### ATTACHMENT 2 (e)

### Course Specifications

**Kingdom of Saudi Arabia**

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

**Course Specifications**

**(CS)**

**Course Specifications**

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| Institution Date of Report  **Majmaah University** 18-6-1435 |
| College/Department : **Science /Mathematics** |

**A. Course Identification and General Information**

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| 1. Course title and code: Introduction to Differential Geometry (MATH473) |
| 2. Credit hours: 4 Hours |
| 3. Program(s) in which the course is offered.  (If general elective available in many programs indicate this rather than list programs) Mathematics Department |
| 4. Name of faculty member responsible for the course : Dr. **Mohamed Ahmed Elsayed Herzallah** |
| 5. Level/year at which this course is offered :7th level |
| 6. Pre-requisites for this course (if any): MATH241 + MATH204 |
| 7. Co-requisites for this course (if any): |
| 8. Location if not on main campus |
| 9. Mode of Instruction (mark all that apply)    85%  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?  15%  Comments: |

**B Objectives**

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| 1. What is the main purpose for this course?   * knowing the theory of curves in R^3-Regular curves - arc length and reparametrization- Natural parametrization – Curvature and Torsion - Serret-Frenet equations * Recognizing the Local theory of surfaces-Simple surfaces-Coordinate transformations-Tangent vectors & tangent spaces - First and second fundamental forms * Knowing the Normal and geodesic curvature – Weingarten map- Principal Gaussian and mean curvatures- Geodesics- Equations of Gauss and Godazzi-Mainardi. |
| 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)   * Using some mathematical programs as matlab to plot the curves and surfaces in the course. * Using the web in some research from the students. * Increasing the hours of self study with several kinds of home works. * Adding some new references. |

**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 | | | | Total of contact | Self-Study | | | Discussion | total |
| Lecture | Tutorial | Lab. | Office hours | Internet | Library | Homework |
| Theory of curves in Regular curves - arc length and reparametrization -Natural parametrization | 3 | 12 | 3 | 0 | 1 | 16 | 4 | 6 | 12 | 2 | 40 |
| Serret-Frenet equations – Existence and uniqueness theorem for space curves-Bertrand curves- Involutes and evolutes | 2 | 8 | 2 | 0 | 1 | 11 | 3 | 3 | 8 | 2 | 27 |
| Mid-term1 |  | 1 |  |  |  | 1 |  |  |  |  | 1 |
| Local theory of surfaces-Simple surfaces-Coordinate transformations-Tangent vectors & tangent spaces | 3 | 12 | 3 | 0 | 1 | 16 | 4 | 6 | 12 | 2 | 40 |
| First and second fundamental forms | 2 | 8 | 2 | 0 | 1 | 11 | 3 | 3 | 8 | 2 | 27 |
| Mid-term 2 |  | 1 |  |  |  | 1 |  |  |  |  | 1 |
| Normal and geodesic curvature – Weingarten map- Principal Gaussian and mean curvatures | 2 | 8 | 2 | 0 | 1 | 11 | 3 | 3 | 8 | 2 | 27 |
| Normal and geodesic curvature – Weingarten map- Principal Gaussian and mean curvatures | 2 | 8 | 2 | 0 | 1 | 11 | 3 | 3 | 8 | 2 | 27 |
| Review |  |  |  |  |  |  |  |  | 4 | 4 | 8 |
| Final exam |  | 2 |  |  |  | 2 |  |  |  |  | 2 |
| Total | 14 |  |  |  |  | 80 | 20 | 24 | 60 | 16 | 200 |

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| 2. Course components (total contact hours and credits per semester): | | | | | | | |
|  | Contact Hours | | | | Self-study | Other: | Total |
|  | Lecture | Tutorial | Laboratory | Practical |
| Contact  Hours | 56 | 14 | 0 | 0 | 144 | 0 | 200 |
| Credit | 56 | 14 | 0 | 0 |  | 0 | 56 |

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| 3. Additional private study/learning hours expected for students per week.  8 h |

