CST 395-2

Research Methodology & Scientific Writing

Course Introduction

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Course Objective

- To equip you with practical skills and knowledge in conducting research, writing research proposals, and mastering scientific writing

Learning Outcomes

- Upon successfully completing this course, you will be able to:
  - Develop a comprehensive understanding of research methodology and its application.
  - Apply skills in conducting literature reviews, identifying research problems, and formulating research questions, while analyzing existing literature to discern trends and gaps.
  - Create well-structured research proposals following established guidelines and standards in scientific writing.
  - Evaluate the effectiveness of different strategies for literature review, citation management, and digital tool utilization, ensuring alignment with research objectives.
  - Develop a fully compliant research proposal and an effective research poster, showcasing proficiency in research communication.

Course Outline

01 Introduction to Research Methodology

02 Literature Review and Problem Identification

03 Formulating Research Questions and Objectives

04 Research Design and Methodology

05 Data Collection and Analysis

06 Proposal Structure and Writing Style

07 Ethical Issues in Conducting Research, Publications and Peer Review Process

08 Presentation Skills and Proposal Defense Preparation

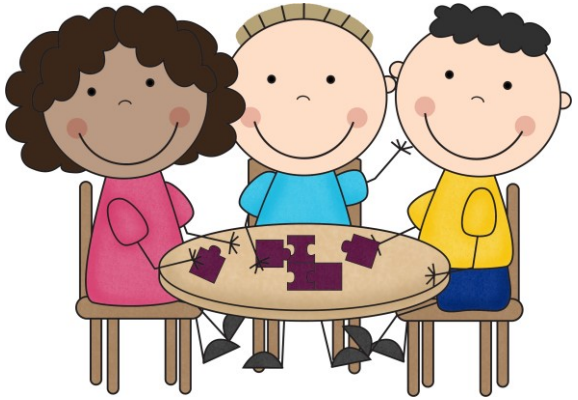
09 Finalizing the Proposal and Preparing an Effective Poster

Workshop: Scientific Writing [Tentative Dates: 17th and 18th of May]

Lecture Schedule

- Thursday 8 am to 11 am

- WHY 3 hrs.?
  - 2 hrs. + 1 hr. for in-class activities
- Before Class
  - Arrange your environment to support collaborative learning



- After Class
  - Restore the classroom to its normal state

Evaluation and Minimum Passing Score

- **End Semester** – 60% (15/60)
  - 01 Hour Theory Paper [**40 Marks**]
    - Physical Examination/ Individual → 40 MCQs
  - Final Proposal [**30 Marks**]
    - Group Submission → Online Report *[Template will be provided]*
    - **Deadline** → **End-exam Date**
  - Systematic Review Paper [**30 Marks**]
    - Group Submission → Research Article *[Template will be provided]*
    - **Deadline** → **End-exam Date**
    - Best paper award → The selected group will get a certificate – Panel will decide [Planned]

Evaluation and Minimum Passing Score (Cont'd)

- **Continuous Assessments** – 40% (10/40)
  - In-class Assessment 01 [**20 Marks**]
    - **Quiz (20 MCQs)**
    - Individual/ Closed Book → **June 17th, 2024**
  - In-class Assessment 02 [**40 Marks**]
    - **Poster Presentation**
    - Group/ Physical Presentation → **July 11th, 2024**
  - Take-home Assessment 01 [**20 Marks**]
    - **Post-class Activities**
    - Individual or Group/ Will be informed at the end of each class → **Throughout the semester**
  - Take-home Assessment 02 [**20 Marks**]
    - **Proposal Presentation**
    - Group/ Online Video → **July 01st, 2024**

Specific Milestones

- Research Topic – Individual Submission [**10 Marks**] **[Take-home Assessment 01]**
  - Every student must submit a research topic
  - Since one group has 3 members at least, one group should have at least 3 topics
  - **Deadline**: **April 24th, 2024**
- Draft Literature Review – Group Submission [**20 Marks**] **[Take-home Assessment 01]**
  - Select one topic from the previously submitted topics
  - Submit a draft literature review of their chosen topic
  - **Deadline**: **May 01st, 2024**
- Research Problem Identification – Group Submission [**20 Marks**] **[Take-home Assessment 01]**
  - Need to finalize their principle supervisor and co-supervisors (Principle supervisor will select co-supervisors if needed only based on student's proposed research and the students can only pick a primary supervisor in this stage)
  - Submit research problem after getting the approval from the principal supervisor
  - **Deadline**: **May 08th, 2024**

