Course Syllabus

1	Course title	Research Methodology
2	Course number	0907703
3	Credit hours (theory, practical)	3, 0
	Contact hours (theory, practical)	3, 0
4	Prerequisites/co-requisites	None
5	Program title	MSc in Computer Engineering and Networks
6	Program code	0907
7	Awarding institution	The University of Jordan
8	School	School of Engineering
9	Department	Computer Engineering Department
10	Level of course	Masters Level
11	Year of study and semester (s)	First Year, First Semester
12	Final Qualification	Passing the exams and the research project
13	Other department (s) involved in teaching the course	None
14	Language of Instruction	English and Arabic
15	Date of production/revision	Feb 24, 2022

16. Course Coordinator:

Instructor: Prof. Gheith Abandah
Office: CPE 406
Office hours: Sun – Thu, 8:30 – 14:00
Phone: 06-535-5000 ext. 22991
Email: abandah@ju.edu.jo
Home page: http://www.abandah.com/gheith

17. Other instructors:

None

18. Course Description:

Issues in Research Methodologies, Performance Evaluation and Benchmarking. Measurement Tools and techniques, Trace Driven and Execution Driven Simulation. Choice of metrics. Benchmarks. Statistical techniques for Performance Evaluation. Trace Generation and Validation, Synthetic Traces, Verification of Simulators. Design of Experiments. Analytical Modeling of Processors, Statistical modeling, Hybrid Techniques. Workload Characterization. Literature Surveys and Writing Research Papers and Reports.

19. Course aims and outcomes:

A- Aims:

The purpose of this course is to introduce the main research methodologies in computer engineering to the graduate student. It is designed to achieve the following objectives:
- Provide awareness about research methodologies and performance evaluation and benchmarking
- Introduce measurement tools and techniques
- Introduce trace driven and execution driven simulation
- Introduce various experiment design methodologies
- Introduce various sources of information for literature review and data collection
- Develop an understanding of the ethical dimensions of conducting applied research
- Appreciate the components of scholarly writing and evaluate its quality

B- Intended Learning Outcomes (ILOs):

Upon successful completion of this course students will be able to:
- a. Define research; explain and apply research terms; describe the research process and the principle activities, skills and ethics associated with the research process. [1, 3, 7, 8]
- b. Demonstrate the ability to choose methods appropriate to research aims and objectives. [1, 5, 7]
- c. Understand the limitations of particular research methods. [1, 3, 4, 8]
- d. Develop skills in qualitative and quantitative data analysis and presentation. [1, 3, 7]
- e. Understand the importance of research ethics and integrate research ethics into the research process. [1, 4, 6]
- f. Develop advanced critical thinking skills. [2, 7]
- g. Demonstrate enhanced writing and presentation skills. [4, 5]

20. Topic Outline and Schedule:

Topic	Week	Achieved ILOs	Evaluation Methods	Refs.
Research, Researchers, and Readers	1	a	Exams and Reports	1(I)
Asking Questions, Finding Answers	2	a	Exams and Reports	1(II)
Making an Argument	3	a	Exams and Reports	1(III)
Writing Your Argument	4	a, g	Exams and Reports	1(IV)
The Ethics of Research	5	a, f	Exams and Reports	1(V)
Performance Evaluation Introduction, Common Mistakes, Selection of Techniques and Metrics	6	b, c, d	Exams	2(1-3)
Types of Workloads, Workload Selection, Workload Characterization Techniques, Monitors	8	b	Exams	2(4-7)
Data Presentation, Ratio Games	9	d	Exams	2(10-11)
Summarizing Measured Data, Comparing Systems	10	d	Exams	2(12-13)
Introduction to Experimental Design, 2^k Factorial Designs	11	b, c, d	Exams	2(16-17)
Introduction to Simulation, Analysis of Simulation Results	12	b	Exams	2(24-25)
Project Presentations	13	a – g	Presentations	1-6

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21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:
- The student attends the class presentations and participates in the discussions.
- The student joins the related online team/group and participates in its discussions.
- The student studies references and research papers.
- The student carries out a research project in computer architecture that surveys original and recent research papers where the student studies basic ideas, state-of-the-art solutions, and expected future directions.
- The student develops a professional report for the research report.
- The student presents the research project in class.

