SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA VIJAYAWADA-10
(An Autonomous college in the jurisdiction of Krishna University, Machilipatnam)

DEPARTMENT OF PHYSICS

Course Code				23PHMAL231			
Title of the Course				**WAVE OPTICS**			
Offered to: (Programme/s)				**B. Sc H Physics, Mathematics**			
L	**4**	**T**	**0**	**P**	**2**	**C**	**4**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	**MAJOR/MINOR**			**Course Relates to:**	**GLOBAL**		
Year of Revision:	**2024**			**Percentage:**	**100%**		
Type of the Course:				EMPLOYABILITY			
Crosscutting Issues of the Course :				ENVIRONMENT AND SUSTAINABILITY			
Pre-requisites, if any				BASIC KNOWLEDGE			

Course Description:

This course explores wave optics, covering the principles of interference, diffraction, polarization, and aberrations. Topics include Fresnel's Bi-Prism, Newton's rings, diffraction gratings, and methods to produce and analyze polarized light. It also delves into laser technology and holography, emphasizing practical applications in wavelength determination, optical devices, and advanced imaging techniques.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	To help students to understand the nature of light, its propagation and interaction with matter which is essential to constantly emerging newest technologies.
2	To create interest among the students about the modern communication systems by studying wave optics
3	Students will be able to understand applications of interference, diffraction, lasers in real life situations.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Understand the phenomenon of interference of light and its formation in (i) Lloyd's single, Newton's rings and Michelson interferometer			
CO2	Distinguish between Fresnel's diffraction and Fraunhofer diffraction and observe the diffraction patterns in the case of a single slit and the diffraction grating			
CO3	Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity.			
CO4	Gain knowledge of various types of optical fibers			
CO5	Comprehend the basic principle of laser, the working of He-Ne laser and Ruby lasers and their applications in different fields			

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1					3				
CO2						2			

CO3						1			
CO4							3		
CO5						3			

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Structure:

Unit- I **12 Hrs.**

Interference of light

A) Division of Wavefront: Introduction, Conditions for the interference of light, Interference of light by division of wavefront and amplitude, Fresnel's Bi-Prism-Determination of Wavelength of Light, Phase change on reflection- Stokes' treatment.

B) Division of Amplitude: Cosine law - colours in thin films, Newton's rings in reflected light - Determination of wavelength of monochromatic light, Michelson interferometer and determination of wavelength.

Unit- II **12 Hours**

Diffraction of light

A) Fraunhofer Class: Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, N-slits (No derivation), Determination of wavelength of light using a diffraction grating, Resolving power of grating,

B) Fresnel's Class: Fresnel's half-period zones, Zone plate, comparison of zone plate with a convex lens.

Unit – III **12 Hours**

Polarisation of light

A) Polarized light: Methods of production of plane-polarized light - Polarisation by reflection (Brewster's law), Malus law, Double refraction, Nicol prism, Nicol prism as polarizer and analyzer

B) Types and production of polarized Light:

Quarter wave plate, Half wave plate, Optical activity, Idea of Plane, circular & Elliptical polarized light (Concept only), Laurent's half shade polarimeter : determination of the specific rotation.

Unit – IV **12 Hours**

Aberrations:

A) Monochromatic aberrations - Spherical aberration, Methods of minimizing spherical aberration, Coma, Astigmatism, - minimization methods,

B) Chromatic aberration - the achromatic doublet; Achromatism for two lenses (i) in contact and (ii) separated by a distance.

Unit – V **12 Hours**

Lasers and Holography

A) Lasers Introduction, Spontaneous emission, stimulated emission, Population Inversion, Laser principle, Einstein coefficients, Ruby, He-Ne laser - Applications of lasers.

B) Holography Basic principle and construction of holography, Applications of holography

Text BOOKS:

- BSc Physics, Vol.2, Telugu Akademy, Hyderabad
- Unified Physics Vol. II Optics, Jai Prakash Nath & Co.Ltd., Meerut., Meerut

REFERENCE BOOKS:

1. A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand &Co.
2. Optics-Murugesan, S. Chand & Co.
3. Optics, F.A. Jenkins and H.G. White, McGraw-Hill
4. Optics, Ajoy Ghatak, Tata McGraw-Hill.
5. Introduction of Lasers – Avadhanulu, S. Chand &Co.

