COMPUTER AIDED MECHATRONICS DRAFTING **Course Code : 314015**

Programme Name/s : **Mechatronics**
Programme Code : **MK**
Semester : **Fourth**
Course Title : **COMPUTER AIDED MECHATRONICS DRAFTING**
Course Code : **314015**

I. RATIONALE

The process of drawing and drafting has evolved with the advancement of technology from a manual process into a digital technique. The skills of Computer Aided Drawing and Drafting (CADD) have become an essential element of this evolution process. This course provides the designers with the powerful tools to modernize the creation, modification and visualization of mechatronics drawings.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply the knowledge and skills of CADD software to create and read electromechanical drawings efficiently and accurately as per industry standards.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use basic commands in CADD software.
- CO2 - Draw complex 2D drawings in CADD software using draw and modify tools.
- CO3 - Use CADD software to give dimensions and write text on 2D geometric entities.
- CO4 - Plot given 2D entities using proper plotting parameters in CADD software.
- CO5 - Draw electromechanical circuits in CADD software.

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	
314015	COMPUTER AIDED MECHATRONICS DRAFTING	CAM	SEC	-	-	4	2	6	3	-	-	-	-	-	25	10	25#	10	25	10	75

Total IKS Hrs for Sem. : 0 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 Describe the importance of computer in drafting and designing. TLO 1.2 Set the CADD workspace and interface for the given situation TLO 1.3 Prepare drawing using User Coordinate System (UCS) and World Coordinate System (WCS) TLO 1.4 Apply different object selection methods in a given situation. TLO 1.5 Use various commands in application menu bar.	**Unit - I Fundamentals of CAD Drawing** 1.1 Fundamentals of Computer Aided Drafting and its applications, Various Software for Computer Aided Drafting. 1.2 CADD Interface: Application Menu, Quick Access Toolbar, Ribbons, Info Center, Command Window, Graphical Area, Status Bar 1.3 CADD initial setting commands: Snap, grid, Ortho, Osnap, Dynamic input, Limits, Units, Ltscale, Object tracking. 1.4 Co-ordinate System- Cartesian and Polar, Absolute and Relative mode, Direct Distance Entry, UCS, WCS. 1.5 Object Selection methods- picking, window, crossing, fence, last and previous. 1.6 Opening, saving and closing a new and existing drawing.	Video Demonstrations Presentations Hands-on
2	TLO 2.1 Draw simple 2D entities using given draw commands. TLO 2.2 Apply formatting commands TLO 2.3 Determine coordinates, distance, area, length, centroid of the given 2D entity TLO 2.4 Use viewing commands.	**Unit - II Draw, Formatting, Enquiry and Zoom Commands** 2.1 Draw Command - Line, Polyline, arc, circle, rectangle, polygon, ellipse, spline, block, hatch. 2.2 Formatting commands - Layers, block, linetype, lineweight, color. 2.3 Enquiry commands – distance, area. 2.4 Zoom Commands – all, previous, out, in, extent, Realtime, dynamic, window, pan.	Video Demonstrations Presentations Hands-on

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.
3	TLO 3.1 Draw given complex 2D entities using relevant modify commands. TLO 3.2 Use grip command to manipulate given 2D entity.	**Unit - III Modify and Edit Commands** 3.1 Modify Command - Erase, trim, extend, copy, move, mirror, offset, fillet, chamfer, array, rotate, scale, lengthen, stretch, measure, break, divide, explode, align. 3.2 Editing Objects by Using Grips - Moving, Rotating, Scaling, Mirroring and Stretching.	Video Demonstrations Presentations Hands-on
4	TLO 4.1 Use various styles of dimensioning to drawn 2D entities. TLO 4.2 Apply Geometric and dimension tolerance symbols on the given entity. TLO 4.3 Write text on given 2D entity. TLO 4.4 Prepare table in drawing. TLO 4.5 Prepare new template for drawing as per requirement. TLO 4.6 Plot 2D entities using proper plotting parameters.	**Unit - IV Dimensioning, Text and Plot Commands** 4.1 Dimensioning commands - Dimension styles, Dimensional Tolerances and Geometrical Tolerances, Modify dimension style. 4.2 Text commands - dtext, mtext command. 4.3 Insert table – table, tablestyle command. 4.4 Template Drawing- Standard template, loading template, create new template. 4.5 Plotting a drawing – adding plotter/printer, page setup, plot style commands.	Video Demonstrations Presentations Hands-on
5	TLO 5.1 Prepare the drawing by circuit builder for given situation. TLO 5.2 Apply Modify Commands TLO 5.3 Insert components in the circuits. TLO 5.4 Apply Edit commands to the circuits	**Unit - V Schematic Components and Editing** 5.1 Circuit builder, insert pneumatic hydraulic and PID components command. 5.2 Edit, copy, Move, Delete, Scoot, Toggle, NO/NC, Reverse connector, Retag and Swap command. 5.3 Insert-Wire, Multiple bus, 3-phase, Source arrow, Ladder. 5.4 Edit-Wire number, Wire trim, Add rung, Strech wire, Toggle wire, Flip wire gap.	Video Demonstrations Presentations Hands-on

