CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Research Methodology*	4	3	0	1	Class XII pass with Mathematics	NIL

* This course is equivalent to the one offered by the Department of Computer Science, University of Delhi for the B.Sc (Hons.) Computer Science program.

Learning Objective

This course allows the students to acquire the necessary skills to conduct research in computer science. It enables the students to understand the entire process of research from problem identification, literature review, designing the project to documenting the outcome.

Learning Outcomes

On the successful completion of the course, the student would be able to:

1. *Identify the problem after conduct of a literature survey.*
2. *Define goals, approach, and scope of the research.*
3. *Explore, download and interpret datasets.*
4. *Effectively record study findings in a research paper format.*

UNIT-I (8 Hours)

Research Fundamentals: Meaning and significance of research, requirements and characteristics of research, types of research - basic, applied analytical, conceptual, empirical, experimental, non-experimental, prospective, retrospective, exploratory / descriptive, qualitative, quantitative, mixed method. Research process, induction and deduction in research, introduction to research tools, qualities of a good researcher.

UNIT-II

(5 Hours)

Problem Identification: Choosing an appropriate problem area, identifying sources of research articles, literature review – stating and evaluating the research problem, techniques and methodologies, state of the art.

UNIT-III (12 Hours)

Data Analytics: Exploring and organizing data sets, pre-processing data, interpreting the data. Choosing appropriate statistics. Descriptive statistics - measures of central tendency and variability, measures of association. Inferential statistics – estimating population parameters, testing hypothesis.

UNIT-IV (10 Hours)

Presenting research outcomes: Essential elements of a research paper - explanation of the research problem, description of methods and data, data analysis and its interpretation, identification of possible weaknesses of the study, presenting and summarizing the research output, drawing conclusions.

UNIT-V (5 Hours)

Publication: Process of journal submission and review. Peer review process - single, blind and double blind. Professional research societies, scientometric analysis - citation index and analysis, plagiarism, plagiarism checker.

UNIT-VI (5 Hours)

Research Ethics: Ethical issues in research, protection from harm, voluntary and informed participation, right to privacy, conflict of interest, honesty with professional colleagues, professional code of ethics, intellectual property rights, fraud and misconduct in science.

Essential/recommended readings
1. Thomas, C. G. (2021). Research Methodology and Scientific Writing, 2ⁿᵈ Ed. Springer. 2. Leedy, P. D., & Ormrod, J. E. (2016). Practical Research: Planning and Design, 11ᵗʰ Ed. Pearson.

Additional References:
1. Ghezzi. C. *Being a Researcher: An Informatics Perspective.* Springer 2. Locharoenrat, K. (2018). *Research Methodologies for Beginners.* PAN Stanford Publication.
3. https://www.unesco.org/en/articles/what-you-need-know-about-unescos-new-ai competency-frameworks-students-and-teachers?hub=32618
4. *Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013*

Suggested Practical List:

Capstone Project: Students must choose an area of interest for research, based on the curriculum (but not limited by it) covered in the program. They should identify a research problem to solve. During the semester the students must document the research journey in the form of a report, which will be evaluated at the end of the semester. The students are encouraged to write a research
paper based on the report, under the guidance of the teacher. The practical class for research methodology course should be utilized to perform the following tasks in the research process.

1. Search the research papers related to the chosen problem using academic search engines like Google Scholar, Scopus search, Web of Science database, etc.
   a. Evaluate the venue of the source of research paper - Journals using citation metrics like CiteScore, SCImago Journal Rank (SJR)), Source Normalized Impact per Paper (SNIP) etc., Conferences venues are evaluated using indexing information, Core Ranking etc.
   b. Summarize the reviewed papers in a tabular format with columns: Paper Title, Author(s), Year, Key Findings, and Citation Count.
   c. Explore reference management tools like Mendley / Zotero / EndNote to organize, store, and manage references.

2. Practice data analysis techniques taught in the class and identify a suitable technique required to solve the chosen research problem.

3. Write the research report and prepare to write the research paper.

a. Choose a document writing software and prepare the report as per the format given by the teacher.
b. Use the plagiarism check tool to assess the similarity index of the report and ensure that it is less than 10%.
c. Explore the journal finder tools available for the publishers and select a suitable journal to submit the manuscript

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DSE – 18
Robotics

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Robotics	4	3	0	1	Class XII pass with Mathematics	DSC-03(Mathematics for Computing-I) ,DSC-06(Mathematics for Computing-II)

Learning Objectives:
1. To teach students the fundamentals of creating and programming a robot to interact with its environment.
2. To perform basic tasks involving motion, sensor data and decision-making.

Learning Outcomes:
1. Explain the fundamentals of robotics and its components