Loyola-ICAM College of Engineering and Technology (LICET)
Department of Electrical and Electronics Engineering
Electrical Engineers League (EEL)
Under
AICTE – Scheme for Promoting Interests, Creativity and Ethics among Students (SPICES)

Event Report

Category: **Value Added Course**

Title of the Event: Building Audio Amplifier through Transformer Design and Fabrication

Date: 05-09-2022 to 07-09-2022 (THREE Days)

Venue: J11 (Classroom), F01 & F02 (Lab Venues)

Details of Participants

- Total No. of Participants: 60
  - II EEE (Batch: 2021 – 2025) : 60
  - III EEE (Batch: 2020 – 2024): NIL
  - IV EEE (Batch: 2019 – 2023): NIL

Technological/ Academic/ Other Benefits generated by conducting the event with respect to:

(a) the institution	• Establish thought leadership • Promote industry-institute collaboration • Showcase the facilities at the institution by bringing practicing engineers and entrepreneurs.
(b) the faculty	• Support in teaching-learning process by promoting doing by learning • Practice Industrial strength listening • Clarifying faculty's image on the avenues of entrepreneurship in the field of electrical application circuits
(c) Students	• Test an idea and generate an application circuit by designing blocks from scratch. • Skill Advancement and academic engagement/ engagement in scholarly activities
(d) Industry/ Society	• Clarifying the image of the avenues of entrepreneurship • Contributing to make the literacy rate go higher thereby helping build a more educated, empowered and aware society

Proceedings of the event

Category: Value Added Course

Report on Building Audio Amplifier through Transformer Design and Fabrication

Date: 05-09-2022 to 07-09-2022 Time: 09:00 am to 05:00 pm

Venue: J11 (Classroom), F01 & F02 (Lab Venues)

Resource Person: Mr. S. V. Sreeraj, Director, EmCog Solutions, Chennai &

Mr. Akshay, Product Developer and Trainer, EmCog Solutions, Chennai

Audience: II EEE (Batch: 2021 – 2025)

Day 1 (05-09-2022):

The trainer inculcated interest among the participants by revisiting the concepts learnt in the theory courses: Electrical Machines and Electromagnetic Fields. He familiarized the concept of creating magnetic field and magnetic moment. Then he explained the term permeability. He later related permeability in transformers and clarified why steel cores are used in transformers. He helped the participants recollect the different types of transformer cores. He then gradually introduced the commercial names of the components of transformer which were not highlighted in the theory course. They are bobbin (coil winding machine), insulation sheet (Class-B insulation sheet, Black leather sheet, etc.), sleeve and a few more.

Familiarising the theoretical concepts, the design equations used to calculate various parameters of transformer components were introduced. The technique to select the type of steel core – Cold Rolled Grain Oriented Steel sheet (CRGO) or Cold Rolled Non-Grain Oriented Steel sheet (CRNGO) was taught. The following parameters were calculated while performing design calculations – $B_{saturation}$, B_{safe}, Dimensions of the core, depending on the type of core (Type 15/ Type 17/ Type 23/ Type 43) the geometry of the bobbin (former), Turns per volt, Number of turns to be wound in the primary and secondary, Thickness of the coil, Current carried by the coils and their corresponding SWG.

After performing the design calculations of the transformer, the concepts related to resistors, PN junction diodes, LED, Polarised electrolytic capacitors, Non-polar capacitors and transistors that were already learnt in the theory course – Electronic Devices and Circuits were refreshed. A few additional information like: types of resistors (ceramic/ carbon film/ metal film – based on type; ⅛ W, ¼ W, ½ W, 1 W, 2 W, 5 W – based on power rating); types of non-polar capacitors (ceramic and polyster) identifying the anode and cathode in an LED and in polarized electrolytic capacitors; selecting the correct transistor depending on the application (2n5551/ 2n5401) and by verifying with the datasheet. Following which, the concepts related to potential divider circuit, forward biasing a diode and capacitors were reinforced by solving simple problems.

Day 2 (06-09-2022):

The second day of the training started by reminding the concepts related to the characteristics of devices that was learnt in the theory course – Electric Circuit Analysis and Electronic Devices & Circuits. The concepts of attenuation, biasing – potential divided biasing, and significance of degrading resistor to reduce the gain were taught. Simple problems pertaining to design of transistor circuits were solved. This helped in better understanding the behaviour of circuits. The concepts related to differential amplifier were also refreshed. Then, the fundamentals related to soldering, use of terminal block to secure two or more wires, use of jumpers to construct circuits and selecting components based on the requirement were taught.

