Project Presentation

EEE 206 Sessional

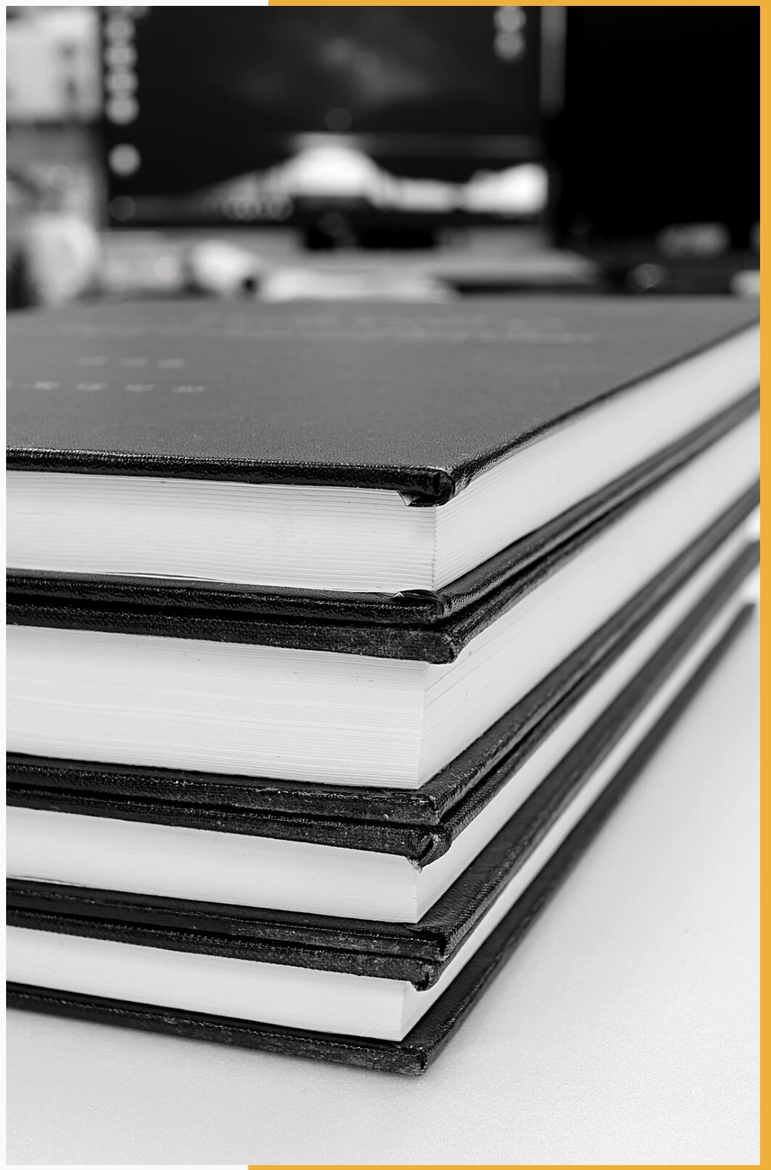
Bangladesh University of Engineering and Technology

29 August 2022

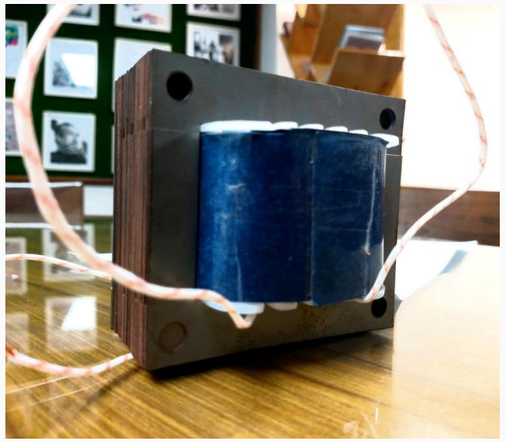
Submitted by B1 Group 3

Bangladesh University of Engineering and Technology
2022

Overview



Objective



Make Step-Down Transformer of 100VA

Supervisors

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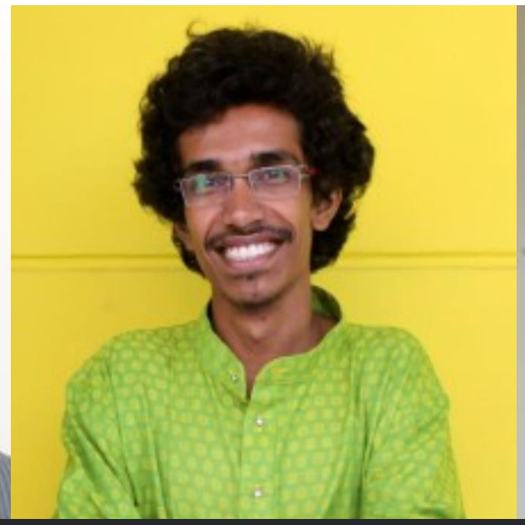
Lecturer
EEE, BUET



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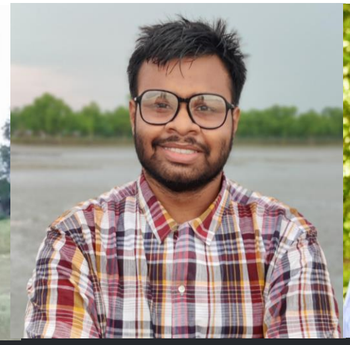
Meet the Team