6. Principles of Optics- BK Mathur, Gopala Printing Press,1995

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SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA: VIJAYAWADA-10

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SEMESTER -END QUESTION PAPER STRUCTURE

Course Code & Title of the Course:	**23PHMAL231(WAVE OPTICS)**
Offered to:	**B. Sc H Physics, Mathematics**
Category:	**SEMESTER: 3**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A:

Short Answer Questions (20 Marks) Answer All questions. Each question carries 4 Marks.

1 (a) What are the conditions for interference of light? (CO1, L3)

OR

(b) In a Newton's ring experiment, the diameter of the 10th dark ring is 0.433 cm. Find the wavelength of the incident light, if the radius of curvature of the lens is 80 cm. (CO1, L3)

2 (a) Distinguish between Fraunhofer and Fresnel diffraction. (CO2, L3)

OR

(b) A diffraction grating has 15 cm of the surface ruled with 6000 lines per cm. Evaluate the resolving power of grating in the first order. (CO2, L3)

3 (a) State the Brewster and Malus law. (CO3, L3)

OR

(b) A half wave plate is constructed for a wavelength of $6000A^0$. Find the value of the wavelength of light for which this plate works as a quarter wave plate. (CO3, L3)

4 (a) Explain spherical aberrations. (CO4, L3)

OR

(b) Derive the condition for Achromatism for when two lenses are separated by distance. (CO4, L3)

5 (a) Write the applications of LASERS. (CO5, L3)

OR

(b) Write the applications of holography. (CO5, L3)

Section B

Long Answer Questions (50 Marks). Answer All questions. Each question carries 10 Marks.

6. a) Describe the experimental arrangement for observation Fresnel Bi prism experiment. (CO2, L2)

(OR)

b) Describe Newton's rings method for measuring the wave length of monochromatic light with necessary theory. (CO1, L2)

7. a) What is diffraction? Explain the Fraunhoffer diffraction due to single slit with intensity distribution. (CO2, L3)

(OR)

b) Describe the construction and working of zone plate. Derive the equation for its focal length. (CO2, L3)

8 a) Describe the construction and working of Nicol prism. Explain how it can be used as polarizer and analyser. (CO3, L1)

(OR)

b) What is specific rotation? Describe how specific rotation of sugar solution can be determined experimentally. (CO3, L2)

9 a) Explain about COMA and ASTIGAMATISM. (CO4, L1)

(OR)

b) Define chromatic aberration, Derive the condition for Achromatism for when two lenses are in contact. (CO1, L2)

10 a) What is LASER? Explain the construction and working of Ruby laser with neat diagram. (CO5, L2)

(OR)

b) Explain the basic principle and construction of holography. (CO5, L2)

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(An Autonomous College in the jurisdiction of Krishna University, Machilipatnam)

Course Code				**23PHMAP231**			
Title of the Course				**WAVE OPTICS**			
Offered to: (Programme/s)				**B.Sc H Physics, Mathematics**			
L	**0**	**T**	**0**	**P**	**2**	**C**	**1**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	**MAJOR, MINOR**			**Course Relates to:**		**L, R, N & G**	
Year of Revision:	**2024**			**Percentage:**		**100 %**	
Type of the Course:				**EMPLOYABILITY & SKILL DEVELOPMENT**			
Crosscutting Issues of the Course :							
Pre-requisites, if any				**BASIC KNOWLEDGE OF OPTICS**			

Course outcomes (Practical):

On successful completion of this practical course the student will be able to,

1. Gain hands-on experience of using various optical instruments like spectrometer, polarimeter and making finer measurements of wavelength of light using Newton Rings experiment, diffraction grating etc.
2. Understand the principle of working of polarimeter and the measurement of specific rotatory power of sugar solution
3. Know the techniques involved in measuring the resolving power of telescope and dispersive power of the material of the prism.
4. Be familiar with the determination of refractive index of liquid by Boy's method and the determination of thickness of a thin wire by wedge method.

Minimum of 7 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. Resolving power of a telescope.
8. Refractive index of a liquid-hallow prism
9. Determination of thickness of a thin wire by wedge method
10. Determination of refractive index of liquid-Boy's method.

