Department of Physics
SYLLABUS-AY 2024-25

S. No.	Semester	Paper	Title of the Paper
1	1	C-1	**Essentials and Applications in Mathematical, Physical & Chemical Sciences (**Course code: **BSCM24101)**
2	1	C-2	**Advances in Mathematical, Physical & Chemical Sciences (**Course code: **BSCM24102)**
3	2	C-3 & M-1	**Mechanics & Properties of Matter (**Course code: **PHY 24201)**
4	2	C-4	**Waves & Oscillations (**Course code : **PHY 24202)**
5	3	C-5 &M-2	**Optics (**Course code : **PHY 23301)**
6	3	C-6	**Heat and Thermodynamics (**Course code : **PHY 23302)**
7	3	C-7	**Electronic Devices and Circuits** (Course code : **PHY 23303)**
8	3	C-8	**Analog and Digital Electronics (Course code: PHY 23304)**
9	4	C-9 & M-3	**Electricity, Magnetism & Electronics (**Course code: **PHY 23401)**
10	4	C-10 &M-4	**Modern Physics (**Course code :**PHY 23402)**
11	4	C-11	**Introduction to Nuclear and Particle Physics** (Course code : **PHY23403**)
12	5	VIB	**Low Temperature Physics & Refrigeration (**Course code: **PHY 205303-6B)**
13	5	VIIB	**Solar Energy & Applications (**Course code : **PHY 205304-7B)**
10	6		**Long Internship**

Semester 3		
Course code : **PHY 23301**		**OPTICS**
S. No.	CO	Description
1	1	To Understand about the different aberrations in lenses and discuss the methods of minimizing them.
2	2	Understand the phenomenon of interference of light.
3	3	Distinguish between Fresnel's diffraction and Fraunhoffer diffraction and observe the diffraction patterns in the case of single slit and the diffraction grating and to describe the construction and working of zone plate and make the comparison of zone plate with convex lens .
4	4	The various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity.
5	5	Comprehend the basic principle of laser, the working of He-Ne laser and Ruby lasers and their applications in different fields. To understand the basic principles of fibre optic communication and explore the field of Holography and Nonlinear optics and their applications.

Semester 3		
Course code : **PHY 23302**		**Heat and Thermodynamics**
S. No.	CO	Description
1	1	Understand the basic aspects of kinetic theory of gases, Maxwell-Boltzman distribution law, equipartition of energies, mean free path of molecular collisions and the transport phenomenon in ideal gases.
2	2	Gain knowledge on the basic concepts of thermodynamics, the first and the second law of thermodynamics, the basic principles of refrigeration, the concept of entropy, the thermodynamic potentials and their physical interpretations and to Understand the working of Carnot's ideal heat engine, Carnot cycle and its efficiency.
3	3	Develop critical understanding of concept of Thermodynamic potentials, the formulation of Maxwell's equations and its applications.
4	4	Differentiate between principles and methods to produce low temperature and liquefy air and also understand the practical applications of substances at low temperatures.
5	5	Examine the nature of black body radiations and the basic theories.

Semester 3		
Course code : **PHY 23303**		**Electronic Devices and Circuits**
S. No.	CO	Description
1	1	Understand the behaviour of P-N junction diodes in forward and reverse bias conditions and analyse the impact of junction capacitance on diode characteristics.
2	2	Analyse and compare the characteristics and operation of different BJT configurations (CB, CE, and CC) and demonstrate proficiency in biasing techniques.
3	3	Comprehend the operation and characteristics of FETs, including JFETs and MOSFETs, and explain the working principles and characteristics of UJTs.
4	4	Describe the operation and applications of various photoelectric devices such as LEDs, photo diodes, phototransistors, and LDRs.
5	5	Understand the operation of rectifiers (half-wave, full-wave, and bridge), analyse the ripple factor and efficiency, and demonstrate knowledge of different filter types and three-terminal voltage regulators .

Semester 3		
Course code : **PHY 23304**		**Analog and Digital Electronics**
S. No.	CO	Description
1	1	Understand Principles and Working of Operational Amplifier
2	2	Apply their knowledge on OP-Amp in different Applications
3	3	To understand the number systems, Binary codes and Complements.
4	4	To understand the Boolean algebra and simplification of Boolean expressions and to analyse logic processes and implement logical operations using combinational logic circuits.
5	5	To understand the concepts of sequential circuits and to analyse sequential systems in terms of state machines

ANNAVARAM SATHYAVATHI DEVI GOVERNMENT DEGREE COLLEGE FOR WOMEN
(An Autonomous Institute accredited with NAAC with "B" Grade in Cycle III)
Church Square Park, Jagannaickpur, Kakinada, Andhra Pradesh

B.Sc. Honours Course Syllabus (Single Major) (w.e.f:2023-24A.B)

SEMESTER-III

COURSE 5: OPTICS

Course code: PHY23301

Theory Credits: 3 **3 hrs/week**

UNIT-I ABERRATIONS

Introduction – monochromatic aberrations, spherical aberration, methods of minimizing spherical aberration, coma, astigmatism and curvature of field, distortion. Chromatic aberration-the achromatic doublet. Achromatism for two lenses (i) in contact and (ii) separated by a distance.

