|  |  |
| --- | --- |
| **Course Title:**  | **Network Simulation and Modeling** |
| **Course Code:** | **453CCN-3**  |
| **Program:** | **Bachelor of Science in Computer Networks** |
| **Department:**  | **Networks and Communications Engineering** |
| **College:** | **Computer Science and Information Systems** |
| **Institution:** | **Najran University**  |

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# A. Course Identification

|  |  |
| --- | --- |
| **1. Credit hours:**  |  |
| **2. Course type** |
| **a.** | University |  | College | **√** | Department |  | Others |  |  |
| **b.** | Required | **√** | Elective |  |  |
| **3. Level/year at which this course is offered:**  | Level (6) |
| **4. Pre-requisites for this course** (if any)**:**N/A   |
| **5. Co-requisites for this course** (if any)**:** |
| N/A   |

## 6. Mode of Instruction (mark all that apply)

| **No** | **Mode of Instruction** | **Contact Hours** | **Percentage**  |
| --- | --- | --- | --- |
| **1** | **Traditional classroom** | 3 | %100 |
| **2** | **Blended**  |  |  |
| **3** | **E-learning** |  |  |
| **4** | **Distance learning**  |  |  |
| **5** | **Other**  |  |  |

**7. Contact Hours** (based on academic semester)

|  |  |  |
| --- | --- | --- |
| **No** | **Activity** | **Contact Hours** |
| **1** | **Lecture** | 35 |
| **2** | **Laboratory/Studio** | 40 |
| **3** | **Tutorial**  | 0 |
| **4** | **Others** (specify) |  |
|  | **Total** | 75 |

# B. Course Objectives and Learning Outcomes

|  |
| --- |
| 1. Course 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.  |
|  |
| 2. Course Main Objective |
| Upon the successful completion of this course, students will be able to:  * Explain how to quantity traffic and understand traffic models (queuing theory).
* Describe discrete event simulation concept 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.
 |

## 3. Course Learning Outcomes

| **CLOs** | **Aligned****PLOs** |
| --- | --- |
| 1 | **Knowledge and Understanding** |  |
| 1.1  | This course provide knowledge about how to quantity traffic and understand traffic models (queuing theory), discrete event simulation concept and develop examples, 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.    | K1, K2  |
| 1.2 |  |  |
|  |  |  |
|  |  |  |
| **2** | **Skills :** |  |
| 2.1  | Use network simulation packages such as NS-2 and Opnet and develop simulation models.    | S3, S4  |
| 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** | **Values:** |  |
| 3.1  | Developing oral presentation skills.  | C1  |
| 3.2  | To illustrate the important components of communication skills and based on developing critical skills, observations, experiments, and feedback.    | C2  |
| 3.3 |  |  |
| 3... |  |  |

# C. Course Content

|  |  |  |
| --- | --- | --- |
| **No** | **List of Topics** | **Contact Hours** |
| 1  | Local area networks  | 8  |
| 2  | Analytical models of LAN  | 8  |
| 3  | Simulation Models  | 8  |
| 4  | Probability and Statistics  | 8  |
| 5  | Simulation of token passing LANs  | 8  |
| 6  | Simulation of CSMA/CD LANs  | 8  |
| 7  | Simulation of STAR LANs  | 10 |
| 8  | Simulation languages  | 16  |
|  |  |  |
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|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| **Total** | 74 |

# D. Teaching and Assessment

## 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| **Code** | **Course Learning Outcomes** | **Teaching Strategies** | **Assessment Methods** |
| --- | --- | --- | --- |
| **1.0** | **Knowledge and Understanding** |
| 1.1 | This course provide knowledge about how to quantity traffic and understand traffic models (queuing theory), discrete event simulation concept and develop examples, 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.    | Lectures, active learning, collaborative and cooperative learning and independent study assignments used as teaching strategies.   * Showing and delivering PPT presentation in the class.
* Using a whiteboard to explain essential points in more detail.
* Motivating students to be active during class by asking questions regularly during lecture.
* Motivating students to work in the home, to search from the internet, to read related reference books by giving them assignments related to simulation and modelling.
* Let students solve scheduling problems in small groups and giving correction on their solution during class.
* Motivating students to be active during class by asking questions regularly.

Giving students tutorial related to scheduling algorithms, thread, memory management etc.    | Following methods are used to assess student's knowledge acquired in this course.  * Class Quizzes.
* Assignment.
* Midterm exam (Each exam consists of multiple choice questions, true/false, fill in the blanks, and theoretical questions.)

