Sh. L. N. Hindu College, Rohtak (Haryana)
Course Plan

Department of Science

Program: B.Sc. (Non Med.)

Electromagnetic Induction & Electronic Devices (PH-201)

SCHEME

Course Name	**Electromagnetic Induction & Electronic Devices**	**Course Type**	**Theory**
Course Code	**PH-201**	**Class**	B.Sc. (Non Med.) II Sem.
Instruction Delivery	**Per week Lectures: 4, Tutorial:1, Practical: -** **Total No. Classes Per Sem: 60(L), 15(T), -(P)** **Assessment in Weightage: Sessional (20%), End Term Exams (80%)**		
Course Coordinator	Mrs. Kanchan Chhabra	**Course Instructors**	Theory: Mrs. Kanchan Chhabra Practical: --Dr. Savita

COURSE OVERVIEW

An Electromagnetic Induction and Electronic Devices course covers the principles of electromagnetic induction, exploring how changing magnetic fields induce electromotive forces (EMF) in conductors. The curriculum often includes topics such as Faraday's law, Lenz's law, mutual inductance, and self-inductance.
Additionally, the course delves into the applications of electromagnetic induction in electronic devices, such as transformers and inductors, working principles of generators and transformers, as well as their applications in power distribution and transmission.

Furthermore, the course may extend to electronic devices like capacitors and inductors in AC circuits, resonant circuits, and filters. The understanding of electromagnetic induction is crucial for designing and analyzing various electronic systems, making it a foundational topic in electrical engineering and related disciplines. Practical applications and hands-on experiments may complement theoretical concepts in such a course.

PREREQUISITE

Lenz's law, mutual inductance, self Inductance, Capacitance, Energy stored in electric & Magnetic fields.

COURSE OBJECTIVE

The objective of this course is to include the concepts of electromagnetic induction, Faraday's law, Lenz's law, mutual inductance, and insights into the practical applications of electromagnetic induction in electronic devices, such as transformers, generators, and inductors. Learning & developing pratical skills how to analyze circuits involving electromagnetic devices, including AC circuits with capacitors and inductors and comprehending their roles in electronic systems. Overall, the goal is to equip students with a solid foundation in electromagnetic induction and

electronic devices, enabling them to apply these principles in diverse engineering applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO No.	Course Outcomes
1	Remember the basic concept of electromagnetic induction, Faraday'slaw, Lenz'slaw, mutual inductance, self inductance. KL1
2	Understand the formulae and properties of electromagnetic devices, including transformers, generators, and inductors. KL2
3	Apply the various concepts to design circuits involving electromagnetic devices, including transformers, generators, and inductors. KL3
4	Analyze the problem-solving skills related to electronic devices, including diagnosing issues, optimizing performance, and proposing solutions. KL4

COURSE

CONTENT

Content
Electromagnetic Induction: Growth and decay of current in a circuit with (a) capacitance and resistance (b) resistance and inductance (c) capacitance and inductance (d) capacitance, resistance and inductance. Alternating current circuit analysis using complex variables with (a) capacitance and resistance (b) resistance and inductance (c) capacitance and inductance (d) capacitance, inductance and resistance, series and parallel resonant circuit. Quality factor. Semiconductor Diodes: Energy bands in solids. Intrinsic and Extrinsic semiconductor, hall effect, P-N junction diode and their VI characteristics, Zener and avalanche breakdown, resistance of a diode, light emitting diodes, photo conduction in semiconductors, photo diode, solar cell. Diode Rectifiers: PN junction half wave and full wave rectifier, types of filter circuits, Zener diode as voltage regulator, simple regulated power supply. Transistors: Junction transistors, Bipolar transistors, working of NPN and PNP transistors, transistor connection, constants of transistor. Transistor characteristic curve, advantage of C-B configuration, principle, construction and working of C.R.O. Transistor Amplifiers: Transistor biasing , method of transistor biasing and stabilization. DC load line, common base and common emitter transistor biasing, common base, emitter amplifiers. Classification of amplifiers. Resistance coupled amplifier, feedback in amplifiers, advantage of negative feedback emitter follower. Oscillators: Oscillators, principle of oscillation, classification of oscillator. Conditions for self sustained oscillation. Barkhousen criteria for oscillations. Tuned collector common emitter oscillator. Hartly oscillator, colpitt ‘s oscillator.

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LESSON PLAN (THEORY AND TUTORIAL CLASSES)

L. No	Topic to be Delivered	Tutorial Plan	Unit
1	Quick Review of terms used i.e. Magnetic flux, lenz law, self inductance, mutual inductance etc..	Practice Questions on Inductance	1
2	Growth & decay of current in L-R Circuit		
3	Charging & Discharging of Capacitor in RC Circuit		
4	Growth of charge in LC Circuit	Practice Questions on charging and discharging of different circuits.	
5	Charging & Discharging in LCR Circuit		
6	Charging & Discharging in LCR Circuit contd…		1
7	Quick Review of A.C, mean, average & r.m.s value of A.C & their relation	Practice Questions on peak, average & r.m.s value of A.C	
8	A.C Circuit containing R only		
9	A.C Circuit containing L only		
10	A.C Circuit containing C only	Practice questions on peak, average & r.m.s value of A.C Contd…	
11	A.C Circuit containing R & L only		
12	A.C Circuit containing R & C only		
13	LCR series A.C Circuit	Discuss important topics.	
14	Resonance condition of LCR series A.C Circuit		
15	Parallel Resonant Circuit	Practice question on LCR circuit	1
16	Sharpness of resonance of LCR Series A.C. Circuit		
17	Sharpness of resonance of LCR Series A.C. Circuit contd..		
18	Energy bands in solids, Types of semiconductor	Revision of previous topics	2
19	Hall Effect		

