

Research Methodology & IPR (AL58)



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Course Contents

Unit I

Introduction: Meaning of Research, Objectives of Research, Types of Research, Ethics in Research, Types of Research Misconduct.

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art, Bibliographic Databases, Conceptualizing Research, Critical and Creative Reading.

Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge flow through Citations, Acknowledgments, and Attributions.

Unit II

Research Design: Need for Research Design, Important Concepts Related to **Research Design:** Dependent and Independent Variables, Extraneous Variable, Variable, Common Control, Confounded Relationship, Research Hypothesis, Experimental and Control Groups, Treatments.

Experimental Designs: Introduction to Randomised Block Design, Complete Randomised Design, Latin Square Design, and Factorial Design.

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Unit III

Method of Data Collection: Primary and Secondary Data Collection.

Sampling Design: Sampling fundamentals, Measurement, and Scaling Techniques, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, and Types of Sample Design.

Data Analysis: Testing of Hypotheses: Null Hypothesis, Alternative Hypothesis, Type I and Type II Errors, Level of Significance. Procedure for Hypothesis Testing: Mean, Variance, Proportions. Chi-square Test, Analysis of Variance (One Way ANOVA), and Covariance (ANOCOVA)

Unit IV

Intellectual Property Rights

Introduction to IPR: Different forms of IPR, Role of IPR in Research and Development. TRIPS Agreement, Patent Cooperation Treaty (PCT).

Patents: Brief history of Patents-Indian and Global Scenario, Principles Underlying Patent Law, Types of Patent Applications in India, Procedure for Obtaining a Patent. Non Patentable Inventions. Rights Conferred to a Patentee, Basmati Rice Patent Case.

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Unit V

Design: What is a Design? Essential Requirements for a Registrable Design, Procedure of Registration of a Design,

Trademarks: Essentials of a Trademark, Registration, and Protection of Trademarks, Rights Conferred by Registration of Trademarks, Infringements, Types of Reliefs, Case Studies.

Copyrights: Characteristics of Copyrights, Rights Conferred by Registration of Copyrights, Registration of Copyrights, Infringements, Remedies against Infringement of Copyrights, Case studies

Text Books

1. C. R Kothari, Gourav Garg, Research Methodology – Methods and Techniques. New Age International Publishers.
2. Dr. B L Wadehra – Law relating to Intellectual property. Universal Law Publishing Co.
3. Dipankar Deb, Rajeeb Dey, Valentina E. Balas “Engineering Research Methodology”, ISSN 1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook), <https://doi.org/10.1007/978-981-13-2947-0>.

Reference Books

1. David V. Thiel “Research Methods for Engineers” Cambridge University Press, 978-1-107-03488-4

Course Outcomes

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

C01: Possess the knowledge of research and conduct a literature review.

C02: Apply the knowledge of research design and design of experiments.

C03: Analyse data collection methods, analysis, and sampling design.

C04: Understand the global and Indian scenarios of patents and patent applications.

C05: Acquire the requirements of registration and infringements related to trademarks, copyrights, and designs.

UNIT- 1

Introduction to Research Methodology

Need for Undergraduate Research

Doing research as an undergraduate student is not only great for your CV, but it hones your critical thinking and problem-solving skills too.

Meaning of Research

- ❖ **The Advanced Learner's Dictionary of Current English:** “A careful investigation or inquiry specially through search for new facts in any branch of knowledge.”

Or

- ❖ **Redman and Mory:** “A systematized effort to gain new knowledge.”

