Subject Code: **ME-123**	Course Title: **Engineering Drawing and Graphics**	Total Contact Hours: **42**	**L: 0**	**T: 0**	**P: 3**	**C: 1.5**
Pre-requisite: **NIL**		Year: **1st**	Semester: **Even**			
Type of Course**: Program Core**						

Learning Objective:

This course provides students basic knowledge of the graphical language used by engineers and technologists globally and helps the students to develop the skill to understand, communicate and document through the language of engineering drawing.

Course outcomes (COs):

On completion of this course, the students will have the ability to:	**Blooms Taxonomy**
CO1: To learn and **understand** descriptive geometry, orthographic & isometric projection, engineering drawing techniques, and computer-aided engineering graphics.	2
C02: To **understand** and translate skills in point, line and plane relationships in projection.	2
C03: To **demonstrate** skills in projection of solids, sections of a solid, development of surfaces and isometric projection	3
C04: To **demonstrate** skills of engineering drawing using 2D/3D CAD software packages	3

List of Experiments (Engineering Graphics Lab.)

S. No.	**Experiment / Activity**	**Hours**	**CO**
1	**Introduction:** Principles of Engineering Graphics and their significance, usage of Drawing instruments, types of drawings, drawing sheet sizes and layout, Lines and their types, Method of dimensioning i.e. aligned & unidirectional systems, Lettering. Use of plain scales, diagonal scale with representative fraction, Conic sections and engineering curves such as spiral, cycloid and involute curves. Orthographic Projections: Horizontal planes, Vertical planes, Front view, Top view, Side view, Projections, First and Third angle of projection, Principles of orthographic projections, sketching of different views of given objects.	9	CO1
2	**Projections of Points and Lines:** Projections of points, Line inclined to one or both the principal planes, Traces of lines	6	CO2
3	**Projections of planes:** Projections of planes such as triangle, square, rectangle etc. Finding inclinations of surface with H.P. & V.P. Obtaining true	3	CO2

	shape of surface, angle between two planes, distance of a point from a given plane.		
4	**Projections of solids:** Projections of solids such as Pyramids, Prisms, Cones, and Cylinders. Axis inclined to one or both the reference planes.	6	CO3
5	**Sections of solids and Isometric Projection:** Projections of solids cut by a plane, Projection to obtain the true shape of section, Sectional orthographic projections	6	CO3
6	**Development of surfaces:** Development of lateral surfaces of solids, To draw development of cut solids, To draw development of transition pieces. (Two hollow solids of different cross sections) – To draw principle views from given developments.	3	CO3
7	**Computer Aided Drafting (Auto CAD):** Advantages of using Computer Aided Drafting package, applications of Computer Aided Drafting, basic operation of drafting package, use of various commands for drawing, dimensioning and editing the drawing.	9	CO4

Textbook Reference:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing.

Reference Books:

1. AICTE's Prescribed Textbook: Engineering Graphics & Design (ISBN: 978-93-91505-066)
2. Jain, Maheshwari, Gautam (2021), Engineering Graphics & Design, Khanna Book Publishing.

Additional resources:

NPTEL, Video Lectures, Web Resources etc.

Evaluation Methods:

Item	Weightage	COs
Midterm exam	20 %	CO1, CO2
Continuous assessment (Drawing on sheets or CAD software, quiz etc)	40 %	CO1, CO2, CO3, CO4
End term Exam	40 %	CO1, CO2,CO3, CO4

CO-PO Correlation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**2**	**1**	**1**	**1**						**2**		**1**	**1**	**1**	**1**
CO2	**2**	**1**	**1**	**1**						**2**		**1**	**1**	**1**	**1**
CO3	**2**	**1**	**1**	**1**						**2**		**1**	**1**	**1**	**1**
CO4	**2**	**1**	**1**	**1**	**2**					**2**		**1**	**1**	**1**	**1**

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Updated by: Dr. Vikas Sharma

CO-PO Mapping Justification

These mappings illustrate how each Course Outcome connects with various Program Outcomes and Program Specific Outcomes, ensuring a comprehensive and aligned learning experience for students in the Mechanical-Mechatronics Engineering Department:

