1. Details of unit revision and its structure

Subject Name	Physics
Course Name	Physics 03 (Physics Part-1, Class XII)
Title	Revision Unit-04_Study Guide
Pre-requisites	Content of Unit 04: Electromagnetic Induction and Alternating Currents
Objectives	After going through this study guide, the learners will be able to: • Consolidate the unit • Prepare notes on the unit
Keywords	

2. Development Team

Role	Name	Affiliation
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Study Guide

Unit 4

Electromagnetic Induction and Alternating Currents

After going through all the modules (9) , videos on the unit and doing the assignments we are now ready for consolidation and checking out on deeper understanding of the concepts .remember you considered ac in detail for the first time in your science .physics course.

Read the unit from NCERT book again

Study the syllabus carefully once again. Each word will now make more sense to you now.

Ask what did you learn? why did you learn?

Make connections between each new concept example what is common between EMI and self-induction, mutual induction.

Mark any part which is still not very clear to you.

Revisit the difficult part again

Syllabus

Chapter-6: Electromagnetic Induction

Electromagnetic induction; Faraday's laws, induced emf and current; Lenz's Law, Eddy currents; Self and mutual induction.

Chapter-7: Alternating Current

Alternating currents, peak and rms value of alternating current/voltage; reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits, watt less current; AC generator and transformer.

Read and study the breakup carefully before revising the unit.

Study the break up

Module 1	• Electromagnetic induction • Faraday's laws, induced emf and current • Change of flux • Rate of change of flux
Module 2	• Lenz's Law • Conservation of energy • Motional emf
Module 3	• Eddy currents • Self-induction • Mutual induction • Unit • Numerical
Module 4	• AC generator • Alternating currents • Representing ac • *Formula* • *Graph* • *Phasor* • Frequency of ac and what does it depend upon • peak and rms value of alternating current/voltage
Module 5	• ac circuits • components in ac circuits • comparison of circuit component in ac circuit with that if used in dc circuit • reactance mathematically • *pure R* • *pure L* • *Pure C* • Phasor, graphs for each
Module 6	• AC circuits with RL, RC and LC components • Impedance; LC oscillations (qualitative treatment only)

	• Resonance • Quality factor
Module 7	• Alternating voltage applied to series LCR circuit • Impedance in LCR circuit • Phasor diagram • Resonance • Power in ac circuit • Power factor • Wattles current
Module 8	• Transformer
Module 9	• Advantages of ac over dc • Distribution of electricity to your home

There are many new ideas and phenomenon which need special care, take time to visualise these.

The word induction means temporary conditional change. What are the conditions? And what changes take place due to it? These must be understood and appreciated about the phenomenon. What is the cause if induced emf? Understand Faradays laws of electromagnetic induction, Lens's law and its relevance to the phenomenon.

The different methods for production of induced emf, and determination of direction of flow of current

Eddy currents in bulk conductors, ways to reduce the effect of eddy currents, self-induction and mutual induction.

Do the conceptual problems, solved examples from the NCERT book.

Next study the application of electromagnetic induction for production of alternating current by an ac generator, design, factors affecting the emf produced.do the relevant mathematics and draw graphs, think about what factors will change the frequency, magnitude and direction of emf produced by the generator. Learn to draw its diagram, explain the significance of radial pole pieces, a rotating shaft, and carbon brushes.

Allow yourself to understand the working of a transformer. that its principle is mutual induction, how the number of turns of primary and secondary windings effect the output from the secondary, remember we are advising allow yourself to understand, because we feel you have to understand the working on your own. So be patient!

Then study alternating current, frequency, peak value, rms value, equation to represent a.c. output from a generator.

Next study ac circuits with pure resistance, capacitor and inductance. Meaning of the term reactance impedance, phase lead and lag.

- **Consolidate the unit**
- **Make fast track sheets**

Example the sheet allows you to keep a brief on any important device/concept learnt in the unit

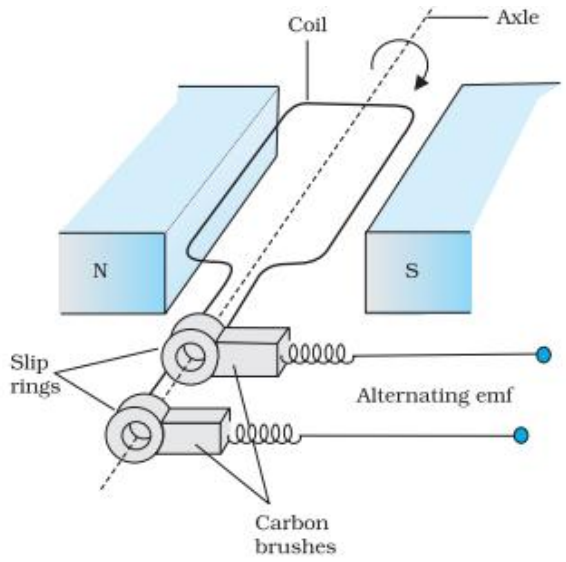
AC generator

A device which converts _____energy into _____ energy

Principle_____

_____

Construction Draw and label each component



Explanation /meaning of

Armature:

Field magnet:

Slip rings:

Brushes:

Rotating shaft:

How rotation of armature coil is done?

