ADSE2011: FUNDAMENTAL ENGINEERING ANALYSIS AND DESIGN FOR MANUFACTURING ENGINEERS II

Effective Term
Semester A 2023/24

Part I Course Overview

Course Title
Fundamental Engineering Analysis and Design for Manufacturing Engineers II

Subject Code
ADSE - Advanced Design and System Engineering
Course Number
2011

Academic Unit
Systems Engineering (SYE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
ADSE2010 Fundamental Engineering Analysis and Design for Manufacturing Engineers I

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

Integrated use of principles from different engineering disciplines has become pervasive in the modern manufacturing environment in the Industry 4.0 era. This course is **Part II** of a two-course sequence, which offers a survey of the fundamental engineering techniques useful for the intelligent manufacturing engineers. Built upon the foundation of practical mechanics and electronics techniques covered in Part I, the students will study principles of robotics and Internet-of-Things at an intermediate level in Part II. These lead up to a term project, in which the students working in teams will design and implement a real-life application that demonstrate the integrated usage of these robotics and Internet-of-Things principles.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Apply the principles of robotics, at an intermediate level, to mechanical systems (e.g. inverse kinematics, dynamics; elements of motion planning).	35	x	x	
2	Apply intermediate-level Internet-of-Things techniques to off-the-shelf hardware devices (e.g. programming microcontrollers to control various external modules and sensors, IoT devices architecture, IoT communications, IoT networks)	35	x	x	
3	Generate and execute simulation models that demonstrate the techniques learned in CILOs 1 and 2.	15	x		
4	Demonstrate, in a team project, the ability to use the knowledge gained in CILOs 1-3, to design and implement a real-life application.	15	x	x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Lectures (including in-class exercises, in-class Q&A and discussions) will be used to explain the key concepts discussed in CILOs 1-3.	1, 2, 3	3 hours/week

2	Laboratory sessions	In the laboratory sessions, the students will apply the key concepts discussed in CILOs 1-3 to execute computer simulation as well as to apply to physical systems (e.g. robot arms, off-the-shelf microcontrollers/ single-board computers)	1, 2, 3, 4	3 hours/week for 2 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Regular Assignments Students will be assessed their understanding of concepts and techniques learned in class, reading materials and their ability to apply these concepts, techniques and subject-related knowledge.	1, 2, 3	15	
2	Laboratory Reports Executing and documenting the practical application of concepts and techniques learned.	1, 2, 3, 4	10	
3	Term Project Report Applying concepts and techniques learned to design and implement a real-life application.	1, 2, 3, 4	30	

Continuous Assessment (%)

55

Examination (%)

45

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination should be obtained.

Assessment Rubrics (AR)

Assessment Task

Coursework (continuous assessment)

Criterion

Achieving all CILOs

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
Examination

Criterion
Achieving CILOs 1-3.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

Intermediate robotics principles/techniques – inverse kinematics, manipulator dynamics, motion planning; Intermediate IoT techniques – programming of microcontrollers/single-board computers to control various external modules and sensors, IoT devices architecture, IoT communications; IoT networks.

Reading List

Compulsory Readings

	Title
1	Lecture notes and slides provided by the instructor

Additional Readings

	Title
1	Practical Electronics for Inventors; 4th Edition; Scherz and Monk; McGraw-Hill, 2016.
2	Robotics and Control: Fundamental Algorithms in MATLAB; 1st Edition, P. Corke; Springer 2021.
3	Internet of Things with Raspberry Pi and Arduino; 1st Edition; Singh, Gehlot, et al.; CRC Press, 2019.
4	Practical Python Programming for IoT; 1st Edition; G. Smart; Packt Publishing, 2020.