UNIT-II INTERFERENCE

Principle of superposition – coherence Conditions for interference of light. Fresnel's biprism determination of wavelength of light –change of phase on reflection. Oblique incidence of a plane wave on a thin film due to reflected light (cosine law) –colors of thin films- Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light. Determination of wavelength of monochromatic light using Newton's rings and Michelson Interferometer.

UNIT-III DIFFRACTION

Introduction, distinction between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction – Diffraction due to single slit-Fraunhoffer, Fraunhofer diffraction pattern with N slits (diffraction grating). Resolving power of grating, Determination of wavelength of light in normal incidence using diffraction grating. Fresnel's half period zones-area of the half period zones-zone plate-comparison of zone plate with convex lens-difference between interference and diffraction.

UNIT-IV POLARISATION

Polarized light: methods of polarization by reflection, refraction, double refraction, Brewster's law, Malus law-Nicol prism polarizer and analyzer, Quarter wave plate, Half wave plate-optical activity, determination of specific rotation by Laurent's half shade Polarimeter. Idea of elliptical and circular polarization

UNIT-V LASERS and HOLOGRAPHY

Lasers: introduction, spontaneous emission, stimulated emission. Population Inversion, Laser principle, Einstein Coefficients-Types of lasers-He-Ne laser, Ruby laser- Applications of lasers. Holography: Basic principle of holography-Gabor hologram and its limitations, Applications of holography.

Reference Books:

1) BSc Physics, Vol .2, Telugu Academy, Hyderabad
2) A Text Book of Optics-N Subramanyam, L Brijlal, S. Chand& Co.
3) Unified Physics Vol. II Optics & Thermodynamics – Jai Prakash Nath & Co. Ltd., Meerut
4) Optics, F.A. Jenkins and H.G. White, Mc Graw-Hill
5) Optics, Ajay Ghatak, Tata Mc Graw-Hill.
6) Introduction of Lasers – Avadhanulu, S. Chand & Co.
7) Principles of Optics- BK Mathur, Gopala Printing Press, 1995

SEMESTER-III

COURSE 5: OPTICS

Practical Credits: 1 **2hrs/week**

Minimum of 6 experiments to be done and recorded

1) Determination of radius of curvature of a given convex lens-Newton's rings.
2) Resolving power of grating.
3) Study of optical rotation –polarimeter.
4) Dispersive power of a prism.
5) Determination of wavelength of light using diffraction grating-minimum deviation method.
6) Determination of wavelength of light using diffraction grating-normal incidence method.
7) Determination of wavelength of laser light using diffraction grating.
8) Resolving power of a telescope.
9) Refractive index of a liquid-hallow prism
10) Determination of thickness of a thin wire by wedge method
11) Determination of refractive index of liquid-Boy's method.

B.Sc. Honours Course Syllabus (Single Major) (w.e.f:2023-24A.B)

SEMESTER-III

Heat and Thermodynamics

Course code: PHY23302

Theory Credits: 3 **3 hrs/week**

UNIT-I: Kinetic Theory of gases: (12 hrs.)

Kinetic Theory of gases-Introduction, Maxwell's law of distribution of molecular velocities (qualitative treatment only) and its experimental verification, Mean free path, Degrees offreedom, Principle of equipartition of energy (Qualitative ideas only), Transport phenomenon in ideal gases: viscosity, Thermal conductivity and diffusion of gases.

UNIT-II: Thermodynamics: (12hrs.)

Introduction- Isothermal and Adiabatic processes, Reversible and irreversible processes, Carnot's engine and its efficiency, Carnot's theorem, Thermodynamic scale of temperature and its identity with perfect gas scale, Second law of thermodynamics: Kelvin's and Clausius statements, Principle of refrigeration, Entropy, Physical significance, Change in entropy in reversible and irreversible processes; Entropy and disorder-Entropy of Universe; Temperature-Entropy (T-S) diagram and its uses ; change of entropy when ice changes into steam.

UNIT-III: Thermodynamic Potentials and Maxwell's equations: (12hrs.)