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 Use basic commands in CADD for given situation.	1	Basic settings of CADD software	4	CO1
LLO 2.1 Use of draw commands in CADD for given drawing . LLO 2.2 Draw given 2D entities in CADD using Draw commands individually.	2	*Drawing 2-D entities like Line, Polyline, Circle, Rectangle, Polygon and Ellipse by using CADD software.	4	CO1 CO2
LLO 3.1 Use formatting commands in CADD for given drawing. LLO 3.2 Draw given 2D geometries in CADD using Draw, Edit and Modify commands.	3	Drawing simple 2-D objects using any combination of 2 or more commands, like polygon+circle, line+circle, etc.	4	CO1 CO2

COMPUTER AIDED MECHATRONICS DRAFTING **Course Code : 314015**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Use draw commands in CADD for given objects . LLO 4.2 Draw 2D entities in CADD using Draw, Edit and Modify commands. LLO 4.3 Apply dimension and write text on 2D geometric entities for given drawing.	4	*Drawing complex 2-D objects like pulley, gear, hexagonal bolts, rivets etc.	4	CO1 CO2 CO3
LLO 5.1 Use basic setting commands in CADD for given situation. LLO 5.2 Draw given 2D entities in CADD. LLO 5.3 Apply dimension and write text on 2D geometric entities.	5	Drawing complex 2-D object like coupling, joints, valves, clamps etc.	4	CO1 CO2 CO3
LLO 6.1 Use basic construction commands in CADD for given object. LLO 6.2 Draw given 2D entities in CADD using first angle of projection . LLO 6.3 Apply dimension and write text on 2D geometric entities.	6	Drawing one problems of orthographic projections using first angle method of projection.	4	CO1 CO2 CO3
LLO 7.1 Use advance construction commands in CADD for given object. LLO 7.2 Draw 2D objects on sectional orthographic in CADD for given situation LLO 7.3 Apply dimension and write text on 2D geometric entities.	7	*Drawing one problem of sectional orthographic projections using First angle method of projection.	4	CO1 CO2 CO3
LLO 8.1 Use advance drawing commands in CADD for given drawing . LLO 8.2 Draw 2D assembly in CADD for given objects. LLO 8.3 Apply dimension and write text on given 2D geometric entities.	8	*Drawing an assembly drawing from the given detailed drawing showing assembly dimensions, part number and bill of Material.	4	CO1 CO2 CO3
LLO 9.1 Draw detailed 2D entities from given assembly in CADD. LLO 9.2 Apply dimension and write text on same 2D geometric entities.	9	Drawing working drawings from given assembly drawing showing conventional representation, dimensions, geometrical tolerances and machining symbols.	4	CO1 CO2 CO3
LLO 10.1 Draw 2D conventional representation for given parts. LLO 10.2 Apply dimension and write text on given 2D geometric entities.	10	Show conventional representation, dimensional, geometrical tolerances, surface finish symbols and bill of material in assembly drawing	4	CO1 CO2 CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Use basic commands in ECAD or Circuitmaker software. LLO 11.2 Draw electromechanical circuits using ECAD or Circuitmaker software.	11	*Drawing simple circuit diagram using circuit building commands.	4	CO1 CO2 CO3 CO5
LLO 12.1 Insert basic symbols in ECAD or Circuitmaker for given circuits. LLO 12.2 Draw electromechanical circuits using ECAD or Circuitmaker software.	12	Drawing and modifying simple circuit like SMPS use in computer / amplifier using Edit components command.	4	CO1 CO2 CO3 CO5
LLO 13.1 Insert electropneumatic symbols in ECAD or Circuitmaker for given circuits. LLO 13.2 Draw given electromechanical circuits using ECAD or Circuitmaker	13	*Drawing simple Electro-pneumatic circuit using insert pneumatic and PID components command.	4	CO1 CO2 CO3 CO5
LLO 14.1 Insert Electro-hydraulic symbols in ECAD or Circuitmaker for given circuits. LLO 14.2 Draw given electromechanical circuits using ECAD or Circuitmaker.	14	*Drawing simple Electro-hydraulic circuit using insert pneumatic and PID components command.	4	CO1 CO2 CO3 CO5
LLO 15.1 Use plot/page setup commands in CADD for given drawings. LLO 15.2 Create title block of the institute with institute logo.	15	Prepare a template for your institute of predefined paper size with title block and institute logo.	4	CO1 CO2 CO3 CO4
LLO 16.1 Use print and page setup commands in CADD for given drawings. LLO 16.2 Take printout of given drawings by using print/plot option.	16	*Plot the drawings from Sr. 2 to 14 on Paper with title block and institute logo	4	CO1 CO2 CO3 CO4

