

<p>Kingdom of Saudi Arabia Ministry of Higher Education <b>Qassim University</b> College of Engineering</p>		<p>المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كلية الهندسة</p>
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## *Turbo-Machinery*

**College:** College of Engineering

**Department:** Mechanical Engineering

**First: Course Definition**

**1- Course Code:** ME 676

**2- Units :** 3

**3 – Semester**

**4 –Prerequisite :**

**5- Co-requisite:** -

**6- Location** (if not on main Campus):

**Second: Course Objectives**

- To provide students with a comprehensive classification of compressible fluid turbines (steam & gas turbines, radial & axial turbines, ...), and analysis of flow behavior through each type.
- To demonstrate the theory of twisted blades for axial flow turbines and the performance analysis of multi-stage turbines.
- To enable students to design mechanical components of turbines (such as blades,...) and understand the unsteady flow phenomena in such type of turbo-machines.
- To give an integrated view of various types of compressors (such as axial & centrifugal compressors ,...) and explain the performance as well as the design considerations for these types of compressors .
- To explain centrifugal pumps (performance, impeller design ) and flow problems; particularly losses, cavitations, water hammer.
- To clearly present water turbine characteristics, performance principles and design aspects.
- To enable students to perform design projects about turbo-machines

**Third: Course Specifications**

**1- Topics to be covered**

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Subject	No of Weeks	Units
- Radial flow turbines	<b>1</b>	<b>3</b>
- Axial flow turbines. Flow through axial stages. Theory of twisted blades. Multi-stage turbines.	<b>3</b>	<b>9</b>
- Design of the turbine blades. Governing of steam and gas turbines. Vibration aspects.	<b>3</b>	<b>9</b>
-Coefficients of performance and design considerations for Axial flow compressors and ducted fans.	<b>2</b>	<b>6</b>
-Coefficients of performance and design considerations for centrifugal compressors	<b>2</b>	<b>6</b>
-Centrifugal Pumps: performance, losses, cavitations, water hammer and impeller design.	<b>2</b>	<b>6</b>
-Water Turbines: Characteristics, design considerations, performance	<b>2</b>	<b>6</b>

## 2- Course components (Total hrs in the Semester)

Lecture	tutorial	Other
45	-----	

## 3- Intended Learning Outcomes of the Course (ILO's)

### a. Knowledge

#### *i) Description of the knowledge to be acquired:*

- Students are expected , by completing this course, to gain Deep comprehension of flow behavior through different types of compressible fluid turbines
- Understand the theory of twisted blades for axial flow turbines and estimate the performance of multi-stage turbines.
- Design mechanical components (blades,...) of turbines and know unsteady phenomena that result from exceeding operability limits.
- Outline structural and thermodynamic differences between axial and centrifugal compressors and perform their blades design.
- Understand different flow problems in centrifugal pumps and be able to design impellers of this type of turbo-machines.
- Perform design and performance analysis for water turbines
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**ii) Teaching strategies to be used to develop that knowledge**

- Lectures
- Assignments, at home
- Discussions in the Class
- Reading (books, internet search)

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**iii) Methods of assessment of knowledge acquired**

- Assignment reports: to assess ability to answer some comprehensive questions.
- Midterm Exams: to assess understanding of the course knowledge.
- Final Exam: to assess understanding of the course knowledge

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**b- Cognitive (Intellectual) Skills**

**i) Cognitive skills to be developed**

- The ability to classify turbo-machines and know aspects of each type
- The ability to understand various phenomena that can occur in different turbo-machines.
- The ability to select and analyze the suitable turbo-machine for a specified application.
- The ability to design turbo-machine blades .

**ii) Teaching strategies to be used to develop these cognitive skills**

- Lectures
- Assignments, at home
- Discussions in the Class
- Reading (books, internet search)

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**iii) Methods of assessment of students cognitive skills**

- Assignment reports: to assess ability to answer some comprehensive questions.
- Midterm Exams: to assess understanding of the course knowledge.
- Final Exam: to assess understanding of the course knowledge.