Eftikhar Sadiq

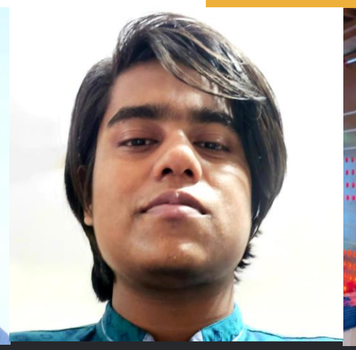
Md. Liton Ali



Toki Bin Alam

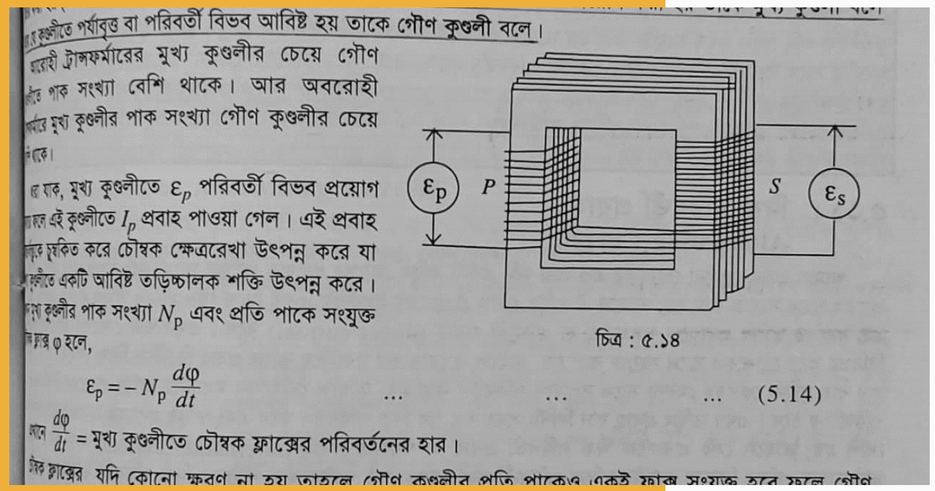
Anindya K Choudhury

Abid Musfiq



Ahnaf Rasheed

Ramim Hasan Shawn



কুণ্ডলীতে পর্যাবৃত্ত বা পরিবর্তী বিভব আবিষ্ট হয় তাকে গৌণ কুণ্ডলী বলে।

ধাপী ট্রান্সফর্মারের মুখ্য কুণ্ডলীর চেয়ে গৌণ
তে পাক সংখ্যা বেশি থাকে। আর অবরোহী
র্মারে মুখ্য কুণ্ডলীর পাক সংখ্যা গৌণ কুণ্ডলীর চেয়ে
থাকে।

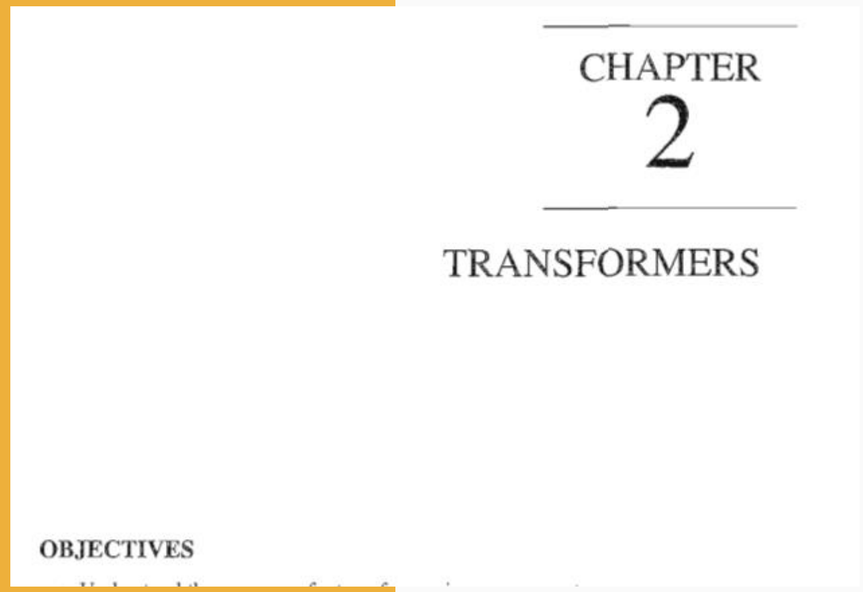
ধরা যাক, মুখ্য কুণ্ডলীতে ε_p পরিবর্তী বিভব প্রয়োগ
ফলে এই কুণ্ডলীতে I_p প্রবাহ পাওয়া গেল। এই প্রবাহ
ক্ষেত্রে চুম্বকিত করে চৌম্বক ক্ষেত্ররেখা উৎপন্ন করে যা
কুণ্ডলীতে একটি আবিষ্ট তড়িচ্চালক শক্তি উৎপন্ন করে।
মুখ্য কুণ্ডলীর পাক সংখ্যা N_p এবং প্রতি পাকে সংযুক্ত
ফ্লাক্স φ হলে,

$$\varepsilon_p = -N_p \frac{d\varphi}{dt} \quad \ldots \quad \ldots \quad \ldots \quad (5.14)$$

যেখানে $\frac{d\varphi}{dt}$ = মুখ্য কুণ্ডলীতে চৌম্বক ফ্লাক্সের পরিবর্তনের হার।

চৌম্বক ফ্লাক্সের যদি কোনো ক্ষরণ না হয় তাহলে গৌণ কুণ্ডলীর প্রতি পাকেও একই ফ্লাক্স সংযুক্ত হবে ফলে গৌণ