Thermodynamic potentials-Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's FreeEnergy and their significance, Derivation of Maxwell's thermodynamic relations from thermodynamic potentials, Applications to (i) Clausius-Clayperon's equation (ii) Value of C_P-C_V (iii) Value of C_P/C_V (iv) Joule-Kelvin coefficient for ideal gases.

UNIT-IV: Low temperature Physics: (12hrs.)

Methods for producing very low temperatures, Joule Kelvin effect, Porous plug experiment ,Joule expansion, Distinction between adiabatic and Joule Thomson expansion, Expression for Joule Thomson cooling, Liquefaction of air by Linde's method, Production of low temperatures by adiabatic demagnetization (qualitative), Practical applications of substancesat low temperatures.

UNIT-V: Quantum theory of radiation: (12 hrs.)

Black body and its spectral energy distribution of black body radiation, Kirchoff's law, Wein's displacement law, Stefan-Boltzmann's law and Rayleigh-Jean's law (No derivations), Planck's law of black body radiation-Derivation, Deduction of Wein's law and Rayleigh-Jean's law from Planck's law, Solar constant and its determination using Angstrom pyroheliometer, Estimation of surface temperature of Sun.

Reference Books:

1) BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2) Thermodynamics, R.C.Srivastava, S.K.Saha&AbhayK.Jain, Eastern Economy Edition.
3) Unified Physics Vol.2, Optics & Thermodynamics, Jai PrakashNath&Co.Ltd., Meerut
4) Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
5) Heat and Thermodynamics -N BrijLal, P Subrahmanyam, S.Chand& Co.,2012
6) Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
7) University Physics, HD Young, MW Zemansky, FW Sears, Narosa Publishers, NewDelhi

Practical Course-C-6: Heat and Thermodynamics

Work load: 30 hrs **2 hrs/week**

Minimum of 6 experiments to be done and recorded

1. Specific heat of a liquid –Joule's calorimeter –Barton's radiation correction
2. Thermal conductivity of bad conductor-Lee's method
3. Thermal conductivity of rubber.
4. Measurement of Stefan's constant.
5. Specific heat of a liquid by applying Newton's law of cooling correction.
6. Heating efficiency of electrical kettle with varying voltages.
7. Thermo emf- thermo couple - Potentiometer
8. Thermal behavior of an electric bulb (filament/torch light bulb)
9. Measurement of Stefan's constant- emissive method
10. Study of variation of resistance with temperature - Thermistor.

A.S.D GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA

Department of Physics

II B.SC PHYSICS (HON) Semester-III

COURSE 7: ELECTRONIC DEVICES AND CIRCUITS(PHY23303)

Theory Credits: 3 **3 Hrs /week**

UNIT I: PN JUNCTION DIODES

P-N junction Diode, Formation of depletion region, Forward and Reverse bias Ideal Diode, Diode equation – Reverse saturation current – Tunnel Diode- Construction, working, V-I characteristics and Applications, Zener diode – V I characteristics, Applications

UNIT II: BIPOLAR JUNCTION TRANSISTOR AND ITS BIASING: (D.C)

Transistor construction, working of PNP and NPN Transistors, Active, Cutoff and Saturation conditions, Configurations of Transistor - CB, CE, and CC, Input and Output Characteristics of CB and CE configurations. Hybrid parameters of a Transistor and equivalent circuit, BJT Transistor Biasing – Need for stabilization, Thermal runaway, Stability factor, Biasing methods - Voltage-Divider Bias.

UNIT III: FIELD EFFECT TRANSISTORS & POWER ELECTRONIC DEVICES

Difference between JFET and BJT, Construction and working of JFET, Drain and Transfer Characteristics, MOSFET - Depletion-type, and Enhancement-Type MOSFETs. FET Biasing: Voltage Divider Biasing. UJT- Construction, working, V-I characteristics. SCR – Construction, Working and Characteristics

UNIT IV: PHOTO ELECTRIC DEVICES:

Light-Emitting Diodes (LEDs) - Construction, working, characteristics and Applications, IR Emitters, Photo diode -Construction, working characteristics and Applications, Phototransistors - Construction, working and characteristics, Applications, Structure and operation of LDR, Applications.

UNIT-V: POWER SUPPLIES:

Rectifiers: Half wave, Full wave and bridge rectifiers - Efficiency (with derivations), ripple factor-Zener diode as Voltage Regulator, Filters- choke input (inductor), L- section, π-section filters. Three terminal fixed voltage IC-regulators (78XX and 79XX).

Reference Books:

1) Electronic Devices and Circuit Theory --- Robert L. Boylestad & Louis Nashelsky.
2) Electronic Devices and Circuits I – T.L.Floyd- PHI Fifth Edition
3) Integrated Electronics – Millmam & Halkias.
4) Electronic Devices & Circuits – Bogart.
5) Sedha R.S., A Text Book Of Applied Electronics, S.Chand & Company Ltd

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA

Department Of Physics

II B.SC PHYSICS (HON.)

