College of San Mateo
Official Course Outline

1. **COURSE ID:** ELEC 421 **TITLE:** Fundamentals of Electric Motor Control
   Units: 4.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; and 48.0-54.0 Lab hours
   Method of Grading: Letter Grade Only
   Prerequisite: ELEC 111, and ELEC 405 Completion of or concurrent enrollment in ELEC 112.

2. **COURSE DESIGNATION:**
   Degree Credit
   Transfer credit: CSU

3. **COURSE DESCRIPTIONS:**
   Catalog Description:
   Theory, construction, and operation of fractional and multi-horse power DC and AC electric motors. Various types of motor controls are investigated including start/brake/stop switching, forward/reverse switching, and speed control systems.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
   Upon successful completion of this course, a student will meet the following outcomes:
   1. Describe the construction and operation of a DC electric motor.
   2. Describe the construction and operation of an AC electric motor.
   3. Describe the construction and operation of a servo motor.
   4. Describe the operation of basic start/brake/stop motor switching.
   5. Describe the operation of basic forward/reverse motor switching.
   6. Describe the operation, construction of, and troubleshooting of basic electric and electronic motor and stepped control.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
   Upon successful completion of this course, a student will be able to:
   1. Describe the construction and operation of a DC electric motor.
   2. Describe the construction and operation of an AC electric motor.
   3. Describe the construction and operation of a servo motor.
   4. Describe the operation of basic start/brake/stop motor switching.
   5. Describe the operation of basic forward/reverse motor switching.
   6. Describe the operation, construction of, and troubleshooting of basic electric and electronic motor and stepped control.

6. **COURSE CONTENT:**
   Lecture Content:
   1. DC motors (objective 1)
      A. Rotary motion
      B. Practical DC motors
      C. Control of field flux
      D. Counter-electromotive force
      E. Armature reaction and inter poles
      F. Motor selection criteria
      G. Basic motor contraction
      H. Shunt motor
      I. Series and compound motors
      J. Reversing motors
   2. AC motors (objective 2)
      A. Alternating field
      B. Rotary field
      C. Stator construction
      D. Rotor construction
      E. Single-phase induction motor
      F. Resistance-start Induction-run motors
      G. Capacitor-start Induction-run Motor

H. Shaded-pole motor
I. Split-phase AC motors
J. Thermal protection
K. Universal motors
L. Three-phase motors
M. Induction motor
N. Wound-rotor motors
O. Synchronous motor

3. Servo motors (objective 3)
   A. DC Servo motors
   B. Wound armature PM motor
   C. Moving coil motor
   D. Brushless DC motor
   E. Stepper motor
   F. PM stepper motor
   G. Variable reluctance stepper motor
   H. AC servo motors
   I. Brushless AC servo motor
4. DC motor Drivers (objective 4)
   A. DC drive fundamentals
   B. Speed regulator
   C. Variable voltage DC drive
   D. Motor braking
   E. Dynamic braking
   F. Regenerative braking
5. AC drives (objective 5, 6)
   A. AC drive fundamentals
   B. AC drive system
   C. Variable voltage inverter
   D. Pulse width modulation drive
   E. Flux vector drives
   F. Programmable motor drives

7. **REPRESENTATIVE METHODS OF INSTRUCTION:**
   Typical methods of instruction may include:
   A. Other (Specify): A. Lectures B. Analytical problem sets C. Essay question sheets D. Topic reading assignments E. Assigned computer activities F. Appropriate lab activities G. System troubleshooting activities

8. **REPRESENTATIVE ASSIGNMENTS**
   Representative assignments in this course may include, but are not limited to the following:
   Writing Assignments:
   Weekly lab handouts and worksheets.
   Reading Assignments:
   Weekly reading assignments from text.

9. **REPRESENTATIVE METHODS OF EVALUATION**
   Representative methods of evaluation may include:
   A. A. Graded problem sets B. Graded homework word problems C. Graded computer based lab activities D. Quizzes E. Midterm F. Final exam

10. **REPRESENTATIVE TEXT(S):**
    Possible textbooks include:
    A. Petruzella, Frank.. *Electric Motor and Control Systems.*, ed. McGraw-Hill,, 2010
    B. Petruzella, Frank.. *Activities Manual for Electric Motors and Control Systems.*, ed. McGraw-Hill, 2010

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Course Originator: Steven Gonzales