Course Specifications of: Computational Methods in Fluid Mechanics and Heat Transfer MEP 608

Program(s) on which the course is given : Post Graduate **M. Eng.** in Mechanical Power Engineering **Compulsory or Elective element of program**: Elective
Department offering the program: Mechanical Engineering / Power
Academic year / Level: year/ 2014/2015
Date of specification approval: 2012

A. Basic Information

Title: ***Computational Methods in Fluid Mechanics and Heat Transfer***

Code: ***MEP 608***
Credit Hours: 3 **Lecture: 3**
Tutorial: **Practical:** **Total; 3**

B- Professional Information

1- Overall aims of course:

By the end of the course the students will be able to:

1- Understand concepts and basic principles of computational methods in fluid mechanics and heat transfer.
2- Understand the use of numerical methods to solve linear, non-linear and partial differential equations.
3- Solve problems on computational and advanced numerical techniques.

2- Intended learning outcomes of course (ILOs)

By completion of the course, the student should be able to:

2.1 Knowledge and understanding

a1. Define theories, fundamentals and specialized knowledge in computational methods in fluid mechanics and heat transfer. (2.1.1)
a2. Outline the scientific developments in computational methods in fluid mechanics and heat transfer. (2.1.3)
a3. Illustrate the methodologies used in computational research. (2.1.7)

2.2 Intellectual skills

b1. Analyze and assess information of computational methods in fluid mechanics and heat transfer.(2.2.1)
b2. Conduct a research study and/or write a scientific essay about research problem in computational methods in fluid mechanics and heat transfer.(2.2.4)
b3. Plan for performance development in computational methods in fluid mechanics and heat transfer.(2.2.6)
b4. Make professional decisions in various professional contexts. (2.2.7)

2.3 **Professional and practical skills**

c1. Master basic professional and modern skills in computational methods in fluid mechanics and heat transfer.(2.3.1)
c2. Assess methods and current tools in computational methods in fluid mechanics and heat transfer.(2.3.3)
c3. Use the various software programs (Ansys15 software) for simulating the fluid mechanics and heat transfer system features.(2.3.6)

2.4 General and transferable skills

d1. Use information technology Computational Methods in Fluid Mechanics and Heat Transfer. (2.4.2)
d2. Work in a group and Lead a team Computational Methods in Fluid Mechanics and Heat Transfer. (2.4.6)
d3. Manage time effectively. (2.4.7)
d4. Conduct self-learning and continuous education practices. (2.4.8)

4- Contents

Topic No.	Topic	No. of weeks	Total no. of hours
1	Introduction to numerical methods	1	3
2	Methods of solving partial differential equations in steady state	2	6
3	Methods of solving partial differential equations in unsteady state	1	3
4	Types of differential equations	2	6
5	Methods of nonlinear differential equations	1	3
6	The methods used in solving momentum and energy equation.	2	6
7	Explicit case studies to solve the flow of fluid over the surface of cylinder.	2	6
8	Implicit case studies to solve the flow of fluid over the surface of cylinder.	1	3
9	Alternating case studies to solve the flow of fluid over the surface of cylinder.	2	6
10	Exam	1	3
11	Total	15	45

4- Course Matrix

ILO's code number	Teaching/learning methods and strategies	Assessment methods and strategies
2.1.1 2.1.2 2.1.3	Formal lectures	Individual coursework assignments, quizzes, oral discussions and reports. Mid-year and /or final written examination is given.
2.2.1 2.2.2	Analysis and problem-solving skills are developed through tutorial/problem sheets and	Analysis and problem-solving skills are assessed through oral and written

2.2.3	small group exercises. Research skills are developed through a small subject oriented research project.	examinations. Design and research skills are assessed through project write-ups, coursework and project reports.
2.3.1 2.3.2	Experiments demonstrations, practical work, laboratory visits.	Practical skills are assessed through laboratory experimental write-ups, coursework exercises and reports, project reports and presentations.
2.4.1 2.4.2	Those skills are not explicitly taught; however, along the course of study the student will acquire those skills to be able to perform his obligations. Attendance of seminars, workshops or conferences will help the student in developing those skills. Presentation by students (either group or individual) will train students for those skills.	Project presentation

5- Assessment schedule

Assessment 1	Assignments	on weeks	1, 3, 6
Assessment 2	Quizzes	on weeks	2, 4, 9, and 13
Assessment 3	Mid-term exam	on weeks	8
Assessment 3	Oral exam	on week	14
Assessment 4	Final exam	on week	15

6- Weighting of assessments

20% (60 marks) Home assignments, Quizzes, and reports
20% (60 marks) Mid-term examination and Oral examination
60% (180 marks) Final-term examination
100% (300 marks) Total

7- List of References

7.1 Text books

- Numerical Heat Transfer and Fluid Flow By: Suhas Patankar 2002
- Numerical Methods for Engineers, Sixth Edition by Steven Chapra and Raymond Canale (Apr 20, 2009)
- Numerical Methods with MATLAB by Amos Gilat and Vish Subramaniam (Mar 22, 2010)
- Applied Computational Fluid Dynamics, 2012 Patankar, Suhas, 2012.

7.2 Websites

* Yahoo scribd.com
* www.sciencedirect.com

8- Facilities required for teaching and learning

Presentation board, computer and data show
Laboratory

Prepared by: Prof. Dr. Mohamed Fayek

Head of Department: Prof. Dr. Osama Ezzat Abdellatif

Matrix of course content and ILO's

Course Title: ***Computational Methods in Fluid Mechanics and Heat Transfer*** **Code: MEP 608**
Lecture: 3. **Tutorial**: ---- **Practical**: ---- **Total:** 3
Program on which the course is given: Post Graduate **M. Eng.** in Power Engineering.
Major or minor element of program: Elective
Department offering the program: Mechanical Engineering / Power
Department offering the course: Mechanical Engineering / Power
Academic year / level: **2014/2015**. **Date of specifications approval: 20152**

Course content	ILO's A	ILO's B	ILO's C	ILO's D
1. Introduction to numerical methods.	a1,a3	b1	c1	d1
2. Methods of solving partial differential equations in steady state.		b2	c3	d2
3. Methods of solving partial differential equations in unsteady state.	a2	b4		d4
4. Types of differential equations.		b2	c2	
5. Methods of nonlinear differential equations.	a3	b3		d3
6. The methods used in solving momentum and energy equation.	a1	b1	c1,c2	
7. Explicit case studies to solve the flow of fluid over the surface of cylinder.	a1,a2	b2		d2
8. Implicit case studies to solve the flow of fluid over the surface of cylinder.	a3		c3	
9. Alternating case studies to solve the flow of fluid over the surface of cylinder.	a2	b1,b3		d1

Matrix of course aims and ILO's

Course Title: ***Computational Methods in Fluid Mechanics and Heat Transfer*** **Code: MEP 608**
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Course aims	ILO's A	ILO's B	ILO's C	ILO's D
1- Understand concepts and basic principles of computational methods in fluid mechanics and heat transfer.	a1,a2	b1,b3	c1 c2	d1 d4
2- Understand the use of numerical methods to solve linear, non-linear and partial differential equations.	a1,a3	b1,b4	c1	d1,d3
3- Solve problems on computational and advanced numerical techniques.	a4	b2,b1	c3	d2