ECET 33000, INDUSTRIAL PROGRAMMING, NETWORKING AND INTERFACING (NEW COURSE)

CREDITS AND CONTACT HOURS
Credit 3 (Theory: 2 Hrs/Week, Lab: 2 Hrs/Week)

INSTRUCTOR OR COURSE COORDINATOR’S NAME
Course Coordinator: Akram Hossain

TEXTBOOK, TITLE, AUTHOR AND YEAR
No textbook is required at this time

INTRODUCTION TO THE COURSE
COURSE CATALOG DESCRIPTION
Monitoring, controlling, and networking smart sensors, controllers, and final control elements. Virtual instrumentation and programming Mechatronics systems using graphical software tools. Data transfer between industrial platforms. Field buses for control application, bus control protocol, SERCOS interface system, controller and smart sensor network, wireless network for process control applications. Networking of multiple controller and communication among them for motion control applications. Motion control programming, programming Languages and tools for Industrial PLC programming. PLCopen, standardization in Industrial programming, and IEC 61131-3.

JUSTIFICATION
This course teaches industrial programming, interfacing and networking related to packaging machinery industry. Importance of such course material and related experience is essential for the graduates to work in field of packaging machinery and automation. Practical knowledge of networking and interfacing among various industrial hardware such as programmable logic controllers, servomotor drives, and computers units are expected of a Mechatronics Engineering Technology graduate. Interfacing hardware and software are essential part of the knowledge to work in modern industrial environment.

PREREQUISITE
Basic Electrical Engineering Technology Courses (such as: ECET 21700, ECET 21400, ECET 21200, and ECET 26200) and Knowledge of Computing or Consent of the Instructor.

SPECIFIC GOALS AND OUTCOME OF THE COURSE
LEARNING OBJECTIVES: After successfully completing this course, a student should be able to:
1) Network smart sensors transducers, controllers, final control elements and Human Machine Interface (HMIs).
2) Perform monitoring, controlling and programming Mechatronics system using virtual instrumentation and graphical software tools
3) Various industrial interface busses, protocols and communication among platforms
4) Recognition of hardware specification and knowledge of integration
5) Set up network of multiple controller, Human Machine Interface(HMI), other field devices
6) Perform standardization in industrial control programming
7) Apply several contemporary software tools for designing and configuring motion control systems

STUDENT OUTCOME: This course covers items a, b, c, d, f, and g ABET Criteria 3

COURSE DELIVERY METHODS (check all that apply)

■ Lecture  ■ Laboratory  □ Online  □ Discussion groups  ■ Projects  □ Other (explain)

FACTORS USED TO DETERMINE THE COURSE GRADE (check all that apply):

■ Quizzes  ■ Exams  ■ Homework  □ Papers  ■ Lab Reports  ■ Class participation
■ How final grade is determined as follows: Several inputs will be used to evaluate students' performance in the course. The letter grade for completion of this course will be based on several input factors. Among them following are probable ratings for student performance: 4 to 6 "pop" quizzes: 100 points; 3 Scheduled Examinations: 300 points; Scheduled Final Examination: 200 points; Homework: 100 points; Laboratory: 200 points; Class Project 200 points; Attendance 100 points.

DETAIL COURSE OUTLINE

Week-by-Week Coverage of Course Material (Sequence may change due to unanticipated setback and due to introduction of new material)

Week #1 & 2: Smart Transducers – Principles, Communications, and Configuration
a) Smart Transducers
b) Configuration
c) Communication Modules and Interfaces

Week #3: Integrated Motion Controllers and Communication Protocol
a) Controller Buses
b) Communicating among Controllers

Week #4 & 5: Virtual Instrumentation Graphical Tools – Modeling and Simulation of Mechatronics Systems
a) Virtual Software Tools
b) Programming Structures
c) Control Design, Simulation and Modeling

Week #5: Networking of Smart transducers, HMIs, Motions Controllers, Motor Drives
a) Gate Keeper - Bridging Dissimilar Buses
b) Types of Network
c) Networking Modules
d) Network Protocol among Transducers, HMIs, Motion Controllers and Motor Drives

Week #6: Field Buses and Features, Function and Application
a) CANbus
b) CANopen
c) Profibus

Week #7: Field Buses and Features, Functions and Application
a) Modbus  
    b) RS 485/RS 422  
    c) DeviceNet  
    d) Ethernet  
    e) EtherCAT  

Week #8: SERCOS (serial real-time communication system) Interface System Function and Application  
    a) Specification and Functionality  
    b) SERCOS III  
    c) SERCOS Next Generation  

Week #9: Direct Computer Control of Servomotor Drives through Ultraware  

Week #10: Wireless Networking and their Application  
    a) Single hop  
    b) Multi-hop  
    c) Smart Wireless Sensor Network for Industrial Applications  

Week #11 & 12: Programming Languages and Tools for Industrial PLC programming  
    a) Standardization in Industrial Programming  
    b) PLCopen  
    c) IEC 61131-3.  

Week #13: Supervisory Control and Data Acquisition (SCADA) Systems  
    a) System Control Strategies  
    b) Redundancy  
    c) Operator Interfaces  
    d) Level of Security  

Week #14, 15 & 16: Projects – Design and Development and Implementation  

Design and Development Projects  

PROJECT -1: MONITORING AND REPORTING OF TEMPERATURE, HUMIDITY, AND LIQUID LEVEL OF SUMP PIT VIA TEXT MESSAGE  

PROJECT -2: MONITORING AND REPORTING OF SIESMIC VIBRATION, TEMPERATURE, AND HUMIDITY, OF SEVERAL CIVIL ENGINEERING STRUCTURES LOCATED DISCRETELY WITH IN A FIVE MILE REDIUS.  

PROJECT -3: AN INDUSTRIAL CONTROL NETWORK SYSTEM NEEDS TO IMPLEMENT WITH FOLLOWING COMPONENTS.