GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-VI

Course Title: Electrical Engineering Project-II
(Course Code: 4360906)

Diploma programme in which this course is offered	Semester in which offered
Electrical Engineering	6th Semester

1. RATIONALE

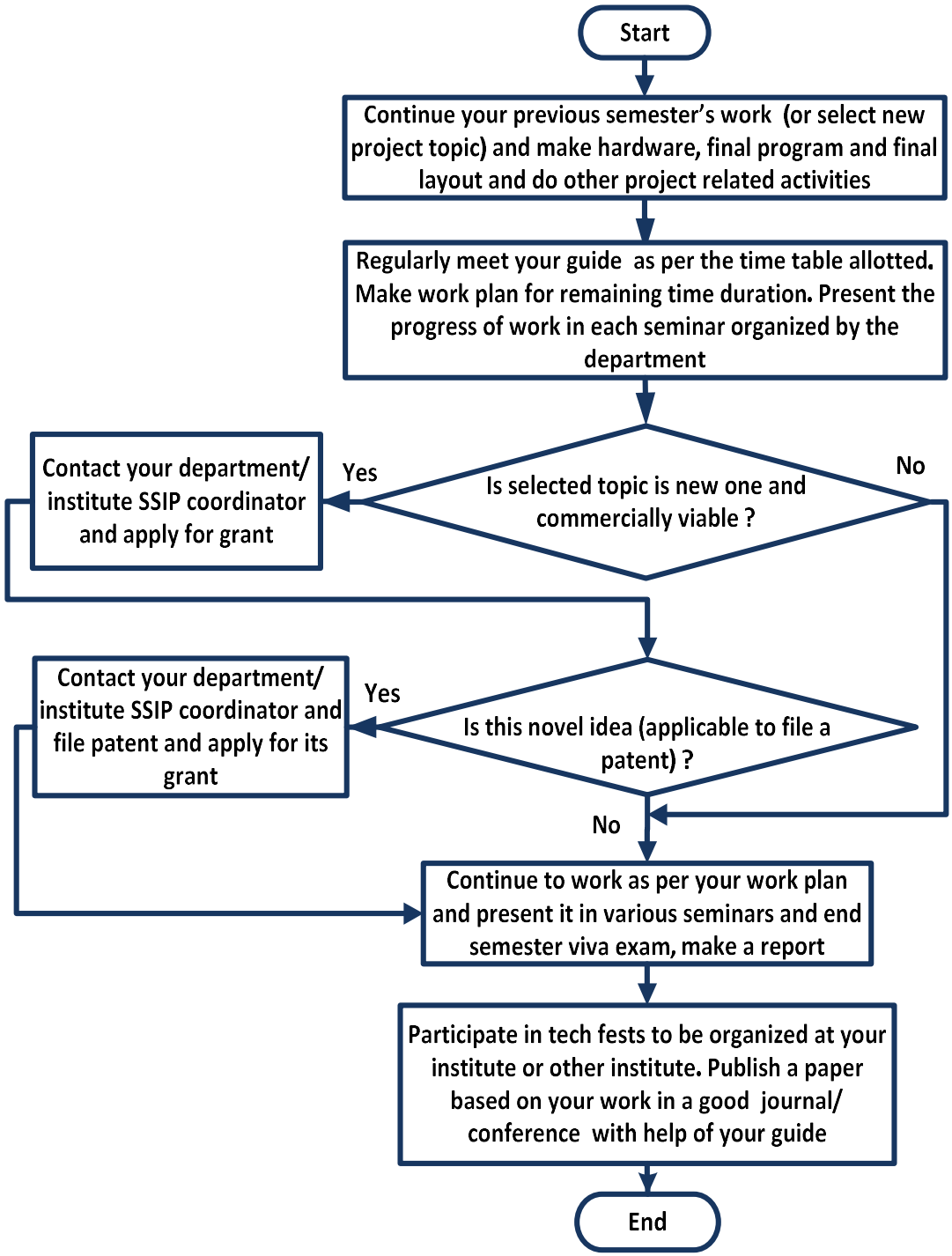
To provide an opportunity to the students for applying the knowledge and technical skills acquired by identifying real life problem of the industries /research organization / society as a whole and providing its innovative solution with implementation, which is economically and technically viable.

In this course - **Electrical Engineering Project-II,** the problem is already identified in 5th semester (or to be identified) for providing solution under the mentoring of the institute guide/industry mentor to develop various competencies. This course is designed to provide virtual industrial experience to the students. This course includes summarizing of the work done in the previous semester (or identify a new problem and start the work), trouble shooting of the project work, testing and assembling of the project, report writing and presenting the final model. Four seminars are included in this course to develop communication skills along with other competencies in students as well as to assess the progress of the work done. This course advocates a holistic student entrepreneurship approach, including startup initiation, grant funding, and patent protection, in alignment with India's self-reliance mission.

