



## AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)

Faculty of Science and Technology (FST)

Department of Computer Science (CS)

Undergraduate Program

COURSE PLAN	SEMESTER: Summer 2023-2024
<b>I. Course Core and Title</b> CSC 4195 Research Methodology <b>II. Credit</b> 3 credit hours (3 hours of theory per week) <b>III. Nature</b> Core Course for CS, CSE, CSSE, CIS <b>IV. Prerequisite</b> Graduating Year	<b>V. Vision:</b> Our vision is to be the preeminent Department of Computer Science through creating recognized professionals who will provide innovative solutions by leveraging contemporary research methods and development techniques of computing that is in line with the national and global context. <b>VI. Mission:</b> The mission of the Department of Computer Science of AIUB is to educate students in a student-centric dynamic learning environment; to provide advanced facilities for conducting innovative research and development to meet the challenges of the modern era of computing, and to motivate them towards a life-long learning process.

### VII - Course Description:

- Define and Comprehend research, research perspective, and need to conduct research.
- Comprehend basic building blocks of research (e.g., framework).
- Define and explain different research methods.
- Define and Explain ethics, research ethics, and its integration in real life scenarios.
- Analyze and Formulate research proposal.
- Evaluate and design research based on problem analysis.
- Comprehend and associate experimental validation techniques in relation to research methods and solutions.
- Comprehend the basics of scientific writing.

### VIII – Course outcomes (CO) Matrix:

By the end of this course, students should be able to:

COs*	CO Description	Level of Domain ***			PO Assessed ****
		C	P	A	
CO1**	<b>Evaluate</b> all relevant resources for designing a computer science and engineering solution and determine the level of novelty of the research.	5			PO-d-1
CO2**	<b>Analyze</b> the collected data to provide valid solution of the research problem acknowledging the limitations.	4			PO-d-2
CO3	<b>Determine</b> and <b>Demonstrate</b> professional codes of ethics and standard in conducting research considering public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability.	3			PO-h-1

CO4	<b>Defend</b> the research solutions based on complex engineering activities by delivering an effective presentation to the audience.			4	PO-j-3
<i>C: Cognitive; P: Psychomotor; A: Affective Domain</i> * CO assessment method and rubric of COs assessment is provided in later section ** COs will be mapped with the Program Outcomes (POs) for PO attainment *** 'Level of Domain' columns represent the level of Bloom's Taxonomy each CO corresponds to. **** The numbers under 'PO Assessed' column represent the POs each CO corresponds to.					

## IX – Topics to be covered in the class and/or lab\*

Time Frame	CO Mapped	Topics	Teaching Activities	Assessment Strategy(s)
Week 1	CO1, CO2 CO4	OBE, Research and Research Methodology	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 2	CO1, CO2 CO4	Research Framework & its implementation	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 3	CO1, CO2 CO3	Research Framework & its implementation	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 4	CO1, CO2 CO4	Research Ethics	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 5	CO1, CO2 CO4	Preparing Research Proposal	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 6	CO1, CO2, CO4	Preparing Research Proposal	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 7	CO1, CO2, CO4	Preparing Research Proposal	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Midterm Exam (Week 8)				
Week 8	CO3, CO4	Research Methodologies	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 9	CO3, CO4	Systematic Literature Review (SLR)	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 10	CO3, CO4	Innovation in Research, Writing and publishing a scientific paper	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 11	CO3, CO4	Innovation in Research, Writing and publishing a scientific paper	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 12	CO3, CO4	Innovation in Research, Writing and publishing a scientific paper	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Week 13	CO3, CO4	Innovation in Research, Writing and publishing a scientific paper	Lecture, Case Study, Question-answer	Quiz, Project Assignment
Final term (Week 16)				
Project Submission/Defense/Viva (Week 17)				

\* The faculty reserves the right to change, amend, add, or delete any of the contents.