চিত্র : ৫.১৪



CHAPTER
2

TRANSFORMERS

OBJECTIVES

Introduction

The First Topic of Power- Transformer

The first topic of the first power course- Transformer

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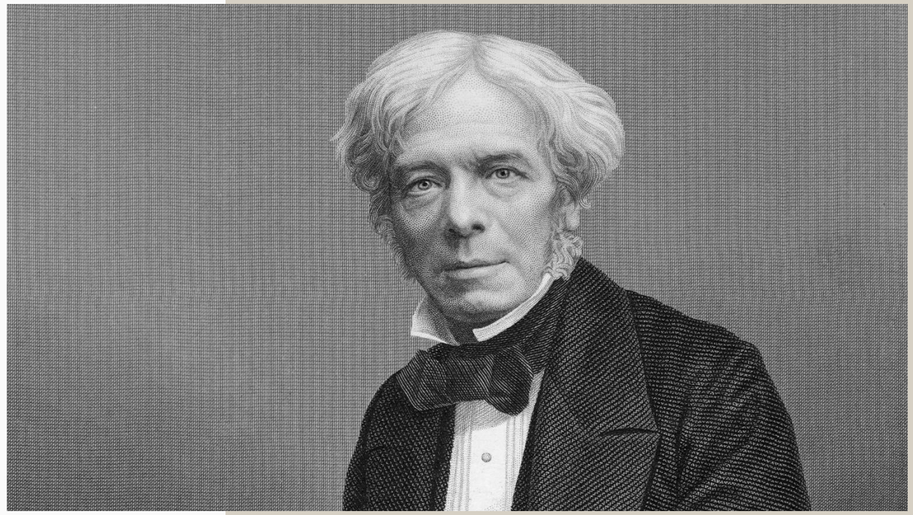
Submitted by B1 Group 3