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)

Micro project

- Prepare a drawing of actual machine part or a circuit diagram in the given CADD software. The students maybe assigned a machine part in a group of 4-5 students by the faculty. The student can bring any part from a nearby industry or from the institute itself. The suggested list of machine parts or circuit diagrams is given below. The list is

suggestive and faculty can add any other similar micro projects. a. PCB metal box b. Switch board c. Ladder diagrams d. Domestic/ office/ institute laboratory/ Generator wiring diagram

Assignment

- Maintain a separate folder on Computer workstation allotted, in which all above mentioned practical's should be saved and will be submitted as a part of SLA.
- Collect at least one 2D drawing like production / lab or machine wiring / PLC / circuit drawings or layouts from their own institute or nearby workshops / industries / builders / contractors and develop them using computer aided drafting approach.
- Explain at least one problem drawn by the student for drafting to all batch colleagues. Teacher will assign the problem to be explained by student.
- Create groups of 5-6 students identified by the teacher. Assign different problems to each group. Assess at least one 2D drawing of one group by the students of other group and note down mistakes committed by the group. Selected students will also guide other students for correcting mistakes, if any.

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 judicial 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.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- 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	Networked Licensed latest version of Computer Aided Drafting software, Autocad 2021 or latest version, Ecad.	1,2,3,4,5,6,7,8,9,10,15
2	Circuit-Maker freeware for PCB design	11,12,13,14,15
3	Plotter/Printer with latest versions (A3/A4 size) Laserjet	16
4	CAD workstation with latest configurations for each student. Microsoft Windows 10 or above, with minimum i5 Processor (2.5 GHz) , 8 GB RAM ,512 SDD	All
5	LCD projector with at least 4500 lumens and aspect ratio 16:10. OR Screen/ Interactive board.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Termwork Each practical will be assessed considering - 60% weightage to process and - 40% weightage to product Continuous assessment based on process and product related performance indicators, laboratory experience. The

students maybe given actual problems from laboratories like generator wiring, hydraulic/ pneumatic circuits of any equipment in the laboratory.

Summative Assessment (Assessment of Learning)

- Practical Exam of 25 marks.

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	2	1	1	2	-	-	3			
CO2	2	1	1	2	-	-	3			
CO3	2	1	1	2	-	2	3			
CO4	2	2	2	2	2	2	3			
CO5	3	2	2	2	-	2	3			

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	Prof. Sham Tickoo	AutoCAD 2021 for Engineers & Designers, Basic & Intermediate	BPB Publications, New Delhi 21 February 2021, ISBN: 978-9389898989
2	Sankar Prasad Dey	Autocad 2014 for Engineers Volume 1	Vikas Publications, New Delhi 21 December 2021, ISBN: 978- 9325983373
3	Prof. Sham Tickoo	AutoCAD 2024: A Problem-Solving Approach, Basic and Intermediate	Dreamtech Press publication, New Delhi August 20, 2023, ISBN:1640571778
4	Kulkarni D. M.	Engineering Graphics with AutoCAD	Prentice Hall India Learning Private Limited, New Delhi 1 January 2010, ISBN: 978-8120337831
5	CADfolks	AutoCAD 2021 For Beginners	Kishore Publication, New Delhi, 5 May 2020, ISBN: 978-8194195399
6	Luke Jumper, Randy H. Shih	AutoCAD 2024 Tutorial First Level 2D Fundamentals	SDC Publication, Kansas City USA June 27, 2023, ISBN: 978-1-63057-585-4
7	Sharad K. Pradhan, K K Jain	Engineering Graphics , AICTE Prescribed Textbook	Khanna Book Publishing, New Delhi First Edition, 1 January 2023, , ISBN:978-9391505509
8	MicroCode Engineering, Inc.	Circuitmaker User Manual	MicroCode Engineering, Inc. First edition, 1988-89

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.cadtutor.net/	Tutorials, articles, forums and downloadable resources covering various CAD software applications.
2	https://ocw.mit.edu/courses/mechanical-engineering/	Lectures, assignments and projects covering topics such as engineering design, CAD/CAM, and product development.
3	https://www.youtube.com/watch?v=cmR9cfWJRUU	Introductory tutorial for beginners to AutoCAD, covering topics such as interface navigation, basic drawing commands and setting up units and layers.
4	https://www.youtube.com/watch?v=QuR-VKis3jU	2D mechanical drawings in AutoCAD, including drawing parts, adding dimensions, annotations and creating detailed technical drawings.
5	https://www.youtube.com/watch?v=IWYKfzx-M1E	2D mechanical drawings in AutoCAD, including drawing parts, adding dimensions and annotations, and creating detailed technical drawings.
6	https://www.youtube.com/watch?v=N5VThCFG0Bs	Complete guide for learning Circuitmaker software.

Note :

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