POs Vs COs

PO1 - Engineering knowledge

1. PO1 - CO1 (Value: 2)
   - Reasoning: CO1 involves understanding and applying descriptive geometry, aligning moderately with PO1, which emphasizes the application of knowledge of mathematics, science, and engineering fundamentals. Descriptive geometry skills contribute directly to the application of engineering knowledge.
2. PO1 - CO2 (Value: 2)
   - Reasoning: CO2 emphasizes skills in point, line, and plane relationships in projection, aligning moderately with PO1's emphasis on applying knowledge to solve complex engineering problems. Understanding projection relationships requires a solid foundation in engineering knowledge.
3. PO1 - CO3 (Value: 2)
   - Reasoning: CO3 involves skills in the projection of solids, aligning moderately with PO1's focus on applying knowledge to solve complex engineering problems. The ability to project solids requires a strong understanding of engineering principles.
4. PO1 - CO4 (Value: 2)
   - Reasoning: CO4 involves applying skills in engineering drawing using CAD software, aligning moderately with PO1's focus on applying knowledge of mathematics, science, and engineering fundamentals. The use of CAD software complements and enhances the application of engineering knowledge.

PO2 - Problem analysis

5. PO2 - CO1 (Value: 1)
   - Reasoning: CO1 doesn't explicitly address problem analysis, resulting in a weak correlation with PO2, which emphasizes the identification, formulation, and analysis of engineering problems. The absence of explicit problem analysis skills in CO1 leads to a weaker correlation.

PO3 - Design/development of solutions

6. PO3 - CO1 (Value: 1)
   - Reasoning: CO1 doesn't explicitly address the design and development of solutions, resulting in a weak correlation with PO3, which focuses on designing solutions for complex engineering problems. The absence of explicit emphasis on solution design in CO1 leads to a weaker correlation.

PO4 - Conduct investigations of complex problems

7. PO4 - CO1 (Value: 1)
   - Reasoning: CO1 doesn't explicitly mention conducting investigations, resulting in a weak correlation with PO4, which focuses on using research-based knowledge, analysis, and interpretation of data to provide valid conclusions. The absence of explicit investigative skills in CO1 leads to a weaker correlation.

PO5 - Modern tool usage

8. PO5 - CO4 (Value: 2)
   - Reasoning: CO4 involves applying skills using 2D/3D CAD software, aligning moderately with PO5's focus on creating, selecting, and applying appropriate techniques and modern engineering tools. The use of CAD software is a modern tool contributing to technical skills.

PO6 - The engineer and society

9. PO6 - No Mapping (Value: -)
   - Reasoning: COs do not explicitly mention societal issues, which are emphasized by PO6. The absence of explicit alignment with societal issues in COs results in no mapping with PO6.

PO7 - Environment and sustainability

10. PO7 - No Mapping (Value: -)
    - Reasoning: COs do not explicitly mention environmental impact and sustainability, which are emphasized by PO7. The absence of explicit alignment with environmental sustainability in COs results in no mapping with PO7.

PO8 - Ethics

11. PO8 - No Mapping (Value: -)
    - Reasoning: COs do not explicitly mention ethical principles and professional ethics, which are emphasized by PO8. The absence of explicit alignment with ethical principles in COs results in no mapping with PO8.

PO9 - Individual and team work

12. PO9 - CO4 (Value: 2)
    - Reasoning: CO4 involves applying skills using 2D/3D CAD software, aligning moderately with PO9's focus on functioning effectively in individual and team work settings. The collaborative use of CAD software aligns with effective teamwork.

PO10 - Communication

13. PO10 - CO1, CO2, CO3 (Value: 2)
    - Reasoning: CO1, CO2, and CO3 involve skills in projection, isometric projection, and communication using CAD software. These align moderately with PO10's focus on effective communication with the engineering community. The use of CAD software enhances communication skills.

