09-12-2025 10:36:10 AM

RAPID PROTOTYPING SYSTEMS **Course Code : 315008**

Programme Name/s : Mechatronics

Programme Code : MK

Semester : Fifth

Course Title : RAPID PROTOTYPING SYSTEMS

Course Code : 315008

I. RATIONALE

Rapid prototyping methods are vital in modern engineering, manufacturing, and design because they allow ideas to be quickly transformed into functioning prototypes. This topic teaches diploma students skills such as solid modeling and 3D printing of cost-effective components. It prepares students to flourish in industrial situations by encouraging creativity, efficiency and practical problem-solving skills.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply Rapid Prototyping systems to produce cost-effective 3D printed components.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Develop a 3D solid model for a given drawing.
- CO2 - Select a relevant rapid prototyping process.
- CO3 - Select relevant material for manufacturing of prototype.
- CO4 - Develop the given prototype by using the FDM 3D printing process.

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	
315008	RAPID PROTOTYPING SYSTEMS	RPS	DSC	2	-	4	-	6	2	-	-	-	-	-	50	20	50#	20	-	-	100

RAPID PROTOTYPING SYSTEMS **Course Code : 315008**

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.* 10 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 Select relevant parametric solid modeling software with justification. TLO 1.2 Choose sketcher tools for 2D Drawing. TLO 1.3 Use different modeling tools for 3D Drawing. TLO 1.4 Identify different steps of 3D models for the parts of the given assembly with minimum tree.	**Unit - I Solid Modeling for Rapid Prototyping** 1.1 Overview of parametric solid modeling software 1.2 Drawing/Sketcher, Editing, modify tools: Line, Rectangle, Circle, Trim, Spline, Mirror, etc. 1.3 Dimensioning constraint and Geometrical constraint. 1.4 Part tool: Extrude, Hole, Revolve, Rib, Sweep, swept blend, Pattern, etc. 1.5 Part Editing tool: Trim, Extend, Erase, Mirror etc. 1.6 Part Modify tool: Chamfer, Round, Copy, Move, Draft, etc.	Chalk-Board Presentations Video
2	TLO 2.1 Explain the concept of Rapid Prototyping. TLO 2.2 Select relevant rapid prototyping process with justification.	**Unit - II Introduction to Rapid Prototyping** 2.1 Definition and the concept of Rapid Prototyping (Additive Manufacturing) 2.2 Differences between AM and traditional manufacturing, advantages and limitations. 2.3 Types of Additive Manufacturing Technologies : Stereolithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modeling (FDM), Digital Light Processing (DLP) , Electron Beam Melting (EBM), Laminated Object Manufacturing (LOM) . Applications, advantages and limitations 2.4 Introduction to 3D Scanner	Chalk-Board Video Presentations

RAPID PROTOTYPING SYSTEMS **Course Code : 315008**

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 Explain the FDM process cycle. TLO 3.2 Select relevant material in the FDM printing process. TLO 3.3 Explain working of the FDM 3D printer and its Parts.	**Unit - III FDM 3D Printing** 3.1 Introduction to the FDM Process 3.2 Generic FDM Process cycle 3.3 Materials for FDM Process PLA, PETG, Nylon, ABS etc. Applications, advantages and limitations 3.4 Working of FDM 3D printer and its Parts- Nozzle, Print Bed, Belts, Motors etc.	Chalk-Board Video Presentations
4	TLO 4.1 Select printing parameters for creating parts. TLO 4.2 Apply post processing operations on 3D printed parts.	**Unit - IV Software and Post processing** 4.1 Overview of Printing Software (Slicer) 4.2 Basic printing process parameters : Layer Height, Shell thickness, Infill Density, Infill Pattern etc 4.3 Post processing : Support removal and Surface Finishing, Painting etc.	Chalk-Board videos Presentations

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 Draw Circle, Rectangle, ellipse and simple 2D component using sketcher commands.	1	*Use the sketcher command to draw simple 2D components.	2	CO1
LLO 2.1 Draw Simple 2D components using Trim, Mirror, move, copy commands.	2	*Use the Modify command to draw simple 2D components.	2	CO1
LLO 3.1 Draw Universal coupling using 2D sketcher commands.	3	Use 2D sketcher commands to draw a given component.	2	CO1
LLO 4.1 Develop 3D model of Cylinder, cube, rectangular plate using 3D modeling commands.	4	*Draw component using 3D modeling commands.	2	CO1
LLO 5.1 Develop 3D model of tool post using 3D modeling commands.	5	*Draw 3D model of assembly-1 using basic commands.	2	CO1
LLO 6.1 Develop 3D model of Drill jig using 3D modeling commands.	6	Draw 3D model of assembly-2 using basic commands	2	CO1
LLO 7.1 Develop a 3D model of Oldham's coupling using 3D modeling commands.	7	Draw a 3D model of assembly-3 using basic commands.	2	CO1
LLO 8.1 Develop a 3D model of Universal coupling using 3D modeling commands.	8	*Draw 3D model of assembly-4 using basic commands.	2	CO1
LLO 9.1 Identify different Rapid prototyping processes to prepare prototype models and give justification.	9	Rapid prototyping process	2	CO2
LLO 10.1 Identify different filament materials for FDM 3D printing and give justification.	10	FDM 3D Printing filament	2	CO3
LLO 11.1 Tessellation of CAD file to STL file using printing parameters	11	*Convert the CAD model and configure print settings for optimal results.	2	CO4
LLO 12.1 Apply Print-Bed Calibration and load filament	12	*Print-bed calibration and loading of the filament.	2	CO4

