IV SEMESTER

TITLE: OPTICS - II, ELECTRICITY & MAGNETISM

Program Name	B.Sc.	Semester	IV
Course Title	**OPTICS - II & ELECTRICITY & MAGNETISM** (Theory)		
Course Code PHY301		No. of Credits	03
Contact Hours	52hours	Duration of SEP Exam	**3 hours**
Formative Assessment Marks	**20**	Summative Assessment marks	**80**

UNIT	TOPIC	No. of hrs
1	**Polarisation and Lasers**	13
2	**Optical fibers and Holography**	13
3	**Magnetic fields and forces, Electromagnetic induction**	13
4	**Alternating Currents and AC Bridges**	13
Total		**52**

Course outcomes: IV Semester

At the end of the topic, students should be able to:

- **Unit 1: Polarization and Lasers**
  1. explain the phenomenon of polarization and various methods of producing polarized light.
  2. analyze the behavior of light in anisotropic media and understand the function of polarizing optical devices.
  3. explain the principles of laser operation, including stimulated emission and population inversion.
  4. describe the construction and working of different types of lasers and their applications.
- **Unit 2: Optical Fibers and Holography**
  1. explain the principles of light propagation in optical fibers.
  2. classify optical fibers and analyze factors affecting signal transmission.
  3. understand the applications of optical fibers in communication and sensing.
  4. explain the basic principles of holography and its applications.

- **Unit 3: Magnetic Fields and Forces, Electromagnetic Induction**
    1. understand the Magnetic Fields and Forces,
    2. understand the concepts of Sources of Magnetic Field, Electromagnetic Induction.
    3. explain the principles and applications Sources of Magnetic Field, Electromagnetic Induction
- **Unit 4: Alternating Currents and AC Bridges**
    1. analyze AC circuits containing resistors, capacitors, and inductors.
    2. understand the concepts of impedance, resonance, and power in AC circuits.
    3. explain the principles and applications of AC bridge circuits.

UNIT - I

Polarization

Review of plane polarized light and method of production; Double refraction at crystals; Huygens' explanation of double refraction; Theory of superposition of two plane polarized waves with perpendicular vibrations, Production and detection of linearly , elliptically and circularly polarized light; Theory of retarding plates - Quarter wave plates and Half wave plates. Optical activity - Fresnel's explanation, Laurent's half shade polarimeter, Problems. **(7 hours)**

LASERs

Introduction: LASER and types of LASERs. Characteristics of a LASER ,Spontaneous and stimulated emission; Einstein's coefficients and optical amplification; Population inversion; Main components of a LASER; Lasing action; Ruby LASER- construction and working - energy level diagram; He-Ne LASER- construction and working - energy level diagram. Spatial Coherence and directionality, estimates of beam intensity; temporal coherence and spectral energy density. Applications of LASERS. Problems **(6 hours)**

UNIT II

Optical fibers

Principle, Description and classification; glass fibers and their advantages, Numerical aperture of fiber;Types of ray paths; Ray paths in a homogeneous medium, in square law media, factors affecting ray paths; Attenuation in optical fibers-types and causes.
Single mode and Multimode optical fibers, Ray dispersion in multi-mode step index fibers and in graded index fibers. Dispersion due to material: Dispersion and maximum bit rates. Application of optical fibers in Communication and as Sensors. Problems

(10 hours)

Holography

Principle of Holography, types of holograms, Recording of holograms; Reconstruction Method in hologram. Theory of Holography between two plane waves. Point source holograms. Applications of holography: 3D reconstruction, Interferometry. (**3 hours**)

UNIT III

Magnetic fields and forces

Force on a moving charge in a magnetic field, Definition of magnetic field, Theory of Ballistic galvanometer -

Ampere's law and Biot – Savart's law (magnetic force and magnetic flux), Magnetic force on a current carrying conductor, Magnetic field due to a straight current carrying conductor (Derivation for Finite/Infinite Length, Ampere's swimming rule, Right hand palm rule), Magnetic field of a circular loop; Force and torque on a circular current loop in a magnetic field, magnetic dipole moment, Field on the axis of a solenoid (derivation, Force between parallel conductors; Definition of ampere; Lorentz force, Hall Effect in conductors. Problems (**9 hours**)