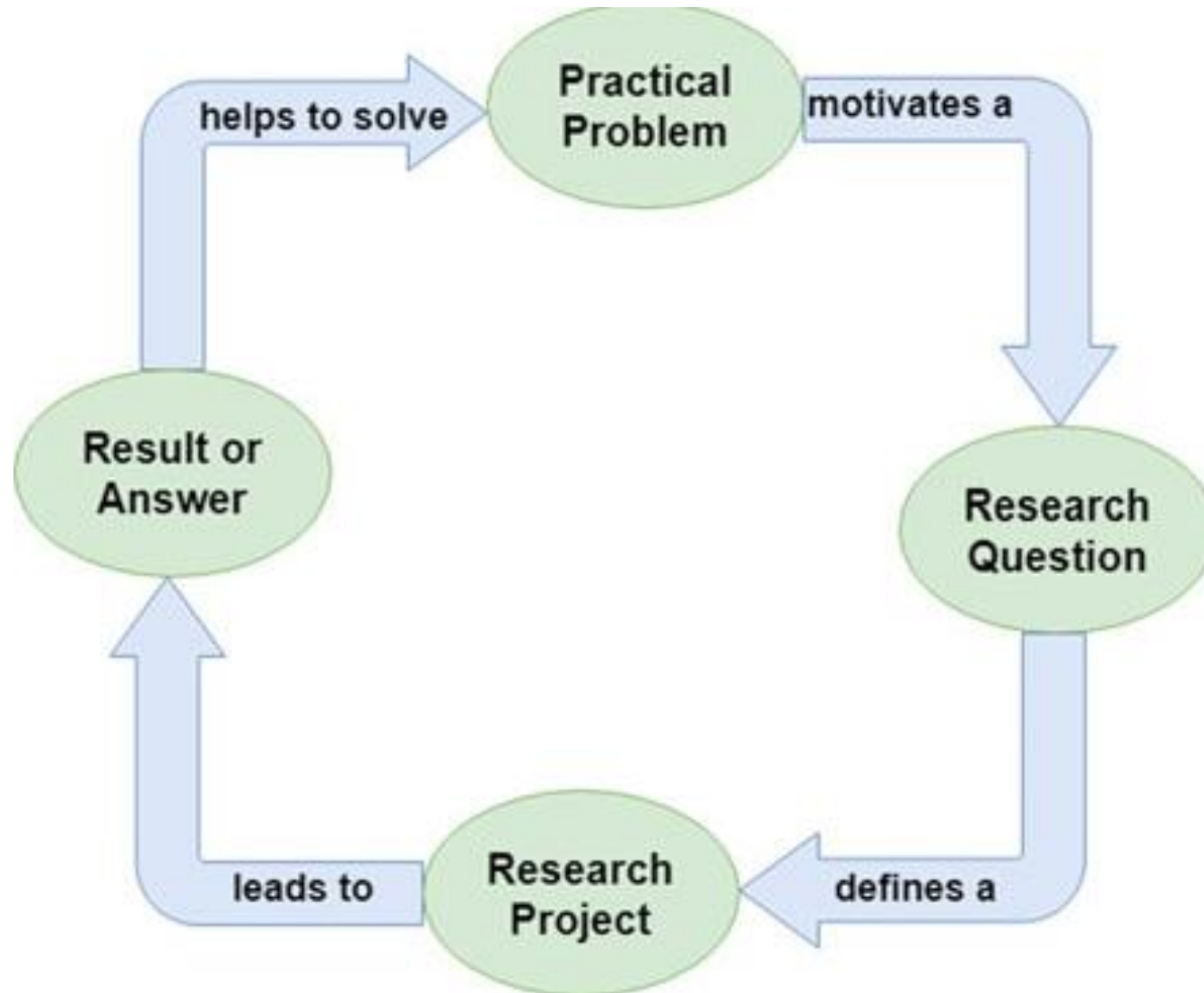
Or

- ❖ **Encyclopedia of Social Sciences:** “The manipulation of things, concepts or symbols for the purpose of generalizing to extend, correct or verify knowledge, whether that knowledge aids in construction of theory or in the practice of an art.”