**X – Mapping of PO to Courses and K, P, A**

PO Indicator ID	PO Indicators Definition (As per the requirement of WKs)	Domain	K	P	A
PO-d-1	Investigate the design of experiments for complex computer science and engineering problems through appropriate research.	Cognitive Level 5 (Evaluate)	K8	P1 P3 P7	
PO-d-2	Analysis and Interpretation of collected data to provide valid conclusion acknowledging the limitations.	Cognitive Level 4 (Analyze)	K8		
PO-h-1	Apply professional codes of ethics and standards considering public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability.	Cognitive Level 3 (Applying)	K7		
PO-j-3	Make and deliver effective presentation based on complex engineering activities	Affective Level 4 (Organizing)			A1 A2

**XI – K, P, A Definitions**

Indicator	Title	Description
K3	Theory based engineering fundamentals	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
K4	Forefront specialist knowledge for practice	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline
K5	Engineering Design	Knowledge that supports engineering design in a practice area
K6	Engineering Practice (Technology)	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
K7	Comprehension of engineering in society	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability
K8	Research Literature	Engagement with selected knowledge in the research literature of the discipline
P1	Depth of knowledge required	Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
P3	Depth of analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
P7	Interdependence	Are high level problems including many component parts or sub-problems
A1	Range of resources	Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information, and technologies)
A2	Level of interaction	Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering, or other issues.

## XII – Mapping of CO Assessment Method and Rubric

The mapping between Course Outcome(s) (COs) and The Selected Assessment method(s) and the mapping between Assessment method(s) and Evaluation Rubric(s) is shown below:

COs	Description	Mapped POs	Assessment Method	Assessment Rubric
CO1	<i>Evaluate</i> all relevant resources for designing a computer science and engineering solution and determine the level of novelty of the research.	PO-d-1	Project/Assignment	Rubric for Project/Assignment
CO2	Analyze the collected data to provide valid solution of the research problem acknowledging the limitations.	PO-d-2	Project/Assignment	Rubric for Project/Assignment
CO3	Determine and Demonstrate professional codes of ethics and standard in conducting research considering public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability.	PO-h-1	Project/Assignment	Rubric for Project/Assignment
CO4	<i>Defend</i> the research solutions based on complex engineering activities by delivering an effective presentation to the audience.	PO-j-3	Presentation and Viva (QA)	Rubric for Presentation and Viva (QA)

## XIII – Evaluation and Assessment Criteria

CO1 [PO-d1]: <i>Evaluate</i> all relevant resources for designing a computer science and engineering solution and determine the level of novelty of the research.				
Assessment Attribute/Criteria	Missing/Incorrect (0)	Inadequate (1)	Satisfactory (2)	Excellent (3)
<b>Problem Analysis and use of State-of-the-Art Resources</b>	Research problem background is not discussed with use of state-of-the-art literature, resources, and technologies to produce an impact.	Discuss the research problem background with few uses of state-of-the-art literature, resources, and technologies to produce minor impact.	Discuss the research problem background with moderate uses of state-of-the-art literature, resources, and technologies to produce modest impact.	Discuss the research problem background with best uses of state-of-the-art literature, resources, and technologies to produce a significant result that is likely to have a major impact.
<b>Critical Reflection and Creativity in Research Objective</b>	The solution simply repeats already established / common knowledge (e.g., SWAT analysis). And Results are not critically confronted with existing literature	Some creative solutions have been presented but have not improved on previous approaches. And Results are critically confronted with few existing literature	Some creative solutions have been presented which incrementally improve on previous approaches. And Results are critically confronted with existing literature	Deep insight demonstrated and presented a creative solution to the real-life problem. And Results are critically confronted with various existing literature
<b>Novelty and Contribution of the Research</b>	Does not discuss and identify the contribution of the research to the	Discuss and identify few contributions of the research to the development of	Discuss and identify major contribution of the research to the development of	Elaborately discuss and identify the contribution of the research to the development of scientific

	development of scientific concepts by recognizing the research gaps of existing research and developments.	scientific concepts by recognizing the research gaps of existing research and developments.	scientific concepts by recognizing the research gaps of existing research and developments.	concepts by recognizing the research gaps of existing research and developments.
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**CO2 [PO-d2]:** Analyze the collected data to provide valid solution of the research problem acknowledging the limitations.

