### ATTACHMENT 2 (e)

### Course Specifications

**Kingdom of Saudi Arabia**

**The National Commission for Academic Accreditation & Assessment**

**Course Specifications**

Differential Geometry (M-5721)

**Course Specifications**

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| Institution: King Saud University Date of Report: February 26, 2017 |
| College/Department: College of Science, Department of Mathematics |

**A. Course Identification and General Information**

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| 1. Course title and code: Differential Geometry, M5721 |
| 2. Credit hours: 4 |
| 3. Program(s) in which the course is offered. M.Sc.  (If general elective available in many programs indicate this rather than list programs) |
| 4. Name of faculty member responsible for the course: Mohammed Guediri |
| 5. Level/year at which this course is offered: Second semester/First |
| 6. Pre-requisites for this course (if any): M5701 |
| 7. Co-requisites for this course (if any) |
| 8. Location if not on main campus: Women Section |
| 9. Mode of Instruction (mark all that apply)  a. Traditional classroom ✓ What percentage? 100%  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? Differentiable manifolds are used in several areas of mathematics as well as Physics and Engineering. In mathematics, Differential Geometry, Theory of Partial differential equations, Global Analysis, use differentiable manifolds as base to build on these subjects. In physics, the general theories of Relativity as well as Mechanics are based on differentiable manifolds. The main objective of this course is to provide foundations of the differentiable manifolds in most general setting which will be useful for the students entering in any of the above mentioned areas. |
| 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)  Preparing additional exercises other than those in the text and reference books for the students to solve, which will enhance the understanding of the students in the subject. Placing these exercises and notes on the webpage of the teacher for the benefit of the students. |

**C. Course Description (Note: General description in the form to be used for the Bulletin or handbook should be attached)**

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| 1. Topics to be Covered | | |
| List of Topics | No. of  Weeks | Contact Hours |
| Submanifolds of Rn, definition of a differentiable manifolds and Examples | 2 | 6 |
| Tangent vectors, tangent bundle, vector fields and flows, Lie derivatives | 4 | 12 |
| Differential of a map, immersions, submersions, submanifolds | 3 | 9 |
| Differential forms, Integration on manifolds | 3 | 9 |
| Lie groups, left invariant vector fields, one-parameter subgroups | 3 | 9 |

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

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| 3. Additional private study/learning hours expected for students per week. |

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| 4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy |

Course Learning Outcomes, Assessment Methods, and Teaching Strategy work together and are aligned. They are joined together as one, coherent, unity that collectively articulate a consistent agreement between student learning, assessment, and teaching.

The ***National Qualification Framework*** provides five learning domains. Course learning outcomes are required. Normally a course has should not exceed eight learning outcomes which align with one or more of the five learning domains. Some courses have one or more program learning outcomes integrated into the course learning outcomes to demonstrate program learning outcome alignment. The program learning outcome matrix map identifies which program learning outcomes are incorporated into specific courses.

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. **Fourth**, if any program learning outcomes are included in the course learning outcomes, place the @ symbol next to it.

Every course is not required to include learning outcomes from each domain.

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|  | **NQF Learning Domains**  **And Course Learning Outcomes** | **Course Teaching**  **Strategies** | **Course Assessment**  **Methods** |
| **1.0** | **Knowledge** | | |
| 1.1 | The vital component of this course is the students acquire the knowledge | On introduction of the concepts, examples and counter examples are constructed to enable the students to test their knowledge of the subject. | Short questions are prepared to check whether the students have conceived the concepts, which will enable to ascertain whether students have gained the proper knowledge of the subject. |
| 1.2 |  |  |  |
| **2.0** | **Cognitive Skills** | | |
| 2.1 | Application through solving exercises | After teaching certain topic, it will be demonstrated how to apply these concepts in getting other results, this will develop the skills of applications. | Exercises will be prepared to derive corollaries of main results by modifying the premises of the results. |
| 2.2 |  |  |  |
| **3.0** | **Interpersonal Skills & Responsibility** | | |
| 3.1 |  |  |  |
| 3.2 |  |  |  |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| 4.1 |  |  |  |
| 4.2 |  |  |  |
| **5.0** | **Psychomotor** | | |
| 5.1 |  |  |  |
| 5.2 |  |  |  |