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA: VIJAYAWADA-10

(An Autonomous College in the jurisdiction of Krishna University, Machilipatnam)

Course Code				23PHMAL233			
Title of the Course				**HEAT & THERMODYNAMICS**			
Offered to: (Programme/s)				**B. Sc H Physics**			
L	**4**	**T**	**0**	**P**	**2**	**C**	**4**
Year of Introduction:		**2024-25**		**Semester:**			**3**
Course Category:		**MAJOR**		**Course Relates to:**		**GLOBAL**	
Year of Revision:		**2024**		**Percentage:**		**100 %**	
Type of the Course:				EMPLOYABILITY			
Crosscutting Issues of the Course :				ENVIRONMENT AND SUSTAINABILITY			
Pre-requisites, if any				BASIC KNOWLEDGE			

Course Description:

The course makes the students able to understand the basic physics of heat and temperature and their relation with energy, work, radiation and matter. The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work. The course contains the study of laws of thermodynamics, thermodynamic description of systems, thermodynamic potentials, and kinetic theory of gases.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	Understand the kinetic theory of gases and transport phenomena, including viscosity, thermal conductivity, and diffusion.
2	Explore thermodynamic principles, including entropy, thermodynamic potentials, and their applications in various processes.
3	Learn the fundamentals of low-temperature physics and radiation laws, with a focus on blackbody radiation and methods of measuring radiation.

COURSE OUTCOMES

Upon successful completion of this course, students should have the knowledge and skills to:

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	State the First Law and define heat, work, thermal efficiency, and the difference between various forms of energy and describe energy exchange processes, reversible and irreversible processes.			
CO2	Understand the microscopic behaviour of molecules, interactions, and the concepts of transport phenomena of heat transfer, mass transfer, and momentum transfer.			
CO3	Use kinetic theory of gases to derive expressions for the pressure of an ideal gas, heat capacities of solids and gases, and transport properties.			
CO4	Understand very low temperatures like the concept of Joule Thomson effect, Liquefaction of gases, and the properties at very low temperatures.			
CO5	Ability to evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations. Examine the nature of black body radiations and the basic theories.			

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1					3				
CO2						2			
CO3						1			
CO4							3		
CO5						3			

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

UNIT-I: **Kinetic Theory of gases**: (12 Hrs)

1.1 Kinetic Theory of gases-Introduction, Maxwell's law of distribution of molecular velocities, Mean free path, Degrees of freedom, Principle of equipartition of energy (Qualitative ideas only),

1.2 Transport phenomenon in ideal gases: viscosity, Thermal conductivity and diffusion of gases.

UNIT-II: T**hermodynamics**: (12 Hrs)

2.1 Introduction to Thermodynamics

Introduction- Isothermal and Adiabatic processes - Work done in these processes, Heat engines - Reversible and irreversible processes, Carnot's engine and its efficiency, Second law of thermodynamics, Carnot's theorem, Thermodynamic scale of temperature

2.2 Entropy

Entropy and its Physical significance, change in entropy in reversible and irreversible processes; Entropy and disorder-Entropy of Universe; Temperature-Entropy (T-S) diagram and its uses

UNIT-III: (12Hrs)

Thermodynamic Potentials and Maxwell's equations: **(NO PROBLEM)**

3.1 Thermodynamic potentials - Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations from thermodynamic potentials,

3.2 Applications of Maxwell's thermodynamic relations: (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 and Van der Waals' gases

UNIT-IV: (12Hrs)

Low temperature Physics:

4.1 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

4.2 Production of low temperature: Adiabatic demagnetization **(Qualitative),** Principle of Refrigeration, effects of chloro and fluoro carbons on ozone layer.

UNIT-V:

5.1 Radiation Laws: (12 Hrs)

Blackbody 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.

5.2 Measurement of Radiation

Pyrometers: Angstrom pyrheliometer and determination Solar constant, Estimation of the surface temperature of Sun.