Project identification and guide allocation:

- Before the start of the sixth semester, project orientation should be held every year by the project coordinator. In this orientation, discussion regarding the selection of a topic (if the work of this semester is not in continuation with the 5th semester's work), the formation of a team, and the selection of a guide (**if it is required to change**) should take place.
- A list of guides with their expertise domain and area of interest should also be given to students.
- This list should also be uploaded to the departmental/institutional website.
- Students should also be given the choice to choose a guide whose area of interest matches with their project domain.
- Students can continue their work from fifth semester's work or select new topic and continue the work.

- The ongoing process and other related tasks are summarized in the following flow chart.



During 6th semester, students should have to follow these steps for project related work:

1) Create actual PCB in laboratory from layout. You may take help of your guide/expert.
2) Component mounting/soldering/wiring practice.
3) Visit the industry related to your work regularly.
4) Get help from guide/Innovation council/research organization to implement method/strategy selected.

5) Report to institute guide/industry mentor regarding stage wise progress regularly.
6) Continue testing and debugging of software with diverse tools to achieve an error-free and efficient compact solution.
7) Write algorithm and draw a flowchart (particularly if project work is based on Microprocessor/Microcontroller).
8) Simulate the circuit (if required).
9) Prepare project report (as per format given by department/available on departmental website).
10) Prepare PPT for presentation (**for various seminars as well as final presentation - at the end of the semester conducted for progressive assessment**).
11) If the project is innovative, explore grant opportunities to support the establishment of a new startup.
12) With help of SSIP coordinator examine intellectual property rights for the purpose of patenting the project.

2. COMPETENCY

The course content should be taught with the aim of developing various skills, enabling students to acquire the following competencies

1 To develop inquisitiveness, innovative skills, and confidence to work independently.
2. To participate effectively in group work.
3. To collect relevant data.
4. To plan and organize the work.
5. To analyze and synthesize the data.
6. To relate knowledge of various courses in a selected problem.
7. To make an appropriate decision whenever it is required.
8. To conduct a survey and investigation.
9. To solve industry problems.
10. To optimize the cost of the project.
11. To design the layout as per requirement.
12. To prepare block diagram, circuit diagram, simulation model and microcontroller program as per requirements.
13. To assess the financial implication and feasibility of the project.
14. To troubleshoot the faults during assembling and testing.
15. To modify the component/system whenever it is required.
16. To prepare the technical report and ppt.
17. To present the work as individual and team.

18. To publish a paper in a good journal/ conference based on the work.
19. To prepare a comprehensive plan for startup grants and consult a SSIP coordinator/patent attorney to identify eligibility of the project work for filing a patent.

3. COURSE OUTCOMES (COs)

CO.1 Summarize the work done in previous semester.

CO.2 Troubleshoot the faults during assembling procedure.

CO.3 Execute testing of project after assembling of final hardware to verify the result.

CO.4 Modify the components of the project, if required.

CO.5 Defend final review with hardware model, report writing, presentation as individual and team.

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. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This major equipment with broad specifications is a guide to procure them by the administrators to use in the laboratory dedicatedly made for the project work.

Sr.No.	Equipment Name with Broad Specifications
1	Dual channel D.C. supply, 0-30 Volt, 2 Amp with display
2	**Tool kits** that include spanners, screw drivers of various size, measuring tape, drilling machine, tester, multi meter, clip on meter, hammer, hack saw, flux, pliers, nose pliers, insulation tape etc.
3	Dual channel Digital Storage Oscilloscope
4	10 MHz function generator
5	Miscellaneous components like Diode, Transistor, Step down Transformers, LED, Relay, various analog digital and microcontroller ICs, soldering irons, soldering wire, connectors, wires, general purpose PCBs and other items required for offered projects as per requirement
6	Lamp load 3-phase 415 V, 0-10 A.
7	Single-phase, Three-phase supply panels with suitable measuring instruments

Sr.No.	Equipment Name with Broad Specifications
8	Microcontroller Programming Software/ Integrated Digital Environment as per requirement
9	Simulation software like MATLAB, PSIM, Proteus etc. as per requirement
10	PCs having latest specifications as per the requirements of the students
11	LCD/LED projectors to be used for presentation in seminars

6. AFFECTIVE DOMAIN OUTCOMES

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

a. Work as a leader/a team member (while doing a project work).
b. Follow safety practices while using D.C. and AC supply and electrical equipment.
c. Work as a group member (while assembling, testing and presenting the project)
d. Practice environmentally friendly methods and processes. (Environment related)

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

7. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency. (**Overall work of Electrical Engineering Project-II should be done in following steps**)

Unit	Unit Outcomes (UOs)	Topics and sub topics
Unit-I Summarize the work done in previous semester.	1a. Monitor the entire work and check the progress of whole work considering the work plan made in previous semester. 1b. Do multiple task (e.g. provide safety/protection/control for electrical power system/ machines) use micro controller. 1c. To make the application smarter use IOT approaches (If it is necessary).	1.1 By adapting innovative/creative ideas try to make the model as per industry standard. 1.2 If applicable and/or feasible try to use microcontroller/microprocessor to control the process. 1.3 Adapt smarter techniques to control the power/process (e.g. control the power/process using WiFi/Bluetooth/SMS etc.).