Final Exam  |
|  |  |  |  |
| 1.3 | Illustrate the wireless LAN networks using IEEE 802.11 standard.  | Lectures, Small Group Work, Small Group Discussion , Giving students tutorial related to scheduling algorithms, thread, memory management etc.  Motivating students to work in the home, to search from the internet, to read related reference books by giving them assignments related to mobile and wireless communication.    | Class Quizzes. Assignment.  Midterm exam (Each exam consists of multiple choice questions, true/false, fill in the blanks, and theoretical questions.) Final Exam  |
| **2.0** | **Skills** |
| 2.1  | 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.    | * Solving algorithm on the whiteboard for students to make them more familiar with various scheduling algorithms.
* Let students solve problems in small groups and giving correction on their solution during class.
* Motivating students to be active during class by asking questions regularly.
* Let students present their work after group discussion session.
* Giving students tutorial related to scheduling algorithm to explain them in more detail.

  | following methods are used to assess a student's cognitive skills in this course.  * Class Quizzes.
* Assignment.
* Midterm exam (Each exam consists of multiple choice questions, true/false, fill in the blanks, and theoretical questions.

   |
| 2.2  | Use network simulation packages such as NS-2 and Opnet and develop simulation models.    | * Solving algorithm on the whiteboard for students to make them more familiar with various scheduling algorithms.
* Let students solve problems in small groups and giving correction on their solution during class.
* Motivating students to be active during class by asking questions regularly.
* Let students present their work after group discussion session.
* Giving students tutorial related to scheduling algorithm to explain them in more detail.

  | following methods are used to assess a student's cognitive skills in this course.  * Class Quizzes.
* Assignment.
* Midterm exam (Each exam consists of multiple choice questions, true/false, fill in the blanks, and theoretical questions.

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|  |  |  |  |
| 2.4 |  |  |  |
|  |  |  |  |
| **3.0** | **Values** |
| 3.1  | Developing oral presentation skills.  | One individual assignment which requires investigation using provided reading material, library resources as a means of developing the self-study. Student presentation to present their finding on assigned problems. Explanation and examples given in class lectures. Introductory class to make the students alert and be conscious of the class attendance, timing, discipline during the contact hours.  |    Capacity for independent study assessed in the individual assignment.  |
| 3.2  | To illustrate the important components of communication skills and based on developing critical skills, observations, experiments, and feedback.    | One individual assignment which requires investigation using provided reading material, library resources as a means of developing the self-study. Student presentation to present their finding on assigned problems. Explanation and examples given in class lectures. Introductory class to make the students alert and be conscious of the class attendance, timing, discipline during the contact hours.  | Capacity for independent study assessed in the individual assignment.  |
| … |  |  |  |

## 2. Assessment Tasks for Students

| **#** | **Assessment task\***  | **Week Due** | **Percentage of Total Assessment Score** |
| --- | --- | --- | --- |
| **1** | Quiz and Assignment  | 2  | 10%  |
| **2** | Midterm Examination 1  | 5  | 15%  |
| **3** | Midterm Examination 2  | 9  | 15%  |
| **4** | Lab Activities  | 8  | 10%  |
| **5** | Lab Final Examination  | 14  | 10%  |
| **6** | Final Examination  | 15  | 40%  |
| **7** | Quiz and Assignment  | 2  | 10%  |
| **8** |  |  |  |

**\*Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

# E. Student Academic Counseling and Support

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| --- |
| **Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :** |
| During the whole semester, 10 hours/week are reserved for students to guide them, to help them and to explain the topic which is not clear to them during the lecture.  |

# F. Learning Resources and Facilities

## 1.Learning Resources

|  |  |
| --- | --- |
| **Required Textbooks** | Matthew N. O. Sadiku and Mohammad Ilyas, Simulation of Local Area Networks, CRC Press, Inc., ISBN: 0849324734.  |
| **Essential References Materials** | * 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.
* 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. Facilities Required

| **Item** | **Resources** |
| --- | --- |
| **Accommodation**(Classrooms, laboratories, demonstration rooms/labs, etc.) | Lecture Rooms with 20 seats with smart table, Mic, Speaker, PC, Auto Projector with Screen and a white board or a smart board (male Section). |
| **Technology Resources** (AV, data show, Smart Board, software, etc.) | 1. Desktop/ Laptop computer Multimedia Projector
2. Laboratory contains an enough number of PC to accommodate all students with Java-related software like JCreator , J2SE , NetBean, Eclipse and JRE licensed version with network package should be installed.
 |
| **Other Resources** (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | 1. A File cabinet to keep class stuffs, papers and students files, and a printer to print program screen shots.   |

# G. Course Quality Evaluation

| **Evaluation****Areas/Issues**  | **Evaluators**  | **Evaluation Methods** |
| --- | --- | --- |
| Feedback about Course Learning Outcomes (CLOs)  | Students, Faculty  | Direct (A course survey is distributed to students to take their opinion)  |
| feedback about the teaching strategies, assessment methods, textbooks, instructor  | Students, Faculty | Direct (A course survey is distributed to students to take their opinion)   |
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**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

**Assessment Methods** (Direct, Indirect)

# H. Specification Approval Data

|  |  |
| --- | --- |
| **Council / Committee** |  |
| **Reference No.** |  |
| **Date** | January 19, 2019 |