Electromagnetic induction

Conducting rod moving in a magnetic field, Expression for induced emf, Faraday's laws of induction, Lenz's law, self-inductance, mutual inductance and energy stored in a magnetic field (derivation). Eddy currents and applications. Problems (**4 hours**)

UNIT IV

Alternating currents

Reactance of a capacitor and an inductor, AC applied to series RL and RC circuits – phasor diagrams, expressions for impedance and current; series and parallel RLC circuits - phasor diagrams, expressions for impedance and current, electrical resonance, resonant frequency, sharpness of resonance; Q factor, power and wattless current in AC circuit . Problems **(9 hours)**

AC Bridges

Definition, Basic ac bridge circuit with impedances and two balance conditions, De Sauty's Bridge, expression for capacitance of a capacitor (derivation), Maxwell's Impedance Bridge, expression for the self inductance of an inductor (derivation) and

Anderson's Bridge, expression for the self inductance of an inductor (no derivation). Problems **(4 hours)**

Reference Books

Optics by A. K. Ghatak, 5th Edition, Tata McGraw-Hill Education

Optics by M. R. Srinivasan, 1st Edition, New Age International

Optics by A. K. Ghatak and K. Thyagarajan, 2nd Edition, Macmillan India

Introduction to Modern Optics by Grant R. Fowles, 2nd Edition, Dover Publications

A text book of Optics, Brij Lal, M N Avadhanulu and Subramanyam, S Chand Publishing, 2012

Principles of Electronics, VK Mehta and Rohit Mehta S Chand and Company, 11th edition 2008

Feynman Lecture Series, volume 2, R P Feynman et al, Narosa Publishing House, New Delhi, 2013,

Electricity and Magnetism, D L Sehgal, K L Chopra N K Sehgal ,S Chand and Company, 6th edition 1988

Electricity and Electronics, DC Tayal, Himalaya publishing house, 6th edition, 1988

Electricity and Magnetism, R Murugeshan ,S. Chand Publishing, 2017

Electricity and Electromagnetism, ICFAI Pearson 2012

Introduction to Electrodynamics, DJ Griffiths, 4th edition Pearson, 2015

Fundamentals of Electricity and Magnetism, DN Vasudeva, S Chand, 2013

A textbook of Electrical Technology, B LThereja and A K Thereja, revised by S K Tarnekar, S Chand and Company, 2005

Fundamentals of Physics by Halliday, Resnick and Walker, Asian books, Pvt Ltd, New Delhi, 5th edition 1994

Electromagnetics by B B Laud, 3rd edition, New Age Internal Publishers, 2011

Introduction to Fiber Optics, A. Ghatak, , Cambridge University Press, 1998

Introduction to Modern Optics, G. Fowles, Dover Publications, 1989

Optics, E. Hecht & A. Ganesan, Pearson Prentice Hall, 2009

Fibre optics through experiments, M.R.Shenoy, S.K.C. Khijwania, et.al. 2009, Viva Books

1. Optical Fiber Communications, Keiser, G., McGraw-Hill International, 2000
2. Optical Fiber Communications – Principles and Practice, Seniors J M, Prentice-Hall of India, 1996
3. An Introduction to Optical Fibers, Cherin, A.H., McGraw Hill Book Company, 1983.
4. The complete book of hologram- How they work and how to make them- By Joseph Emil Kasper, Steven A Feller, 2001

The hologram-Principles and techniques by Richardson Martin J John Wiley & Sons

SYLLABUS for IV semester BSc Physics
PRACTICAL PHYSICS IV

Refractive index of glass - Brewster's law
Specific rotation of a liquid using polarimeter
Wavelength of LASER- diffraction at a wire/due to graduations of a metal scale
Wavelength of LASER - diffractions Wavelength of LASER – diffraction at a single slit
Measurement of numerical aperture of an optical fibre
To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece.
Impedance of RC circuit-determination of frequency of AC
Determination of L & C by equal voltage method
Determination of high resistance by leakage using BG
Determination of capacitance of a capacitor using BG
Determination of B_H using Helmholtz double coil galvanometer
Determination of earth's magnetic field using BG
De Sauty's bridge
Maxwell's impedance bridge
Anderson's bridge
Series LCR circuit
Parallel LCR circuit
Black box- identification of R,L and C
Determination of frequency of ac mains using sonometer

