

Programme Name/s : Automobile Engineering.
Programme Code : AE
Semester : Third
Course Title : AUTOMOBILE WORKING DRAWING & CAD
Course Code : 313008

I. RATIONALE

Engineering drawings and Computer-Aided Design (CAD) act as a universal communication language for engineers, architects, and technicians, enabling them to convey ideas, and specifications effectively. These tools offer precise and standardized representations of components and assemblies, promoting clear communication among team members, clients, manufacturers, and other stakeholders. Additionally, they allow individuals to visualize detailed and accurate drawings before the manufacturing process, aiding in 2D drafting and ultimately saving valuable time and resources.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Prepare engineering drawings manually using prevailing drawing instruments & using CAD Software.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Use various drawing codes, conventions and symbols as per IS SP-46.
- CO2 - Draw production drawings for manufacturing automobile components.
- CO3 - Draw assembly drawings for automobile components.
- CO4 - Draw complex 2D geometric figures using CAD Software.
- CO5 - Use software to write dimension and text on the given 2D geometric drawings.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week	SLH		NLH			Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks	
															Practical							
											CL	TL	LL	FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min													
313008	AUTOMOBILE WORKING DRAWING & CAD	AWD	SEC	1	-	4	1	6	3	-	-	-	-	-	25	10	-	-	25	10	50	

Total IKS Hrs for Sem. : Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, ## On Line Examination , @\$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Use IS SP-46 codes for preparing production drawing. TLO 1.2 Prepare production drawing using standard conventions.	Unit - I Conventional representation 1.1 Engineering Material Conventions. 1.2 Conventional breaks in pipes, rod and shaft. 1.3 Conventional representation of common features like slotted head, radial rib, knurling, serrated shaft, splined shaft, ratchet and pinion, repeated parts, square on shaft, holes on circular pitch, internal and external threads. 1.4 Conventional representation of standard parts like ball and roller bearing, gears, springs. 1.5 Pipe joints and valves. 1.6 Counter sunk and counter bored holes. 1.7 Tapers.	Lecture Using Chalk-Board Model demonstratio Model Demonstration

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Calculate tolerances on the given machine components. TLO 2.2 Identify type of fit between mating parts of machine components based on given tolerance values. TLO 2.3 Prepare production drawing using suitable convention and codes.	Unit - II Production Drawing 2.1 Limits, Fits and Tolerances: Definitions, introductions to ISO system of Tolerance. Dimensional tolerances: Terminology, selection and representation of dimensional tolerance- number and grade method. Definitions concerning Tolerancing and Limits system, unilateral and bilateral tolerance, Hole and shaft base systems, Types of fits-Clearance, transition and Interference, Selection of fit for engineering applications. Calculation of limit sizes and identification of type of fit from the given sizes like 050 H7/s6, 030 H7/d9 etc. 2.2 Geometrical Tolerances: Types of geometrical tolerances, terminology for deviation, representation of geometrical tolerance on drawing. 2.3 General welding symbols, length and size of weld, surface contour and finish of weld, all round and site weld, symbolic representation in Engineering practices and its interpretation. 2.4 Machining symbol and surface texture: Indication of machining symbol showing direction of lay, sampling length, roughness grades, machining allowances, manufacturing methods. Representation of surface roughness on drawing.	Lecture Using Chalk-Board Model demonstration Video Demonstration
3	TLO 3.1 Identify various components in given detail drawings. TLO 3.2 Identify sequence of assembling it. TLO 3.3 Prepare assembly drawing from given detailed drawing. TLO 3.4 Prepare bill of material.	Unit - III Details to assembly 3.1 Introduction to assembly drawing, accepted norms to be observed for assembly drawings, sequence for preparing assembly drawing, Bill of Material (BOM). 3.2 Screw-jack. 3.3 Couplings: Universal couplings. 3.4 Piston & Connecting rod assembly.	Lecture Using Chalk-Board Model Demonstration Video Demonstrations

