

المركزالوطني للتقويم والاعتماد الأكاديمي

**National Center for Academic Accreditation and Evaluat**

**T6. COURSE SPECIFICATIONS**

**(CS)**

**Variational inequalities**

**Math 655**

**Course Specifications**

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| Institution: King Saud University | Date: 26-11-2018 |
| College/Department :Science- Mathematics | |

**A. Course Identification and General Information**

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| 1. Course title and code:  **Variational inequalities**  **Math 655** |
| 2. Credit hours: 3(3+0+0) |
| 3. Program(s) in which the course is offered.  (If general elective available in many programs indicate this rather than list programs)  Ph.D. (Doctorate Program) of science in Mathematics |
| 4. Name of faculty member responsible for the course  Several professors of computational mathematics |
| 5. Level/year at which this course is offered: First or second year |
| 6. Pre-requisites for this course (if any):  None |
| 7. Co-requisites for this course (if any):  None |
| 8. Location if not on main campus:  Main campus |
| 9. Mode of Instruction (mark all that apply):  100  x  a. traditional classroom What percentage?  b. blended (traditional and online) What percentage?  c. e-learning What percentage?  d. correspondence What percentage?  f. other What percentage?  Comments: |

**B Objectives**

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| 1. What is the main purpose for this course?  The main purpose for the course is to introduce the following concepts:   * Providing the students with a broad knowledge of mathematics particularly the in-depth knowledge of the chosen branch. * Equipping the student with the ability to pursue independent research in an active area of mathematics. * Meeting the requirements of higher educational institutions and research centers for highly qualified mathematicians. * Satisfying the aspirations of a growing number of M.Sc. degree holders in mathematics to obtain a higher qualification locally. * Promoting the quality of the department’s performance and fostering its research activities. |

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| 2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)   * Increased use of IT or web based reference material. * Studying and analysing some of the recent research papers. * Change the content as a result of new research in the field. |

**C. Course Description** (Note: General description in the form used in Bulletin or handbook)

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| Course Description: |

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| 1. Topics to be Covered | | |
| List of Topics | No. of  Weeks | Contact hours |
| Basic concepts. Formulation of the variational inequalities. | 2 | 6 |
| Existence and uniqueness results. Fixed point approach. | 2 | 6 |
| Penalty method. Lagrange multiplier method. | 2 | 6 |
| Error estimate for the finite element approximation. Applications. | 3 | 9 |
| Linear complementarity problems and its generalization. | 2 | 6 |
| Equivalence among variational inequality problems. | 2 | 6 |
| Unilateral problem and complementarity problem and their significance. | 2 | 6 |

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| 2. Course components (total contact hours and credits per semester): | | | | | | | |
|  | | Lecture | Tutorial | Laboratory/  Studio | Practical | Other: | Total |
| Contact  Hours | Planed | 45 |  |  |  |  | 45 |
| Actual | 45 |  |  |  |  | 45 |
| Credit | Planed | 3 |  |  |  |  | 3 |
| Actual | 3 |  |  |  |  | 3 |

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| 3. Additional private study/learning hours expected for students per week.  15  For self-study and homework and computer assignments. |

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| 4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy | | | |
| **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 intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.) | | | |
| **Code**  **#** | **NQF Learning Domains**  **And Course Learning Outcomes** | **Course Teaching**  **Strategies** | **Course Assessment**  **Methods** |
| **1.0** | **Knowledge** | | |
| 1.1 | Tell how to deal with various simulated problems from physics, science and engineering numerically. | -Through Lecturers  -Using computer labs and internet. | -Through homework assignments  -Written exams. |
| 1.2 |  |  |  |
| **2.0** | **Cognitive Skills** | | |
| 2.1 | Prepare and present some parts of the course | Lectures, homework assignments, discussion in the class, self-study. | Marking the homework assignments, and oral discussions in the class. |
| 2.2 |  |  |  |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| 3.1 | Demonstrate some parts of the lesson and homework assignments. | Homework assignments and discussions in the class. | Marking the homework assignments and oral discussions in the class. |
| 3.2 |  |  |  |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| 4.1 | Demonstrate algorithms and illustrate solutions of some problems numerically. | Homework assignments and Programming assignments. | Marking the homework assignments. |
| 4.2 |  |  |  |
| **5.0** | **Psychomotor** Not applicable | | |
| 5.1 |  |  |  |
| 5.2 |  |  |  |

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| 5. Schedule of Assessment Tasks 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 | Home Assignment weekly | weekly | 10 % |
| 2 | First MidTerm | 7 | 25 % |
| 3 | Second MidTerm | 12 | 25 % |
| 4 | Final Exam | 16 | 40 % |
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**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 advice. (include amount of time teaching staff are expected to be available each week)  10 office hours declared to the students. |

**E Learning Resources**

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| 1. List Required Textbooks [Variational Inequalities and Complementary Problems: Theory and Applications](http://www.amazon.com/Variational-Inequalities-Complementary-Problems-Applications/dp/0471276103/ref=sr_1_27?s=books&ie=UTF8&qid=1331501588&sr=1-27) by [Jacques Louis Lions](http://www.amazon.com/Jacques-Louis-Lions/e/B001HCWZRQ/ref=sr_ntt_srch_lnk_27?qid=1331501572&sr=1-27) (May 28, 1980).[An Introduction to Variational Inequalities and Their Applications (Classics in Applied Mathematics)](http://www.amazon.com/Introduction-Variational-Inequalities-Applications-Mathematics/dp/0898714664/ref=sr_1_7?s=books&ie=UTF8&qid=1331501522&sr=1-7) by [David Kinderlehrer](http://www.amazon.com/David-Kinderlehrer/e/B001HQ1NL6/ref=sr_ntt_srch_lnk_7?qid=1331501522&sr=1-7) and [Guido Stampacchia](http://www.amazon.com/Guido-Stampacchia/e/B0028EWCIO/ref=sr_ntt_srch_lnk_7?qid=1331501522&sr=1-7) (Jan 1, 1987). |
| 2. List Essential References Materials (Journals, Reports, etc.) [Finite-Dimensional Variational Inequalities and Complementarily Problems II](http://www.amazon.com/Finite-Dimensional-Variational-Inequalities-Complementarity-Problems/dp/038795581X/ref=sr_1_4?s=books&ie=UTF8&qid=1331501522&sr=1-4) by Francisco Facchinei and Jong-Shi Pang (Feb 6, 2003). Elsevier, Variational inequalities periodicals and journals. |
| 3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.  Websites interested in variational inequalities |
| 4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.  Matlab, Mathematica and Mable 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.)   * Room for 20 students equipped with blackboard and projector. * T.V. with remote connection for female section. |
| 2. Technology resources (AV, data show, Smart Board, software, etc.)  Smart Board, Matlab, Mathematica, Mable. |
| 3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)   * Computers connected to internet. * Printers. |

**G Course Evaluation and Improvement Processes**

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| 1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching  Course evaluation by the students at the end of the semester |
| 2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department   * Re-evaluating the contents of the subject every year by the teaching professors. * Observations of the group of faculty teaching the course. |
| 3. Processes for Improvement of Teaching   * Encouraging the students to attend the lecture and sessions held in the department. * Students should take a look at the most recent references and research work published. |
| 4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)  Reviewing the contents of the subject on the light of the general study plane of the department. |
| 5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. |

Name of Course Instructor: \_Prof. Bessem Samet\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date Specification Completed: 26-11-2018

Program Coordinator: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date Received:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_