GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2023 (COGC-2023)
Semester-V

Course Title: Mechatronics Engineering Project-I
(Course Code: 4352003)

Diploma program in which this course is offered	Semester in which offered
Mechatronics Engineering	5th Semester

1. RATIONALE

This course enables the students to exercise some of the knowledge and/or skills developed during the programme to new situation or problem for which there are number of engineering solutions. This course includes a planning of the project which is to be completed within the time allocated, the maintenance of a log bookand the preparation of a report. The report contains the reasons for all decisions taken. This course also aims to develop the managerial skills such as leadership, coordination, team work, supervision skills, planning the resources, etc. Thus by studying this course, abilities like innovativeness, creativity, imitativeness, performance qualities, etc. are developed in students.

2. COMPETENCY

The course content should be taught and implemented to develop different skills so that students can acquire the following competency.

a. Apply innovative, creative and logical approach for problem identification.
b. Plan, Use, Monitor and Control resources optimally and economically.

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge, and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

CO	CO Statement
CO-1	Perform various tasks like market survey, industrial visits, creative & innovative techniques, etc to identify project.
CO-2	Select the problem and outline the conceptual model of its solution.
CO-3	Modify the conceptual model of a solution based on safety, quality, cost or sustainability & environmental responsibility.
CO-4	Prepare plans and estimates for the solution and Project-I report.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
0	0	4	2	0	0	50	50	100

Legends: L-Lecture; T– Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, CA - Continuous Assessment; ESE-End Semester Examination.

5. SUGGESTED PRACTICAL EXERCISES

Following practical outcomes (PrOs) are the subcomponents of the Course Outcomes (COs). Some **POs** marked **'*'**are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to the 'Psychomotor Domain.'

A project awareness program will be arranged at the end of semester IV or well before the start of semester-V to initialize the Project-I activities. Showcase them previously completed projects. Activities are mentioned in exercise-01 may be completed during the project awareness program. During this program students should be guided to follow the following steps to gather the data about the problem.

1. Refer to the curriculum of courses Mechatronics Engineering Project-I and Mechatronics Engineering Project–II. Check with local companies or industries to see if they have any projects that student can work on.
2. If required; seek advice from faculties/guides, industry professionals and/or anybody who have expertise in the field of mechatronics engineering. They can guide them in finding suitable projects and even suggest potential project topics. If interested, they may attend workshops or seminars related to Mechatronics engineering projects to learn about the latest trends and techniques used in this field.
3. If required; start by conducting a thorough research in the field/industry or explore online platforms to get an idea of what type of mechatronics engineering projects are currently being done. Look for relevant resources such as journals, websites, and blogs that focus on mechatronics engineering projects.

Exercise No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs.
01	**Data collection for the project:** a. Understand the importance of a project. b. Overview the previously completed projects. c. Understand Project domains/areas and project constraints. d. Understand Dos and Don'ts in context of the project. e. Understand product design criterion and parameters on which the performance of a product depends. f. Conduct a site visit or literature survey to gather the information for the problem selection. g. Record key findings and/or collect key data about the problem from the visit or literature survey.	-	16

Exercise No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs.
	Note: 1. This exercise will be done by each student, individually. 2. Students may work on any real life problem connected with the mechatronics engineering domain. It may be a User Defined Problem (UDP) or live problem from industry (IDP). Extension or modification of existing product/project should be allowed. It should not necessarily be a physical model only.		
02	**Project Selection.** Refer to the data collected during an exercise-01 and do the following. a. Finalize Project-I groups and discuss findings of exercise-01 of each group member. b. Prepare a group's work allocation schedule (planned and actual) covering all the milestone activities/ tasks of the project for the entire term duration. c. Explanations of following aspects 1) Determination of logic 2) Market survey and Feasibility using the infrastructure of the Institute. 3) Making of relevant drawing/drafting. 4) Incorporating major manufacturing processes if possible. 5) Non repetitive in nature 6) To develop the generic as well as technology related skills. 7) Having measurable and analytical and results. 8) Innovative in nature d. Apply relevant product/system design and management technique like Root Cause Analysis (RCA), Fault Tree Analysis (FTA), Ishikawa (Fishbone) Diagram, Pareto Analysis, Statistical Process Control (SPC), Design of Experiments (DOE), Value Stream Mapping (VSM), Simulation and Modeling, 5-S strategies, 7-S framework, SWOT analysis, Life Cycle Management (LCM), Lean Manufacturing, Six Sigma, Total Quality Management (TQM) etc and outline the conceptual model of the solution with key data. And Computer programming software C, C++, Python, SQL etc. e. Prepare project definition. f. Project model Components. Explanation of components that may be used in project: 1) Sensor (limit switch, Proximity, LDR, etc..) 2) Use logic through programmable IC (micro controller) or Language base. 3) Motor (DC, Stepper, AC, RC-Servo). 4) Digital gates. 5) Seven segment led or LCD as a display device. 6) Hydraulic and pneumatic components 7) P.L.C. Note:	-	12