In addition, soldering nuances to avoid burning the backside of PCB due to overheating were taught. Safety and protection procedures to be followed like use of safety gloves were emphasized. The circuit designed was soldered on PCB during this session. Moreover, certain sums based on amplifier circuits were given as extra practice for the students who completed the task well ahead of scheduled time.

DAY 3 (07-09-2022):

Amplifier circuit was implemented on PCB. A centre-tapped transformer as per the design calculations was built using assorted components and bobbin. Participants gained hands-on experience on the use of bobbin. Students were given training to use bobbin batch-wise. The core with dimension as calculated in the design calculation was constructed by arranging E and I sheets sequentially. The primary and secondary windings were wound on the E – I Core of the transformer one after the other. After each winding process is complete the coils were insulated using black leatheroid sheet and class B insulation sheet. After completing the whole process, the continuity of the completed transformer was tested using multimeter and also it's working within the range 9-0-9 V was also verified. Finally, the PCB and the transformer designed were connected together and the working of the developed product was checked.

Relevant Courses in the current semester

EC3301 Electronic Devices and Circuits

- Devices – Characteristics
- Amplifier

EE3303 Electrical Machines – I

- Transformers

EE3301 Electromagnetic Fields

- Electromagnet
- Magnetic field – flux

EE3251 Electric Circuit Analysis

- Voltage division Circuit
- Application of circuit laws and theorems

Relevant Program Outcomes

- PO1 – Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

- PO2 – Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3 – Design/development of solutions: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4 – Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5 – Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- PO9 – Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10 – Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11 – Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12 – Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Schedule

<table>
<tr><th>Day</th><th>Time</th><th>BATCH 1 (30)</th><th>BATCH 2 (30)</th></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="4">Day 1
(5/9/22)</td><td>09:00 am to 11:00 am</td><td>XFMR Design & calculation</td><td>AUDIO DESIGN Part 1</td></tr>
<tr><td>11:15 am to 12:45 pm</td><td>Basics & Soldering Techniques</td><td>AUDIO DESIGN Part 2</td></tr>
<tr><td>01:30pm to 03:00 pm</td><td rowspan="2">XFMR winding, Soldering Practise and sample soldering on PCB board (power supply)</td><td>AUDIO DESIGN Part 3</td></tr>
<tr><td>03:00 pm to 05:00 pm</td><td>Basics & Soldering Techniques</td></tr>
<tr><td rowspan="4">Day 2
(6/9/22)</td><td>09:00 am to 11:00 am</td><td>AUDIO DESIGN Part 1</td><td>XFMR Design & calculation</td></tr>
<tr><td>11:15 am to 12:45 pm</td><td>AUDIO DESIGN Part 2</td><td>XFMR winding, Soldering Practise</td></tr>
<tr><td>01:30 pm to 03:00 pm</td><td>AUDIO DESIGN Part 3</td><td rowspan="2">XFMR winding and soldering on PCB board (as per SOP)</td></tr>
<tr><td>03:00 pm to 05:00 pm</td><td>XFMR winding and soldering on PCB board (as per SOP)</td></tr>
<tr><td rowspan="4">Day 3
(7/9/22)</td><td>09:00 am to 11:00 am</td><td colspan="2" rowspan="3">XFMR winding, soldering on PCB board (as per SOP), Integration of Audio Panel board
Testing & Trouble shooting, Enclosure packing & take away</td></tr>
<tr><td>11:15 am to 12:45 pm</td></tr>
<tr><td>01:30 pm to 03:00 pm</td></tr>
<tr><td>03:00 pm to 05:00 pm</td><td colspan="2">Design Challenge</td></tr>
</table>

Venue Details

Date	Time	BATCH 1	BATCH 2
05-09-2022	FN (9am to 11am)	J11	F01 & F02
	FN (11.15am to 12.45pm)		
	AN (1.30pm to 3pm)	F01 & F02	
	AN (3pm to 5pm)		
06-09-2022	FN (9am to 11am)	F01 & F02	J11
	FN (11.15am to 12.45pm)		
	AN (1.30pm to 3pm)		F01 & F02
	AN (3pm to 5pm)		
07-09-2022	FN (9am to 11am)	F01 & F02	
	FN (11.15am to 12.45pm)		
	AN (1.30pm to 3pm)		
	AN (3pm to 5pm)		

Feedback