**4/1/4. Course Specification:**

# COURSE SPECIFICATIONS

## Form

Course Title: Distributed Systems

Course Code: 14016481-3

| | |
|---|---|
| **Date**: 2018 –10 – 21. | **Institution**: Umm Al-Qura University |
| **College**: College of Computer and Information Systems **Department**: Department of Computer Science | |

## A. Course Identification and General Information

1. Course title and code: Distributed Systems 14016481-3
2. Credit hours: 3
3. Program(s) in which the course is offered. Master of Computer Science (Artificial Intelligence)

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course Dr. Murtaza Ali Khan
5. Level/year at which this course is offered: 2/3
6. Pre-requisites for this course (if any):
7. Co-requisites for this course (if any):
8. Location if not on main campus:
9. Mode of Instruction (mark all that apply):

| | | | |
|---|---|---|---|
| a. Traditional classroom | | percentage? | 100 |
| b. Blended (traditional and online) | | percentage? | |
| c. E-learning | | percentage? | |
| d. Correspondence | | percentage? | |
| f. Other | | percentage? | |

Comments:

## B Objectives

1. The main objective of this course

This course provides a graduate-level introduction to parallel and distributed systems. Both shared-memory parallel computers and distributed-memory clusters will be studied.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The course will teach state of the art theoretical and practical knowledge in the field of parallel and distributed systems. Students will be assigned assignments and project to implement the distributed computing techniques to get hands on experience. At the end of the course, a seminar/presentation event will take place in which students will present their course projects/research work.

## C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

**Course Description:**

We will cover fundamental and current research topics in the design, implementation, and evaluation of parallel and distributed systems. Our focus will be on the systems software and distributed programming systems, but some hardware issues will also be covered. Topics will include parallel algorithms, parallelization strategies, virtual machines, and operating system support. Aspects of the practice and research issues in distributed will be covered.

**1. Topics to be Covered**

| List of Topics | No. of Weeks | Contact hours |
|---|---|---|
| Introduction to parallel and distributed systems | 1 | 3 |
| Hardware architectures (multiprocessors, clusters, etc.) | 2 | 6 |
| Concurrency and synchronization | 2 | 6 |
| Data and work partitioning | 2 | 6 |
| Granularity | 1 | 3 |
| Load balancing | 2 | 6 |
| P-Threads, Locks and semaphores | 2 | 6 |
| MPI, MapReduce and Hadoop | 2 | 6 |

**2. Course components (total contact and credit hours per semester):**

| | | Lecture | Tutorial | Laboratory/ Studio | Practical | Other | Total |
|---|---|---|---|---|---|---|---|
| Contact Hours | Planned | 42 | | | | | 42 |
| | Actual | 42 | | | | | 42 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Credit | Planned | 3 | | | | | 3 |
| | Actual | 3 | | | | | 3 |

**3. Individual study/learning hours expected for students per week.** 9-12

**4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies**

**On the table below are the five NQF Learning Domains, numbered in the left column.**

**First**, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

**Curriculum Map**

| Code # | NQF Learning Domains And Course Learning Outcomes | Course Teaching Strategies | Course Assessment Methods |
|---|---|---|---|
| **1.0** | **Knowledge** | | |
| 1.1 | Understand the fundamental of distributed systems | Lecture, Group discussion | Exams, HWs, Quizzes |
| 1.2 | Ability to apply knowledge of distributed computing to write distributed systems code | Lecture, Group discussion | Exam, HWs, Quizzes |
| 1.3 | An ability to recognize the use of distributed computing modeling methods to model real life data | Lecture, Group discussion | Exam, HWs, Quizzes |
| 1.4 | Develop ability to identify current techniques, skill, and tools necessary for the development of distributed computing solutions | Lecture, Group discussion | Exams, HWs, Quizzes |
| **2.0** | **Cognitive Skills** | | |
| 2.1 | Apply conceptual understanding of distributed systems principles and theories | Lecture, Project | Exam, HWs |
| 2.2 | Implement and evaluate distributed systems process, component, or program | Lecture, Case studies, | Exams, Reports |
| 2.3 | Investigate the real-world problems in the context of distributed systems and design innovative solutions | Lecture, Project | Project Report, Project presentation |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| 3.1 | Demonstrate own learning and professional development | Group discussion, Project | Project Report, Project presentation |

