4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: Singularities of Caustics and wave fronts

Course Code: 4047108-4

Course Specifications

Institution: Umm Al-Qura University	Date: November 12, 2018
College/Department : Faculty of Applied Science – Department of Mathematical Sciences	

A. Course Identification and General Information

1. Course title and code: **Singularities of Caustics and wave fronts (4047108-4)**			
2. Credit hours **4 Credit Hours**			
3. Program(s) in which the course is offered: (If general elective available in many programs indicate this rather than list programs) **PhD in mathematics** (If general elective available in many programs indicate this rather than list programs)			
4. Name of faculty member responsible for the course **Dr. Fawaz Allohaibi**			
5. Level/year at which this course is offered**: PhD, Level 3**			
6. Pre-requisites for this course (if any) : **Curves and singularities 4047107-4**			
7. Co-requisites for this course (if any) : --			
8. Location if not on main campus **Al-Abdia Campus and Alzahir Campus**			
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

1. What is the main purpose for this course? **The course is intended to give an introduction to the ideas of modern singularity theory, using curves, families of curves and families of surfaces.**
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) **a) The course material is posted on the Web (CT) that could be accessed by the students enrolled in the course only.** **b) Students are encouraged to use online programs as one of computing resources .** **c) Use e-learning facilities more efficiently.** **d) Use computer packages for solving exercises**

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

Course Description: This is a 4 credit hours course comprising approximately 60 hours of lectures.

1. Topics to be Covered		
List of Topics	No. of Weeks	Contact hours
Symplectic spaces: defintians and examples, cotangent bundle, space of extremals of variational problem	**1**	**4**
Contact spaces : definitions and examples, projectivised cotangent bundle	**1**	**4**
Lagrangian submanifolds symplectic spaces	**1**	**4**
Legendre submanifolds of contact spaces	**1**	**4**
Lagrangian bundles, Lagrangian projections, caustics, Legendre projections, wave fronts, examples from differential geometry	**2**	**8**
Legendre transformation, dual surfaces	**1**	**4**
Local singularities: generating functions for Legendre and Lagrange germs. Space of germs of functions, classification of function germs singularities	**3**	**12**
Moser's homotopy method and Malgrange preparation theorem	**2**	**8**
Versality of families of functions	**1**	**4**
Stability of Lagrange, Legendre projections	**2**	**8**

2. Course components (total contact hours and credits per semester):

	Lecture	Tutorial	Laboratory/ Studio	Practical	Other:	Total
Contact Hours	60	0				60
Credit	4	0				4

1. Additional private study/learning hours expected for students per week.
   Four hours weekly for homework and revision

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 successful completion of the course, the student should be able to		
1.1	Define the related basic scientific facts, concepts, principles and techniques of singularities of caustics.	**Lectures Tutorials Discussion Problem Solving**	**Exams Home work.**
1.2	Recognize the relevant theories of Lagrangian and Legendre submanifolds and their applications.		
2.0	**Cognitive Skills**		
2.1	Representing problems mathematically.	**Lectures Tutorials Solve Problem Brain Storming**	**Exams Quizzes. Homework. Discussion**
2.2	distinguish different rules in the theory of singularities of Caustics		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Develop connections of singularity theory with other disciplines in Manifold theory	**Cooperative education Competitive education**	**Home work. Reports. Quizzes. Discussion**
3.2	Solve problems using a range of formats and approaches in basic science		
3.3	show the ability to work independently and within groups.		

4.0	**Communication, Information Technology, Numerical**		
4.1	Learn how to summarize lectures or to collect materials of the course.	**Lectures tutorials brain storming**	**Home work. Reports. Discussion**
4.2	Learn how to solve difficulties in learning: **solving problems – enhance educational skills**		
5.0	**Psychomotor**		
5.1	Not applicable	Not applicable	Not applicable

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 periodic exam	6	20
2	Second periodic exam	10	20
4	Homework + reports + Quizzes	Over all weeks	20
5	Final exam	End	40

D. Student Academic Counseling and Support

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)
1- Office hours per week in the lecturer schedule (6 hours per week).
2- Contact with students by e-mail,SMS, and e-learning facilities.

E Learning Resources

1. Required Text(s)
- V.I. Arnold, S.M. Gusein-Zade, A.N. Varchenko, Singularities of differentiable maps, Vol.1, Birkhauser, Basel,1986
- V Arnold, Singularities of Caustics and Wave Fronts, Kluwer academic publisher, 1990.

2. Essential References
V. I. Arnold, Singularities of caustics and wave fronts, Mathematics and its Applications (Soviet Series) 62, Kluwer, Dordrecht, 1990, xiv+259 pp. Apink, Aul

3. Recommended Books and Reference Material (Journals, Reports, etc) (Attach List):
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4.Electronic Materials, Web Sites etc
https://en.wikipedia.org/wiki/Singularity_theory

5. Other learning material such as computer-based programs/CD, professional standards/regulations: **Maple**

F. Facilities Required

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 (Lecture rooms, laboratories, etc.) -Classroom with capacity of 25-students. - Library.
2. Computing resources: **Online programs and computer laboratory**
3. Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list): --

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching**:** **Student feedback through electronic facilities organized by the deanship of registration and acceptance.**
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department **(i) Evaluation of the teachers by internal & external faculty members.** **(ii) Visiting to the classrooms.** **(iii) Mutual visits between colleagues and giving advices to each other after each lecture**
3 Processes for Improvement of Teaching **(i) Analysis of student course evaluation and feedback** **(ii) Peer evaluation and feedback** **(iii) Review of course portfolios** (iv) **Workshops on pedagogical methods**
4. Processes for Verifying Standards of Student Achievement (eg. 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) **Analysis of course assessments by other reviewers on a periodic basis.**
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. **(i) Material and learning outcomes are periodically reviewed internally and externally.** **(ii) Comparing course content and teaching methodologies with similar courses offered at other departments and universities.** **(iii) Studying the outcomes of the students' evaluations of the course and use it to improve teaching strategies.**

Faculty or Teaching Staff: **Dr. Fawaz Alharbi** _____
Signature: _____ **Fawaz Alharbi** ___ Date Report Completed: _____
Received by: _____ Dean/Department Head
Signature: _____ Date_____