

المركز الوطني للتقويم والاعتماد الأكاديمي

**National Center for Academic Accreditation and Evaluation**

### ATTACHMENT 5.

**T6. COURSE SPECIFICATIONS**

**(CS)**

Methods in Fluid Dynamics (MATH612)

**Course Specifications**

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| Institution: King Saud University | Date: 25.11.2018 |
| College/Department : College of Science / Department of Mathematics | |

**A. Course Identification and General Information**

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| 1. Course title and code: Methods in Fluid Dynamics (MATH612) |
| 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)  Master of Science in Mathematics (thesis and courses option). |
| 4. Name of faculty member responsible for the course  Any member of the teaching staff in the Department of Mathematics in the specialty of Applied Mathematics |
| 5. Level/year at which this course is offered: 2nd or 3rd semester. |
| 6. Pre-requisites for this course (if any): Partial Differential Equations (MATH512) |
| 7. Co-requisites for this course (if any): (None) |
| 8. Location if not on main campus: |
| 9. Mode of Instruction (mark all that apply):  Lectures  70%  Lectures  a. traditional classroom What percentage?  b. blended (traditional and online) What percentage?  c. e-learning What percentage?  d. correspondence What percentage?  30%  Exercises and Problems  f. other What percentage?  Comments: |

**B Objectives**

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| 1. What is the main purpose for this course?  This course introduces:   1. Basic equations of Compressible flow, 2. Analytical and Computational methods of solving Navier - Stoke's equation, 3. Boundary layer theory. 4. Finite difference methods for inviscid and viscos compressible flows.. 5. Finite element methods for inviscid and viscos compressible flows.. |

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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)  1. Encourage students to refer and read certain books about methods in Fluid Dynamics.  2. Encourage students to access to internet websites interested in methods in Fluid Dynamics.  3. Encourage students to take overview of some journals interested in methods in Fluid Dynamics.  4. Mathematical model from real life will be developed and the methods studied will be used to reproduce the situation with the help of numerical methods.  5. Matlab will be introduced as package to apply for the numerical computations |

**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  equations of compressible flow | 4 | 12 |
| Analytical and computational  methods  for solving Navier –Stoke's equation | 5 | 15 |
| The concept of boundary layer theory | 3 | 9 |
| Numerical methods for inviscid and  viscous compressible flows | 3 | 9 |
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| 2. Course components (total contact hours and credits per semester): | | | | | | | |
|  | | Lecture | Tutorial | Laboratory/  Studio | Practical | Other: | Total |
| Contact  Hours | Planed | 20 |  |  |  | 15 | 45 |
| Actual | 10 |  |  |  |  |  |
| Credit | Planed |  |  |  |  |  |  |
| Actual |  |  |  |  |  |  |

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| 3. Additional private study/learning hours expected for students per week. 10 hours weekly for independent study and doing homework and computer assignments  10 |

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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**  After studying this course, the student will acquire the following knowledge :   * To know the proof of boundary layer theory * To know some analytical and computational  methods  for solving Navier –Stoke's equation * To know finite difference and finite element methods for inviscid and  viscous compressible flows | | |
| 1.1 | * To know how to deal with basic equations of compressible flow |  |  |
| 1.2 | * To know the proof of boundary layer theory |  |  |
| **1.3** | * To know some analytical and computational  methods  for solving Navier –Stoke's equation | | |
| 1.4 | * To know finite difference and finite element methods for inviscid and  viscous compressible flows |  |  |
| 1.5 | * To develop the programming techniques using Matlab |  |  |
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| **2.0** | **Cognitive Skills** | | |
| 2.1 |  |  |  |
| 2.2 |  |  |  |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| 3.1 | After completion of this course, the students will be able to solve real life problems of fluid flow. |  |  |
| 3.2 | Ideas development and sharing them with others in team works. |  |  |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| 4.1 | Students gain a lot of information by searching through the internet and references in order to solve problems relevant to this course. |  |  |
| 4.2 | Developing Numerical model using numerical technique |  |  |
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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 | Encouraging students to perform internet research and presentation of examples of material that can be gathered through such research |  |  |
| 2 | There will be individual class presentations on research problem |  |  |
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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) |

**E Learning Resources**

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| 1. List Required Textbooks   1. Computational Methods for Fluid Dynamics, by J. H. Ferziger and M. Peric, Springer, Copyright 2002. 2. Basics of Fluid Mechanics and Introduction to Computational Fluid Dynamics, by **Petrila**, Titus, **Trif**, Damian, Springer, Copyright 2005.  Numerical Mathematics,Authors: **Quarteroni**, Alfio, **Sacco**, Riccardo, **Saleri**, Fausto, Springer, Copyright 2007. |
| 2. List Essential References Materials (Journals, Reports, etc.) Journal of Computational Physics: thoroughly treats the computationalaspects of physical problems, presenting techniques for the numerical solution of mathematical equations arising in all areas of physics.  1. Journal of fluid mechanics: is a [peer-reviewed](http://en.wikipedia.org/wiki/Peer_review) [scientific journal](http://en.wikipedia.org/wiki/Scientific_journal) in the field of [fluid mechanics](http://en.wikipedia.org/wiki/Fluid_mechanics). It publishes original work on theoretical, computational, and experimental aspects of the subject. 2. Computational Fluid Dynamics,[T. J. Chung](http://www.google.com.sa/search?tbo=p&tbm=bks&q=inauthor:%22T.+J.+Chung%22),Cambridge University Press, 2002.  Essential Computational Fluid Dynamics,[Oleg Zikanov](http://www.google.com.sa/search?tbo=p&tbm=bks&q=inauthor:%22Oleg+Zikanov%22),John Wiley & Sons,  2011.International Journal for Numerical Methods in Fluids  is a [peer-reviewed](http://en.wikipedia.org/wiki/Peer_review) [scientific journal](http://en.wikipedia.org/wiki/Scientific_journal) covering developments in [numerical methods](http://en.wikipedia.org/wiki/Numerical_method) applied to [fluid dynamics](http://en.wikipedia.org/wiki/Fluid_dynamics). |
| 3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.  <https://www.youtube.com/watch?v=lfXDJKKPGfY>  <https://www.youtube.com/watch?v=pAuQ4Hj2ZrU&list=PLqOZ6FD_RQ7m8oL297GkRRszNN1Q-l6wb&index=2> |
| 4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.   1. Matlab 2. Mathematica |

**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.)   1. Classrooms, 2. Computer lab |
| 2. Technology resources (AV, data show, Smart Board, software, etc.) |
| 3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)   1. data show, 2. Smart Board, 3. Software for computational methods |

**G Course Evaluation and Improvement Processes**

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| 1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching  By survey and discussion |
| 2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department |
| 3. Processes for Improvement of Teaching |
| 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)   1. By class evaluations 2. By homework 3. By group assignments |
| 5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. |

Name of Course Instructor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature: **Dr.Khawaja Zafar Elahi** \_\_\_\_ Date Specification Completed: \_\_**24.11.2018**

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

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