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Describe the importance of computer in drafting and designing. TLO 4.2 Set the CADD workspace and interface. TLO 4.3 Work with the User Coordinate System and World Coordinate System. TLO 4.4 Apply different object selection methods in a given situation. TLO 4.5 Use various commands in application menu bar.	Unit - IV Fundamentals of CAD drawing 4.1 Fundamentals of Computer Aided Drafting and its applications, Various Software's for Computer Aided Drafting. 4.2 CADD Interface: Application Menu, Quick Access Toolbar, Ribbons, InfoCenter, Command Window, Graphical Area, Status Bar. 4.3 CADD initial setting commands: Snap, grid, Ortho, Osnap, Dynamic input, Limits, Units, Ltscale, Object tracking. 4.4 co-ordinate System- Cartesian and Polar Absolute, Relative mode, Direct Distance Entry, UCS, WCS. 4.5 Object Selection methods- picking, window, crossing, fence, last and previous. 4.6 Opening, saving and closing a new and existing drawing.	Presentations Video Demonstrations
5	TLO 5.1 Use viewing commands. TLO 5.2 Apply formatting commands. TLO 5.3 Draw simple 2D entities using given draw & Modify commands. TLO 5.4 Determine coordinates, distance, area, length, centroid of the given 2D entity. TLO 5.5 Use grip command to manipulate given 2D entity. TLO 5.6 Use different dimensioning styles for Dimension the given 2D entities. TLO 5.7 Apply Geometric and dimension tolerance symbols on the given entity. TLO 5.8 Write text on given 2D entity.	Unit - V Draw, Edit, Modify, Formatting, Dimensioning and text command 5.1 Zoom Commands – all, previous, out, in, extent, Realtime, dynamic, window, pan. 5.2 Draw Command - Line, arc, circle, rectangle, polygon, ellipse, spline, block, hatch. 5.3 Modify Command - Erase, trim, extend, copy, move, mirror, offset, fillet, chamfer, array, rotate, scale, lengthen, stretch, measure, break, divide, explode, align. 5.4 Formatting commands - Layers, block, linetype, lineweight, color. 5.5 Enquiry commands – distance, area. 5.6 Editing Objects by Using Grips - Moving, Rotating, Scaling, Mirroring and Stretching. 5.7 Dimensioning commands - Dimension styles, Dimensional Tolerances and Geometrical Tolerances, Modify dimension style. 5.8 Text commands - dtext, mtext command.	Presentations Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Prepare drawing using convention and code as per IS-SP46.	1	*Draw various conventional representations as per IS SP-46.	4	CO1
LLO 2.1 Use various tolerances and symbols in drawing.	2	*Draw Dimensional and Geometrical Tolerances, Welding Symbols, Surface Roughness and Machining Symbols on the given figures.	4	CO1
LLO 3.1 Use various tolerances and symbols in production drawing.	3	Develop Production drawing of Automobile components showing dimensional and geometrical Tolerance, surface finish etc. (any two)	4	CO2
LLO 4.1 Draw assembly drawing using standard procedure for assembly of components of Screw Jack.	4	*Prepare assembly drawing from the given detailed drawing showing fits, part numbers, bill of material, assembly dimensions.	4	CO3
LLO 5.1 Draw assembly drawing using standard procedure for assembly of Piston and Connecting rod.	5	Prepare assembly drawing from the given detailed drawing showing fits, part numbers, bill of material, assembly dimensions.	4	CO3
LLO 6.1 Draw assembly drawing using standard procedure for assembly of components universal joint..	6	Prepare assembly drawing from the given detailed drawing showing fits, part numbers, bill of material, assembly dimensions.	4	CO3
LLO 7.1 Use basic commands in CAD software.	7	*Prepare a template for your institute of A-4 size with a title block and institute logo.	4	CO4
LLO 8.1 Use basic commands in CADD software LLO 8.2 Draw 2D entities in CADD software.	8	*Drawing 2-D entities like Line, Polyline, Circle, Rectangle, Polygon and Ellipse by using CADD software.	4	CO4
LLO 9.1 Use basic commands in CADD software. LLO 9.2 Draw 2D entities in CADD software using Draw commands individually.	9	Drawing simple 2-D entities.	4	CO4
LLO 10.1 Use basic commands in CADD software. LLO 10.2 Draw 2D entities in CADD software using Draw, Edit and Modify commands.	10	Drawing complex 2-D objects like gear.	4	CO4
LLO 11.1 Use basic commands in CADD software. LLO 11.2 Draw 2D entities in CADD software using Draw, Edit and Modify commands. LLO 11.3 Apply dimension and write text on 2D geometric entities.	11	*Drawing complex 2-D object like Piston.	4	CO4 CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 12.1 Use basic commands in CAD software. LLO 12.2 Draw 2D figure in CAD software. LLO 12.3 Apply dimension and write text on 2D geometric entities.	12	*Drawing any two problems of orthographic projections using first angle method of projection.	4	CO4 CO5
LLO 13.1 Use basic commands in CAD software. LLO 13.2 Draw 2D figure in CAD software. LLO 13.3 Apply dimension and write text on 2D geometric entities.	13	Drawing any two problems of orthographic projections using third angle method of projection.	4	CO4 CO5
LLO 14.1 Use basic commands in CAD software. LLO 14.2 Draw 2D figure in CAD software. LLO 14.3 Apply dimension and write text on 2D geometric entities.	14	*Drawing any two problems of sectional orthographic projections using First angle method of projection.	4	CO4 CO5
LLO 15.1 Use basic commands in CAD software. LLO 15.2 Draw 2D figure in CAD software. LLO 15.3 Apply dimension and write text on 2D geometric entities.	15	Drawing any two problems of sectional orthographic projections using third angle method of projection.	4	CO4 CO5
Note : Out of above suggestive LLOs - • '*' Marked Practicals (LLOs) Are mandatory. • Minimum 80% of above list of lab experiment are to be performed. • Judicial mix of LLOs are to be performed to achieve desired outcomes.				

