# SYE2010: FUNDAMENTAL ENGINEERING ANALYSIS AND DESIGN FOR MANUFACTURING ENGINEERS I

**Effective Term**
Semester B 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. In this course (Part I of a two-course sequence), students will learn the elements of fundamental engineering techniques useful for the intelligent manufacturing engineers. Students will learn the basics of practical mechanics and electronics principles. With this foundation, 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 configure simple electronics systems (e.g. with 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.

**Learning and Teaching Activities (LTAs)**

| | LTAs | Brief Description | CILO No. | Hours/week (if applicable) |
|---|---|---|---|---|
| 1 | Lectures | Students will engage in lectures and discussions to gain knowledge about the key concepts discussed in CILOs 1-4. | 1, 2, 3, 4 | 3 hours/week |
| 2 | Laboratory sessions | Students will apply the key concepts discussed in CILOs 1-4 to simple physical systems in the laboratory sessions. | 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 Student will execute and document 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

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# 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. |