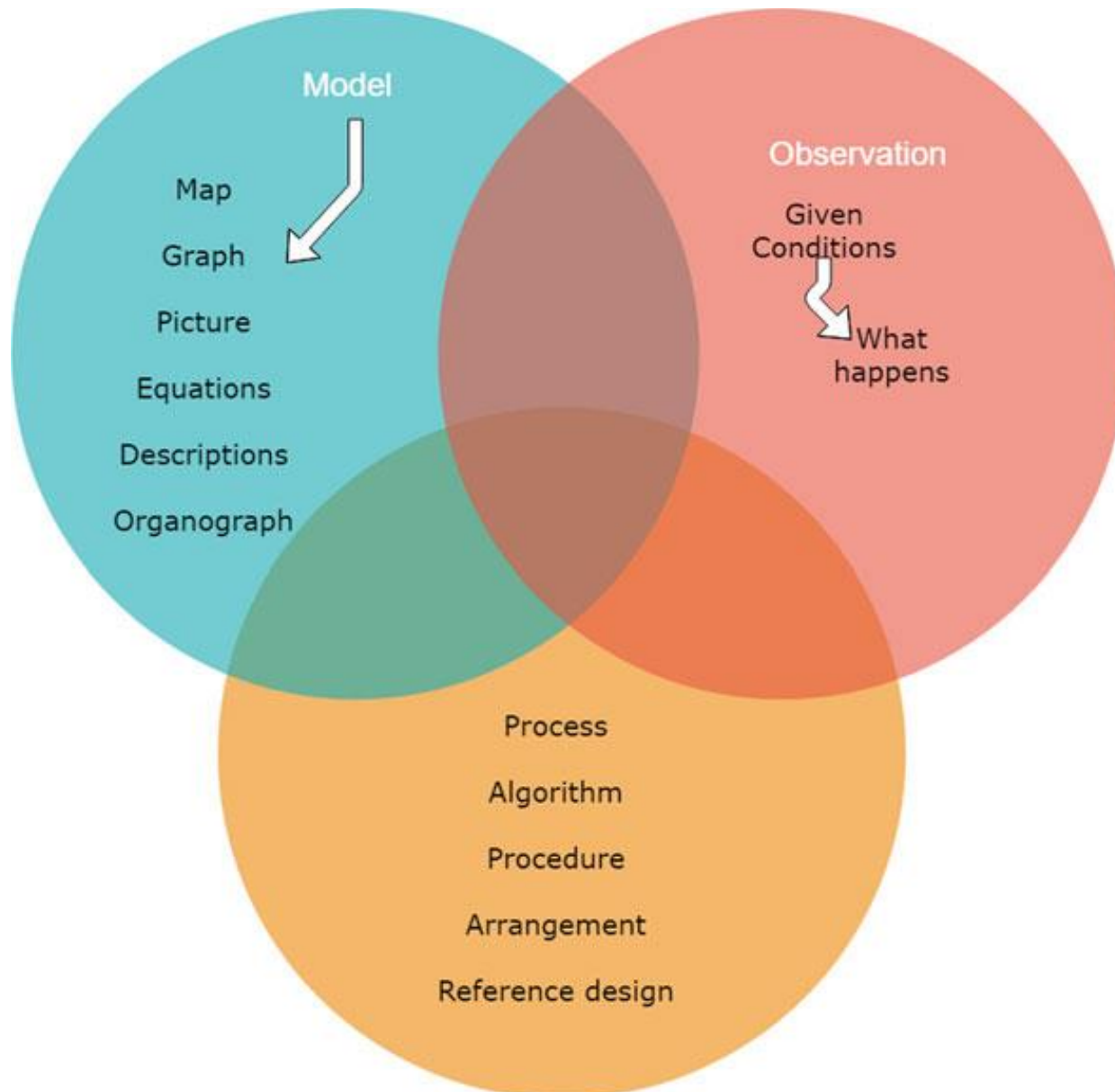
Or

- ❖ 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 inquisitiveness for that which is unknown and useful on a particular aspect so as to make an original contribution to expand the existing knowledge base.