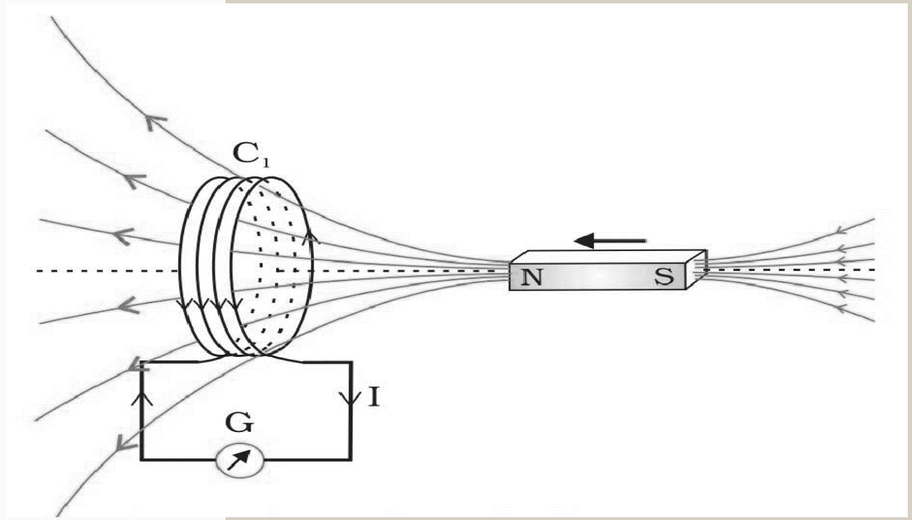
Theoretical



Faraday’s Law

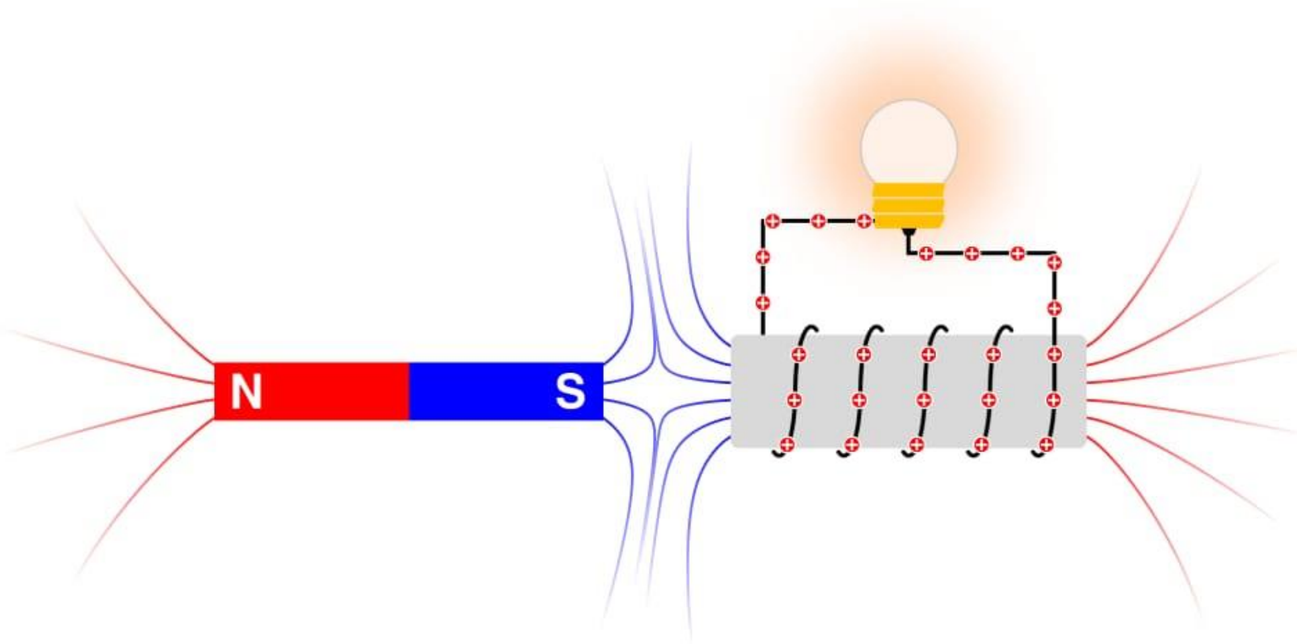
Electromagnetic and Mutual Induction

Power Supply Through Transformer



Theoretical

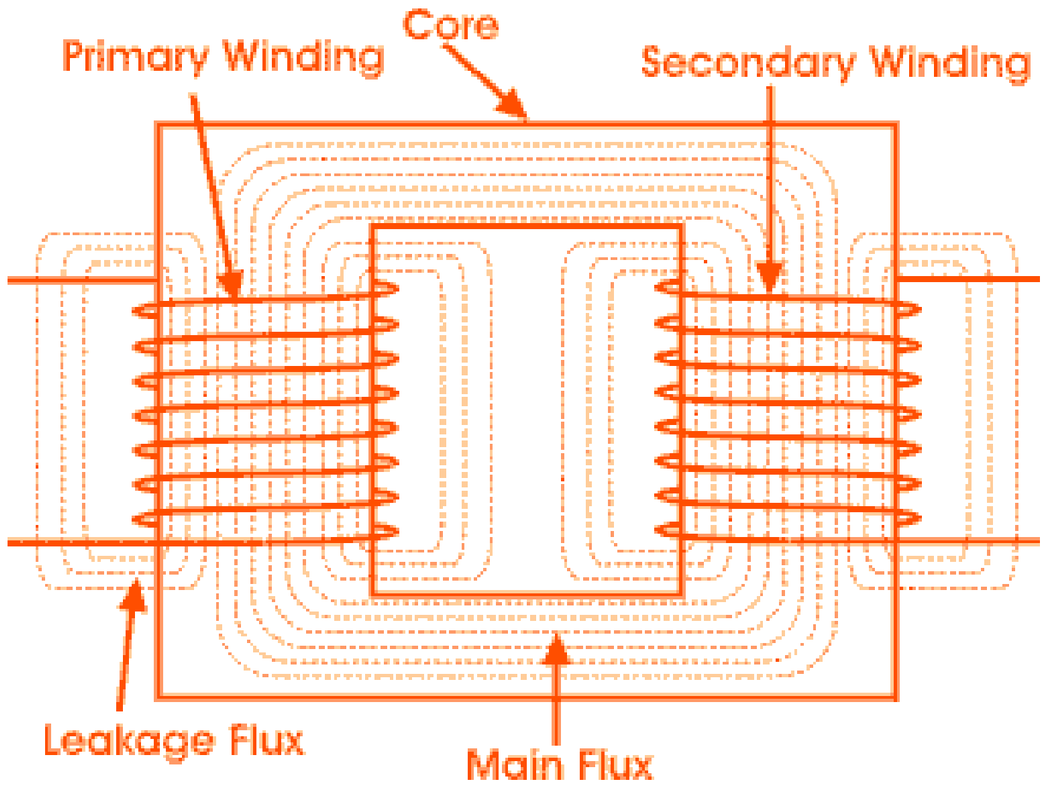
Faraday’s Law



Submitted by B1 Group 3

Theoretical

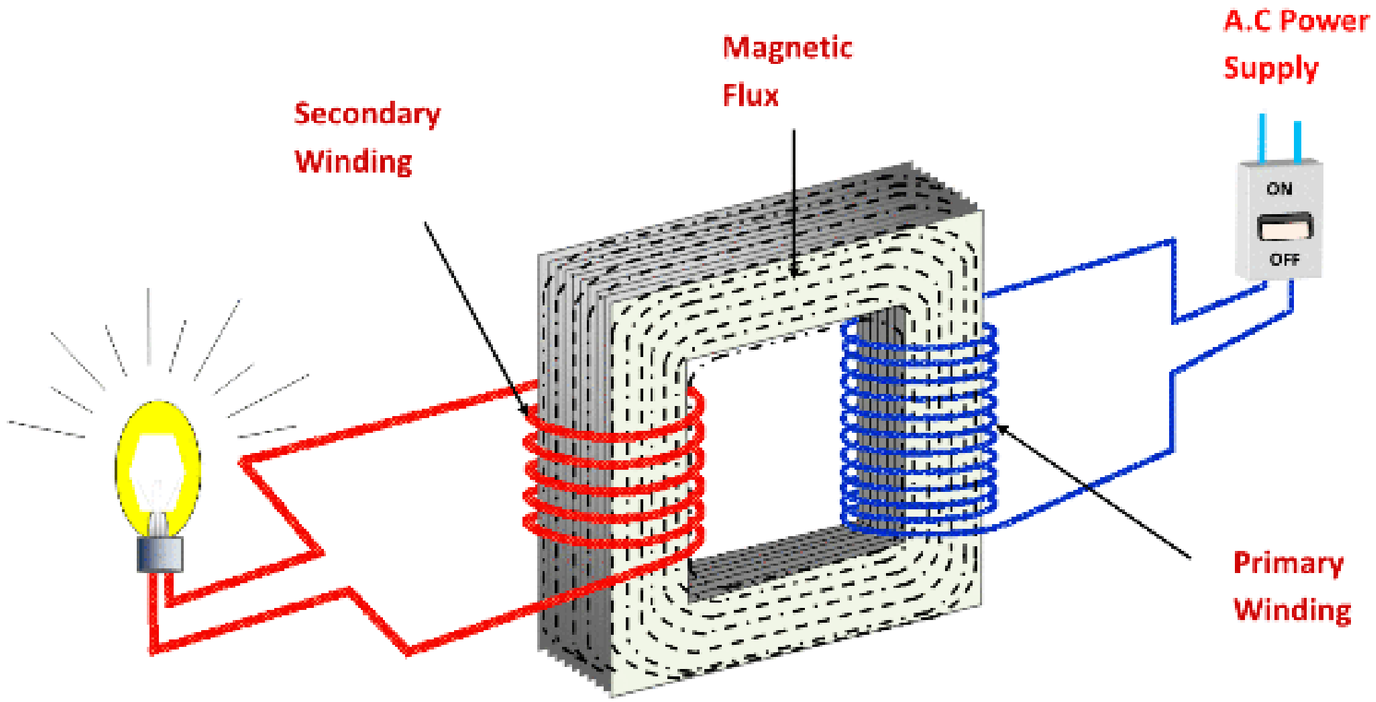
Electromagnetic and Mutual Induction



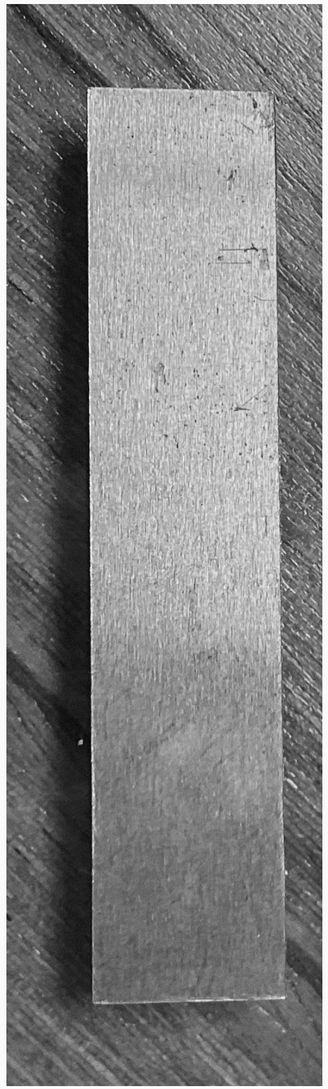
Submitted by B1 Group 3

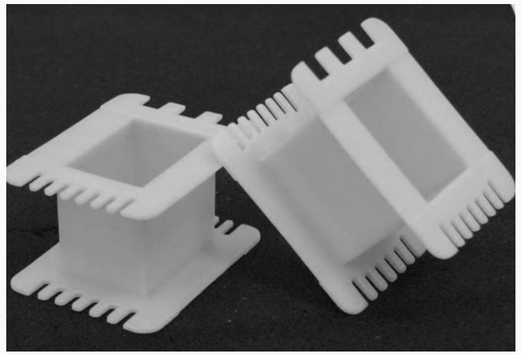
Theoretical