**Suggested Guidelines for Learning Outcome Verb, Assessment, and Teaching**

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| **NQF Learning Domains** | **Suggested Verbs** |
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| **Knowledge** | list, name, record, define, label, outline, state, describe, recall, memorize, reproduce, recognize, record, tell, write |
| **Cognitive Skills** | estimate, explain, summarize, write, compare, contrast, diagram, subdivide, differentiate, criticize, calculate, analyze, compose, develop, create, prepare, reconstruct, reorganize, summarize, explain, predict, justify, rate, evaluate, plan, design, measure, judge, justify, interpret, appraise |
| **Interpersonal Skills & Responsibility** | demonstrate, judge, choose, illustrate, modify, show, use, appraise, evaluate, justify, analyze, question, and write |
| **Communication, Information**  **Technology, Numerical** | demonstrate, calculate, illustrate, interpret, research, question, operate, appraise, evaluate, assess, and criticize |
| **Psychomotor** | demonstrate, show, illustrate, perform, dramatize, employ, manipulate, operate, prepare, produce, draw, diagram, examine, construct, assemble, experiment, and reconstruct |

Suggested ***verbs not to use*** when writing measurable and assessable learning outcomes are as follows:

Consider Maximize Continue Review Ensure Enlarge Understand

Maintain Reflect Examine Strengthen Explore Encourage Deepen

Some of these verbs can be used if tied to specific actions or quantification.

**Suggested assessment methods and teaching strategies are:**

According to research and best practices, multiple and continuous assessment methods are required to verify student learning. Current trends incorporate a wide range of rubric assessment tools; including web-based student performance systems that apply rubrics, benchmarks, KPIs, and analysis. Rubrics are especially helpful for qualitative evaluation. Differentiated assessment strategies include: exams, portfolios, long and short essays, log books, analytical reports, individual and group presentations, posters, journals, case studies, lab manuals, video analysis, group reports, lab reports, debates, speeches, learning logs, peer evaluations, self-evaluations, videos, graphs, dramatic performances, tables, demonstrations, graphic organizers, discussion forums, interviews, learning contracts, antidotal notes, artwork, KWL charts, and concept mapping.

Differentiated teaching strategies should be selected to align with the curriculum taught, the needs of students, and the intended learning outcomes. Teaching methods include: lecture, debate, small group work, whole group and small group discussion, research activities, lab demonstrations, projects, debates, role playing, case studies, guest speakers, memorization, humor, individual presentation, brainstorming, and a wide variety of hands-on student learning activities.

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| 5. Schedule of Assessment Tasks for Students During the Semester | | | |
|  | Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.) | Week Due | Proportion of Total Assessment |
| 1 | Home assignments | 3rd | 5% |
| 2 | Mid-term examination | 6th | 20% |
| 3 | Home assignments | 8th | 5% |
| 4 | Mid-term examination | 12th | 20% |
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| 5 | Final examination | 16th | 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)  Ten office hours are made available for students for consulting the teacher and for academic advice. |

**E. Learning Resources**

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| 1. List Required Textbooks  W. Boothby, An introduction to differentiable manifolds and Riemannian  Geometry, Academic Press, 1975. |
| 2. List Essential References Materials (Journals, Reports, etc.)  S. Gallot, D. Hulin, J. Lafontaine, Riemannian Geometry, Springer-Verlag Berlin  Heidelberg 1987, 1990, 2004. |
| 3. List Recommended Textbooks and Reference Material (Journals, Reports, etc) |
| 4. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.) |
| 5. 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.)  Exercises sheets and some useful notes will be available on the webpage of the faculty teaching the course. |

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| 2. Computing 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) |

**G Course Evaluation and Improvement Processes**

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| 1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching  A form containing questions regarding students satisfaction about the course and teaching will be distributed to get the feedback to improve the effectiveness of the teaching. |
| 2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor |
| 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) |

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| 5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. |

**Faculty or Teaching Staff: \_Mohammed Guediri**

**Signature: \_\_\_guediri\_\_\_\_\_\_\_\_\_\_ Date Report Completed: February 26, 2017**

**Received by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Dean/Department Head**

**Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**