

المركزالوطني للتقويم والاعتماد الأكاديمي

**National Center for Academic Accreditation and Evaluation**

### ATTACHMENT 5.

**T6. COURSE SPECIFICATIONS**

**(CS)**

Variational theory and minimal submanifolds ( 672M )

**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 theory and minimal submanifolds ( 672M ) |
| 2. Credit hours: 3 |
| 3. Program(s) in which the course is offered.  (If general elective available in many programs indicate this rather than list programs)  Ph.D.. in Mathematics |
| 4. Name of faculty member responsible for the course  **Dr. Sharief Deshmukh** |
| 5. Level/year at which this course is offered: First Year |
| 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):  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 course is designed for the research students who are willing to make career in Differential Geometry. This course will enhance the analytic thinking and an introduction to calculus of variations on Riemannian manifolds. |

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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)  -Creating a Web site for the material to be available to all students at any time.  - Home works and assignments to be marked in order to keep the students following the course |

**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 |
| The first and second variation of arc length, | 3 | 9 |
| Jacobi fields conjugate points, comparison theorems of Morse and Rauch, Myer's theorem on compactness of Riemannian Manifolds, | 2 | 6 |
| Variation of immersion, Normal variation | 2 | 6 |
| First and second variation of the area function | 2 | 6 |
| Minimal submanifolds, stability of minimal submanifolds, | 2 | 6 |
| Index of minimal submanifolds, minimal submanifolds in spheres | 2 | 6 |
| complex submanifolds of a complex projective space. | 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.  5  5 hours a week for homework and revision. |

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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 | Understanding the applications of calculus of variations to differential geometry and analytic tools used in getting topological information of the manifolds. | - Contact with Lecturers through office hours.  - Tutorial discussions.  -Homework assignments. | - Short quizzes in tutorial classes.  - Two mid term exams. In addition to the final exam.  - Evaluation of skills during lectures and tutorials |
| 1.2 |  |  |  |
| **2.0** | **Cognitive Skills** | | |
| 2.1 | To prepare the students to appreciate the implications of deep results in this course. Clarifying the main points of the course and linking previous knowledge to the lectures through solving problems, also identifying how useful the material in applications. | - Constructing as many examples as possible, so that the students appreciate this sophisticated course.  -Directing the students to how to think in formulating mathematical models through discussions during the lectures. | Communications in class, Quizzes, Home-work and Exams. |
| 2.2 |  |  |  |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| 3.1 | Directing students to the way of thinking , handling the material and encouraging them to discuss any minor problems related to the material. | -The use of different sources for the material  -Correcting home works and directing students to good presentation of their home work. | Continuous checking to the student skills in understanding the course. Encouraging students to participate in giving seminars and their impressions on the important results. |
| 3.2 |  |  |  |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| 4.1 | The use of computational tools and presentation of homework. | Encouraging students to use the available different tools in studying the course. | Giving a letter of appreciation to the distinguished students. |
| 4.2 |  |  |  |
| **5.0** | **Psychomotor** | | |
| 5.1 | Not applicable | Not applicable | Not applicable |
| 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 | First midterm exam. | Week 6 | 20% |
| 2 | Second mid term exam. | Week 10 | 20% |
| 3 | Homework | Over all weeks | 10% |
| 4 | Final exam | end | 50% |
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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  Differential Geometry and the Calculus of variations, by R. Hermann. |
| 2. List Essential References Materials (Journals, Reports, etc.)  Foundations of Mechanics, R. Abraham |
| 3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.  J. Simons, Minimal varieties in Riemannian manifolds, Annals of Math. (2)88(1968), 62-106 |
| 4. Other learning material such as computer-based programs/CD, professional standards or regulations and 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.)  Lecture Room |
| 2. Technology resources (AV, data show, Smart Board, software, etc.)  Not required |
| 3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) |

**G Course Evaluation and Improvement Processes**

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| 1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching  The students are required to write a detailed report at the end of the course. |
| 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) |
| 5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. |

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

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date Specification Completed: \_\_\_\_\_\_\_\_\_\_\_\_

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

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