		1.4 Create Printed Circuit Board/Panel.
Unit-II Troubleshoot the faults during assembling procedure.	2a. Identify components with required ratings. 2b. Select appropriate method/process to make the working model. 2c. Prepare program for microcontroller (if required) as per the algorithm made in previous part of the project. 2d. Divide the work of hardware as well as software among the team as per the ability of each student. 2e. Identify the faults and trouble shoot it while assembling.	2.1 Verify Component ratings and Specifications. 2.2 Develop program in Assembly/high level language (if it is required). 2.3 Do Mounting, Soldering and wiring. 2.4 Make final design for model/panel that requires less space. 2.5 Do continuity test for PCB tracks/wiring. 2.6 Start to make final program as per algorithm. 2.7 Assemble hardware and check. 2.8 Trouble shoot the faults if arises.
Unit-III Execute testing of project after assembling of final hardware to verify the result.	3a. Test the project 3b. Acquire results to check whether any changes are necessary or not.	3.1 Analyze and test the hardware after loading the software (if microcontroller is used). 3.2 Check and modify program of microcontroller (if necessary). 3.3 Complete remaining fabricating, soldering and wiring of hardware after testing.
Unit-IV Modify the components of the project, if required.	4a. Make the final model as per the requirement. 4b. Care for safety while using/demonstrating it. 4c. Make the model as per the industry standard (if possible). 4d. Modify the components (and microcontroller program also if required) while doing above three steps.	4.1 Design final layout. 4.2 Arrange different sections/parts logically and properly. 4.3 fabricate and construct final model as per industry standard (if possible). 4.4 Modify the components if is found necessary in previous stages. 4.5 Modify the microcontroller program also (if required) if is found necessary in previous stages.

Unit-V Defend final review with hardware model, report writing, presentation as individual and team.	5a. Complete the work of making the model and give final touch to it. 5b. Prepare the final report of whole work. 5c. Mention future scope of the work done in the report. 5d. Prepare the final presentation. 5e. Take part in the relevant competition, conference, symposium etc. 5f. Prepare and publish a paper.	5.1 Finish the work of hardware and programming (if required). 5.2 Prepare project report as per institute/GTU guideline. 5.3 At last portion of report/presentation, mention the future scope of the work done. This may give proper direction to other students/industries to work further/better on the selected and/or similar topic. 5.4 Prepare PPT and present as per schedule. 5.5 Demonstrate the work with model and ppt. 5.6 Take part in various competitions (like conference, symposium hackathon, ideathon, model making competition and SSIP events) arranged by GTU or any other institutes/ organizations. 5.7 Prepare a research paper (if it is appropriate and advisable) based on the work done with help of your guide and present it in a good journal/ conference. 5.8 Apply for grant to SSIP or other funding agencies and protect the work by applying for a patent if it is required and advisable.

Note:- *Departmental SSIP (Student Startup Innovation Policy) team may check each project and may decide whether any project is appropriate for SSIP scheme or not. If project is found viable for that, students of that group (with help of departmental SSIP coordinator) have to apply for grant (for Startup and/or patent filing) to SSIP or other funding agency.*

8. SCOPE OF PROJECTS

Scope of the project work should be decided based on the following criteria:

(i) Relation to diploma programme curriculum: When student intend to select topics for the project work, they need to choose a project which relates well to their curriculum (it may be beyond curriculum but it should relate to it) and requires implementation of theories already learnt and skills already possessed by them from the previous semesters.

(ii) Abilities possessed by the group of students: Projects should be chosen so that it can be completed mainly using student's problem-solving capabilities and depth of learning. It is natural that highly motivated students or high achievers may come out with projects which are

more complex and challenging. Teachers should guide students to choose challenging projects according to the student's ability.

(iii) Resources available: Students and Guides should keep in mind the availability of resources while deciding the topic and the scope of the project. Some of the important resources which need consideration are:

- Time available
- Raw material/components required
- Manufacturing/fabrication equipment and tools required
- Testing/Measuring equipment and instruments required
- Access to journals (library/digital)
- Expertise for theoretical guidance available in college (or nearby Institutions or nearby industries)
- Expertise and Technology required for fabrication (if required)
- Software required

9. TYPES OF PROJECTS: In general, the projects are of the following types:

(i) Design projects
(ii) Prototype (design, make, test and evaluate)
(iii) Advanced experimental work requiring the development of existing equipment to be need and developed
(iv) Field works: This could include surveys, using equipment, charting data and information from virtual observation.
(v) Comparative studies: Theoretical study of two systems/ mechanisms/ processes in detail and comparing them on the basis of cost/ energy conservation/ impact on environment/ technology used etc.
(vi) Application of emerging technology: Theoretical study of some emerging technology and feasibility of its application in some real-life situation in detail.
(vii) Fabrication of some equipment/ machine etc.
(viii) Development of software/ application to solve some complex problem related to Electrical Engineering field.