TEXT BOOKS

1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2. Unified Physics Vol.2, Optics & Thermodynamics, Jai Prakash Nath &Co.Ltd., Meerut

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Model Question Paper

Title of the Paper: Thermodynamics and Radiation Physics

Section-A

Answer the following Questions: 5X4=20M

1. (A). Write a note mean free path. (CO1, L1)

(OR)

(B). Explain the second law of thermodynamics in terms of entropy. (CO2, L2)

2. (A). Prove $C_p - C_v = R$ (CO3, L3)

(OR)

(B). Write the principle of refrigeration. (CO4, L3)

3. (A). How did you find the solar constant? (CO5, L2)

(OR)

(B). Find the R.M.S velocity of hydrogen at N.T.P and at C? (CO1, L3)

4. (A). Calculate the efficiency of a reversible engine that operates between the temperatures 200^0 C and 120^0 C? (CO1, L3)

(B). Calculate the temperature inversion of helium gas. Given a=3.44 $x10^{-3}$ntm^4/mol^2 and b = 0.023 $x10^{-3}$ m^3 /mol. (CO1, L3)

5. (A). Find the wavelength at which maximum energy is radiated by a black at a temperature of 227^0 C and Wien's constant is 2.877$x10^{-3}$ mk. (CO1, L3)

(OR)

(B) Calculate the temperature of the sun from the following data S= 1.34 kW/m^2, radius of the sun = 7.92X10^5 km. Distance of the sun from the earth = 1.5X10^5km and Stefan's constant =5.7X10^{-8} Wm^{-2}K^{-4}

Section-B

Answer the following: 5X10=50M

1 (A) Derive an expression for Maxwell's law of distribution of molecular speeds in a gas. (CO1, L1)

(OR)

(B) Define coefficient of viscosity. On the basis of kinetic theory of gases, derive an expression for the coefficient of viscosity. (CO1, L1)

2 (A) Describe the working of Carnot's reversible engine and derive an expression for its efficiency. (CO2, L2)

(OR)

(B) What are reversible and irreversible processes? How does the entropy change in each of these processes? (CO2, L2)

3 (A) Define the four thermodynamic potentials. Obtain Maxwell's thermodynamic equations using these potentials. (CO3, L3)

(OR)

(B) State and explain the Joule-kelvin effect. Obtain an expression for Joule-kelvin coefficient. (CO3, L3)

4 (A) What is adiabatic demagnetization? How is this principle used in producing low temperatures? (CO3, L2)

(OR)

(B) Explain Joule-kelvin effect. Derive an expression for Joule-Thompson cooling. (CO4, L2)

5 (A) Derive the Planck's formula for the distribution of energy in black body radiation.(CO5, L2)

(OR)

(B) What is a pyrometer? Describe the construction and working of Angstrom pyrheliometer (CO5, L2)

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA: VIJAYAWADA-10

(An Autonomous College in the jurisdiction of Krishna University, Machilipatnam)

Course Code				**23PHMAP232**			
Title of the Course				**HEAT & THERMODYNAMICS**			
Offered to: (Programme/s)				**B.Sc H Physics**			
L	**0**	**T**	**0**	**P**	**2**	**C**	**1**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	**MAJOR**			**Course Relates to:**		**L, R, N & G**	
Year of Revision:	**2024**			**Percentage:**		**100 %**	
Type of the Course:				**EMPLOYABILITY & SKILL DEVELOPMENT**			
Crosscutting Issues of the Course :							
Pre-requisites, if any				**BASIC KNOWLEDGE OF HEAT**			

Course Description

Students would gain practical knowledge about heat and radiation, thermodynamics, thermo emf, RTD etc. and perform various experiments.

Course Objectives:

1. The primary objective of this course is to provide the fundamental knowledge to understand the behaviour of thermal systems.
2. This course provides a detailed necessary transfer through solids, fluids, and experimental analysis, including the application and heat vacuum.
3. Convection, conduction, and radiation heat transfer in one and two dimensional steady and unsteady systems are examined.

COURSE OUTCOMES

Upon successful completion of this course, students should have the knowledge and skills to:

CO1: Determine the thermal conductivity of bad conductor-Lee's method, thermal conductivity of rubber and Coefficient of thermal conductivity of copper by using Searle's apparatus.

CO2: Study the heating efficiency of electrical kettle with varying voltages.

CO3: Determine Specific heat of a liquid by Joule's calorimeter and study Barton's radiation correction by plotting a graph between temperature and time and Specific heat of a liquid by applying Newton's law of cooling correction.

CO4: Study temperature variation of resistance in a thermostat.