Research Flow Diagram



The categories of knowledge in research



- ❖ Good research involves systematic collection and analysis of information and is followed by an attempt to infer a little bit beyond the already known information in a way that is a significant value addition.
- ❖ Usually, engineering research is a journey that traverses from a research area (example: Control Systems), to the topic (example: Control of Microbial Fuel Cells) and finally onto the problem (example: Adaptive Control of Single Chamber Microbial Fuel Cells)
- ❖ (Area → Topic → Problem).

Objectives of Research

- ❖ To discover answers to questions through the application of scientific procedures.
- ❖ To find out the truth which is hidden and which has not been discovered as yet.
- ❖ Research objectives fall into a number of following broad groupings:
 - ✓ To gain familiarity with a phenomenon or to achieve new insights into it (**exploratory or formulative research studies**)
 - ✓ To portray accurately the characteristics of a particular individual, situation or a group (**descriptive research studies**)
 - ✓ To determine the frequency with which something occurs or with which it is associated with something else (**diagnostic research studies**)
 - ✓ To test a hypothesis of a causal relationship between variables (**hypothesis-testing research studies**)

Objectives of Research cont.

- ❖ 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.
- ❖ The objectives should be framed such that in the event of not being able to achieve the desired result that is being sought, one can fall back to understanding why it is not possible, because that is also a contribution toward ongoing research in solving that problem.
- ❖ Of course, someone else might come along and actually propose a different approach where the desired objective is indeed possible to be achieved.

Types of Research

❖ Descriptive vs Analytical:

- ✓ ***Descriptive research*** includes surveys and fact-finding enquiries of different kinds. The major purpose of descriptive research is description of the state of affairs as it exists at present. (*Ex post facto research*)
- ✓ In ***analytical research***, the researcher has to use facts or information already available, and analyze these to make a critical evaluation of the material.

❖ Applied vs Fundamental:

- ✓ ***Applied research*** aims at finding a solution for an immediate problem facing a society or an industrial/business organization.
- ✓ ***Fundamental research*** is mainly concerned with generalizations and with the formulation of a theory. (Related to natural phenomenon, pure mathematics)

Types of Research

❖ Quantitative vs Qualitative:

- ✓ **Quantitative research** is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity.
- ✓ **Qualitative research** is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind. This type of research aims at discovering the underlying motives and desires, using in depth interviews for the purpose.

❖ Conceptual vs Empirical:

- ✓ **Conceptual research** is related to some abstract idea(s) or theory. It is generally used by philosophers and thinkers to develop new concepts or to reinterpret existing ones.
- ✓ **Empirical research** relies on experience or observation alone, often without due regard for system and theory. It is data-based research, coming up with conclusions which are capable of being verified by observation or experiment.

Some Other Types of Research

❖ One-time research or Longitudinal research

- ✓ In the former case the research is confined to a single time-period, whereas in the latter case the research is carried on over several time-periods.

❖ Field-setting research or Laboratory research or Simulation research

- ✓ Depending upon the environment in which it is to be carried out.

❖ Clinical or Diagnostic research

- ✓ Such research follow case-study methods or in-depth approaches to reach the basic causal relations.

❖ Exploratory or Formalized research

- ✓ The objective of *exploratory research* is the development of hypotheses rather than their testing, whereas *formalized research* studies are those with substantial structure and with specific hypotheses to be tested.

Some Other Types of Research

❖ Historical research

- ✓ Research which utilizes historical sources like documents, remains, etc. to study events or ideas of the past, including the philosophy of persons and groups at any remote point of time.

❖ Conclusion-oriented and Decision-oriented research

- ✓ While doing *conclusion oriented research*, a researcher is free to pick up a problem, redesign the enquiry as he proceeds and is prepared to conceptualize as he wishes.
- ✓ *Decision-oriented research* is always for the need of a decision maker and the researcher in this case is not free to embark upon research according to his own inclination.