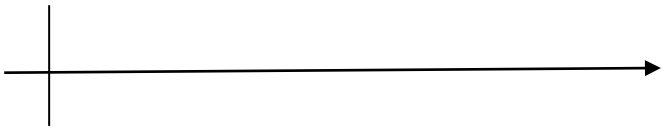
Theory and working

Write briefly the expression for ac output generated

$$e = NABwsinwt$$

write briefly and in points how the generator works

AC output graph



Label each axis

AC output depends upon

Based on the mathematical expression

a)_____b_____c_____d_____

Function of give design to explain the function

a) **Slip rings**
b) **Field magnet**
c) **Radial field**
d) **Carbon brushes**
e) **Rotating shaft**

A sheet for transformer

Transformer:

A device _____

Principle:

Construction:

Step up and step down transformer:

Working /mathematical explanation:

Explanation /meaning of

1. Primary
2. Secondary
3. Core
4. Planar winding of primary and secondary coils
5. Resistance of primary and secondary coil wires
6. Load resistance
7. Input and output voltage
8. Number of turns of windings
9. Transformation ratio
10. Primary current
11. Secondary current
12. Efficiency of transformer
13. Transformer losses
14. Ways to minimise transformer losses.

- **Some more suggestions**

AC and AC circuits

- **AC generator**
- **Output of ac generator Mathematical and graphical**
  Difference between
    - ✓ **AC and DC**
    - ✓ **Angular frequency and frequency**
    - ✓ **Vector and phasor**
    - ✓ **Value of voltage and current**
    - ✓ **Resistance , reactance and impedance**

Average **peak** **rms**

Q factor **watt less current** **power factor**

Resonance in LC circuit

Conditions for resonance

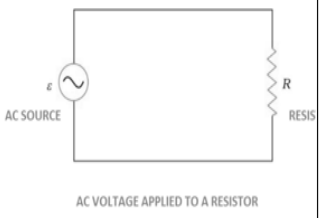
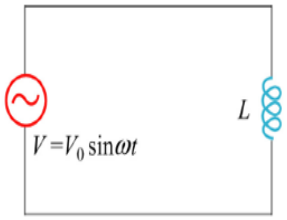
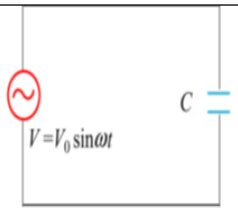
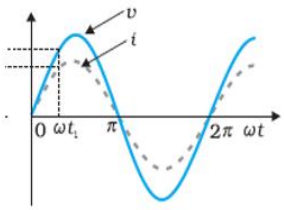
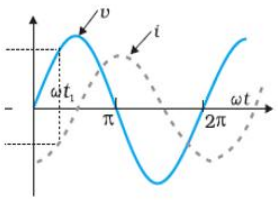
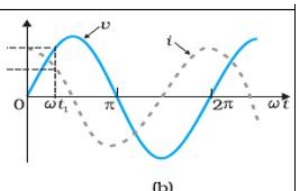
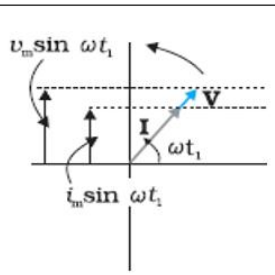
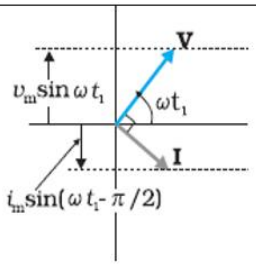
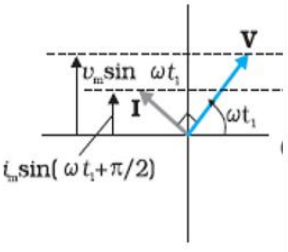
LC circuit in resonance in India (220V 50 Hz)will also be in resonance in a country with (110V, 60 Hz

Complete the table to keep different concepts in one sheet .

	Pure resistance	Pure capacitance	Pure inductance	LC	LCR
ciruit					
Resistance Reactance impedance					
Voltage Current (mathematically)					
Voltage Current (graphically)					
Phasor diagram					
Resonant					

condition Resonant frequency					

Some of this is filled for you

	Pure resistance circuit	Pure inductive circuit	Pure capacitive circuit
Circuit diagram			
Input voltage	$V=V_0\sin\omega t$	$V=V_0\sin\omega t$	$V=V_0\sin\omega t$
Current	$I=\frac{V_0}{R}\sin\omega t$ $I=I_0\sin\omega t$	$I = I_0\sin\left(\omega t - \frac{\pi}{2}\right)$	$I = I_0\sin\left(\omega t + \frac{\pi}{2}\right)$
Resistance/ reactance	R	$X_L=2\pi fL$	$X_C=1/2\pi fC$
Current voltage graph			
Current voltage phasor			

Do questions from NCERT (text book and exemplar)

Study hard and enjoy!!