SYE2010: FUNDAMENTAL ENGINEERING ANALYSIS AND DESIGN FOR MANUFACTURING ENGINEERS I

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Fundamental Engineering Analysis and Design for Manufacturing Engineers I

Subject Code
SYE - Systems Engineering
Course Number
2010

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
Nil

Precursors
MA1200 Calculus and Basic Linear Algebra I, or MA1300 Enhanced Calculus and Linear Algebra I

Equivalent Courses
ADSE2010 Fundamental Engineering Analysis and Design for Manufacturing Engineers I

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 I of a two-course sequence, which offers a survey of the fundamental engineering techniques useful for the intelligent manufacturing engineers. The students will learn the basics of practical mechanics and electronics principles. With this foundation, the students will further learn techniques such as elementary robotics and elementary Internet-of-Things techniques. In the laboratory sessions, students will work in teams to apply the learned principles practically.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe and apply basic principles of engineering mechanics to simple structures, to explain their static and dynamic behaviour.	40	x		
2	Describe and apply basic principles of practical electronics to simple circuits and devices, to explain their behaviour and responses.	40	x		
3	Apply elementary robotics techniques to simple mechanical systems (e.g. simple mechanisms).	10	x	x	
4	Apply elementary electronics and/or internet-of-things techniques to low-cost off-the-shelf hardware devices.	10	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 1-4.	1, 2, 3, 4	3 hours/week

2	Laboratory sessions	In the laboratory sessions, the students will apply the key concepts discussed in CILOs 1-4 to apply to simple physical systems.	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, 4	40	
2	Laboratory Reports Executing and documenting the practical application of concepts and techniques learned.	1, 2, 3, 4	10	

Continuous Assessment (%)

50

Examination (%)

50

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 1-4.

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

- Basic statics analysis of particles and rigid bodies; basic kinematics and kinetic analyses of particles and rigid bodies; calculation of equation of motion of particles and rigid bodies;
- Basic principles of RLC circuits; basic DC and sinusoidal analysis; elements of diodes, amplifiers; elements of digital electronics;
- Basic robotics principles/techniques – spatial descriptions and transformation; forward kinematics;
- Basic electronics and IoT techniques applied to low-cost off -the-shelf hardware devices.

Reading List

Compulsory Readings

	Title
1	Lecture notes and slides provided by the instructor

Additional Readings

	Title
1	Vector Mechanics for Engineers: Statics, 12th Edition; Beer, Johnston and Mazurek; McGraw-Hill, 2018.
2	Vector Mechanics for Engineers: Dynamics, 12th Edition; Beer, Johnston, Cornell and Self; McGraw-Hill, 2018.
3	Practical Electronics for Inventors; 4th Edition; Scherz and Monk; McGraw-Hill, 2016.

4	Robotics and Control: Fundamental Algorithms in MATLAB; 1st Edition, Corke; Springer 2021.
5	Internet of Things with Raspberry Pi and Arduino; 1st Edition; Singh, Gehlot, et al.; CRC Press, 2019.