4/1/4. Course Specification:

COURSE SPECIFICATIONS

Form

Course Title: **Fluid Mechanics (2)**

Course Code: **4047701-4**

Course Specifications

Institution: Umm Al-Qura University Date : 28 / 10 / 2017
College/Department : Faculty of Applied Science/ Department of Mathematical Sciences

A. Course Identification and General Information

1. Course title and code: Fluid Mechanics(2) (4047701-4)				
2. Credit hours: 4 Hours				
3. Program(s) in which the course is offered: PhD in Mathematics				
4. Name of faculty member responsible for the course: Prof. Abdullah A. Abdullah				
5. Level/year at which this course is offered : Leve 1/ PhD				
6. Pre-requisites for this course (if any): ---				
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?	85	
b. blended (traditional and online)		What percentage?		
c. e-learning	✓	What percentage?	15	
d. correspondence		What percentage?		
f. other		What percentage?		
Comments:				

B Objectives

1. What is the main purpose for this course? The main purpose for this course is to introduce advanced topics and quantitative techniques for the study of Fluid Mechanics and its applications.
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. Updating references used in teaching process. 2. Using e-learning facilities more efficiently. 3. Encouraging students to collect problems from web based references and supervise discussions in the class.

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 Fluid Mechanics. The course comprises approximately comprising 52 hours of lectures. The role of the course is to introduce the mechanics of various Non-Newtonian Fluids. It is assumed that students entering this course have previously taken courses in Continuum Mechanics and Fluid Mechanics (1).

1. Topics to be Covered		
List of Topics	No. of Weeks	Contact hours
Chapter 1 - Introduction - Briefly recap on the basic conservation laws of Continuum Mechanics. - Develop the stability analysis for an incompressible viscous fluid confined to a finite region. - Develop the general constitutive expression for a stress tensor that depends on fluid density and velocity gradients alone. Particularize the model to incompressible fluids.	4	16
Chapter 2 – Non-Newtonian Fluids - Introduce the general Reiner-Rivlin fluid and determine constraints to ensure that the stress tensor always does work. - Investigate the problem of pure shear ow for a Reiner-Rivlin fluid. Discuss the relevance of the model to the experimentally observed properties of fluids. - Particularization the Reiner-Rivlin fluid to the generalized Newtonian fluid. - Introduce the Power-Law fluid. - Introduce the Bingham fluid. - Investigate pipe flow for:- • the generalized Newronian fluid; • the power-law fluid; • the Bingham fluid.	3	12
Chapter 3 – Memory Fluids - Introduce the Maxwell Fluid. - Extend the Maxwell fluid to tensor-valued functional involving history. - Introduce the Oldroyd-B fluid. - Investigate the problem of shear ow for the Oldroyd-B fluid. - Comment on the relevance of the Oldroyd-B model to the observed ow of polymers.	4	16

Chapter 4 – Liquid Crystals - Introduce the three main classes of liquid crystal and description of their properties. - Introduce the idea of a "Director" and develop the general continuum model of a liquid crystal. - Define the Oseen-Frank Free energy. - Introduce the Landau - de Gennes theory of liquid crystals based on the so-called Q-tensor. - Discuss various classes of boundary conditions applicable to the modelling of Nematic liquid crystals. - Investigate various steady state solutions for Nematic liquid crystals under various boundary conditions. - Discuss the Fredericks transition in a Nematic Liquid Crystal Layer	4	16

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	Course Teaching	Course

#	And Course Learning Outcomes	Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Have an enhanced knowledge and understanding of Non-Newtonian fluids, Memory fluids and liquid crystals.	Lectures-Discussion-solve problems	Short quizzes, periodical and final exams.
1.2	Have the ability to recall the learned material of the course.	Lectures-Discussion-solve problems	Short quizzes, periodical and final exams.
2.0	**Cognitive Skills**		
2.1	Be able to apply the learned material of the course in real life problems.	Lectures-Discussion-solve problems	Short quizzes, periodical and final exams.
2.2	Be able to integrate related topics from separate parts of the course	Lectures – Discussion-solve problems	Short quizzes, periodical and final exams
3.0	**Interpersonal Skills & Responsibility**		
3.1	Have the ability to prove theorems and develop lemmas using different techniques	Lectures – Discussion-solve problems	Short quizzes, periodical and final exams
3.2	Be able to describe and analyze models using related equations	Lectures – Discussion-solve problems	Short quizzes, periodical and final exams
4.0	**Communication, Information Technology, Numerical**		
4.1	Have the ability to use computers programs in obtaining numerical solutions and carrying out statistical tests.	Discussion - Use Matlab or Mathematica to solve some problems numerically.	Homework projects
5.0	**Psychomotor**		
	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) - Office hours are specified throughout the week (6 hours/week) - Contacts with students by e-mail, SMS, and e-learning facilities.

E Learning Resources

1. List Required Textbooks - G. Astarita and G. Marrucci, Principles of Non-Newtonian Fluid Mechanics, McGraw Hill Book Company Ltd. (1974). - J. Betten, Creep Mechanics, Springer Berlin Heidelberg (2008). - P.G. de Gennes and J.Prost, The Physics of Liquid Crystals, OUP (1995).
2. List Essential References Materials (Journals, Reports, etc.)
3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)
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.) Properly equipped classroom.
2. Computing resources (AV, data show, Smart Board, software, etc.) - Classroom equipped with desktop computers. - Projectors and related items. - Numerical packages. - Compilers
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) Non

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching Student feedback on effectiveness of teaching is arranged electronically at the end of the term by the University.
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department - Course report. - Lecture development.
3 Processes for Improvement of Teaching Several workshops on the improvement of teaching are conducting yearly by the University.
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) Non
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. Reviewing process of courses for improvement and development is done normally every five years.

Name of Instructor: Prof. Abdullah A. Abdullah
Signature:_____Date Report Completed: 28 / 10 / 2017
Name of Field Experience Teaching Staff : _____
Program Coordinator:_____
Signature: _____ Date Received:_____