List of experiments

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

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA: VIJAYAWADA-10

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SEMESTER END EXAMINATION 2024-2025

Title of the Paper: HEAT AND THERMODYNAMICS

Semester: III **Course code:**

Max Time: 3 Hrs **Max Marks: 70 M**

SECTION- A

Answer all the questions: **5x4=20 M**

1. a. What is mean free path? Obtain an expression for mean free path on the basis of kinetic theory of gases. L1, 4M

OR

b. Explain transport phenomena with reference to a gas. L2, 4M

2. a. State and explain the first law of thermodynamics. L1, 4M

OR

b. Calculate the change in entropy when 1 kg of ice at 0^0C is changed to 2^0C (latent heat of ice is 80 kcal / kg. L3, 4M

3. a. Determine Clasius Clapeyron equation. Mention its applications. L2, 4M

OR

b. Determine the Ratio between two Specific heats. L3, 4M

4. a. Determine the temperature of Sun with the help of Wien's law, given b = 2.92 x 10^{-3} mk. Maximum wave length = 4900^0A. L3, 4M

OR

b. What is black body? Write a short note on Ferry's black body? L1, 4M

5. a. Write the properties of a good refrigerant. L1, 4M

OR

b. Calculate the temperature of inversion of helium gas, given a = 3.44 x 10^{-3} nt - m^4 / mol^2 and b = 0.0237 x 10^{-3} m^3 / mole and R = 8.31 joule / mole – K. L3,4M

SECTION- B

Answer all the questions: **5x10=50M**

6. a. Explain the Maxwell's law of distribution of molecular speeds. L1, 10 M

OR

b. On the basis of kinetic theory of gases, derive expressions for viscosity and thermal conductivity of a gas. Obtain the relations between these two. L2, 10 M

7. a. Describe the working of Carnot's engine and derive an expression for its efficiency. L3, 10M

OR

b. Define entropy. What is the physical significance of entropy? Write a note on entropy change in a reversible process. L2, 10 M

8. a. What are thermodynamic potentials? Derive Maxwell's thermodynamic relations from thermodynamic potentials. L1, 10 M

OR

b. Obtain an expression for the difference of molar specific heat using Maxwell's relations for a perfect gas. L2, 10 M

9. a. What is Joules Thomson effect? Obtain an expression for cooling produced when a gas suffers Joules Thomson effect. L1, 10 M

OR

b. What is adiabatic demagnetisation? How is this principle used in producing low temperatures? L2, 10 M

10. a. What is Planck's hypothesis? Derive Planck's formula for the distribution of energy in black body radiation. L2, 10 M

OR

b. What is solar constant? Determine the solar constant using angstrom pyrheliometer. L1, 10 M

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Course Code			**23PHMAL233**				
Title of the Course			**ELECTRONIC DEVICES & CIRCUITS**				
Offered to: (Programme/s)			**II B.Sc. H PHYSICS**				
L	**4**	**T**	**0**	**P**	**0**	**C**	**4**
Year of Introduction:	**2024-25**		**Semester:**		**3**		
Course Category:	**MAJOR**		**Course Relates to:**		**L, R, N, G**		
Year of Revision:	**2024**		**Percentage:**		**100 %**		
Type of the Course:			**EMPLOYABILITY**				
Crosscutting Issues of the Course :			**ENVIRONMENT AND SUSTAINABILITY AND HUMAN VALUES AND PROFESSIONAL ETHICS**				
Pre-requisites, if any			**BASIC KNOWLEDGE OF MATERIAL**				

Course Description:

This course provides an in-depth study of electronic devices and circuits, covering the fundamentals of P-N junction diodes, transistors, and their biasing techniques. It also explores advanced power electronic devices, photoelectric devices, and power supplies. Key topics include diode characteristics, transistor configurations, FETs, MOSFETs, rectifiers, and filter circuits, emphasizing their practical applications in electronics.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	To introduce semiconductor devices such as the P.N. junction diode, Zener diode, and tunnel and their characteristics, operations, circuits, and applications.
2	To introduce PNP and NPN transistor operation and various modes of operations, characteristics, relations and their Hybrid parameters.
3	To analyse and interpret FET and MOSFET circuits for small signals at low and high Frequencies
4	To study the characteristics of different Photoelectric devices
5	To study the different types of Rectifiers & filters

UNIT I: PN JUNCTION DIODES 12 Hrs

P-N junction Diode, Formation of the depletion region, Forward and Reverse bias - Reverse saturation current, Zener diode - V-I characteristics, Zener diode as Voltage Regulator, Tunnel Diode - working, V-I characteristics, Advantages and Disadvantages of P-N, Zener & Tunnel diodes.