Specific Milestones (Cont'd)

- Research Aim, Questions and Objectives – Group Submission [**10 Marks**] **[Take-home Assessment 01]**
  - Finalize their research aim, questions and objectives
  - Get the approval from the principal supervisor
  - Submit approved research aim, questions and objectives
  - **Deadline**: **May 15th, 2024**
- Research Design and Methodology – Group Submission [**20 Marks**] **[Take-home Assessment 01]**
  - Prepare a draft research design and methodology section and submit
  - **Deadline**: **May 25th, 2024**
- Finalizing the Data Collection Plan – Group Submission
  - Finalize their data collection plan
  - Begin collecting data
  - **Deadline**: **June 12th, 2024**

Specific Milestones (Cont'd)

- Draft Research Proposal – Group Submission [**10 Marks**] **[Take-home Assessment 01]**
  - Submit the draft research proposal according to the given template
  - **Deadline**: **June 19th, 2024**
- Evaluate a Proposal – Group Submission [**10 Marks**] **[Take-home Assessment 01]**
  - Students should peer-review another group's proposal and provide feedback
  - Previously submitted proposals will be randomly assigned to each groups
  - **Deadline**: **June 25th, 2024**
- Proposal Presentation – Group Submission [**20 Marks**] **[Take-home Assessment 02]**
  - Duration will be 05 minutes
  - Every student should be contributed
  - Record this as a video and upload to a cloud storage
  - Submit the video link to the given location
  - **Deadline**: **July 01st, 2024**

Specific Milestones (Cont'd)

- Poster Presentation – Group Presentation [**40 Marks**] **[In-class Assessment 02]**
  - Prepare a poster to present the research proposal to the audience
  - Specific panel will be evaluated the research proposal and provide feedback to improve the proposal
  - Accepted or Rejected will be informed based on the defined criteria and rejections can happen due to following reasons
    - **Lack of originality or significance** – does not contribute new knowledge or insights to the field or fails to address the identified research problem
    - **Objectives are not feasible to achieve** – objectives are unrealistic or cannot be accomplished within the scope of the research project
    - **Poor methodology** – inappropriate for addressing the research questions, or lacks thoroughness, accuracy, and reliability of the research process and its findings
    - **No data available/ Data is available but not enough to continue the research**
    - **Failed to defend the proposal idea/ Not confident about the proposed approach/ Inadequate literature review** – why the research is important and how it will contribute to the field
    - **Insufficient resources or support**
    - **Ethical considerations** – human participants, use of animals, or potential environmental impact may requires ethical approval
  - **Rejected proposal groups need to come up with different research title** for the Final Research Project course
  - **Presentation Date**: **July 11th, 2024**

Specific Guidelines

- Research titles **must be selected from the provided areas**.
- Each **research area will have a maximum number of projects** based on supervisor availability.
- If an area reaches its maximum, **students should choose an alternative area when seeking a supervisor**.
- A **Google Doc will be shared to mention the 1st and 2nd preference** of the supervisors for the project.
- **Supervisors will select research projects to supervise based on their interest** in the proposed research.
- **Once a supervisor agrees to supervise a research project** and the title is selected, it **cannot be changed** thereafter.
- The **selected title will remain unchanged for the student's 400 Level Final Research Project** unless the proposal is rejected.

Specific Guidelines (Cont'd)

- **Any changes to the title or supervisor**, except in the case of proposal rejection, **will incur a 50% penalty in the Final Proposal and Systematic Review Paper**, which is part of the end-semester evaluation.
- **Students are expected to work on all objectives** defined in their research.
- During evaluations, **the panel has the right to ask questions on any aspect of the research to assess the student's familiarity** with the project.
- When proposing a solution for an identified research problem, **students must outline a clear method for evaluating the proposed solution**.
- The **university does not provide hardware resources for research projects**. **Students should develop a plan for getting necessary resources** if their selected field requires them.

Research Areas

No.	Main Area	Sub-areas	Maximum Projects Allowed
1	Artificial Intelligence and Machine Learning	Deep Learning, Natural Language Processing (NLP), Reinforcement Learning, Recommender Systems, Deepfake Analysis	**18**
2	Data Science, Big Data and Analytics	Data Mining, Predictive Modeling, Big Data Management, Data Privacy and Security, Financial/Business Analytics, Anomaly Detection (e.g. financial datasets), Quantitative Finance, Predictive Analytics in Marketing, Motives and Effectiveness in Open Innovation	**15**
3	Data Management and Analytics	Database Design and Administration, Data Warehousing and Business Intelligence Solutions, Advanced Analytics and Machine Learning for Data-driven Decision-making	**12**
4	Information Security	Network Security, Cybersecurity, Cryptography, Intrusion Detection/Prevention, Cyber Threat Intelligence, Secure Software Development, Threat detection and prevention, Risk assessment methodologies and vulnerability management, Incident response solutions, Security awareness training and education programs	**9**

Research Areas (Cont'd)

No.	Main Area	Sub-areas	Maximum Projects Allowed
5	Human-Computer Interaction	User experience design, Interaction techniques (gestures, voice, etc.), User interface development, Usability testing and evaluation, Virtual reality and augmented reality	**6**
6	Image Processing and Computer Vision	Image Processing, Computer Vision, Medical Image Analysis, Automobile Applications	**6**
7	Software Engineering	Agile methodologies, DevOps practices, Software testing and quality assurance, Continuous integration and deployment, Software architecture and design patterns	**3**
8	Social Computing and Online Communities	Social Network Analysis, Online Social Behavior Analysis, Community Detection and Analysis, Recommender Systems for Social Networks, Sentiment Analysis and Opinion Mining, Online Collaboration and Crowdsourcing	**3**
9	Ontology Engineering	Ontology development, Ontology integration, Ontology evaluation, and Ontology-based applications	**3**
10	Bioinformatics and Medical Instrumentation	Bioinformatics, Simulators for Medical Education, BioSignal Processing, Medical Instrument Design & Prototyping	**3**

Research Areas (Cont'd)

No.	Main Area	Sub-areas	Maximum Projects Allowed
11	Educational Technology	Learning Management Systems (LMS), Educational Software Applications, Online Assessments and Automated Grading, Learning Analytics, Emerging Technologies (AI, AR, VR) in Education, Technology Integration Frameworks, E-Learning, Blended Learning, Technology Enhanced Assessment and Feedback	**3**
12	Computer Networks and Data Communication	Network Performance Analysis and Optimization, Wireless and Mobile Networking, Cloud Networking, Software-Defined Networking (SDN),Network Simulation and Modeling, Network Management and Control, Network Virtualization, Edge Computing and Networking, Green Networking and Energy Efficiency	**3**
13	Embedded Systems and Internet of Things (IoT)	Embedded Systems and Device Interfacing, IoT Devices and Sensors, Edge Computing, IoT Applications in Various Domains (Healthcare, Smart Cities, Agriculture, etc.), IoT Data analytics, AIoT	**3**
14	Signal Processing	Bio Signal Processing, Audio Signal Processing	**3**

Research Areas (Cont'd)

No.	Main Area	Sub-areas	Maximum Projects Allowed
15	Cloud Computing and Distributed Systems	Cloud infrastructure management, Distributed computing frameworks (e.g., Hadoop, Spark), Performance optimization in distributed systems	**3**
16	Robotics	Manipulators, Mobile Robots, Neurorobotics, Rehabilitation Robotics, HAPTICS, Neuroprosthetics, Robot Operating Systems (ROS)	**3**
17	Geographic Information Systems (GIS)	GIS, Remote Sensing, Cartography, Spatial Analysis, Geodatabase Management, Geospatial Data Visualization, Spatial Modeling and Simulation, GIS Programming and Development, Spatial Decision Support Systems (SDSS)	**3**
18	IT Law and Digital Forensics	Cybercrime Legislation Analysis, Design and Develop Digital Evidence Handling Procedures/Systems, Intellectual Property Rights in the Digital Era, Exploration of Legal and Ethical Implications of Artificial Intelligence, Digital Forensics Techniques and Tools, Legal Aspects of Emerging Technologies, Design and Develop Robust Digital Evidence Handling Procedures/Systems, Develop Digital Evidence Analysis Tools, Develop Forensic Imaging and Acquisition Tools, Incident response and digital forensics procedures	**3**


QUESTIONS?