Course Code	18MES101L	Course Name	ENGINEERING GRAPHICS AND DESIGN	Course Category	S	Engineering Sciences	L	T	P	C
							1	0	4	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mechanical Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Learning			Program Learning Outcomes (PLO)

		1	2	3
CLR-1 :	Utilize engineering graphic fundamentals. apply the same to draw/evaluate engineering curves and projection of objects			
CLR-2 :	Draw projection of solid objects like prisms, cylinders, pyramids and cones used in various engineering objects			
CLR-3 :	Draw the projection of combination of solids, and section of solids. Create building plans for construction			
CLR-4 :	Create 3D part models. Develop its surfaces using solid-modeling software for effectiveness, clarity, accuracy, portability			
CLR-5 :	Evaluate the assembly of engineering component parts. Create 2D drawings for assembly of engineering components			
CLR-6 :	Draw, Create, Evaluate, Interpret engineering 2D and 3D surfaces of engineering components using modeling software			

Course Learning Outcomes (CLO): *At the end of this course, learners will be able to:*

PLO columns: 1 Engineering Knowledge, 2 Problem Analysis, 3 Design & Development, 4 Analysis, Design, Research, 5 Modern Tool Usage, 6 Society & Culture, 7 Environment & Sustainability, 8 Ethics, 9 Individual & Team Work, 10 Communication, 11 Project Mgt. & Finance, 12 Life Long Learning, 13 PSO-I, 14 PSO-II, 15 PSO-III

		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO-1 :	Identify engineering graphics. Draw objects like points, lines, planes, and solids in perspective & orthographic projections	3	90	85	H	H	L	L	L	L	H	L	H	L	H	L	L	L	L
CLO-2 :	Draw projection of solids like prism, cylinder, pyramid and cone inclined in general positions, obtain auxiliary views	2	95	90	M	M	L	L	M	H	H	L	L	H	L	L	L	L	L
CLO-3 :	Draw projection of combination of solids made out of primitives, draw the section of solids, create building plans	3	90	85	H	H	M	M	H	H	H	H	M	H	L	H	L	L	L
CLO-4 :	Create 3D part models. Develop its surfaces with solid modeling software for effectiveness, clarity, accuracy, portability	3	90	85	H	H	H	H	H	H	H	L	H	H	L	H	M	L	M
CLO-5 :	Evaluate the assembly of parts including interference of parts. Create 2D drawings of assembly of parts	3	85	80	H	H	M	H	H	H	H	H	L	H	L	H	L	M	L
CLO-6 :	Draw graphics of engineering pans with point, line, plane, solids, in perspective and orthographic projections	2	90	85	M	M	L	M	L	L	L	H	L	L	L	L	L	L	L

		Engineering graphics and Projection	Projection of solids using CAD software	Projections of combination of solids	Part Modeling and Drawing	Assembly Modeling and Drawing
Duration (hour)		15	15	15	15	15
S-1	SLO-1	Principles, Standards, Conventions	Introducing CAD Software, layers, dimensions, tolerance, annotations	Combinations of solids, Constructive Solid Geometry(CSG), Boolean operations	3D modelling, parametric, non- parametric, parts of CSG, surface, wireframe, shaded	Part/ component model creation for assembly.
	SLO-2	Angle Projection, Symbols, Dimensions	Create, modify, customize, print using CAD	Creating combination of solids, isometric, perspective views, shaded, wire-frame	Rendered models, background, shadows, multi-view, isometric, perspective views	Study of various widely used assembly of parts like flanged joint, universal joint etc.
S-2	SLO-1	2D Geometric Constructions	Demo: Menu, Toolbars, Drawing Area, Dialog box, windows, Shortcut menus	Constructive Solid Geometry, Boolean operations, Creating combination of solids	3D modelling, parametric, non- parametric, parts of CSG, surface, wireframe, shaded	Creation of parametric parts for assembly
	SLO-2	2D Geometric Constructions	Command Line, Status Bar, Different zoom methods, Create, Select, Erase objects	isometric, perspective, shaded, wire-frame	Rendered models, background, shadows, multi-view, isometric, perspective views	non- parametric parts for assembly
S-3	SLO-1	Conic Curves ellipse by eccentricity method	Draw straight lines, rectangle, polar, absolute, relative	Constructive Solid Geometry, Boolean operations, Creating combination of solids	Viewing models in multi-view, isometric, and perspective views	Creation of parametric parts for assembly
	SLO-2	Conic Curves ellipse by eccentricity method	Orthographic constraints, Ortho ON, snap to objects manually, automatically	isometric, perspective, shaded, wire-frame	Viewing models in multi-view, isometric, and perspective views	non- parametric parts for assembly
S-4	SLO-1	Cycloids, Epicycloids	drawing lines, arcs, circles, polygons, create, edit, use layers, extend lines	Constructive Solid Geometry, Boolean operations, Creating combination of solids	Modelling industrial part drawings	Creation of parametric parts for assembly
	SLO-2	Hypocycloid	Dimensioning objects, annotations	isometric, perspective, shaded, wire-frame	Modelling industrial part drawings	non- parametric parts for assembly
S-5	SLO-1	Involute of a Square, Circle	Demo: drawing page, print, units/ scale/ limits settings, standards for dimensioning	Constructive Solid Geometry, Boolean operations, Creating combination of solids	Design new components as a team	Creation of parametric parts for assembly
	SLO-2	Spirals	ISO, ANSI Std. dimensioning, tolerancing	isometric, perspective, shaded, wire-frame	Design new components as a team	non- parametric parts for assembly
S-6	SLO-1	Introduction to perspective projection with terminologies and concepts	Projection of solid prisms and cylinders inclined to both the planes	Section of right regular solid with axis perpendicular to one principal planes and	3D Part to 2D Drawings geometric dimensioning and tolerancing annotations	Simple assembly of parts,
	SLO-2	Orthographic multiview and isometric projection	change of position method, reference line method / auxiliary projections,	cutting plane perpendicular to any one principle plane true shape of the section	generating 2D from 3D models, printing drawings, generating sectional views	associated part and assembly
S-7	SLO-1	Perspective projection of a point, line	Projection of solid prisms and cylinders inclined to both the planes	Section of right regular solid with axis perpendicular to one principal planes and	Geometric dimensioning and tolerancing annotations	Simple assembly of parts,
	SLO-2	Perspective projection of a planes, solids	Change of position method	cutting plane perpendicular to any one principle plane true shape of the section	Geometric dimensioning and tolerancing annotations	associated part and assembly

