost authorship

- Ghost authorship refers to a situation in which someone makes a substantial contribution to a piece of writing, such as an article, manuscript, or book, **but their contribution is not acknowledged or credited publicly**. In other words, a ghost author is someone who has played a significant role in the creation of a work but is not listed as an author or contributor.
- In some cases, **individuals may prefer to remain anonymous** for personal or professional reasons. In other situations, a more senior or well-known figure may take credit for a piece of work that was largely produced by a junior or less-established collaborator.

Accountability of Authors

- **Accountability** of authors in publications is a crucial aspect of ethical and responsible research and writing. Authors of academic and scientific publications are expected to adhere to certain standards and principles to ensure the integrity and credibility of their work.
- **Double submission** is an important ethical issue related to authorship, which involves submission of a paper to two forums simultaneously. The motivation is to increase publication possibility and possibly decrease time to publication. Reputed journals want to publish original papers, i.e., papers which have not appeared elsewhere, and strongly discourage double submission.