Assessment Attribute/Criteria	Missing/Incorrect (0)	Inadequate (1)	Satisfactory (2)	Excellent (3)
<b>Data Analysis</b>	Does not discuss the research method, its appropriateness, data collection, analysis, and synthesis for proposing solution to the research problem.	Lack of discussion on the research method, its appropriateness, data collection, analysis, and synthesis for proposing solution to the research problem.	Discuss the research method, its appropriateness, data collection, analysis, and synthesis for proposing solution to the research problem.	Elaborately discuss the research method, its appropriateness and details on data collection, analysis, and synthesis for proposing valid solution to the research problem.
<b>Solution and Validation</b>	The proposed solution, research problem, and research data are not reflecting each other.	The proposed solution is inexplicitly discussed reflecting the research problem and collected data.	Moderately discuss the solution of the research problem in relation to the research objective based on the collected research data.	Elaborately discuss the solution of the research problem by establishing a direct connection between proposed solutions with the research objective based on the collected research data.
<b>Limitation and Scope of Future Studies</b>	Does not discuss the research limitations and scope of future studies.	Lack of discussion on the research limitation and scope of future studies	Moderately discuss abstract and concluding remarks of the research with its limitations and scope of future studies.	Elaborately discuss abstract and concluding remarks of the research with its limitations and scope of future studies.

**CO3 [PO-h1]:** Determine and Demonstrate professional codes of ethics and standard in conducting research considering public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability.

Assessment Attribute/Criteria	Missing/Incorrect (0)	Inadequate (1)	Satisfactory (2)	Excellent (3)
<b>Free of Plagiarism, Data Falsification Citations and References</b>	Research paper is highly plagiarized (similarity index is > 30%). Paragraph texts are written without any in-text citations and use of references. Research data is completely fabricated or altered intentionally to fit into the	Submit research paper with relatively high plagiarism (similarity index is > 20-30%). Works cited were not listed for in-text citations or works cited included resources not mentioned in the report. There is some evidence that the research data is fabricated or altered	Submit relatively plagiarism free research paper (similarity index is 10-15%). Citations within text and in corresponding reference list were included what may have some formatting problems. There is rarely evidence that the research data is fabricated or altered	Submit plagiarism free research paper (similarity index is <10%). In-text citations and reference list citations were complete and properly formatted in APA or any other standard style. The Research data is not fabricated or altered intentionally to fit into the predetermined research findings.

	predetermined research findings. Materials are not cited and referenced if they are taken from other sources. And attributed to a source from which it has not been obtained ( <i>i.e., false citation</i> )	intentionally to fit into the predetermined research findings. Materials are seldom cited and referenced if they are taken from other sources. And mostly attributed to a source from which it has not been obtained ( <i>i.e., false citation</i> )	intentionally to fit into the predetermined research findings. Materials are properly cited and referenced if they are taken from other sources. And not attributed to a source from which it has not been obtained ( <i>i.e., false citation</i> )	Materials are properly cited and referenced if they are taken from other sources. And not attributed to a source from which it has not been obtained ( <i>i.e., false citation</i> )
<b>Professional codes of ethics and standard</b>	The research does not demonstrate professional codes of ethics and standard in conducting research considering public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability.	The research inexplicitly demonstrates professional codes of ethics and standard in conducting research considering public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability.	The research demonstrates professional codes of ethics and standard in conducting research considering public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability.	The research elaborately demonstrates professional codes of ethics and standard in conducting research considering public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability.
<b>Formatting and Submission</b>	Late submission, several errors in spelling and grammar. Present a Confusing organization of concepts, sentences rambling, and details are often repeated.	Submitted in due time, Considerable errors exist in spelling, formatting, and grammar. Some obvious problems of organizing the answer in a logical order of the report.	Submitted in due time, Few errors in spelling, formatting, and grammar. Presents most of the details in a logical flow of the report organization.	Submitted in due time, the report is complete and there are no errors in spelling, format, and grammar. Consistently presents a logical and effective organization.

**CO4 [PO-j3]:** *Defend* the research solutions based on complex engineering activities by delivering an effective presentation to the audience.