S-8	SLO-1	Orthographic multiview of point, line	Projection of solid prisms and cylinders inclined to both the planes	Section of right regular solid with axis perpendicular to one principal planes and cutting plane perpendicular to any one principle plane true shape of the section	Generating 2D drawings from 3D models	Simple assembly of parts,
	SLO-2	Orthographic multiview of planes, solids	Reference line method		Generating 2D drawings from 3D models	associated part and assembly
S-9	SLO-1	Isometric projection of a point, line	Auxiliary projections	Section of solids with axis inclined to both the planes and cutting plane perpendicular to any one principal plane only.	Generating sectional views	Simple assembly of parts,
	SLO-2	Isometric projection of planes, solids	Auxiliary projections		Generating sectional views	associated part and assembly
S-10	SLO-1	Isometric to orthographic multiview sketching	Viewing isometric and perspective views, shaded, wire-frame models	Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Printing drawings to printer or as .pdf	Simple assembly of parts,
	SLO-2	Orthographic multiview to isometric sketch	Oblique prismatic solids and its projections		Printing drawings to printer or as .pdf	associated part and assembly
S-11	SLO-1	Orthographic multiview projection of lines inclined to both planes	Projection of solid pyramids and cones inclined to both the planes	Building/ Dwelling drawing, Terminology, conventions, sectional plan and side-view of Building/ dwelling, include windows, doors, fixtures,	Development of surfaces: un-cut, & cut right / oblique regular solids	Assembly Drawings: exploded view with assembly annotations part details
	SLO-2	Orthographic multiview projection of planes inclined to planes, auxiliary projection	change of position method and reference line method / auxiliary projections,		Simple position with cutting planes perpendicular to any one principal plane	Printing assembly drawings to printer and as pdf
S-12	SLO-1	Projection of lines inclined to both the planes	Projection of solid pyramids and cones inclined to both the planes	Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Development of surfaces: un-cut, & cut right / oblique regular solids	Exploded view with assembly annotations
	SLO-2	true length, true inclinations, traces of lines	Change of position method		Simple position with cutting planes perpendicular to any one principal plane	part details
S-13	SLO-1	Projection of lines inclined to both the planes	Projection of solid pyramids and cones inclined to both the planes	Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Development of surfaces: un-cut, & cut right / oblique regular solids	Exploded view with assembly annotations
	SLO-2	true length, true inclinations, traces of lines	Change of reference line method		Simple position with cutting planes perpendicular to any one principal plane	part details
S-14	SLO-1	Finding shortest distance between a point and a plane	Auxiliary projections	Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Design of real time surface-development	Exploded view with assembly annotations
	SLO-2	Shortest distance between two lines	Auxiliary projections		Design of real time surface-development	part details
S-15	SLO-1	shortest distance between point and plane	Viewing isometric and perspective views, shaded, wire-frame models	Sectional plan elevation, and sectional side-view of Building/ dwelling, include windows, doors, fixtures, etc.	Design of real time surface-development	Printing assembly drawings
	SLO-2	shortest distance between point and plane	Oblique pyramidal solids and projections		Design of real time surface-development	Printing assembly drawings

Learning Resources

1. Bhatt, N.D., Engineering Drawing (First Angle Projection),53rd ed., Charotar Publishing House, 2017
2. Bethunc, J., Engineering Graphics with AutoCAD 2017, Pearson Education, 2016
3. Khristofor Artemyevich Arustamov, Problems in projective geometry, MIR Publishers, Moscow, 1972
4. Natarajan, K.V., A Text Book of Engineering Graphics, 21st Edition, Dhanalakshmi Pub., 2012
5. Shah. M. B.,Rana, B. C, Engineering Drawing, Pearson Education, Pvt. Ltd., 2005
6. Jeyapoovan. T., Engineering Drawing and Graphics using AutoCAD, Vikas Pub. House, 2015
7. Narayanan, K. L., Kannaiah, V., Engineering Graphics, Scitech Publications,2010
8. Luzzader, Warren J., Duff John M., Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Prentice Hall of India Pvt. Ltd,, 2005.
9. Mohammad Dastbaz, Chris Gorse, Alice Moncaster (eds.), Building Information Modelling, Building Performance, Design and Smart Construction, Springer 2017
10. User Manual of Respective CAD Softwares

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	40%	-	30%	-	30%	-	30%	-	30%
	Understand										
Level 2	Apply	-	40%	-	40%	-	40%	-	40%	-	40%
	Analyze										
Level 3	Evaluate	-	20%	-	30%	-	30%	-	30%	-	30%
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Dr. R. Kalimuthu, ISRO,	1. Dr. Ramkumar P, IIT Madras, ramkumar@iitm.ac.in	1. Mr. D. Kumaran, SRMIST
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Note: For all B.Tech Programmes other than Civil, Mechanical, Automobile, Aerospace and Mechatronics, the entire course would be conducted using CAD Software only.