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20	Semiconductor Diode, biasing & V- I Curve		
21	Static and dynamic resistance of a diode		
22	Zener diode	Practice questions on Zener diode	
23	Solar cell , Rectifiers		
24	Half wave rectifier, full wave rectifier and Ripple factor		
25	Filter circuit and its types		
26	Filter circuit and its types contd…	Practice questions on Rectifiers & Filter circuit	2
27	Regulated power supply		
28	Photodiode		
29	Light Emitting diode		
30	Transistor:PNP and NPN		3

31	Configuration of transistor,gains and relation between different parameters	Practice questions on diode circuit	3
32	Input , output characteristics curve of CB and CE configuration for NPN and PNP transistor		
33	C.R.O.	Practice questions on transistors	
34	Different types of biasing circuits		
35	Amplifier and their types, feedback in amplifiers	Discuss previous question papers.	
36	Emmiter follower circuit		
37	Hartly oscillator		
38	Colpitt's oscillator		

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Text Book

S.K. Varma, Mechanics & Electronic Devices

Reference Books

Ashok Sharma, Electromagnetism and Electronic Devices

Dr. Nawal Kishore, Mechanics and Electromagnetism

Web/Links for e-content

- https://youtu.be/DoxYgvYCO6c?si=m9UUgkUsUl4sbS86
- https://youtu.be/h0Y9jDKqScQ?si=tcdZvxId5-5WIc9d
- Microsoft PowerPoint - Chap29_PHY2049.ppt (ucf.edu)

PRACTICE QUESTIONS (QUESTION BANK)

S No	Problem
1	What is parallel resonant circuit? find its quality factor.
2	Explain the breakdown mechanism of a gener diode under reverse bias condition.
3	Draw a circuit and explain working of half wave rectifier. find its efficiency.
4	Explain the frequency response curve of RC coupled amplifier using diagram. what are its advantages and disadvantages?
5	What are transient currents and time constant of CR circuit?
6	Can we use 15 Hz AC for Lightning purpose? Explain
7	Explain the principle, working and construction of CRO.

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8	What are different feedback topologies draw circuit diagram.
9	How colpitt's oscillator is different from Hartly oscillator?
10	Discuss working of NPN transistor.
11	Discuss in detail the discharging of a capacitor through inductance and resistance?
12	Explain the principle & construction of a solar cell. Draw its VI characteristics curve.
13	What do you mean by quality factor of an AC circuit

30	*Find the value of* $\oint_C \frac{1}{z(z+\pi\, i)} dz$, *where C is* $\lvert z+3\, i\rvert = 1$
31	*Find the value of* $\oint_C \frac{5\, z+2}{z^2-z} dz$, *where C is* $\lvert z\rvert = 2$
32	*Find the value of* $\oint_C \frac{sin^2 z}{(z-\frac{\pi}{6})^3} dz$, *where C is* $\lvert z\rvert = 1$
33	*Find the value of* $\oint_C \frac{1}{z}\ cos\, cos\, z\ dz$, *where C is* $9\, x^2 + 4\, y^2 = 1$
34	*Write expansion of* $\frac{z}{(z+1)(z+2)}$ *about* $z = -2$
35	*Show that* $\frac{1+2z}{z^2+z^3} = \frac{1}{z^2} + \frac{1}{z} - 1 + z - z^2 + z^3 - \cdots \ldots$, *where* $0 < \lvert z\rvert < 1$
36	*Write expansion of* $\frac{(z-2)(z+2)}{(z+1)(z+4)}$ *for* $1 < \lvert z\rvert < 4$
37	Describe the singularity and its type with example of a complex variable function
38	Describe the residues and discuss the method to calculate residue at $z = a$ which is a pole of order 3.
39	Express $f(z) = \frac{sinsin\, z}{z-\pi}$ in Laurent's series about $z = \pi$
40	Determine the residues of $f(z) = \frac{z}{(z-1)^2(z-2)(z-3)}$ at its poles
41	Calculate the value of $\oint_C \frac{z-3}{z^2+2z+5}\ dz$ where C is the circle $\lvert z+1-i\rvert = 2$

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42	Quantify 'm' if $\oint_C \left\{ z\left(cos\, cos\, \frac{1}{z}\right)\right\} dz = m\pi$ where C is $\|z\| = 1$
43	Apply Rouche's Theorem to show that all the roots of $z^7 - 5z^3 + 12 = 0$ lie between the circles $\|z\| = 1$ & $\|z\| = 2$
44	If $f(z)$ is an integral function satisfying the inequality $\|f(z)\| \leq M \ \forall z$, where M is positive constant. Show that $f(z)$ is constant.
45	Apply residue theorem to show that $\int_0^{\pi} \frac{3}{9 + sin^2\theta} d\theta = \frac{\pi}{\sqrt{10}}$
46	Determine the value of $\int_0^{\pi} \frac{1+2coscos\,\theta}{5 + 4coscos\,\theta} d\theta$ using residue theorem.
47	Deduce the value of real integral $\int_{-\infty}^{\infty} \frac{x^2}{(x^2+1).(x^2+4)} dx$

48	Deduce the value of real integral $\int_0^{\infty} \frac{coscos\, x}{(x^2+1)^2} dx$
49	Deduce the value of real integral $\int_0^{\infty} \frac{coscos\, x}{\sqrt{x}} dx$
50	Deduce the value of real integral $\oint_C tan\, tan\, z\ dz\ where\ C\ is\ \|z\| = 2$

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