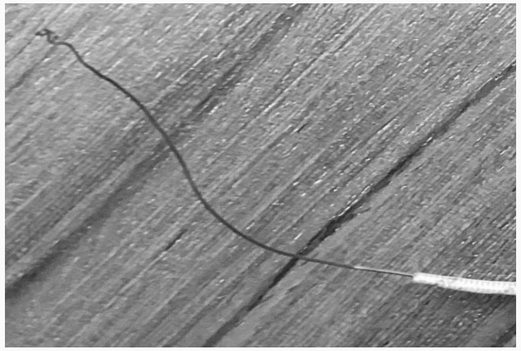
Power Supply Through Transformer

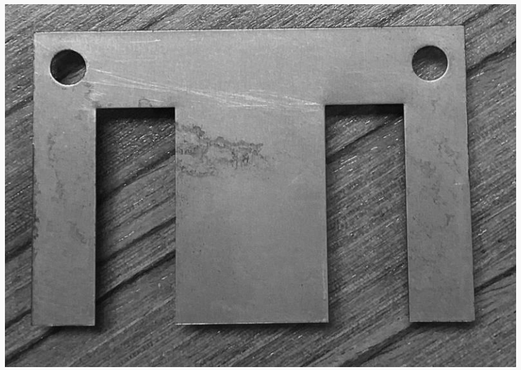


Submitted by B1 Group 3









Equipment

1. I Core
2. E Core
3. Wires
4. Bobbin
5. Scotch Tape
6. Lighter
7. Insulation Paper
8. Lab E-Volt Machine for Testing

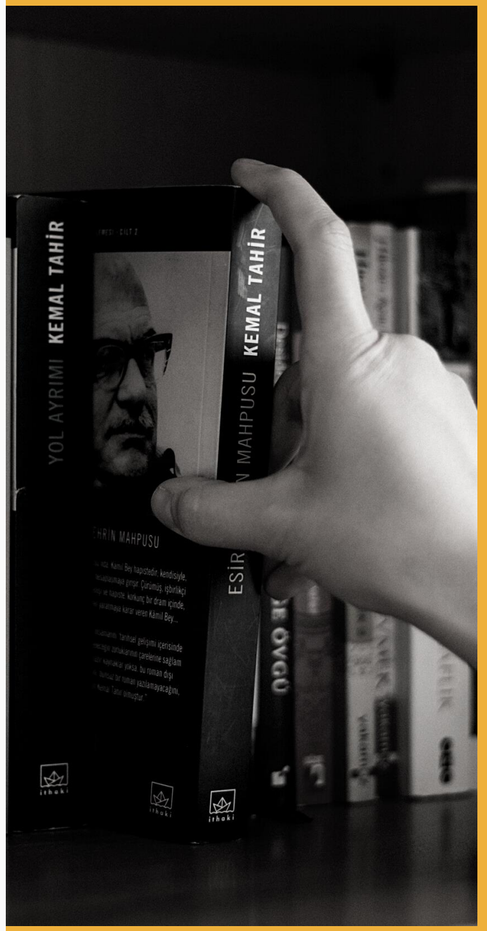
Procedure

Wiring the Bobbin

- HT side wiring with 960 turns
- Wrapping Insulation Paper
- LT side wiring with 480 turns
- Final wrapping using insulation paper

