

<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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## Advanced Topics in Electrical Machines

**College:** Engineering

**Department:** Electrical

**First: Course Definition**

**1- Course Code:** EE 631

**2- Units:** 3 credit hrs

**3- Semester:**

**4- Prerequisite:**

**5- Co-requisite:**

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

- Second: Course Objectives**
- Developing the knowledge of the students in symmetrical component theory
  - Developing the knowledge of the students in the operation of three-phase induction motor fed from unbalanced voltage supply
  - Developing the knowledge of the students in transient condition operation of three-phase induction motors
  - Developing the knowledge of the students in induction motor dqo and abcdq modelling
  - Developing the knowledge of the students in balanced and unbalanced operation conditions of induction motors such as stator and rotor phase failures
  - Developing the knowledge of the students in transient condition operation of three-phase synchronous motors
  - Developing the knowledge of the students in synchronous machine dqo, direct phase and abcdq modelling
  - Developing the knowledge of the students in balanced and unbalanced operation conditions of synchronous machines such as armature phase and damper bars failure
  - Developing the skills of the students regarding the analysis of the balanced and unbalanced operation of machines

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- Acquainting the students with the necessary information and skills for determining the loading conditions of the machines when operated under unbalanced conditions

### Third: Course Description

#### 1- Topics to be covered

Subject	No of Weeks	Units
I. Unbalanced operation of three-phase induction motors 1.1- Introduction 1.2- Symmetrical Component Theory 1.3- Analysis of Three-Phase Induction Motor Fed From Unbalanced Voltage Supply 1.4- Derating Factor	5	15
II- Transient Condition Analysis of Three-Phase Induction Motors 2.1- Modelling; DQO Modelling, ABCDQ Modelling 2.2- Balanced Operation 2.3- Unbalanced Operation 2.4- Stator and Rotor Phase Failures	5	15
III. Transient Condition Analysis of Three-Phase Synchronous Motors 3.1- Modelling, DQO Modelling, Direct-Phase Modelling, ABCDQ Modelling 3.2- Balanced Operation 3.3- Unbalanced Operation 3.4- Armature Phase Failure 3.5- Damper Bars Failure	5	15

#### 2- Course components (Total hrs in the Semester): 45

Lectures	Exercises	Other
45	---	----

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

##### a. Knowledge

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

Elements of a drive system Unbalanced operation of three-phase induction motors  
 1.1- Introduction

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- 1.2- Symmetrical Component Theory
- 1.3- Analysis of Three-Phase Induction Motor Fed From Unbalanced Voltage Supply
- 1.4- Derating Factor Transient Condition Analysis of Three-Phase Induction Motors
- 2.1- Modelling; DQO Modelling, ABCDQ Modelling
- 2.2- Balanced Operation
- 2.3- Unbalanced Operation
- 2.4- Stator and Rotor Phase Failures
- III. Transient Condition Analysis of Three-Phase Synchronous Motors
- 3.1- Modelling, DQO Modelling, Direct-Phase Modelling, ABCDQ Modelling
- 3.2- Balanced Operation
- 3.3- Unbalanced Operation
- 3.4- Armature Phase Failure

- 3.5- Damper Bars Failure

**ii) Teaching strategies to be used to develop that knowledge**

- Class lectures.
- Students' presentations
- Group discussion in the Class
- Assignments
- Case study Report (data collection, internet search, and reporting)

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

- Exams.
- Quizzes.
- Homework assignments.
- Term projects.

**b- Cognitive (Intellectual) Skills**

**i) Cognitive skills to be developed**

- The ability to analyze, and determine the dc drives performance characteristics.
- The ability to analyze, and determine the ac drives performance characteristics.
- The ability to select the suitable driver for a certain load

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

- Class lectures.
- Case studies analysis.
- Term projects.

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

- Students' seminars and presentations.
- Term projects.

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- Written reports.

**c. Interpersonal Skills and Responsibility**

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

- Decision making based on engineering analysis.
- Communication skills.
- Team work.

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

- Reports.
- Term team projects.
- Presentations and seminars

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

- Evaluation of the team projects.
- Written reports.
- Students' seminars and presentations.

**d. Communication, Information Technology and Numerical Skills**

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

- Literature search.
- Problems numerical modelling.
- Utilization of computer applications in analysis and design.

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

- Class lectures.
- Case studies analysis.
- Computer lab sessions.
- Term projects.

**iii) Methods of assessment of students numerical and communication skills**

- Term projects.
- Written reports.
- Students' seminars and presentations.

**e. Psychomotor (if applicable) & Other Non-cognitive Skills**

**i) Description of the psychomotor or other skills to be developed and the level of performance required**

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- NA

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

**iii) Methods of assessment of student's psychomotor skills**  
- NA

**4- Student Assessment Schedule**

<i>Serial</i>	<i>Assessment tool (test, group project, examination etc.)</i>	<i>Week due</i>	<i>Weight</i>
1	Term Project – 1	3 <sup>rd</sup>	15 %
2	Mid Term Exam -1	7 <sup>th</sup>	15 %
3	Term Project – 2	10 <sup>th</sup>	15 %
4	Term Project – 3	13 <sup>th</sup>	15 %
5	Final Exam	16 <sup>th</sup>	40 %

**5- Student Support**

- Providing electronic library for references and scientific periodicals.  
- Providing the necessary computer applications for the course.

**6- Learning Resources**

**i) Essential Books (References)**  
- R. T. Smith, Analysis of Electrical Machines, Mc-Graw Hill, London.  
- J. R. Smith, Response Analysis of AC Electrical Machines. Mc-Graw Hill, London.

**ii) Course Notes** Course materials are uploaded on the College Web-Site ([www.qec.edu.sa](http://www.qec.edu.sa)) to be available for the students.

**iii) Recommended Books**  
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**iv) Electronic Books & Web Sites:**  
- Scientific journals and forums.

**v) Periodicals**  
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**7- Course Evaluation and Improvement Processes**

- i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching**
- Students' Questionnaires,
  - Observing the students opinions recorded in the college student site
  - Appeal box
  - Carrying out extensive questioners by a sample of the distinguished students just after the graduation from the college.-

- ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department**
- Instructor report
  - Public faculty seminars.
  - Periodical review of the teaching methods by both the department council and the education affairs vice dean.-

- iii) Processes for Improvement of Teaching**
- Assessment of students' work by external examiners.
  - Analysis of students' evaluation of course and instructor.
  - Seminars by industry professionals.
  - Evaluation of the course outlines and student works by external staff member,
  - Periodical contact with different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines.

- 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/exams with a external evaluator.

- 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 every 2 years.