Semester-III

COURSE 7: ELECTRONIC DEVICES AND CIRCUITS (PHY23303)

Practical Credits: 1 **2 Hrs/week**

Minimum of 6 experiments to be done and recorded

1) V-I Characteristics of junction diode
2) V-I Characteristics of Zener diode
3) Transistor characteristics – CB configuration
4) Transistor characteristics – CE configuration
5) FET input and output characteristics
6) UJT characteristics
7) LDR characteristics
8) Full wave and Bridge rectifier with filters

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II B.SC PHYSICS (HON.)

Semester-III

COURSE 8: ANALOG AND DIGITAL ELECTRONICS

Theory Credits: 3 **2hrs/week**

UNIT I: OPERATIONAL AMPLIFIERS

a) Concept of feedback in CE amplifier, negative and positive feedback, advantages and disadvantages of negative feedback, Basic concepts of differential amplifier, Block diagram of op amp and its equivalent circuit, IC Diagram (IC 741), Ideal voltage transfer curve, Open loop Op-Amp configurations- differential, inverting and non-inverting Op-Amps. b) Voltage Series Feedback Amplifier (Non-Inverting Op amp): Gain and Bandwidth derivations: Voltage Shunt Feedback Amplifier, (Inverting Op amp): Gain and Bandwidth derivations

UNIT II: PRACTICAL OPERATIONAL AMPLIFIER AND APPLICATIONS

a) Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Input offset voltage, Input bias current, Input offset current, total output offset voltage, CMRR, slew rate and concept of virtual ground. b) Applications of Op-Amp: Linear Applications: Voltage Follower, Summing Amplifier, Subtracting Amplifier, Averaging Amplifier, Difference Amplifier, Integrator and Differentiator, Square Wave response of Integrator and Differentiator (Brief explanation only).

UNIT III: NUMBER SYSTEMS, CODES AND LOGIC GATES

a) Number Systems and Codes: Decimal, Binary, Octal and Hexadecimal number systems, conversions, Binary addition, Binary subtraction using 1's and 2's complement methods, BCD code and Gray code –Conversions. b) Logic Gates: Construction and truth tables of OR, AND, NOT gates, Universal gates – Basic construction and truth tables of NOR & NAND, Realization of logic gates using NAND and NOR, XOR and XNOR Logic gates symbol and their truth tables. De Morgan's Laws, Boolean Laws, Simplification of Boolean Expressions using Boolean Laws.

UNIT IV: ARITHMETIC CIRCUITS & DATA PROCESSING CIRCUITS

a) Half Adder and Full Adder: Explanation of truth tables and Circuits. Half Subtractor and Full Subtractor: Explanation of truth tables and Circuits, 4 - bit binary Adder/Subtractor. b) Multiplexers - 2 to 1 Multiplexer, 4 to 1 multiplexer, De-multiplexers: 1 to 2 Demultiplexer, 1 to 4 Demultiplexer, Applications of Multiplexers and Demultiplexers Decoders: 1 of 2 decoders, 2 of 4 decoders, Encoders: 4 to 2 Encoder, 8 to 3 Encoder, Applications of decoders and encoders

UNIT V: SEQUENTIAL LOGIC CIRCUITS & CODE CONVERTERS

a) Combinational Logic vs Sequential Logic Circuits, Sequential Logic circuits: Flip flops, Basic NAND, NOR Latches, Clocked SR Flip-flop, JK Flip-flop, D Flip-flop, Master-Slave Flip- flop, Conversion of Flip flops. b) Code Converters: BCD to Decimal Converter, BCD to Gray Code Converter, BCD to 7 segment Decoders.

Reference Books:

1. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
2. Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011
3. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., TMH
4. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
5. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
6. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

SEMESTER-III

COURSE 8: ANALOG AND DIGITAL ELECTRONICS

Practical Credits:1 **2 hrs/week**

Minimum six experiments to be done and recorded.

1) To study the operational amplifier as inverting feedback amplifier with verifying gain.
2) To study the operational amplifier as non-inverting feedback amplifier with verifying gain.
3) To study operational amplifier as adder
4) To study operational amplifier as subtractor
5) To study operational amplifier as differentiator
6) To study operational amplifier as integrator
7) Logic Gates- OR, AND, NOT and NAND gates. Verification of Truth Tables.
8) Verification of De Morgan's Theorems.
9) Construction of Half adder and Full adders-Verification of truth tables
10) Flip flops
11) Multiplexer and De-multiplexer
12) Encoder and Decoder