4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: **Introduction to Special Relativity**

Course Code: **4046504-4**

Course Specifications

Institution: Umm Al-Qura University Date : 3/2/1439
College/Department: Faculty of Applied Science/ Department of Mathematical Sciences

A. Course Identification and General Information

1. Course title and code: Introduction to Special Relativity (4046504-4)			
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) Master in Mathematics			
4. Name of faculty member responsible for the course: DR. Mohammad Bilal Abdul Ghaffar			
5. Level/year at which this course is offered: Level 3/ Master			
6. Pre-requisites for this course (if any): Continuum Mechanics			
7. Co-requisites for this course (if any):			
8. Location if not on main campus: Al-Abidiyah campus and Al-Zahir campus			
9. Mode of Instruction (mark all that apply)			
a. traditional classroom	✓	What percentage?	70
b. blended (traditional and online)	✓	What percentage?	10
c. e-learning	✓	What percentage?	10
d. correspondence		What percentage?	
f. other	✓	What percentage?	10
Comments:			

B Objectives

1. What is the main purpose for this course? The principal aim of tensor analysis is to investigate the relations which remain valid when we change from one coordinate system to any other. The laws of physics cannot depend on the frame of reference which the physicist chooses for the description of such laws. Accordingly, it is aesthetically desirable and sometimes convenient to utilize tensor analysis as the mathematical background in which these laws can be formulated. Now, it has applications in most branches of theoretical physics and engineering such as mechanics, fluid mechanics elasticity, plasticity and electromagnetism, etc.
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 - Encourage students to use the Internet to search for information and updated material. B - The inclusion of vocabulary and details to be within the e-learning site for the professor to make it easier for students to obtain. C - Including vocabulary compared served in other local, regional and global sections.

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

Course Description: This is a 4 credit postgraduate course introducing advanced topics in tensor calculus and special relativity. The course comprises approximately comprising 60 hours of lectures.

1. Topics to be Covered		
List of Topics	No. of Weeks	Contact hours

Chapter 1 - Tensors and their Algebra - Transformation of Coordinates. - Summation Convention. - Kronecker Delta, Scalar, Contravariant and Covariant Vectors. - Tensors of Higher Rank. - Symmetry of Tensors. - Algebra of Tensors: Addition, Subtraction, Equality, Inner and Outer Products, Contraction. - Quotient Law. - Irreducible Tensor. - Metric Tensor. - Fundamental and Associated Tensors. - Relative and Absolute Tensors.	5	20
Chapter 2 - Christoffel Symbols and Covariant Differentiation - Christoffel Symbols. - Transformation Laws for Christoffel Symbols. - Equation of Geodesic. - Covariant Differentiation. - Divergence of a Vector Field. - Curl of a Vector Field. - Divergence of Tensor Field.	5	20
Chapter 3 - Special Theory of Relativity functional - Galilean Transformation. - Postulates of Special Relativity. - Lorentz Transformation. - Length Contraction. - Time Dilation. - Addition of Velocities. - Variation of Mass with Velocity. - Equivalence of Mass and Energy. - Four Dimensional Formalism. - Relativistic Classification of Particles. - Maxwell's Equations and their Lorentz Invariance.	5	20

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

	Lecture	Tutorial	Laboratory or Studio	Practical	Other:	Total
Contact Hours	60	-				60
Credit	4	-				4

3. 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**		
1.1	Have an enhanced knowledge of the basic concepts of tensor calculus and its origin.	Use various educational tools during the lecture such as open discussion, problem solving.	Quiz Homework Midterm exam Final exams
1.2	Have an enhanced knowledge of the basic concepts of special relativity and its origin.		
1.3	Have the ability to recall the learned material of the course.		
2.0	**Cognitive Skills**		
2.1	Be able to apply the learned material of the course in real life problems.	Use various educational tools during the	Quiz Homework Midterm exam
2.2	Be able to integrate related topics from		

	separate parts of the course	lecture such as open discussion, problem solving.	Final exams
3.0	**Interpersonal Skills & Responsibility**		
3.1	Have the ability to prove theorems and develop lemmas using different techniques	Use various educational tools during the lecture such as open discussion, problem solving.	Quiz Homework Midterm exam Final exams
3.2	Be able to describe and analyze models using related equations		
4.0	**Communication, Information Technology, Numerical**		
4.1	Use of internet resources, e-learning and communication using blackboard	Encourage students to do research and investigate using the internet and contact digital libraries.	Student solve problems through TV network and then assessment this activity.
4.2	Use software such as matlab and maple for their calculations		
5.0	**Psychomotor**		
5.1	Not applicable		

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	Periodic exam (1)	6	20
2	Periodic exam (2)	10	20
3	Homework + Quizzes	Over all weeks	20
4	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) Assign office hours weekly for students.

E. Learning Resources

1. List Required Textbooks - Tensor Analysis with Applications by Zafar Ahsan, Anamaya Publication, 2008. - Tensor Analysis by Edward Nelson, Princeton University Press.
2. List Essential References Materials (Journals, Reports, etc.) - The Special Theory of Relativity : A Mathematical Approach by Anandijiban Das, Springer Verlag, 1996.
3. List Recommended Textbooks and Reference Material (Journals, Reports, etc.) - Introduction to Special Relativity by Wolfgang Rindler, second edition, Oxford University Press, 1991.
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
5. Other learning material such as computer-based programs/CD, professional standards or regulations and software Matlab and Maple software

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 (Classrooms, laboratories, demonstration rooms/labs, etc.) Provide a suitable classroom.
2. Computing resources (AV, data show, Smart Board, software, etc.) E-Learning lab.
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) - Overhead projector. - Laboratory equipment for individual students.

G Course Evaluation and Improvement Processes

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching - Ask questions during lectures. - Course evaluation questionnaire conducted electronically by the University at the end of the term.

2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department - Results analysis. - Self- assessment of the program - External revisions and assessment. - Course report. - Annual reports sufficiently prepared by the head of department.
3. Processes for Improvement of Teaching - Application of modern technologies in the education. - Application of e-learning. - Programs and trainings to improve the skills of teaching and learning.
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) None
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. - Comparisons of the course with other institutes in other universities. - Reviewing process of courses for improvement and development is done normally every five years.

Name of Instructor: DR. Mohammad Bilal Abdul Ghaffar

Signature : _____ Report Completed: 3/2/1439
Name of Field Experience Teaching Staff _____

Program Coordinator:_____

Signature: _____ Date Received: