1. **Course Number and Course Title:**

   COE 431 – Industrial Cyber Physical Systems

2. **Credit Hours:**

   2-3-3

3. **Prerequisites and/or Co-Requisites:**

   Prerequisite: Prerequisites: COE 410 (Embedded Systems: Design and Applications) or ELE 341 (Electronics II)

4. **Name and Contact Information of Instructor:**

   Dr. Abdul-Rahman Al-Ali

5. **Course Description (Catalog Description):**

   Covers Cyber Physical Systems' conceptual model and layers; microprocessor-based data acquisition units and their industrial applications in the Cyber Physical Systems; programmable logic controllers and their industrial applications in the Cyber Physical Systems; web-based monitoring and control of industrial plants; recent development in industrial automation. Include class projects.

6. **Textbook and other Supplemental Material:**

   Textbook:

   - Handouts, Lab Manual and Reading Material.

   Supplemental material:

   - Max Rabiee, Programmable Logic Controllers: Hardware and Programming, 4th ed, Goodheart-Wilcox, 2017.

   - Alla G. Kravets (ed.); Alexander A. Bolshakov (ed.); Maxim V., Cyber-Physical Systems: Industry 4.0 Challenges, 1st ed, Springer International Publishing, 2019.

7. **Course Learning Outcomes:**

   Upon completion of the course, students will be able to:
   1. Analyze data acquisition units' architectures, select interface and program.
   2. Select Programmable Logic Controllers architectures, interface and programing language.
   3. Design and implement an industrial automation system using programmable logic controllers. within of the CPS contexts.
   4. Design and implement an industrial automation system using an industrial PC.
   5. Implement remote monitoring and control of industrial process using the CPS concept.
   6. Solve some smart city applications using the CPS concept.

8. **Teaching and Learning Methodologies:**

   Methods include lectures, labs, homework, quizzes, exams, project and class discussions.

9. Course Topics and Schedule:

Topics	Week of Classes
Cyber Physical Systems models and layers	1st
Programmable logic controllers: Hardware and software architectures	2nd &3rd
Design automation system using PLC	4th & 5th
PLC Communications: MPI, PROFIBUS	6th & 7th
Project1	8th
Real-time industrial process	9th &10th
Basic building blocks of data acquisition unit (DAQ)	11th
Programming and Interfacing data acquisition unit to the PC	12th
Applications of LabVIEW: Fuzzy Logic	13th
Project 2	14th
Projects Demonstrations and Presentations	15th &16th
Total:	**16**