PO11 - Project management and finance

14. PO11 - No Mapping (Value: -)
    - Reasoning: COs do not explicitly mention project management and finance, which are emphasized by PO11. The absence of explicit alignment with project management and finance in COs results in no mapping with PO11.

PO12 - Life-long learning

15. PO12 - No Mapping (Value: -)
    - Reasoning: COs do not explicitly mention life-long learning, which is emphasized by PO12. The absence of explicit alignment with life-long learning in COs results in no mapping with PO12.

PSO Vs COs:

PSO1 - Identify, formulate, analyze, and develop manufacturing, design, industrial, mechatronics, and thermal systems for solving various problems in industry and society.

1. PSO1 - CO1 (Value: 1)
    - Reasoning: While CO1 involves descriptive geometry and engineering drawing techniques, it doesn't explicitly address the comprehensive development of manufacturing, design, and mechatronics systems. The absence of explicit alignment with the broad scope of PSO1 results in a weak correlation.
2. PSO1 - CO2 (Value: 1)

- Reasoning: CO2 focuses on point, line, and plane relationships in projection, but it doesn't encompass the broader aspects of manufacturing, design, and mechatronics systems. The absence of explicit alignment with the scope of PSO1 results in a weak correlation.

3. PSO1 - CO3 (Value: 1)

- Reasoning: CO3 involves skills in the projection of solids, which contributes to understanding 3D aspects but may not fully cover the broad range of systems mentioned in PSO1. The absence of explicit alignment with the comprehensive scope of PSO1 results in a weak correlation.

4. PSO1 - CO4 (Value: 2)

- Reasoning: CO4 involves applying skills in engineering drawing using CAD software, aligning moderately with PSO1's emphasis on developing manufacturing, design, and mechatronics systems. The use of CAD software contributes to the development of such systems.

PSO2 - Pursue higher education and research in fundamental, applied, and interdisciplinary areas to gain knowledge in emerging scientific technologies.

5. PSO2 - CO1 (Value: 1)

- Reasoning: CO1 involves descriptive geometry and engineering drawing techniques, but it may not fully align with the broader scope of pursuing higher education and research in various areas. The absence of explicit alignment with the scope of PSO2 results in a weak correlation.

6. PSO2 - CO2 (Value: 1)

- Reasoning: CO2 focuses on point, line, and plane relationships in projection, which may not fully cover the interdisciplinary areas mentioned in PSO2. The absence of explicit alignment with the interdisciplinary scope of PSO2 results in a weak correlation.

7. PSO2 - CO3 (Value: 1)

- Reasoning: CO3 involves skills in the projection of solids, which contributes to understanding 3D aspects but may not fully cover the interdisciplinary areas mentioned in PSO2. The absence of explicit alignment with the interdisciplinary scope of PSO2 results in a weak correlation.

8. PSO2 - CO4 (Value: 1)

- Reasoning: CO4 involves applying skills in engineering drawing using CAD software, but it may not fully align with the pursuit of higher education and research in various areas. The absence of explicit alignment with the scope of PSO2 results in a weak correlation.

PSO3 - Utilize mechanical engineering skills to build a career in research labs and industry.

9. PSO3 - CO1 (Value: 2)

- Reasoning: CO1 involves understanding and applying descriptive geometry, orthographic & isometric projection, and engineering drawing techniques. These align moderately with PSO3's emphasis on utilizing mechanical engineering skills for building a career in research labs and industry.

10. PSO3 - CO2 (Value: 2)

- Reasoning: CO2 emphasizes skills in point, line, and plane relationships in projection, contributing to the understanding of 3D aspects relevant to PSO3. This alignment is moderate and contributes to building a career in research labs and industry.

11. PSO3 - CO3 (Value: 2)

- Reasoning: CO3 involves skills in the projection of solids, which aligns moderately with PSO3's emphasis on utilizing mechanical engineering skills for building a career in research labs and industry.

12. PSO3 - CO4 (Value: 2)

- Reasoning: CO4 involves applying skills in engineering drawing using CAD software, aligning moderately with PSO3's emphasis on utilizing mechanical engineering skills for building a career in research labs and industry.