UNIT –II: TRANSISTOR AND ITS BIASING: (D.C) 12 Hrs

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 CE configurations. Relation between α, β and γ relation, Hybrid parameters of a Transistor and equivalent circuit,

UNIT III: TRANSISTORS & POWER ELECTRONIC DEVICES 12 Hrs

BJT Transistor Biasing - Need for biasing, BJT biasing- methods, basic stability, fixed bias, collector-to-base bias, self-bias, Stabilization against variations in V_{BE}, I_c, and β, Stability factors, (S, S′, S′′), Bias compensation, Thermal runaway, Thermal stability.

FET - Construction, Working, drain and transfer characteristics. MOSFET-enhancement, depletion MOSFET, construction and working, Characteristics of MOSFET, applications of MOSFET.

UNIT IV: PHOTO ELECTRIC DEVICES: 12 Hrs

Light-emitting diodes (LEDs) - Construction, working, characteristics and Applications, Photodiode - Construction, working characteristics and Applications,

Phototransistors - Construction, working and characteristics, Applications, LDR - Structure and operation, Applications

UNIT-V: POWER SUPPLIES: 12 Hrs

Rectifiers: Half wave, full wave, bridge rectifier, derivations of characteristics of rectifiers.

Filters -Inductor filter (Series inductor), Capacitor filter (Stunt inductor), π Filter, comparison of various filter circuits in terms of ripple factors.

TEXT 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

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SEMESTER -END QUESTION PAPER STRUCTURE

Course Code & Title of the Course:	**23PHMAL233 ELECTRONIC DEVICES & CIRCUITS**
Offered to:	**II B.Sc. H PHYSICS**
Category:	**SEMESTER: 3**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions (20 Marks)

Answer All questions. Each question carries 4 Marks.

Q1 (a) Show that Zener diode can work as a voltage regulator

OR

(b) What are the advantages and disadvantages of PN Junction Diode

Q2 (a) Explain the input and output characteristics of CE configuration

OR

(b) Write a short on Hybrid parameters of a Transistor.

Q3 (a) Explain collector-to-base biasing.

OR

(b) Write any five applications of MOSFET.

Q4 (a) Write a short note on structure and operation of Phototransistor.

OR

(b) Mention any four applications of Photodiode.

Q5 (a) Explain the construction and working of a Half wave rectifier.

OR

(b) Explain the working of capacitor filter.

Section B: Long Answer Questions (50 Marks)

Answer All questions. Each question carries 10 Marks.

Q6 (a) Explain the construction and working and V-I characteristics of a PN Junction diode

OR

(b) Discuss the working of a Tunnel diode. Explain its V-I characteristics.

Q7 (a) Describe the construction & working of a NPN Transistors. Explain its Active, Cut-off and Saturation conditions.

OR

(b) Define the terms α, β and γ terms of a transistor and obtain the relation between them

Q8 (a) Explain the construction, working drain and transfer characteristics of a FET

OR

(b) Explain the need for biasing. Explain various methods of Biasing.

Q9 (a) Discuss the construction, working & characteristics of a Light-emitting diodes.

OR

(b) Describe the construction, working & characteristics of a photo transistor.

Q10 (a) With a circuit diagram, explain the construction & working of a bridge rectifier

OR

(b) Explain the construction & working of an inductor and II filter.

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA: VIJAYAWADA-10
(An Autonomous College in the jurisdiction of Krishna University, Machilipatnam)

Course Code				**23PHMAL233**			
Title of the Course				**ELECTRONIC DEVICES & CIRCUITS**			
Offered to: (Programme/s)				**II B.Sc. H PHYSICS**			
L	**4**	**T**	**0**	**P**	**0**	**C**	**4**
Year of Introduction:		**2024-25**		**Semester:**		**3**	
Course Category:		**MAJOR**		**Course Relates to:**		**L, R, N, G**	
Year of Revision:		**2024**		**Percentage:**		**100 %**	
Type of the Course:				**EMPLOYABILITY**			
Crosscutting Issues of the Course :				**ENVIRONMENT AND SUSTAINABILITY AND HUMAN VALUES AND PROFESSIONAL ETHICS**			
Pre-requisites, if any				**BASIC KNOWLEDGE OF MATERIAL**			

COURSE OBJECTIVE: The course objectives for a practical course in Electronic Devices and Circuits might provide hands-on
experience with the fundamental principles of electronic devices and circuits.