Exercise No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs.
	1. Student's group size will preferably be in a range of 3 to 5; based on the project's requirement. 2. Interdisciplinary groups may be allowed as per the project's demand. 3. Each project group will be assigned a guide. Preferably, all or majority of the department's faculties should be assigned duty of Project-I guide-ship.		
03	**Plans & estimates of the project.** Refer to the details collected during an exercise-01 and 02 and do as directed below, whichever is applicable. a. Prepare user manual containing project specifications. b. Prepare detailed and assembly production drawings. c. Prepare Operation Process Chart (OPC), Process plans, Quality/test plans, Statement of Bought-out parts, Statement of Raw material, Budget estimation and any other relevant documents.	-	16
04	**Project-I report.** a. Prepare a computerized project report with following guidelines. PAGE : A4 (print both side) MARGIN : TOP 15mm BOTTOM 15mm INSIDE & OUTSIDE 30mm (mirror margining) FONT : ARIAL FONT SIZE: TITLE:12 BOLD, CONTENT:12, SPACING :18pt HEADER: PROJECT TITLE, PAGE No ON TOP RIGHT. FOOTER : ACADEMIC YEAR, SHORT NAME **SAMPLE FORMAT OF PROJECT-I REPORT** • The Report may include the following. Text shown in the square bracket [ ] is an explanation on the chapter/topic. Certificate (in the Format given in Appendix-C) Acknowledgement **Index** 1. Abstract: [A brief summary of the project, including its objectives, methodology, and results.] 2. Introduction: [An introduction to the project, including its background and scope.] 3. Literature Review: [A review of the existing literature related to the project, including any relevant theories or concepts. This may include Prior Art Search.] 4. Methodology: [A description of the research methodology used in the project, including data collection and analysis methods.] 5. The Outline of the solution: [This may include output of exercise-01 to 03] 6. Results and Discussion: [A presentation of the project's probable results, including any statistical analysis, charts, or graphs. This	-	12

Exercise No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs.
	section should also include a discussion of the results and their implications.] 7. Conclusion: [A summary of the project's main findings.] 8. Recommendations: [Suggestions for future research or improvements.] 9. References: [A list of all sources cited in the report.] 10. Appendices: [Any additional materials that support the report, such as photographs, technical drawings, circuits, software or data sets.] b. Print Project-I report in required number of copies, after guide's approval. c. Submit Hard/soft copy: Project-I report, Project-I Logbook, Additional records referred in appendices, if any. Note: 1. Each project group will present their work after completion of each exercise as per department's plan. 2. Projects may be showcased in Institutional/regional level events.		
Total (Hours)		**-**	**56**

Note:

I. More **Practical Exercises** can be designed and offered by the concerned course teacher to develop the industry-relevant skills/outcomes to match the COs. The above table is only a representative list**.**

II. Care must be taken in assigning and assessing the study report as it is a Second-year study report. The study report, data collection, and analysis report must be assigned to a group. A teacher has to discuss the type of data (which and why) before the group starts their market survey.

The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above-listed **Practical Exercises** of this course required, which are embedded in the COs and ultimately the competency.

6. Sample rubrics Performance Indicators for the PrOs

Criteria	%	Excellent (90-100%)	Good (75-89%)	Average (50-74%)	Poor (0-49%)
Logbook	10%	Always maintains proper order of meetings and assigned tasks	Consistently maintains proper order of meetings and assigned tasks	Sometimes maintains proper order of meetings and assigned tasks	Rarely maintains proper order of meetings and assigned tasks
Literature Survey	10%	Always lists journals, websites etc. and generate idea with scope of	Consistently lists journals, websites etc. and generate idea with scope of	Sometimes lists journals, websites etc. and generate idea with scope of	Rarely lists journals, websites etc. and generate idea with scope of

