

<p><b>Kingdom of Saudi Arabia</b>  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 Electric Drive Systems

**College:** Engineering

**Department:** Electrical

### First: Course Definition

**1- Course Code:** EE 633

**2- Units:** 3 credit hrs

**3- Level:** 3<sup>rd</sup>

**4- Prerequisite:**

**5- Co-requisite:**

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

### Second: Course Objectives

- To make the students familiar with Variable Speed Drive Systems
- To develop the knowledge of the students in Synchronous Motor Drive
- To develop the knowledge of the students in Single-Phase Rectifiers with Motor Load
- To acquaint the students the knowledge of Three-Phase Rectifiers with Motor Load
- To give the students an understanding of Chopper-Fed Drives
- To develop the knowledge of the students in Induction Motor Control by AC Power Controller
- To provide the students with the knowledge in Induction Motor with Voltage Source Inverters
- To develop the knowledge of the students in Synchronous Motor Drives
- To develop the skills of the students regarding the choice and analysis of the dc and ac drives.
- To acquaint the students with the necessary information and skills for designing the drive systems.

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### Third: Course Description

1- Topics to be covered		
Subject	No of Weeks	Units
1. Variable Speed Drive Systems 1.1 Elements of a drive system 1.2 Selecting the drive elements	2	6
2. Single-Phase Rectifiers with Motor Load 2.1 Fully-controlled rectifier drives 2.2 Half- controlled rectifier drives	2	6
3. Three-Phase Rectifiers with Motor Load 3.1 fully-controlled bridge rectifier drives 3.2 Rectifiers with free-wheeling	2	6
4. Chopper Drives 4.1 Class A chopper 4.2 Class C chopper 4.3 Class E chopper 4.4 Chopper source filters	3	9
5. Induction Motor Control by AC Power Controller 5.1 Operation of the symmetrical controller 5.2 Pump or fan drives	2	6
6. Induction Motor with Voltage Source Inverters 6.1 PWM and Sinusoidal PWM 6.2 Constant air-gap flux 6.3 Field weakening	2	6
7. Synchronous Motor Drives 7.1 Voltage source inverter drive 7.2 Permanent-magnet synchronous motor	2	6

### 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
- Performance of fully- and half- controlled single-phase rectifier fed dc motor

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- Performance of fully-controlled three-phase bridge rectifier fed dc motor
- Performance of dc motor fed from three-phase bridge rectifiers with free-wheeling
- Performance of class A, class B and class C chopper fed Drives
- Types of chopper source filters
- Induction motor control by AC power controller Motor operation using the symmetrical controller
- Pump or fan type drives
- Performance of induction motor with voltage source inverters when employing different control techniques
- Synchronous motor drives fed from voltage source inverter
- Permanent-magnet synchronous motor driven from inverters

- 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.
  - Written reports.

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**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**

- NA

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**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**

Serial	Assessment tool (test, group project, examination etc.)	Week due	Weight
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)**  
- S. W. Dewan, G. R. Slemon, A. Strughen, Power Semiconductor Drives, Prentice-hall, USA, 2002.  
- G. K. Dubey, Fundamentals of Electric Drives, 2001.

**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**  
- Rashid, M. H., "Power Electronics- Circuits, Devices, and Applications", third Edition, Prentice-hall, USA, 2004.  
- C. Lander, Power Electronics

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

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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**

- 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.

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