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Students should maintain a separate A3 size sketch book which will be part of term work and submit it along with drawing sheets. The following assignment should be drawn in the sketchbook
- Solve assignment on conventional representation of standard mechanical components.
- Draw Production drawing of at least four machine components showing dimensional and geometrical Tolerance, surface finish etc.
- Solve any two problems on details to assembly.
- Write Auto CAD commands like dimensioning & text for simple components.
- Note- Problems on the Drawing sheet and in the sketchbook should be different.

Micro project

- Prepare a report of production drawings from nearby workshops/industries and establish an item reference number on that drawing for the convention or tolerance value.
- Visit nearby fabrication workshop and prepare report on various types of welding symbols used for fabrication work.

- Visit nearby process industries like sugar factory, chemical industries, water treatment plant, etc. and prepare report representing conventional representation of various piping joints.
- Visit Institute's Power engineering Lab and prepare detailed drawings of Various IC Engine components using proper measuring instruments.
- Drawings of automobile components engine Valves, camshaft, crankshaft, clutch, and bevel gear ball bearings using software.
- Any other micro-projects suggested by subject faculty on similar line.
- Write Auto CAD commands like draw, modify, and formatting for simple components.
- Write Auto CAD commands like dimensioning & text for simple components.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Models/ Charts of Conventional representation and Production drawing.	1,2,3
2	Drawing equipment and instruments for class room teaching-large size:T-square or drafter (Drafting Machine).Set square (450 and 300-600)Protector.Drawing instrument box (containing set of compasses and dividers).Drawing sheets, drawing pencils H,2H, Eraser, Drawing pins / clips.	1,2,3,4,5,6
3	Drawing Table with Drawing Board of Full Imperial/ A1 size.	1,2,3,4,5,6
4	Models of assembly.	4,5,6
5	Network licence latest version of computer edit drafting software.	7,8,9,10,11,12,13,14,15
6	CAD workstation with the latest configuration for each student.	7,8,9,10,11,12,13,14,15
7	Plotter / Printer with the latest version.	7,8,9,10,11,12,13,14,15
8	LCD projector and screen / interactive board.	7,8,9,10,11,12,13,14,15
9	Set of various industrial drawings being used by industries.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Conventional representation	CO1	3	0	0	0	0
2	II	Production Drawing	CO1,CO2	3	0	0	0	0
3	III	Details to assembly	CO1,CO2,CO3	3	0	0	0	0
4	IV	Fundamentals of CAD drawing	CO4	3	0	0	0	0
5	V	Draw, Edit, Modify, Formatting, Dimensioning and text command	CO4,CO5	3	0	0	0	0
Grand Total				15	0	0	0	0

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Term work, Self-Learning (Assignment)

Summative Assessment (Assessment of Learning)

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XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	-	1	-	-	-			
CO2	3	2	-	1	-	-	-			
CO3	3	2	-	1	-	-	-			
CO4	3	2	-	1	1	-	1			
CO5	3	2	-	1	1	-	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -

*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Bureau of Indian Standards.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	October 2003 ISBN: 81-7061-091-2
2	Bhatt, N.D.	Engineering Drawing	Charotar Publishing House, 2011 ISBN: 978-93-80358-17-8
3	Bhatt, N.D.; Panchal, V. M	Machine Drawing	Charotar Publishing House, 2011 ISBN: 978-93-80358-11-6
4	Narayan, K. L. Kannaiah, P. Venkata Reddy, K.	Production Drawing	New Age International Publications, 2011, ISBN: 978-81-224-2288-7
5	Sidheswar, N. Kannaiah, P. Sastry, V.V.S.	Machine Drawing	Tata McGraw Hill Education Private Ltd, New Delhi, 2011, ISBN-13: 978-0-07-460337-6
6	Jeyapoovan T	Essential of engineering drawing and graphics using AutoCAD	Vikas Publication House Private Limited, Noida, 2011, ISBN: 978-8 1259 53005
7	Pradhan, S.K Jain, K.K	Engineering Graphics	Khanna Book Publishing CO(P) LTD, New Delhi, ISBN No. 978-93-91505-50-9
8	Autodesk	AutoCAD user guide	Autodesk press, USA, 2015

Sr.No	Author	Title	Publisher with ISBN Number
9	Prof. Sham Tickoo	AutoCAD 2023 for Engineers and Designers, Basic and Intermediate	BPB Publications, ISBN : 978-9355510860

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=VCaZsnVxa2Y	Conventional Representation
2	https://www.youtube.com/watch?v=VO-xekz8vps	Limits, fit & tolerances
3	https://youtu.be/VRi2LMm6jHU	Assembly
4	https://youtu.be/5Pj7vkcolXk	AutoCAD
5	https://www.youtube.com/watch?v=iCLGQNEAs7o	AutoCAD

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students