LEARNING OUTCOMES:

1. Understand the principles of electronic devices and circuits and their applications in real-world scenarios.
2. Analyze and design electronic circuits using diodes, transistors, and operational amplifiers.
3. Understand the importance of biasing and stability in electronic circuits and how to achieve them.
4. Develop the skills to design and analyze amplifier circuits and to understand the concept of feedback and its application in electronic circuits.
5. Analyze and design simple oscillators, power supplies, and filters.
6. Gain hands-on experience with electronic test equipment such as multimeters, oscilloscopes, and function generators.
7. Develop skills in circuit construction, measurement, and testing.
8. Learn how to troubleshoot and diagnose electronic circuit problems.
9. Understand the safety procedures for working with electronic circuits and equipment.

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

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA: VIJAYAWADA-10
(An Autonomous College in the jurisdiction of Krishna University, Machilipatnam)

Course Code				**23PHMAP234**			
Title of the Course				**ANALOG AND DIGITAL ELECTRONICS**			
Offered to: (Programme/s)				**B.Sc H Physics**			
L	**0**	**T**	**0**	**P**	**2**	**C**	**1**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	**MAJOR**			**Course Relates to:**			**L, R, N & G**
Year of Revision:	**2024**			**Percentage:**			**100 %**
Type of the Course:				**EMPLOYABILITY & SKILL DEVELOPMENT**			
Crosscutting Issues of the Course :							
Pre-requisites, if any				**BASIC ELECTRONICS**			

Course Description:
This lab course provides hands-on experience with operational amplifiers, number systems, logic gates, arithmetic circuits, data processing circuits, and sequential logic circuits. Students will explore basic differential amplifiers, internal Op-Amp blocks, and applications such as voltage followers and amplifiers. They will learn binary-to-decimal conversions, Boolean algebra, and logic gate operations. The course covers arithmetic circuits like adders and subtractors, as well as multiplexers, demultiplexers, decoders, and encoders. Sequential logic circuits, including various types of flip-flops, are also examined. The lab emphasizes practical skills and foundational knowledge essential for understanding and applying electronic circuit principles.

Course Aims and Objectives:

S. NO	COURSE OBJECTIVES
1	Study internal blocks, characteristics, and applications of operational amplifiers, including inverting/non-inverting amplifiers, comparators, integrators, and differentiators.
2	Convert between binary/decimal systems, apply Boolean algebra, and work with basic logic gates like NAND, NOR, and exclusive-OR.
3	Create and analyze half/full adders and subtractors, and 4-bit binary adders/subtractors.
4	Build and understand multiplexers, demultiplexers, decoders, and encoders for data processing.
5	Design and convert RS, SR, JK, D, T, and Master-Slave flip-flops for sequential circuits and code converters.

Course Outcomes
At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Understand Op-Amps	K2		
CO2	Gain the knowledge of Number Systems and Logic Gates	K1		
CO3	Design Arithmetic Circuits	K6		
CO4	Implement Data Processing Circuits	K3		
CO5	Design and convert Sequential Logic Circuits	K3		

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1									
CO2									
CO3									
CO4									
CO5									

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

UNIT-I: OPERATIONAL AMPLIFIERS – I 12 Hours

1(a) Operational Amplifiers: Basic differential amplifiers, Op-Amp supply voltage, IC identification, Internal blocks of Op-Amp.

1 (b) Characteristics of ideal and practical Op-Amp (IC 741) its parameter offset voltages and currents, CMRR, slew rate, concept of virtual ground.

Unit-II OPERATIONAL AMPLIFIERS-II 12 Hours

2(a) Applications of Op-Amp: Op-Amp as a voltage follower, Inverting amplifier, non-inverting amplifier, and voltage follower.

2(b) Summing amplifier, difference amplifier, comparator, integrator, Differentiator.

UNIT-III: NUMBER SYSTEMS, CODES AND LOGIC GATES 12 Hours

a) Number systems - Conversion of binary to decimal system and vice versa. Binary addition and subtraction (1's and 2's complement methods). BCD code and Gray code - Conversions

b) Logic Gates: Basic logic gates, NAND and NOR as universal gates, exclusive-OR gate, Laws of Boolean algebra - Simplification of Boolean Expressions using Boolean Laws, De Morgan's laws-statement and proof.