| | | | |
|---|---|---|---|
| 3.2 | Work effectively in groups to accomplish a common goal and show leadership qualities | Group discussion, Project | Project Report, Project presentation |
| 3.3 | Act ethically and responsibly with high moral standards | Lectures, discussion | Anti-plagiarism software, paper review, presentation |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| 4.1 | Ability to communicate clearly in oral and written form with range of audiences | Project | Project Report, Project presentation |
| 4.2 | Use of latest high-performance computing tools | Lecture, Project | Project Report, Project presentation |
| 4.3 | Demonstrate the ability to use mathematical and statistical techniques in the design and analysis of distributed computing systems. | Lecture, Case studies, Project | Exams, Project Report, Project presentation |
| **5.0** | **Psychomotor (if any)** | | |
| 5.1 | Ability to operate and construct necessary tools required for a distributed computing system | Research activities, Projects | Project, HWs, presentations |

**5. Assessment Task Schedule for Students During the Semester**

| | Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.) | Week Due | Proportion of Total Assessment |
|---|---|---|---|
| 1 | HW 1 | 2 | 5% |
| 2 | Quiz 1 | 3 | 5% |
| 3 | HW 2 | 5 | 5% |
| 4 | Quiz 2 | 6 | 5% |
| 5 | Midterm Exam | 8 | 20% |
| 6 | Project | 10 | 30% |
| 7 | Final Exam | 15 | 30% |

## D. Student Academic Counseling and Support

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| 1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)<br>i. Office Hours for student counseling and support – Three hours/week<br>ii. Availability of teaching Staff on e-learning resources like uqu20/Piazza |

## E Learning Resources

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| 1. List Required Textbooks<br>i. Ajay D. Kshemkalyani. Distributed Computing: Principles, Algorithms, and Systems. Cambridge University Press, latest edition.<br>ii. Nicola Santoro. Design and Analysis of Distributed Algorithms. Wiley-Interscience, latest edition. |
| 2. List Essential References Materials (Journals, Reports, etc.)<br>i. Recent research papers in Distributed Systems journals |
| 3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.<br>i. https://twitter.com/, #hpc<br>ii. https://www.chpc.ac.za/ |
| 4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.<br>i. Unix/Linux<br>ii. MATLAB, MPI, distributed computing software |

## F. Facilities Required

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| Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access, etc.) |
| 1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)<br>i. One classroom (25 seats)<br>ii. One lab (25 PCs) |
| 2. Technology resources (AV, data show, Smart Board, software, etc.)<br>i. Visualization software<br>ii. Whiteboard<br>iii. Internet connection |
| 3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) |

## G Course Evaluation and Improvement Procedures

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| 1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching |

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| i. At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous. |
| 2. Other Strategies for Evaluation of Teaching by the Instructor or the Department<br>i. Course file of the course will be maintained and evaluated by some senior faculty member.<br>ii. Instructor evaluation is performed for every semester |
| 3. Procedures for Teaching Development<br>i. Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc. |
| 4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution)<br>i. A random sample from the marked papers may be evaluated by an independent senior faculty member.<br>ii. Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained. |
| 5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.<br>i. Department has curriculum committee that periodically review courses.<br>ii. Faculty council review offer program as per need. |

**Name of Course Instructor:** Dr. Murtaza Ali Khan

**Signature:** *Murtaza Ali Khan* **Date Completed:** Oct. 22, 2018

**Program Coordinator:** _____

**Signature:** _____ **Date Received:** _____