10. ACCESSMENT OF PROJECT WORK

Project Guide and/or Program coordinator and/or Project evaluation committee will assess the project work in four different project seminars as per the assessment rubrics suggested here. Total four seminars are to be held during the fifth semester and continuous assessment (CA for 50 marks) is to be done as per the following suggested sheet. (Remaining 50 marks are for the end semester exam - ESE which shall be conducted by the GTU). If two independent projects for 5^{th} and 6^{th} semester are offered, project guide/program coordinator/ project evaluation committee will slightly change the assessment criteria.

Evaluation of Electrical Engineering Project-II (4360906)

Serial No.	Students Name	Enrollment Number	Name of Guide	Project Title	Marks (Continuous Assessment)				
					Seminar-I (out of 10)	Seminar-II (out of 10)	Seminar-III (out of 10)	Final Evaluation (out of 20)	Total (out of 50)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Project evaluation committee **Project Coordinator** **Head of the Department**

Sample assessment rubrics to be used to verify the progressive work done by the student for different seminars/final evaluation

Sr. No.	Activity	Criteria for performance evaluation	High Proficiency	Proficiency	Some Proficiency	No/Limited Proficiency	Score
			8 to 10 Marks	6 to 8 Marks	3 to 5 Marks	0 to 2 Marks	
1	**Seminar-1**	Make necessary hardware/software till time and start troubleshooting the faults during assembling procedure.	Made necessary hardware/software. Assembled required hardware and started troubleshooting the faults during assembling.	Made small portion of necessary hardware/software. Assembled hardware and troubleshooting the faults during assembling.	Made very small portion of necessary hardware/software. Assembled hardware and not started troubleshooting the faults during assembling.	Did not make necessary hardware/software. Did not assemble hardware and not started troubleshooting the faults.	Out of 10
2	**Seminar-2**	Execute the testing of project after assembling of final hardware to verify the result.	Started testing of project and verified the result	Started testing of project and verified some result	Started testing of project and not verified the result	No approach at all for testing of project as well as verification of results	Out of 10
3	**Seminar-3**	Modify the components (and program of microcontroller if required) of the project whenever it is required	Did all the possible tests and modified the components (and program of microcontroller if required)	Did all the possible tests and modified some components (and program of microcontroller if required)	Did all the possible tests and did not modify any components	Did not perform any tests and did not modify any components	Out of 10
4	**Seminar-4 (Final evaluation at the end of 6th semester)**	Defend final review with hardware model, report writing, present as individual and team.	Student explained the work very effectively and confidently and successfully demonstrated the hardware/model	Student explained the work very effectively and confidently and demonstrated the hardware/model with less confidence	Student explained the work with less confidence and not able to demonstrate the hardware/model confidently	Student didn't explain the work effectively and confidently and not able to demonstrate the hardware/model confidently	Out of 20
						Total (Internal assessment)	**Out of 50**

11. SOFTWARE/LEARNING WEBSITES

- https://www.electronicsforu.com/
- https://www.electrical4u.com/
- https://www.mathworks.com/
- https://www.arduino.cc/
- https://www.alldatasheet.com/
- https://www.allaboutcircuits.com/
- https://circuitglobe.com/
- https://www.electricaltechnology.org/
- www.vlab.co.in

12. PO-COMPETENCY-CO MAPPING:

Semester I	Electrical Engineering Project-II (Course Code: 4360906)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solution	PO4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency	**Troubleshoot the faults during assembling & testing, modify the work whenever it is required, make final working model and present as individual and team**						
Course Outcomes CO1 Summarize the work done in previous semester.	3	-	-	-	-	-	-
CO2 Troubleshoot the faults during assembling procedure.	3	-	3	3	-	3	-
CO3 Execute testing of project after assembling of final hardware to verify the result.	3	3	3	3	3	3	3
CO4 Modify the components of the project, if required.	2	3	3	3	3	3	3
CO5 Defend final review with hardware model, report writing, presentation as individual and team.	3	-	2	-	-	3	3

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

13. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Person

Sr. No.	Name and Designation	Institute	Contact No.	Email
1.	Dr Hemant I. Joshi, Lecturer in Electrical Engineering	R C Technical Institute, Ahmedabad	9998579554	hemantjoshi0711@gmail.com