UNIT-IV: ARITHMETIC CIRCUITS & DATA PROCESSING CIRCUITS 12 Hours

a) Half Adder and Full Adder, Half and Full Subtractor, 4-bit binary Adder/Subtractor.

b) Multiplexers - 2 to 1, 4 to 1 and 8 to 1 multiplexer, De-multiplexers: 1 to 2, 1 to 4 Demultiplexer, Decoders: 1 of 2, 2 of 4 decoders, Encoders: 4 to 2, 8 to 3 Encoder,

UNIT-V: SEQUENTIAL LOGIC CIRCUITS & CODE CONVERTERS 12 Hours

5(a) Sequential digital circuits: Flip-flops, RS, Clocked SR, JK.

5(b) D, T, Master-Slave, Flip-flop, Conversion of Flip-flops.

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)

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA: VIJAYAWADA-10

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SEMESTER -END QUESTION PAPER STRUCTURE

Course Code & Title of the Course:	**ANALOG AND DIGITAL ELECTRONICS (23PHMAP234)**
Offered to:	**B.Sc (H) Physics**
Category:	**SEMESTER: 3**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions (20 Marks)

Answer All questions. Each question carries 4 Marks.

1. (A) Write a short note on the slew rate and concept of virtual ground of an OP-AMP.

(OR)

(B) Draw the block diagram of an OP-Amp.

2. (A) Explain how an OP Amp acts as a voltage follower.

(OR)

(B) Draw the summing amplifier using an OP-Amp and explain its operation

3. (A) Explain how the NAND gate can act as a universal gate

(OR)

(B) Explain the procedure of 2's complement of binary addition

4. (A) (i) Convert $(625)_{10}$ into a binary number

(ii) Convert $(110111)_2$ into decimal number

(OR)

(B) Show that the logic expression $\overline{AB}(A+B)=\bar{A}B+A\bar{B}$

5. (A) Explain about Clocked SR Flipflop

(OR)

(B) Explain about Master Slave Flipflop

Section B: Long Answer Questions (5X10=50 Marks)

Answer All questions. Each question carries 10 Marks.

6. (A) What is an Operational amplifier? Give the comparison between ideal practical OP-Amp.

(OR)

(B) Briefly explain basic differential amplifiers and also explain about IC identification of an OP-Amp.

7. (A) Explain inverting and non-inverting amplifiers and obtain the expression for their output voltages

(OR)

(B) Explain how the operational amplifier acts as an Integrator and Differentiator

8. (A) State and prove De Morgan Laws

(OR)

(B) Explain logic gates with truth tables

9. (A) Explain the construction and working of half and full adders with truth tables

(OR)

(B) Distinguish between the multiplexer and De-multiplexers. Explain about 8:1 Multiplexer.

10. (A) Draw the logic circuits and truth tables of JK, Clocked RS flip flops

(OR)

(C) Explain the conservation of RS to JK & JK to T flip-flops

SRI DURGA MALLESWARA SIDDHARTHA MAHILA KALASALA: VIJAYAWADA-10
(An Autonomous College in the jurisdiction of Krishna University, Machilipatnam)

Course Code				**23PHMAP234**			
Title of the Course				**ANALOG AND DIGITAL ELECTRONICS**			
Offered to: (Programme/s)				**B.Sc H Physics**			
L	**0**	**T**	**0**	**P**	**2**	**C**	**1**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	**MAJOR**			**Course Relates to:**			**L, R, N & G**
Year of Revision:	**2024**			**Percentage:**			**100 %**
Type of the Course:				**EMPLOYABILITY & SKILL DEVELOPMENT**			
Crosscutting Issues of the Course :							
Pre-requisites, if any				**BASIC ELECTRONICS**			

Course Description:
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CO2	Gain the knowledge of Number Systems and Logic Gates	K1		
CO3	Design Arithmetic Circuits	K6		
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CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1									
CO2									
CO3									
CO4									
CO5									

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Structure

This lab list covers the key areas of an **ANALOG AND DIGITAL ELECTRONICS** course, providing hands-on practice with technology

1. To study the operational amplifier as an inverting feedback amplifier with verifying gain
2. To study the operational amplifier as a non-inverting feedback amplifier with verifying gain
3. To study operational amplifiers as an adder
4. To study operational amplifiers as a subtractor
5. To study operational amplifiers as a differentiator
6. To study operational amplifier as an 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

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