Ph.D. Entrance Test - SYLLABUS
Computer Science
Part -1
Research Methodology (50 %)

Research Aptitude

- Research:
  - Meaning
  - Types: Fundamental, Applied, Interdisciplinary.
  - Characteristics: Systematic, Logical, Empirical, Replicable, Objective, Analytical.
  - Positivism approach to research: Objective, measurable, and experiment-based research in CS.
  - Post-positivistic approach to research: Context-aware, mixed-method research including human factors in CS.

- Methods of Research:
  - Experimental: Test algorithms, systems, or software prototypes. Measure performance metrics (speed, memory usage, accuracy).
  - Descriptive: Surveys, case studies, system analysis, user behavior studies. Like Google Forms, SurveyMonkey, Microsoft Excel, SQL databases.
  - Historical: Document Analysis, Version Control archives, Bibliometric studies.
  - Qualitative methods: Thematic analysis, Grounded theory, Content analysis, Narrative research.
  - Quantitative methods: Statistical Methods, Regression analysis, Hypothesis Testing, Probability theory, ML as a Research tool.

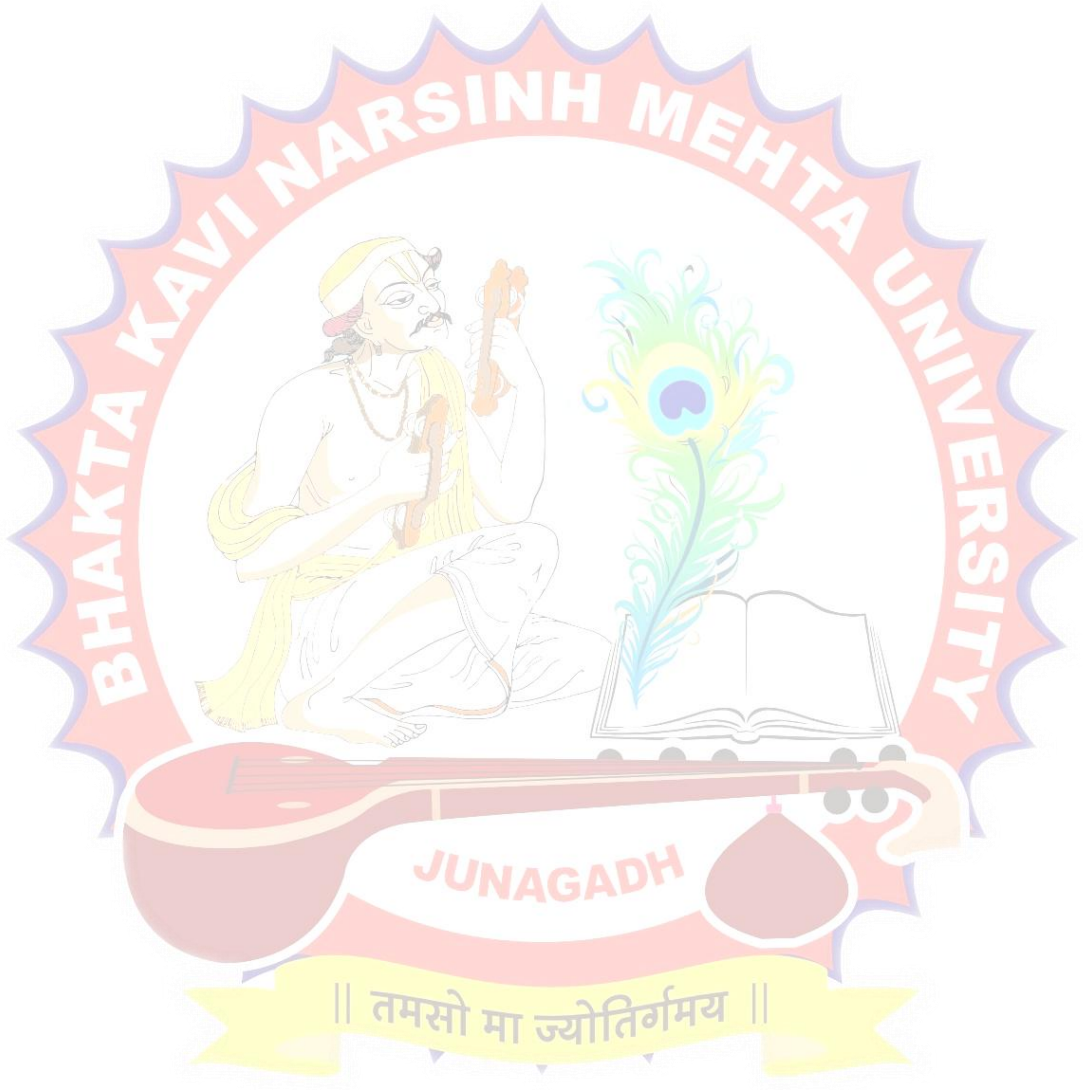
- Steps of Research:
  - Identify the Research Problem
  - Review of Literature
  - Formulate Hypothesis
  - Research Design
  - Data Collection
  - Data Analysis
  - Interpretation of Results
  - Report Writing

- Thesis and Article writing: Format and styles of referencing
  - Format or Structure: Title, Abstract, Introduction, Literature Review, Methodology, Results & Discussion, Conclusion, References
  - Styles of referencing: IEEE style, APA/MLA, Tools to manage reference are LaTex, Mendeley, MS Office, Zotero, EndNote.

- Application of ICT in Research:
  - Digital Libraries like IEEE, ACM, Springer.
  - Programming and analysis tools like Python, R, MATLAB.
  - Databases like SQL, NoSQL.
  - Collaboration Platforms like GitHub, Google drive, Overleaf.
  - Visualization tools like Tableau, Matplotlib, Seaborn.

Note: Above application of ICT is used in Research for literature review, experiments, simulations, data collection, analysis, visualization, and research dissemination in Computer Science.

- Research Ethics:
    - Avoid plagiarism
    - Do copyright, patents and software licence.
    - Protect sensitive data and prevent bias in AI/ML research.
    - Acknowledge to all contributors, co-authors, and data sources.



Part-2
Core Subjective Paper – Computer Science (50 %)

Unit - 1: Discrete Structures and Optimization

Unit - 2 : Computer System Architecture

Unit - 3 : Programming Languages and Computer Graphics

Unit – 4 : Database Management Systems

Unit – 5 : System Software and Operating System

Unit – 6 : Software Engineering

Unit – 7 : Data Structures and Algorithms

Unit – 8 : Theory of Computation and Compilers

Unit – 9 : Data Communication and Computer Networks

Unit – 10 : Artificial Intelligence (AI)