RAPID PROTOTYPING SYSTEMS **Course Code : 315008**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 13.1 Develop the 3D print model of the cube using PLA filament.	13	Print a 3D model of a Solid component	2	CO4
LLO 14.1 Develop a 3D model of any sliding pair of square blocks and square bars using PETG /ABS/Nylon filament.	14	*Print sliding pair using FDM 3D print model.	2	CO4
LLO 15.1 Develop a given Gear Pair 3D print model using different filaments. PETG /ABS/Nylon filament	15	Print FDM 3D model of any Gear Pair.	2	CO4
LLO 16.1 Generate support for curved overhang model	16	Print curved overhang model using FDM 3D printer.	2	CO4
LLO 17.1 Generate support for the square overhang model	17	*Print Square Overhang model using FDM 3D printer	2	CO4
LLO 18.1 Apply Post process to the 3D printed object.	18	Post-process operations to the overhang prototype.	2	CO4
LLO 19.1 Develop ASTM D 638 Tensile Test specimen using PLA filament.	19	*Print the given ASTM D 638 3D print model.	2	CO4
LLO 20.1 Develop Knuckle Joint 3D print model using PLA filament.	20	Print Knuckle Joint 3D model.	2	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) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Hardware: FDM 3D Printer	8,9,10,11,12,13,14,15,16,17,18
2	Software: 3D printing software (slicing software).	8,9,10,11,12,13,14,15,16,17,18
3	Filament PLA, PETG, Nylon, ABS	8,9,10,11,12,13,14,15,16,17,18
4	Hardware: Personal Computer, (i3/i5 or higher),RAM min.4GB.Display wide screen preferable	All
5	Operating system: Windows 7/ Windows 8/ Windows 10 or Higher.	All
6	Software: Any parametric solid modeling software	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	Solid Modeling for Rapid Prototyping	CO1	5	0	0	0	0
2	II	Introduction to Rapid Prototyping	CO2	6	0	0	0	0

RAPID PROTOTYPING SYSTEMS **Course Code : 315008**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
3	III	FDM 3D Printing	CO3	5	0	0	0	0
4	IV	Software and Post processing	CO4	4	0	0	0	0
Grand Total				**20**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Lab Wok , Viva

Summative Assessment (Assessment of Learning)

- Practical Exam

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	2	1	1	-	1			
CO2	3	2	2	-	1	-	1			
CO3	3	2	2	-	1	-	1			
CO4	3	2	2	-	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	Prof. Sham Tickoo	CATIA V5-6R2023 for Designers	CADCIM Technologies, 21 st Edition 2024,ISBN:-978-1640572409.
2	Prof. Sham Tickoo	Solid Edge ST10 for Designers	BPB,15 th Edition, 2018, ISBN:-978-9387284104.
3	Prof. Sham Tickoo	SOLIDWORKS 2023 for Designers	CADCIM Technologies, USA, 21st edition, 2024, ISBN:-978-1-64057-172-3
4	Ian Gibson, David W. Rosen, Brent Stucker.	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing	Springer, 2nd Edition, 2014, ISBN:-978-1493921133

RAPID PROTOTYPING SYSTEMS **Course Code : 315008**

Sr.No	Author	Title	Publisher with ISBN Number
5	Ben Redwood, Mr.Filemon Schoffer, Mr.Brian Garret.	The 3D Printing Handbook: Technologies, design and applications	3D Hubs, First Edition, 2017, ISBN:-978-9082748505
6	Sheku Kamara, Kathy S. Faggiani	Fundamentals of Additive Manufacturing for the Practitioner	Wiley, First addition 2021, ISBN:-978-1-119-75038-3
7	Tyler Kerr	3D Printing Introduction to Accessible, Affordable Desktop 3D Printing	Springer Cham, First addition 2022, ISBN978-3-031-19352-1
8	Gary C. Confalone, John Smits, Thomas Kinnare	3D Scanning for Advanced Manufacturing, Design, and Construction	Wiley, First addition,2023 ISBN: 978-1-119-75851-8

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=vjX4PDJcFOI	Solid Modeling
2	https://www.youtube.com/watch?v=t7yv4gSnNkE	Fundamentals of Additive Manufacturing Technologies
3	https://www.youtube.com/watch?v=9JTRqfNAqhM	Introduction to Additive Manufacturing
4	https://www.youtube.com/watch?v=htMr1oFE7Zg	CAD Models for Additive Manufacturing

Note :

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