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**c. Interpersonal Skills and Responsibility**

**i) Description of the interpersonal skills and capacity to carry responsibility to be developed**

- Team work
- Ideas development and sharing with others

**ii) Teaching strategies to be used to develop these skills**

- Assignments, at home
- Discussions in the Class
- Reading and reporting (books, Internet search)

**iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility**

- Encouraging question raising: to assess the student ability in dialog and problem discussion.
- Organizing presentations: to assess the student ability in developing systematic work and defending his ideas.
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**d. Communication, Information Technology and Numerical Skills**

**i) Description of the skills to be developed in this domain**

- Use of the internet search
- Report writing

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<p><b>ii) Teaching strategies to be used to develop these skills</b></p> <ul style="list-style-type: none"> <li>• Assignments, at home</li> <li>• Assignment Reports (reading books, Internet search)</li> <li>-</li> </ul> <p><b>iii) Methods of assessment of students numerical and communication skills</b></p> <ul style="list-style-type: none"> <li>- Assignment Reports: to assess technical report writing abilities</li> <li>-</li> <li>-</li> </ul>
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***e. Psychomotor (if applicable) & Other Non-cognitive Skills***

<p><b>i) Description of the psychomotor or other skills to be developed and the level of performance required</b></p> <ul style="list-style-type: none"> <li>- Not applicable</li> <li>-</li> <li>-</li> <li>-</li> </ul>
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<p><b>ii) Teaching strategies to be used to develop these skills-</b></p> <ul style="list-style-type: none"> <li>-</li> <li>-</li> <li>-</li> <li>-</li> <li>-</li> </ul>
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<p><b>iii) Methods of assessment of student's psychomotor skills</b></p> <ul style="list-style-type: none"> <li>-</li> <li>-</li> <li>-</li> <li>-</li> </ul>
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**4- Student Assessment Schedule**

<b>Serial</b>	<b>Assessment tool (test, group project, examination etc.)</b>	<b>Week due</b>	<b>Weight</b>
1	Group project	End of term	20%
2	Homework for each part of the program	One week after finishing the related part of the program	10%

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3	Two Mid-term exams	Seventh and thirteenth weeks respectively	30%
4	Final Exam	End of term	40%
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### 5- Student Support

- 4 office hours are offered by the instructor in addition to extra assistance if necessary.

### 6- Learning Resources

**i) Essential Books (References)**

- Cohen, G. F. C. Rogers and H. I. H. Saravanamuttoo, Gas Turbine Theory, Longman, 1996
- R. K. Turton, Principles of Turbo-machinery, Chapman and Hall, 1995
- R. I. Lewis, Turbo-machinery Performance Analysis, Arnold, 1996

**ii) Course Notes**

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**iii) Recommended Books**

- Fluid mechanics and Thermodynamics of Turbomachinery , S.L. Dixon , Pergamon Press Ltd
- turbines, compressors and fans by: S.M. Yahya, Tata Mc Graw Hill
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**iv) Electronic Books & Web Sites:**

- course materials are uploaded on college web-site ([www.qec.edu.sa](http://www.qec.edu.sa))
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**v) Periodicals**

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**7- Course Evaluation and Improvement Processes**

**i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching**

- Questionnaires
- Observing the students opinions presented in student site and in meetings
- Appeal box
- Graduation questionnaire, especially filled by distinguished graduate students
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**ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department**

- Periodical review of the teaching methods by both the department council and the education affairs vice dean
- other special questionnaires
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**iii) Processes for Improvement of Teaching**

- Evaluation of the course outlines by other qualified staff members from other institutions
- Periodical contact with the different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines.
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**iv) Processes for verifying standards of student achievement**

- check marking by an independent faculty member of a sample of student work
- periodic exchange and remarking of a sample of assignments with a faculty member in another institution)
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**v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.**

- Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university).
- Consequently, actions are to be taken to improve the course delivery when necessary.
- Review of the course objectives, outcomes and curriculum each 2 years
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