Note: A minimum of EIGHT (8) experiments must be performed

Reference Books for Physics practical syllabus IV semester

BSc Practical Physics (Revised Edition) C L Arora, S Chand & Co, 2007
An Advanced course in practical Physics, D Chatopaddhyay, P C Rakshit, B Saha, New Central Book Agency Pvt. Ltd., 2002
Physics through experiments B. Saraf, Vikas Publications 2013
A Laboratory manual of Physics for Undergraduate classes, 1st Edition, D P Khandelwal, Vikas Publications 1985

Advanced Practical Physics for students, B L Flint and Worsnop, Asia Publishing House, 1971

A Text book of Practical Physics , I Prakash & Ramakrishna, Kitab Mahal, 11th Edition,2011

Advanced Level Physics Practicals, Michael Nelson & Jon M Ogborn, Heinemann Educational Publishers, 4th Edition, 1985

BSc Course for Benagluru City university Frame work for Physics as per Higher Education Council Guidelines (for three major)

B.Sc. Course Physics Question paper pattern

PART A		Total marks
1 Mark answers		
1x10=10 marks (10 out of 12)	a) True or false b) Fill in the blanks c) One word / one phrase d) MCQs	10
PART B		
2 Mark answers (10 out of 12 questions)		
2x10=20 marks	Short answers (direct and conceptual)	20
PART C		
6 Mark answers (answer any 5 out of 8)	Long answers (Single or Split questions in one main question)	
6x5=30 marks		30
PART D		
4 Mark answers (answer any 5 out of 8)		
4x5=20 marks	Problems	20
	Total	80 marks

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B.Sc. Course Physics Question paper pattern

PART A		**Total marks**
1 Mark answers		
1x10=10 marks (10 out of 12)	**a) True or false** **b) Fill in the blanks** **c) One word / one phrase** **d) MCQs**	**10**
PART B		
2 Mark answers (10 out of 12 questions)		
2x10=20 marks	**Short answers (direct and conceptual)**	**20**
PART C		
6 Mark answers (answer any 5 out of 8)	**Long answers (Single or Split questions in one main question)**	
6x5=30 marks		**30**
PART D		
4 Mark answers (answer any 5 out of 8)		
4x5=20 marks	**Problems**	**20**
	Total	**80 marks**

Distribution of Marks for the Practical Examination

Sl. no.	Particulars	Marks
1.	Writing Formulae / Statement with symbols, units and explanation of terms	05
2.	Drawing illustrative diagrams and expected graphs	05
3.	Setting up of the experiment& taking readings	10
4.	Calculations and graphs drawn based on experimental data.	10
5.	Accuracy of results with units	05
6.	Valuation of Practical Record	05
	Total	40

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Distribution of Marks for the Practical Examination		
Sl. no.	Particulars	Marks
1.	Writing Formulae / Statement with symbols, units and explanation of terms	**05**
2.	Drawing illustrative diagrams and expected graphs	**05**
3.	Setting up of the experiment& taking readings	**10**
4.	Calculations and graphs drawn based on experimental data.	**10**
5.	Accuracy of results with units	**05**
6.	Valuation of Practical Record	**05**
Total		**40**

PHYSICS ELECTIVE COURSE

Sem	Course category	Course code	Course title	Credits assigned	Instructional hours per week		Duration of exam (hrs)	Marks		
					Theory	Practical		IA	Exam	Total
III	Physics		**ENERGY SOURCES**	02	02	-------	$1\frac{1}{2}$	10	40	50
IV	Physics		**SPORTS SCIENCE**	02	02	-------	$1\frac{1}{2}$	10	40	50