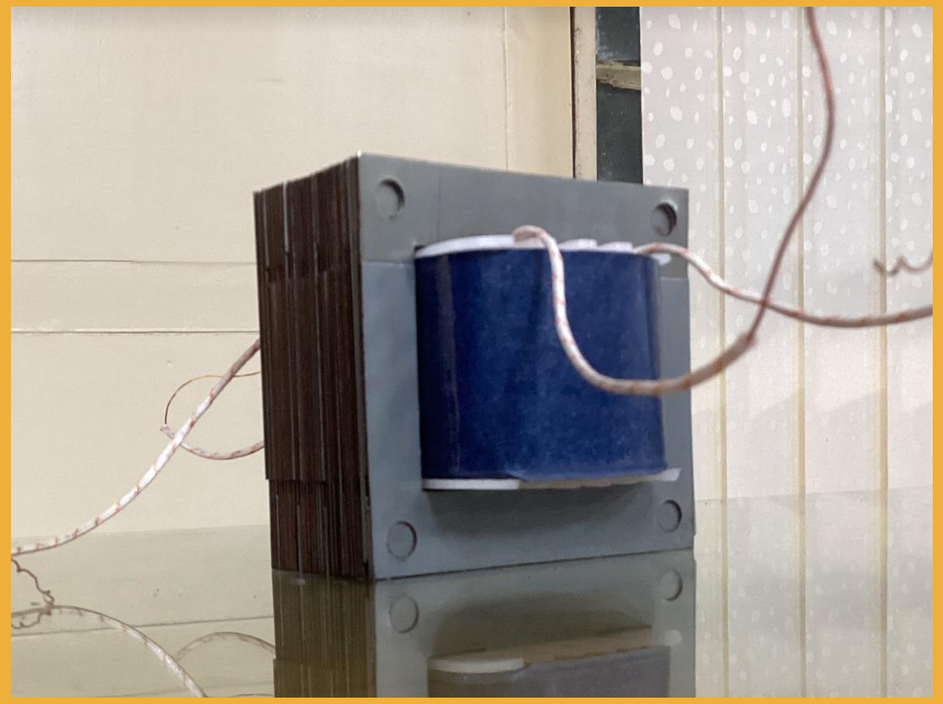
Assembling the cores

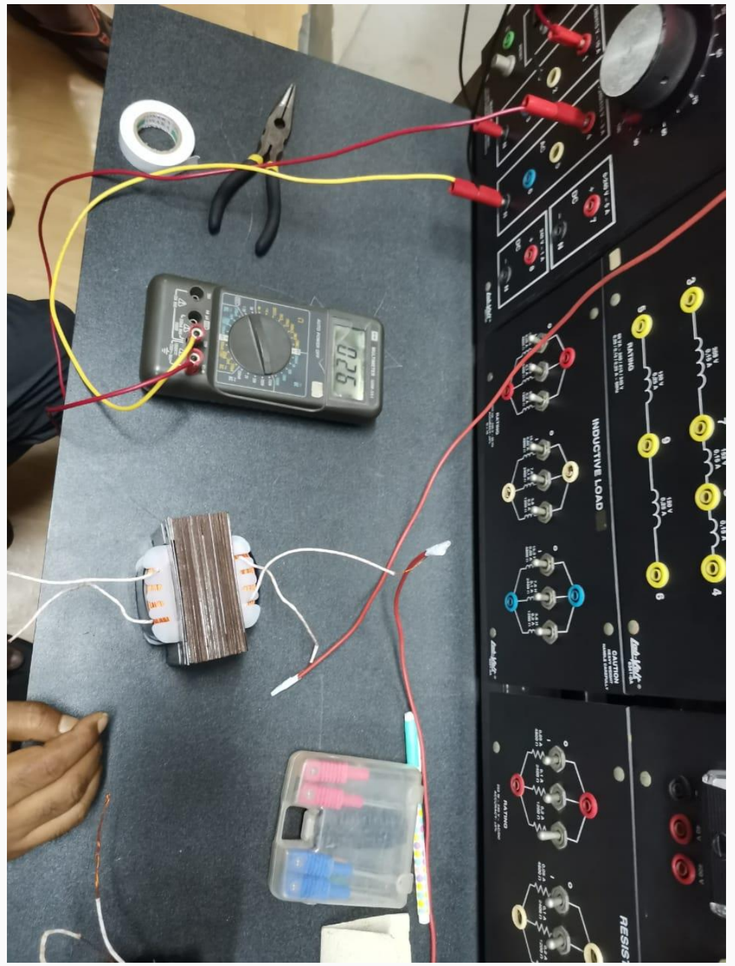
- Inserting E and I shaped cores in the bobbin.



