4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: **Riemannian Geometry**

Course Code: **4047601-4**

COURSE SPECIFICATIONS

Institution Umm Al-Qura University
College/Department Faculty of Applied Science/ Department of Mathematical Science

A. Course Identification and General Information

1. Course title and code Riemannian geometry (4047601-4)
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) **PhD in Mathematics**
4. Name of faculty member responsible for the course Dr. Elsaid lashin
5. Level/year at which this course is offered Level 1
6. Pre-requisites for this course (if any) ---
7. Co-requisites for this course (if any) ----
8. Location if not on main campus Male and female sections (Al-Abdiya and alzaher)

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?	

B Objectives

What is the main purpose for this course?

- **Be able to understand the cocepts of parallel transport, connections, covariant derivative and curvature .**
- **Be able to find Levi-Civita connections .**
- **Understanding the concepts of Geodesics and considering first and second variations of arc length .**
- **Deal with Jacobi fields, conjugate points and comparison theorems .**
- **Studying the existence theorems of geodesics .**
- **Be familiar with spaces of curves in Riemannian manifolds .**

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. Encouraging students to collect problems from web based reference material and supervise classroom discussions.
2. Update references used in teaching process.

3. Use e-learning facilities more efficiently.

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

1. Topics to be Covered		
List of Topics	No. of Weeks	Contact Hours
Warming-Up: **Riemannian metric and Covariant differentiation .**	2	8
Geodisics and Parallel transport(theory and examples) .	4	16
Theory of surfaces , Curvature tensor and Spaces of constant Gaussian curvature .	4	16
Triangulation of surfaces , Euler characteristic and Gauss-Bonnet theorem .	5	20

2. Course components (total contact hours and credits per semester):							
	Contact Hours				Self-Study	Other	Total
	Lecture	Tutorial	Laboratory	Practical			
Contact Hours	60						60
Credit	4						4

3. Additional private study/learning hours expected for students per week. 5

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

	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 (a)State the definition of a Riemannian manifold M and calculate the length of a curve and the area of a domain in M ; (b)Calculate the Riemannian metric on surfaces embeddedin the3-dimensional Euclidean space ; ©Define a connection on a manifold, state the Levi-Civita theorem and calculate the connection for different surfaces; (e)State the properties of geodesics on a Riemannian manifold and calculate the parallel transport of vectors	Lectures Tutorials Discussion Problem Solving	Exams Home work.

	along geodesics for different manifolds .		
2.0	**Cognitive Skills**		
2.1	(i)State the definition of the Riemann curvature tensor and calculate the Riemann curvature tensor for some 2-dimensional manifolds. (ii)Define the various geometrical concepts that are introduced in the course, be able to use and interpret them in specific examples . (iii)Use the theory , methods and techniques of the course to solve problems .	Homework consisting in solving selected exercises. Encourage and develop self - education	Homework Oral and written tests. Research projects.
3.0	**Interpersonal Skills & Responsibility**		
3.1	Punctual attendance of classes is required. Students should demonstrate their sense of responsibility for learning by completing both reading and writing assignments in due time. Students learn to manage their time. Accustom students to take responsibility of self –learning Students should act responsibly and ethically in carrying	Discussion. Explanation. Guidance and supervision of the group Assignments for research projects.	Home work. Reports. Quizzes. Discussion
4.0	**Communication, Information Technology, Numerical**		
4.1	Ability to communicate in written and in oral. Ability to write reports in English Ability to explain each step in the problem solving process. Ability to apply course concepts to mathematical problem solving model. Ability to use information technology in communication and research projects. Interact with life problems using different methods of thinking and problem solving.	Lectures tutorials brain storming	Periodic written and oral tests. Discussion. Observation.
5.0	**Psychomotor**		
Not applicable			

5. Schedule of Assessment Tasks for Students During the Semester			
Assessment	Assessment task (eg. essay, test, group project, examination etc.)	Week due	Proportion of Final Assessment
1	Midterm 1	6^{th} week	20%
2	Midterm 2	10^{th} week	20%
4	Homework + reports + Quizzes	During the semester	20%
5	Final exam	End of semester	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 (4 hours per week). 2- Contact with students by e-mail,SMS, and e-learning facilities.

E. Learning Resources

1. Required Text(s): Jost,Jurgen (2002), Riemannian Geometry and Geometric Analysis, Berlin: Springer-Verlag,ISBN3-540-42627-2.
2. Essential References :Petersen,Peter(2006),Riemannian Geometry,Berlin:Springer-Verlag,ISBN0-387-98212-4. ,
3. Recommended Books and Reference Material (Journals, Reports, etc) (Attach List): Use previous list
4.Electronic Materials, Web Sites etc http://ebookee.org/
5. Other learning material such as computer-based programs/CD, professional standards/regulations: Microsoft Word

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Lecture rooms, laboratories, etc.) -Classroom with capacity of 30-students. - Library.
2. Computing resources: Not available
3. Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list): None

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching: • Student feedback through electronic survey organized by the deanship of registration and acceptance.
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department • Evaluation of the teachers by internal & external faculty members. • Visiting to the classrooms. • Mutual visits between colleagues and giving advices to each other after each lecture
3 Processes for Improvement of Teaching • Analysis of student course evaluation and feedback • Peer evaluation and feedback • Review of course portfolios • 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. • Material and learning outcomes are periodically reviewed internallyand externally. • Comparing course content and teaching methodologies with similar coursesoffered at other departments and universities. • Studying the outcomes of the students' evaluations of the course and useitto improve teaching strategies.

Faculty or Teaching Staff: _____
Signature: ___ _____ Date Report Completed: _____
Received by: _____ Dean/Department Head
Signature: _____ Date_____