# Course Specification
## (Bachelor)

| | |
|---|---|
| Course Title: | Network Simulation and Modeling |
| Course Code: | 442CCN-3 |
| Program: | Bachelor of Science in Computer Networks |
| Department: | Networks and Communications Engineering |
| College: | Computer Science and Information Systems |
| Institution: | Najran University |
| Version: | 1.0 |
| Last Revision Date: | Feb 2024 |

## Table of Contents

## A. General information about the course:

### 1. Course Identification

| | | | | | |
|---|---|---|---|---|---|
| **1. Credit hours: (3 (2, 2, 1) [Theory, Lab, Tutorial] )** | | | | | |
| **2. Course type** | | | | | |
| **A.** | ☐University | ☐College | ☒ Department | ☐Track | ☐Others |
| **B.** | ☒ Required | | ☐Elective | | |
| **3. Level/year at which this course is offered: (Level 7 / Year 4)** | | | | | |
| **4. Course general Description:** | | | | | |

Introduction to simulation concepts, discrete event simulation, random number generation, input modeling; statistical analysis of simulation, computer networks simulation, Discrete-time Markov chains (DTMC), Continuous-time Markov chains (CTMC), Queuing models (M/M/1, M/M/c/k, M/G/1). Well-known network simulation packages such as ns2 and/or OPNET are considered.

**5. Pre-requirements for this course** (if any)**:**

202CCN-4

**6. Co-requisites for this course** (if any)**:**

N/A

**7. Course Main Objective(s):**

Upon the successful completion of this course, students will be able to:

- Explain how to quantify traffic and understand traffic models (queuing theory).
- Describe discrete event simulation concepts and develop examples.
- Illustrate queuing models such as M/M/1, M/D/1/ and M/M/c/k, calculations of service time, mean waiting time and other performance parameters.
- Use network simulation packages such as NS-2 and Opnet and develop simulation models.
- Apply basic aspects of network simulation and modelling.

## 2. Teaching mode (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | Traditional classroom | 75 | 100% |
| 2 | E-learning | | |
| 3 | Hybrid<br>• Traditional classroom<br>• E-learning | | |
| 4 | Distance learning | | |

## 3. Contact Hours (based on the academic semester)

| No | Activity | | Contact Hours |
|---|---|---|---|
| 1. | **Lectures** | [2 contact hours ´ 15 weeks] | 30 |
| 2. | **Laboratory/Studio** | [2 contact hours ´ 15 weeks] | 30 |
| 3. | **Field** | | |
| 4. | **Tutorial** | [1 contact hour 15 weeks] | 15 |
| 5. | **Others (specify)** | | |
| **Total** | | | 75 |

## B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| **1.0** | **Knowledge and understanding** | | | |
| 1.1 | This course provides knowledge about how to quantity traffic and understand traffic models (queuing theory), discrete event simulation concepts and develop examples, queuing models such as M/M/1, M/D/1/ and M/M/c/k, calculations of service time, mean | K1, K2 | TS: 1-Interactive Lectures using PowerPoint slides and explaining the essential points in more detail with the help of a whiteboard.<br>TS: 2- Encouraging the students to use the online links to know the concepts in detail.<br>TS: 3 – Recall the topics discussed in the last | **Indirect:**<br>- Students CLO Survey<br>**Direct:**<br>- Quizzes.<br>- Assignment.<br>- Midterm exam (Exam consists of multiple-choice questions, |

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| | waiting time and other performance parameters. | | lecture by asking questions to the students.<br>TS: 4 – Motivating students to be active during class by asking questions regularly during the lecture.<br>TS: 5 – Associating the topics in with the course learning outcomes (CLO). | true/false, fill in the blanks, and theoretical questions.)<br>- Final Exam |
| **2.0** | **Skills** | | | |
| 2.1 | Use network simulation packages such as NS-2 and Opnet and develop simulation models. | S3, S4 | TS: 1-Interactive Lectures using PowerPoint slides and explaining the essential points in more detail with the help of a whiteboard.<br>TS: 2- Encouraging the students to use the online links to know the concepts in detail.<br>TS: 3 – Recall the topics discussed in the last lecture by asking questions to the students.<br>TS: 4 – Motivating students to be active during class by asking questions regularly during the lecture.<br>TS: 5 – Associating the topics with the course learning outcomes (CLO). | **Indirect:**<br>- Students CLO Survey<br>**Direct:**<br>- Quizzes.<br>- Assignment.<br>- Midterm exam (Exam consists of multiple-choice questions, true/false, fill in the blanks, and theoretical questions.)<br>- Final Exam |
| 2.2 | Illustrate queuing models such as M/M/1, M/D/1/ and M/M/c/k, calculations of service time, mean waiting time and other performance parameters. | S5, S6 | | |
| ... | | | | |
| **3.0** | **Values, autonomy, and responsibility** | | | |
| 3.1 | Developing oral presentation skills. | V1 | TS: 1-Interactive Lectures using PowerPoint slides and explaining the essential points in more detail with the help of a whiteboard.<br>TS: 2- Encouraging the students to use the online | **Indirect:**<br>- Students CLO Survey<br>**Direct:**<br>- Quizzes.<br>- Assignment.<br>- Midterm exam (Exam consists |
| 3.2 | To illustrate the important components of communication skills and based on developing critical skills, observations, | V2 | | |