		product	product	product	product
Concept development and finalization of topic	10%	Always compares existing concepts and derives final topic	Consistently compares existing concepts and derives final topic	Sometimes compares existing concepts and derives final topic	Rarely compares existing concepts and derives final topic
Drawings, plans and estimates	20%	Always provides required no. of views of each part with required details in detail and assembly drawings and prepare necessary plans & estimates	Consistently provides required no. of views of each part with required details in detail and assembly drawings and prepare necessary plans & estimates	Sometimes provides required no. of views of each part with required details in detail and assembly drawings and prepare necessary plans & estimates	Rarely provides required no. of views of each part with required details in detail and assembly drawings and prepare necessary plans & estimates
Budget Analysis	10%	Always list parts used in the assembly and costing with competitive rates	Consistently list parts used in the assembly and costing with competitive rates	Sometime list parts used in the assembly and costing with competitive rates	Rarely list parts used in the assembly and costing with competitive rates
Presentation	10%	Always discuss all content with outline and methodology used	Consistently discuss all content with outline and methodology used	Sometime discuss all content with outline and methodology used	Rarely discuss all content with outline and methodology used
Report write-up	10%	Always preparer basic category/section and summary	Consistently preparer basic category/section and summary	Sometime preparer basic category/section and summary	Rarely preparer basic category/section and summary
Conclusion, Future Scope	10%	Conclusion and future scope derived appropriately	Conclusion and future scope derived but partial	No relevant conclusion or future scope	No conclusion or future scope

7. MAJOR EQUIPMENT/INSTRUMENTS REQUIRED

Sr.No.	Equipment Name	PrO.No.
1.	Computer with word processor and modeling software	4

8. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above COs and PrOs. More can be added to fulfill the development of this course competency.

a. Work as a leader/team member.
b. Follow safety practices.
c. Follow ethical practices
d. Maintain tools and equipment
e. Practice environment-friendly methods and processes.(Environment Related)

9. SOFTWARE/LEARNING WEBSITES

- https://www.theengineeringprojects.com/
- https://asmedigitalcollection.asme.org/mechanicaldesign
- https://blog.creationcrate.com/mechanical-engineering-projects/
- https://plagiarisma.net/
- https://howtomechatronics.com/category/projects

10. PO-COMPETENCY-CO MAPPING

Semester V	POs						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
Competency & Course Outcomes	Basic & Discipline-specific knowledge	Problem Analysis	Design/development of solutions	Engineering Tools, Experimentation & Testing	Engineering practices for society, sustainability & environment	Project Management	Life-long Learning
Competency	Apply systematic approach for problem selection and provide its safer, qualitative, cost effective or sustainable solution.						
Perform various tasks like market survey, industrial visits, creative & innovative techniques, etc to identify project..	3	-	-	-	-	2	2
Select the problem and outline the conceptual model of its solution.	2	2	-	-	2	2	2
Modify the conceptual model of a solution based on safety, quality, cost or sustainability & environmental responsibility.	3	2	3	2	3	2	2
Prepare plans and estimates for the solution and Project-I report.	-	-	-	2	-	2	2

Legend:'3' for high, '2' for medium, '1' for low, and '-'for no correlation each CO with PO.

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE (GTU Resource Persons)

Sr. No.	Name and Designation	Institute	Contact No.	Email
1.	Hitesh J Soni, Lecturer Mechanical Engineering	BBIT, V. V. Nagar	9924177967	hjsoni@bbit.ac.in
2.	Bhavesh V Patel, Lecturer Mechanical Engineering	BBIT, V. V. Nagar	9925232822	bvpatel@bbit.ac.in

12. BOS Resource Persons

Sr.No.	Name and Designation	Institute	Contact No.	Email
1	Dr. S. H. Sundarani, BOS Chairman & HOD Mechanical	Government Polytechnic, Ahmadabad	9227200147	gpasiraj@gmail.com
2	Dr. Rakesh D. Patel, BOS Member & HOD	B. & B. Institute of Technology, V. V.	9825523982	rakeshgtu@gmail.com

	Mechanical	Nagar		
3.	Dr. Atul S. Shah, BOS Member & Principal	B. V. Patel Institute of Technology, Bardoli	7567421337	asshah97@yahoo.in

Appendix-A

SAMPLE LOGBOOK

Enrolment No: Name of the Student:

Date: Time from: to (Total hrs)

Place/s of work or visit:	
Detailed description of work done:	
Name of concerned person/s, if any	
Document/s referred, collected, created or modified, if any	
Financial details, if any	
Student's dated sign	Guide's dated sign

Appendix-B

PROCESS PLAN

Drawing No: Part No/Id: Name of the Part:

Raw material: Raw wt: Finish wt:

Op. No	Name of Operation	Size, tol., surface finish etcreq'd	Machine details	Machining Parameters	Cutting Tools, Jig/ Fixture, coolant etcreq'd	Measuring, inspection, Test instruments required	Time in Hr	
							Set-up	machining

Student's dated sign Project guide's dated sign

Appendix-C

SAMPLE CERTIFICATE

This is to certify that Enrolment No: _____

Mr./Ms._____

from_____College has completed Mechatronics Engineering Project-I Report of Semester-V having title _____in a group consisting of _____ students under the guidance of the Faculty Guide _____ in the academic year: _____

The mentor from the industry for the project, if any:

Name:

Industry:

Contact Details:

Institute Guide Industry Guide Head of Department