Implementation

Testing





Submitted by Harper Russo

Results

The results of this study can be concluded into the following points:

Both open circuit test and short circuit test was done at HT side of the transformer. We get the following data:

Open Circuit Test		Short Circuit Test	
P_{oc}	5 W	P_{sc}	10 W
V_{oc}	240 V	V_{sc}	26 V
I_{oc}	0.22 A	I_{sc}	0.416 A

Submitted by Harper Russo

Results

The results of this study can be concluded into the following points:

After Applying rated voltage of 240V at primary, at secondary we get

V_p = 240V

V_S = 109.5

Turns Ratio, a = $\frac{V_p}{Vs}$ =2.2

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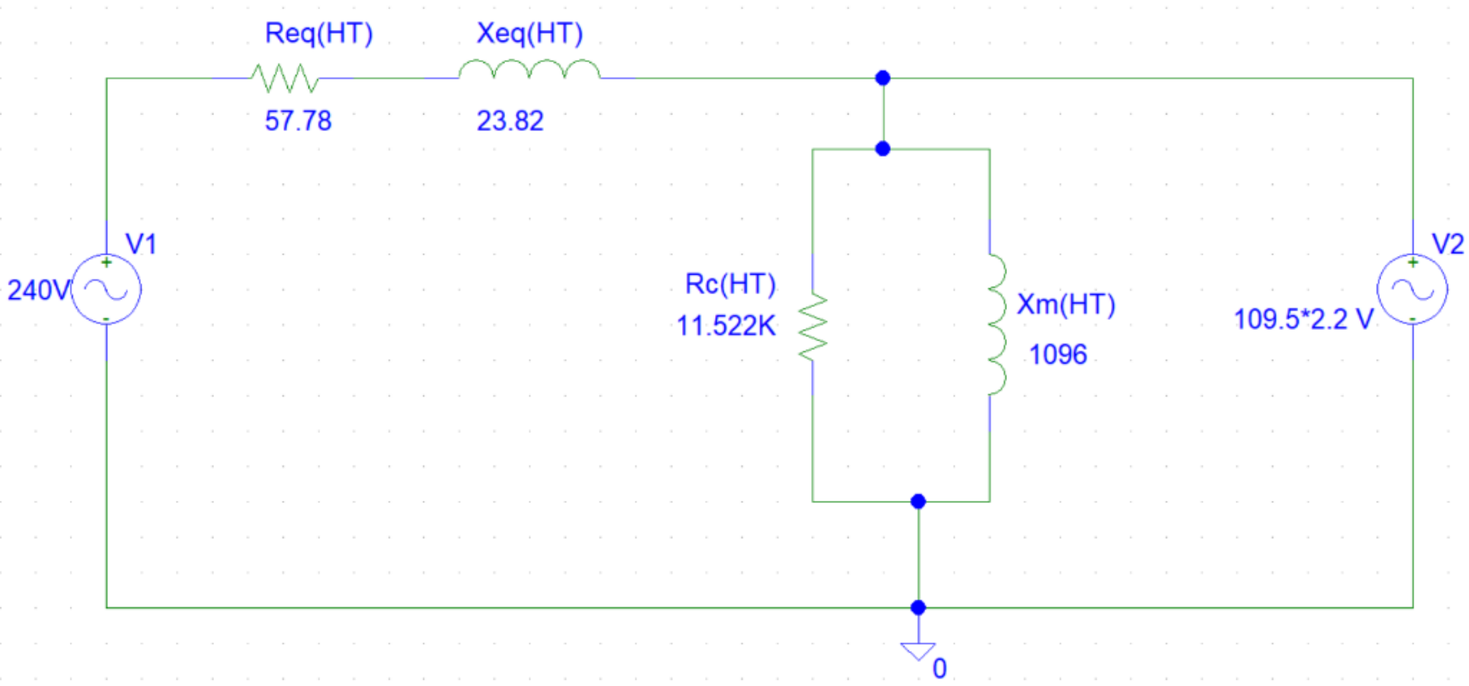
Results

The results of this study can be concluded into the following points:

The final equivalent circuit of the transformer in terms of HT side/Primary side:



Analysis

- Error in Turns Ratio
- Value of Rc and Xm is quite acceptable.

- The Unavailability of Core and Bobbin of Accurate Size
- Air Gap in the Core
- Inexperience in Winding