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| | experiments, and feedback. | | links to know the concepts in detail.<br>TS: 3 – Recall the topics discussed in the last lecture by asking questions to the students.<br>TS: 4 – Motivating students to be active during class by asking questions regularly during the lecture.<br>TS: 5 – Associating the topics in with the course learning outcomes (CLO). | of multiple-choice questions, true/false, fill in the blanks, and theoretical questions.)<br>- Final Exam |
| ... | | | | |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1. | Local area networks | 10 |
| 2. | Analytical models of LAN | 10 |
| 3. | Simulation Models | 15 |
| 4. | Probability and Statistics | 10 |
| 5. | Simulation languages | 10 |
| 6. | Simulation of CSMA/CD LANs | 10 |
| 7. | Simulation of STAR LANs | 10 |
| | **Total** | **75** |

## D. Students Assessment Activities

| No | Assessment Activities * | Assessment timing (in week no) | Percentage of Total Assessment Score |
|---|---|---|---|
| 1. | Quiz and Assignment | 2nd to 5th week | 10% |
| 2. | Midterm Examination ١ | 9th week | 20% |
| 3. | Lab Activities | 1st to 14th week | 10% |

| No | Assessment Activities * | Assessment timing (in week no) | Percentage of Total Assessment Score |
|---|---|---|---|
| 4. | Lab Final Examination | 15th week | 10% |
| 5. | Final Examination | 16th to 18th week | 40% |

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

## E. Learning Resources and Facilities

### 1. References and Learning Resources

| | |
|---|---|
| **Essential References** | 1. Obaidat, Mohammad S., Faouzi Zarai, and Petros Nicopolitidis, eds. Modeling and simulation of computer networks and systems: Methodologies and applications. Morgan Kaufmann, 2015.<br>2. Matthew N. O. Sadiku and Mohammad Ilyas, Simulation of Local Area Networks, CRC Press, Inc., ISBN: 0849324734. |
| **Supportive References** | 1. Raj Jain, The Art of Computer Systems Performance Analysis: Techniques of Experimental Design, Measurement, Simulation, and Modeling, New York: John Wiley and Sons, Inc., ISBN: 0471503363 2.<br>2. Emad Aboelela, Network Experiments Manual for Peterson/Davie Computer Networks, 4/e, Morgan Kaufmann; 2nd edition, 2007, ISBN: 0123739748 |
| **Electronic Materials** | Available in Blackboard |
| **Other Learning Materials** | |

### 2. Required Facilities and equipment

| Items | Resources |
|---|---|
| **facilities**<br>(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.) | Lecture Rooms with 30 seats and a whiteboard or a smartboard. |
| **Technology equipment**<br>(projector, smart board, software) | Desktop/ Laptop computer<br>Multimedia Projector |
| **Other equipment**<br>(depending on the nature of the specialty) | A File cabinet to keep Class Stuff, Markers, papers and student Files, and a printer to print program screenshots. |

## F. Assessment of Course Quality

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| Effectiveness of teaching | Students, instructors and peer review | - Online course survey: By the end of each semester, students give their opinions about many factors in the course. They give feedback about teaching strategies, assessment methods, textbooks, instructors, etc.<br>- Feedback about Course Learning Outcomes (CLOs): A course survey is distributed to students to get their opinions about the CLOs. |
| Effectiveness of students' assessment | Instructor, faculty, and student | - Discussion with other faculty members about students' understanding and the best way of teaching them.<br>- Peer consultation on teaching<br>- Discussions within the group of faculties teaching the same course before |
| Quality of learning resources | Instructor and Faculty | - Describe the relationship between the course's topics and CLOs.<br>- Course syllabus must be distributed in the first week. It should contain the necessary information about the course (CLOs, assessment methods, descriptions, etc.)<br>- Feedback from the students about the understanding of lectures in academic advising hours.<br>- Analysis of the critical topics with real-life examples and preparation of good effective PPT slides.<br>- By suggesting good teaching methodologies<br>- Ensure that all students participate in the class.<br>- Encourage students to attend during office hours to clarify their doubts. |
| The extent to which CLOs have been achieved | Peer and instructor | - The course coordinator has to approve the exams and grades of students in exams.<br>- The curriculum committee will review all courses by the end of each semester and approve actions and improvements plan to be carried out.<br>- Getting feedback from the students who will pass the course and work in the practical field.<br>- The vice dean and the dean of the college have to approve the final grades. |

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| the planning arrangements for periodically reviewing course effectiveness and planning for improvement | Instructor | - Each semester, the instructor has to teach the course according to the previous course materials (Course specification, report, improvement plan, etc.).<br>- By the end of each semester, the instructor must prepare a course file which contains all activities and practices taken in the course. Achievements of CLOs can be used if the students' levels improved or not |

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

## G. Specification Approval

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|---|---|
| COUNCIL /COMMITTEE | NETWORK AND COMMUNICATIONS ENGINEERING DEPARTMENT COUNCIL |
| REFERENCE NO. | **14450824-0482-00014** |
| DATE | **5/3/2024** |