Assessment Attribute/Criteria	Missing/Incorrect (0)	Inadequate (1)	Satisfactory (2)	Excellent (3)
<b>Presentation delivery (eye contact and body language)</b>	Absent in the presentation schedule/not presenting anything to the audience	Does not look at the audience, frequently reads from notes and slides, clearly shows lack of confidence	Keeps eye contact with audience most of the time, use few gestures and movements, shows some confidence.	Keeps eye contact with audience all the time, use natural gestures and movements, looks confident.
<b>Enthusiasm/Audience Awareness</b>	Shows no interest in the topic presented, fails to increase audience	Shows little enthusiasm about the topic being presented, raises	Shows some enthusiasm about the topic, raises audience	Demonstrate strong enthusiasm about the topic, significantly increases audience



	understanding of the knowledge of the topic.	audience understanding and awareness of some points.	understanding and awareness of most of the points.	understanding and knowledge of the topic, convinces an audience to recognize the validity and importance of the subject.
<b>Creativity and Use of Media</b>	No attempt of using creative multimedia presentation.	The presentation was largely traditional in the use of multimedia, little sign of creativity.	The presentation has some creative in design and use multimedia.	The presentation was creative in design and effectively use multimedia.

#### XIV- Course Requirements

- Students are expected to attend at least 80% of the class.
- Students are expected to participate actively in the class.
- For both terms, there will be at least 2 quizzes based on the theoretical knowledge and conceptual understanding of the topic covered discussed in the classes.
- Submit report based on the given course related problems.
- Submission of assignments and projects should be in due time.

#### XV – Evaluation & Grading System\*

Mid-term	Final term
Class Attendance and Performance: 10% Assignment/Case study/Quiz: 30%	Class Attendance and Performance: 10% Assignment/Case study/Quiz: 14% Project, Presentation, and viva: 36%
<b>Total Midterm Marks: 40%</b>	<b>Total Final term marks: 60%</b>
<b>Grand Total: 100 Marks</b>	

Letter	Grade Point	Numerical %
A+	4.00	90-100
A	3.75	85 - < 90
B+	3.50	80 - < 85
B	3.25	75 - < 80
C+	3.00	70 - < 75
C	2.75	65 - < 70
D+	2.50	60 - < 65
D	2.25	50 - < 60
F	0.00	< 50
I		Incomplete
W		Withdrawal
UW		Unofficially Withdrawal

\* The evaluation system will be strictly followed as par with the AIUB grading policy.

\* CO attainment will be achieved with 60% of the evaluation marks.

#### XVI – Textbook/ References

1. Zelkowitz, M. V. and Wallace, D. R. (1998), Experimental models for validating technology, Computer, vol. 31, no. 5, pp. 23-31.
2. Dillman, D. A., Smyth, J. D., & Christian, L. M. (2009). Internet, mail, and mixed-mode surveys: the tailored design method (3rd ed.).

3. Hoboken, N.J.: Wiley & Sons. Fowler, F. J. (1995). Improving survey questions: design and evaluation. Thousand Oaks: Sage Publications.
4. Cohen, J., Cohen, P., West, S., & Aiken, L. (2003). Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.
5. Shadish W.R., Cook T.D. & Campbell P.T. (2002) Experimental and Quasi-Experimental Design for Generalized Causal Inference. Boston, Mass: Houghton Mifflin
6. Bruning, J. L. & Kintz, B. L. (1997). Computational handbook of statistics (4th ed.). New York: Longman.

## XVII - List of Faculties Teaching the Course

FACULTY NAME	SIGNATURE
DR. AFROZA NAHAR	
PROF. DR. ASRAF ALI	
DR. MD. ABDULLAH - AL – JUBAIR	

## XVIII – Verification

<b>Prepared by:</b> ----- <b>Dr. M. Mahmudul Hasan</b> <i>Course Convener</i>  Date:.....	<b>Moderated by:</b> ----- <b>Dr. M. Mahmudul Hasan</b> <i>Point Of Contact</i> <i>OBE Implementation Committee</i>  Date:.....	<b>Checked by:</b> ----- <b>Dr. Akinul Islam Joney</b> <i>Head (Undergraduate Program)</i> <i>Department of Computer Science</i>  Date:.....
<b>Verified by:</b> ----- <b>Dr. Md. Abdullah-Al-Jubair</b> <i>Director</i> <i>Faculty of Science &amp; Information Technology</i>  Date:.....	<b>Certified by:</b> ----- <b>Prof. Dr. Dip Nandi</b> <i>Associate Dean,</i> <i>Faculty of Science &amp; Information Technology</i>  Date:.....	<b>Approved by:</b> ----- <b>Mr. Mashiour Rahman</b> <i>Dean,</i> <i>Faculty of Science &amp; Information Technology</i>  Date:.....