5 Important Ethics in Research

1. Minimizing the risk of harm.
2. Obtaining informed consent.
3. Protecting anonymity and confidentiality.
4. Avoiding deceptive practices.
5. Providing the right to withdraw.

Types of Research Misconduct

- ❖ Publishing the same paper in two different journals without telling the editors.
- ❖ Submitting the same paper to different journals without telling the editors.
- ❖ Not informing a collaborator of your intent to file a patent in order to make sure that you are the sole inventor.

Types of Research Misconduct Cont.

- ❖ Including a colleague as an author on a paper in return for a favor even though the colleague did not make a serious contribution to the paper.
- ❖ Discussing with your colleagues confidential data from a paper that you are reviewing for a journal.
- ❖ Using data, ideas, or methods you learn about while reviewing a grant or a papers without permission.
- ❖ Trimming outliers from a data set without discussing your reasons in paper.

Types of Research Misconduct Cont.

- ❖ Using an inappropriate statistical technique in order to enhance the significance of your research.
- ❖ Bypassing the peer review process and announcing your results through a press conference without giving peers adequate information to review your work.
- ❖ Conducting a review of the literature that fails to acknowledge the contributions of other people in the field or relevant prior work.

Types of Research Misconduct Cont.

- ❖ Stretching the truth on a grant application in order to convince reviewers that your project will make a significant contribution to the field.
- ❖ Stretching the truth on a job application or curriculum vita.
- ❖ Giving the same research project to two graduate students in order to see who can do it the fastest.
- ❖ Overworking, neglecting, or exploiting graduate or post-doctoral students.

Types of Research Misconduct Cont.

- ❖ Failing to keep good research records.
- ❖ Failing to maintain research data for a reasonable period of time.
- ❖ Making derogatory comments and personal attacks in your review of author's submission.
- ❖ Promising a student a better grade for sexual favors
- ❖ Using a racist epithet in the laboratory.
- ❖ Wasting animals in research.

Types of Research Misconduct Cont.

- ❖ Not reporting an adverse event in a human research experiment.
- ❖ Exposing students and staff to biological risks in violation of your institution's biosafety rules.
- ❖ Sabotaging someone's work.
- ❖ Stealing supplies, books, or data
- ❖ Rigging an experiment so you know how it will turn out.

Criteria of Good Research

The qualities of a good research can be stated as:

❖ Good research is **systematic**

- ❑ It means that research is structured with specified steps to be taken in a specified sequence in accordance with the well defined set of rules.
- ❑ It rejects the use of guessing and intuition in arriving at conclusions.

❖ Good research is **logical**

- ❑ Logical reasoning makes research more meaningful in the context of decision making.

❖ Good research is **empirical**

- ❑ Research is related basically to one or more aspects of a real situation and deals with concrete data that provides a basis for external validity to research results.



❖ Good research is **replicable**

- ❑ This characteristic allows research results to be verified by replicating the study and thereby building a sound basis for decisions.

Literature Review and Technical Reading

The primary goal of literature review is to know the use of content/ideas/approaches in the literature to correctly identify the problem that is vaguely known beforehand, to advocate a specific approach adopted to understanding the problem, and to access the choice of methods used.

New and Existing Knowledge

- New knowledge in research can only be interpreted within the context of what is already known, and cannot exist without the foundation of existing knowledge.
- Existing knowledge  Text Book
- New knowledge  Research Papers

New and Existing Knowledge cont.

- Useful research should elucidate **how** and **why** certain technical development took place.
- An effective review of literature ensures a firm foundation for advancing knowledge, facilitates theoretical growth, eliminates areas that might be of interest, and opens new avenues of possible work.

New and Existing Knowledge cont.

- An efficient literature review is centered around concepts and not authors.
- Through a good literature review, the state of art in the chosen field is well understood.

Remember

“there is no one
best way for
undertaking all
research”