22. Evaluation Methods and Course Requirements:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:
- Open-book Exams
- Report for the Research Project
- Presentation for the Research Project

23. Course Policies:

A- Attendance policies:
- Attendance is required

B- Absences from exams and handing in assignments on time:
- A makeup exam can be arranged for students with acceptable absence causes.
- The project report must be handed in in time.

C- Health and safety procedures:
- All health and safety procedure of the university and school should be followed.

D- Honesty policy regarding cheating, plagiarism, misbehavior:
- All submitted work must be yours
- Cheating will not be tolerated

E- Grading policy:
- Term Project's Report and Presentation   30%
- Midterm Exam   30%
- Final Exam   40%
- Total   100%

F- Available university services that support achievement in the course:
- Join the Microsoft Team at Link
- Check program announcements at the Facebook group: https://www.facebook.com/Master-in-Computer-Engineering-and-Networks-in-the-University-of-Jordan-257067841079897/

24. Required equipment: (Facilities, Tools, Labs, Training….)

A classroom with whiteboard and projection facilities, library, and computer laboratory.

25. References:

Required book(s), assigned reading and audio-visuals:
1. Wayne Booth, George Colomb, Joseph Williams, Joseph Bizup, and William FitzGerald, The Craft of Research, 4th Edition, The University of Chicago Press, 2016.
2. Raj Jain, The Art of Computer Systems Performance Analysis, Wiley, 1991.
3. Instructor's slides at http://www.abandah.com/gheith/?page_id=2842.

Recommended books, materials, and media:
4. Hennessy and Patterson. Computer Architecture: A Quantitative Approach, 6th ed., Morgan Kaufmann, Elsevier Inc., 2017.
5. Peter Bock, Getting It Right: R&D Methods for Science and Engineering, Academic Press, 2001.
6. C.R. Kothari, Research Methodology, Methods and Techniques, 2nd Edition, New Age International Publishing, 2004.

26. Additional information:

Meeting time: Sunday 4:00 – 7:00 in CPE001

Students are assumed to have a background in the following topics:
- Computer Organization and Architecture
- Statistics and Linear Algebra

27. Important Dates:

Date	Event
Sun 27 Feb, 2022	First Lecture
Sun 24 Apr, 2022	Midterm Exam
Sun 8 May, 2022	Term project proposal is due
Sun 5 Jun, 2022	Term project report is due and project demonstrations
Sun 5 Jun, 2022	Last Lecture
Jun 11 – 23, 2022	Final Exam Period

Name of Course Coordinator: **Prof. Gheith Abandah**   Signature: ----------------- Date: -----------

Head of curriculum committee/Department: ---------------------------- Signature: -------------------------

Head of Department: -- Signature: ----------------------

Head of curriculum committee/Faculty: ---------------------------------- Signature: -------------------

Dean: -- -Signature: --

<u>Learning Outcomes for the Master's program in Computer Engineering and Networks</u>

Upon completion of the Computer Engineering and Networks program, the student is expected to be able to:

1. Discuss and analyze the basic concepts, principles, techniques and theories in the fields of computer architecture, wired and wireless networks, and security of computer network systems.

2. Employ higher-order thinking skills, critical and creative thinking, and practice scientific thinking and logical analysis in investigating, diagnosing and addressing the issues and problems related to computer engineering and networks.

3. Perfectly use the methods and techniques related to the fields of computer engineering in the design, analysis and management of systems and resources.

4. Show an interest in independent self-learning and continuous professional development, demonstrate commitment to acquire and generate unique knowledge and skills, and propose new ideas and programs that contribute to the development of the science of computer engineering and networks.

5. Demonstrate the proficiency and practice precision in achievement, work effectively in a team environment, and prepare presentation on important and modern topics that will develop the techniques used in the fields of computer engineering and networks.

6. Fulfill his/her responsibilities, exercise his/her rights and duties within the value system of the society, and properly deal with the national institutions and the local community.

7. Efficiently employ the research methodologies and the tools emerging from them, the methods for data collection, analysis and interpretation in the preparation of his/her thesis, and the preparation of different types of research related to computer engineering and networks. Accordingly, he/she prepares qualitative reports in the light of its results.

8. Assess changes that have been occurred in the field of computer engineering and networks, analyze various factors that control it domestically, regionally and globally, investigate and diagnose the network of relations and international interactions that influence it, and provide scenarios for its possible future developments.