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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 | - Define Regular curves - arc length and reparametrization-  - outline theory of curves in R^3- the Local theory of surfaces-Simple surfaces-Coordinate transformations-  - State Tangent vectors & tangent spaces - First and second fundamental forms  -Recall Weingarten map- Principal Gaussian and mean curvatures- Geodesics | a-Lectures | Evaluating questions at the end of the lecture  - Sudden quizzes and some oral questions  - Achievement tests |
| 1.2 | - Define Natural parameterization – Curvature and Torsion - Serret-Frenet equations  - Recognize the Normal and geodesic curvature - Equations of Gauss and Godazzi-Mainardi. | b-Different questions in the lecture |  |
| **2.0** | **Cognitive Skills** | | |
| 2.1 | - explain how to find the curvature and torsion of the curve  - summarize the theory of curves, simple surfaces and Serret Frenet equations.  - explain the plotting of curves and surfaces with determining the main properties of them.  - Applied Weingarten map and geodesics. | - Raise the spirit of dialogue and discussion among students.  - Ask indirect questions interesting and varied and give incentive to those who based solution. | Evaluating questions at the end of the lecture  - Sudden quizzes and some oral questions. |
| 2.2 | - interpret the nature parameterization, first and second fundamental forms to surfaces.  - analyze mathematical programs as matlab to plot different curves and surfaces. | - Assigning students solve the exercises in each chapters | Achievement tests |
| **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 | Report 1+homework | 3 | 10 |
| 2 | Mid term 1 | 6 | 15 |
| 3 | Report 2+homework | 9 | 10 |
| 4 | Midterm 2 | 12 | 15 |
| 5 | Tutorial over the whole semester |  | 10 |
| 6 | 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)  students are encouraged to come during the office hours (4 hours per week) to discuss their mathematical problems and difficulties they face |

**E. Learning Resources**

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| 1. List Required Textbooks  1- M.D. Carmo, Differential Geometry of Curves and Surfaces, Birkhauser, Boston, 1992.  2- M. M. Lipschutz, Schaum's Outline of Differential Geometry, McGraw-Hill, New York, 1969. |
| 2. List Essential References Materials (Journals, Reports, etc.)  1) M.D. Carmo, Differential Geometry of Curves and Surfaces, Birkhauser, Boston, 1992.  2) H. W. Guggenhimer, Differential Geometry, McGraw-Hill, New York, 1977.  3) M. Spivak, Introduction to Differential Geometry, Vol. 1, 3rd edition, Addison-Wesley, 1965 |
| 3. List Recommended Textbooks and Reference Material (Journals, Reports, etc) |
| 4. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.)  http://www.sciencedirect.com/  http://www.siam.org//  http://www.cmi.univ-mrs.fr//  http://www.arxiv.org//  http://www.lms.ac.uk/  http://www.ams.org/  http:// mathforum.org/advanced/numerical.html/  http://www.ingentaconnect.com/ content/  http://www.zentrablblatt-math.org/ zmath/en/  http://www.ma.hw.ac.uk |
| 5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.  Matlab program |

**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 rooms must be suitable to the number of students |
| 2. Computing resources (AV, data show, Smart Board, software, etc.)  Computer and Projector |
| 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  At the end of the semester feedback is taken from the students on a prescribed Performa |
| 2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor  Departmental meetings, frequent meetings/ consultation among the teaching staffs, meeting between course coordinators and the tutors |
| 3 Processes for Improvement of Teaching  This may be done from time to time by the course coordinator in consultation with other faculty members teaching this course, and expert opinion may be taken |
| 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)  The course material and knowledge acquired by the students are periodically reviewed and changes if necessary are approved by the department |

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| 5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.  The chairman and the faculty implement the proposed changes, if any. |

**Faculty or Teaching Staff: Dr: Mohamed Ahmed Elsayed Herzallah**

**Signature: Mohamed A. E. Herzallah Date Report Completed: 18- 6- 1435**

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

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