Submitted by B1 Group 3

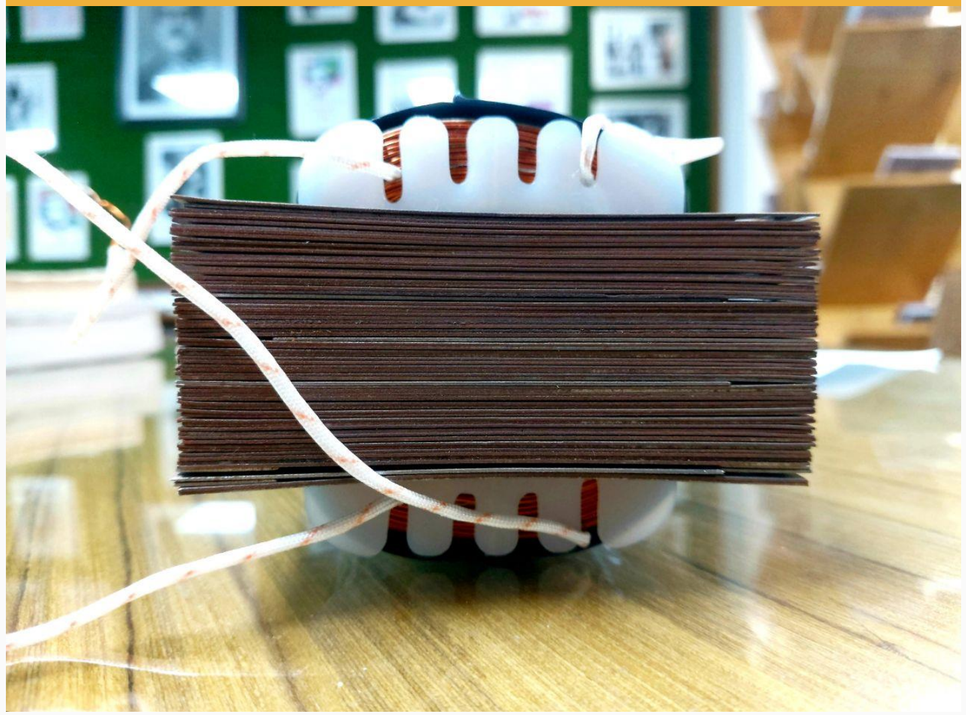
Limitation

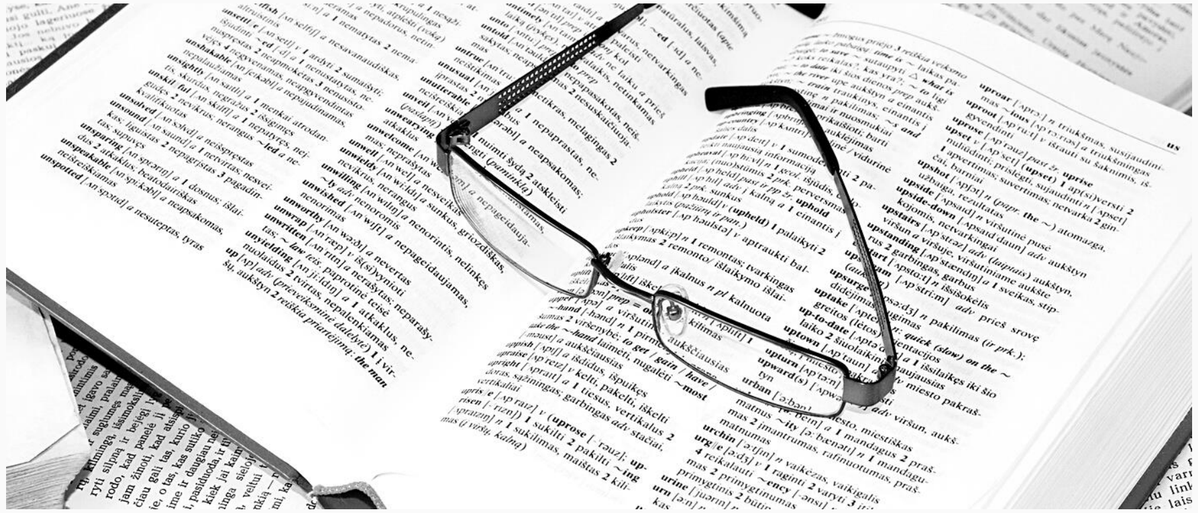
- Limited Time Period
- Inaccessibility to Marketplaces
- Scheduled Load-shedding Period
- Unavailability of Quality Raw Materials
- Unavailability of Auto Winding Machine

Applications

- Portable Voltage converter
- UPS
- Solar Panel

Conclusion





The Project is successful in imparting the key structural concepts of transformer.

Thank You

Q & A Session

Submitted by B1 Group 3

Results Appendix

The results of this study can be concluded into the following points:

- From open circuit test,

Power factor angle, θ = $\cos^{-1}\frac{Poc}{Voc \times Ioc}$ = 84.567 degree

Admittance, $Y_E = \frac{Ioc}{Voc} \angle -\theta = \frac{1}{Rc} - j\frac{1}{Xm}$ = 8.679*10^-5 – j(9.1255*10^-4)

R_C = 11.522 kΩ

X_M = 1096 Ω

- From short circuit test,

Power factor angle, θ = $\cos^{-1}\frac{Psc}{Vsc \times Isc}$ = 22.398 degree

Impedance, $Z_{SE} = \frac{Vsc}{Isc} \angle\theta = Req - j\,Xeq$ = 57.78 + 23.82j

R_{eq} = 57.78 Ω

X_{eq} = 23.82 Ω

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Submitted by Harper Russo

Pre-Calculation Appendix

The results of this study can be concluded into the following points:

Rating: 240V/120V Step down transformer

Apparent Power: 100 VA

Current Rating:

Primary:	Secondary:
V_P = 240 V	V_S= 120 V
$I_{P,\,max} = \frac{S}{V} = \frac{100}{240}$ A = 0.41667 A	$I_{S,\,max} = \frac{S}{V} = \frac{100}{120}$ A = 0.833 A

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Submitted by B1 Group 3

Pre-Calculation Appendix

The results of this study can be concluded into the following points:

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SWG of Wire selection:

	SWG number	Current Capacity, A	
Primary	SWG 27	0.359	0.538
Secondary	SWG 23	0.768	1.15

Finding Bobbin Size:

$$\text{Bobbin Area} = \frac{\sqrt{VA}}{6.32} = \frac{\sqrt{100}}{6.32} = 1.58\ inch^2$$

Page Number **A.4**

Pre-Calculation Appendix

The results of this study can be concluded into the following points:

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Submitted by B1 Group 3

Finding Turns Ratio:

Turns per volt, TPV = $\frac{1}{4.44fBA}$

Where,

Frequency, f = 50 Hz

Magnetic Flux density, B = 1.2 T

Bobbin Area, A = $11.52 \times 10^{-4}\ m^2$

TPV = $\frac{1}{4.44\times50\times1.2\times11.52\times10^{-4}}$ = 3.23 ≈ 4

Primary Winding Turns = 240*TPV = 960

Secondary Winding Turns = 120*TPV = 480

Total wire Required:

Bobbin Perimeter = 2(L+W) = 2(1.5+1.25) inch = 5.5 inch = 0.1397 m

Total wire for primary = 960*0.1397m = 134.112 m

Total wire for secondary = 480*0.1397m = 67.056 m