Syllabus and Model Papers

M.Sc. Physics
1st Semester

Under Choice Based Credit System (CBCS)
[Effective from 2021-2022 Admitted Batches]

Department of Physics
College of Science and Technology
Andhra University
Visakhapatnam.

M.Sc. Physics
Course Curriculum under CBCS

M.Sc. Physics – I Semester – FIRST YEAR
[Effective from the admitted batch 2021-2022]

THEORY	P 101	Classical Mechanics
	P 102	Introductory Quantum Mechanics
	P 103	Mathematical Methods of Physics
	P 104	Electronic Devices & Circuits
LABORATORIES	P 105	Modern Physics Lab 1
	P 106	Electronics Lab 1

SCHEME OF INSTRUCTION AND EXAMINATION UNDER CBCS

M.Sc. Physics – I Semester – FIRST YEAR
[Effective from the admitted batch 2021-2022]

Theory Code	Title of the Paper	T	P	Semester End Exam Marks	Mid Exam Marks	Total Marks	Pass Minimum	Credits
P-101	Classical Mechanics	4	-	80	20	100	40	4
P-102	Introductory Quantum Mechanics	4	-	80	20	100	40	4
P-103	Mathematical Methods of Physics	4	-	80	20	100	40	4
P-104	Electronic Devices & Circuits	4	-	80	20	100	40	4
P-105	Modern Physics Lab 1 (Practical-80 & Record-20)	-	3	100		100	50	4
P-106	Electronics Lab 1 (Practical-80 & Record-20)	-	3	100		100	50	4
	Total					**600**		**24**

(**T**- Theory Hrs /Week, **P**- Practical Hrs/Week)

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M.Sc. Degree Examination
Physics

SYLLABUS

First Semester

P 101 – Classical Mechanics
(Effective from the admitted batch of 2021-2022-CBCS)

<u>Course Objectives</u>:

1. To demonstrate knowledge and understanding of the following fundamental concepts in dynamics of particles.
2. To represent the equations of motion for complicated mechanical systems using the Newtonian, D'Alembert, Lagrangian and Hamiltonian formulation of classical mechanics.
3. The course discusses the planetary motion and Kepler's laws, Legendre transformations, canonical transformations, Hamilton's equation of motion, Hamilton-Jacobi equations and its applications.
4. It explains the motion of rigid bodies and Euler's angles, Coriolis effect.
5. The course discusses the special theory of relativity and its applications and also gave the introduction to the general theory of relativity.

<u>Course Outcomes</u>:

1. Students will be able to know the concepts of classical mechanics describe and understand the motion of a mechanical system using Lagrange-Hamilton formalism.
2. They are able to know about canonical transformations, Hamilton's equations of motion.
3. They are able to understand the concept of planar and spatial motion of a rigid body.
4. They are able to differentiate special theory of relativity and general theory of relativity.

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UNIT-I: Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation

Chapter: 1. Section: 1, 2, 3, 4, 5 & 6.

Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties, Energy function and the conservation of Energy

Chapter: 2. Section: 1, 2, 3, 5 & 6

UNIT-II: Reduction to the equivalent one body problem. The equation of motion and first Integrals, the equivalent One – Dimensional problem and classification of orbits, the differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force, The motion in time in the Kepler problem, Scattering in a central force field.

Chapter: 3. Section. 1, 2, 3, 5, 6, 7 & 8

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

Chapter: 7 Section: 1, 2, 3, 4 & 5.

UNIT-III: Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the Poisson bracket formulation, the angular momentum Poisson bracket relations.

Chapter: 8. Section: 1, 2, 4, 5, 6 & 7.

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton – Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.

Chapter: 9. Section: 1, 2, 3 & 5.

UNIT-IV: Independent coordinates of rigid body. The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter: 4. Section: 1, 4, 6, 8 & 9.

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body

Chapter: 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4.

UNIT – V: Special Theory of Relativity, Basic Postulates of the Special Theory, Lorentz Transformations, Velocity Addition and Thomas Precession, Relativistic Kinematics of Collisions and Many-Particle Systems, Relativistic Angular Momentum, Lagrangian Formulation of Relativistic Mechanics, Covariant Lagrangian Formulations, Introduction to the General Theory of Relativity.

Chapter 7 Sections 1 to 11.

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Text Book:

1. Classical Mechanics - H. Goldstein

Reference Books:

1. Classical Mechanics - J. B. Upadhayaya
2. Classical Mechanics - Gupta Kumar Sharma
3. Classical Mechanics - N C Rana and P S Joag
4. Classical Mechanics - Takwale and Puranik
5. Classical Mechanics - G Aruldhas
6. Classical Mechanics - C R Mondal
7. Introduction to Special Relativity - Robert Resnick

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Model Question Paper
Andhra University
M.Sc. Degree Examination
Physics

First Semester
P 101 – Classical Mechanics
(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit
All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) State and prove D' Alembert's principle.
   b) Derive Lagrange's equation of motion of a particle using D' Alembert's principle.

(OR)

2. a) Obtain Lagrange's equation of motion from Hamilton's principle for conservative systems.
   b) What is meant by conservation of energy?

Unit – II

3. a) What is the first integral of motion?
   b) Show that the orbit of a planet moving around the sun under the inverse square law of force is a conic.

(OR)

4. a) Derive Hamilton's equations of motion using Legendre transformations.
   b) Give the Physical significance of the Hamiltonian.

Unit – III

5. a) Explain the equations of Canonical Transformation?
   b) Give examples to Canonical Transformations.

(OR)

6. a) Derive the Hamilton – Jacobi equation from Hamilton's principle function.
   b) Solve the problem of one-dimensional harmonic oscillator using Hamilton Jacobi Method.

Unit – IV

7. a) Derive the Eigenvalue equation of the inertia tensor and the principal axis transformation.
   b) What is the degree of freedom of linear triatomic molecule?

(OR)

8. a) Define moment of inertia tensor.
   b) Derive Euler's equations of rotational motion of a rigid body.

Unit – V

9. a) What are the basic postulates of the special theory of relativity?
   b) Derive the equations for the velocity addition and Thomas precession.

(OR)

10. a) Explain the Lagrangian formulation of relativistic mechanics
    b) Derive the equation for the covariant Lagrangian.

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M.Sc. Degree Examination
Physics

SYLLABUS

First Semester

P 102 – Introductory Quantum Mechanics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. It is an experimental fact that often a particle behaves like a wave and a wave behaves like a particle. A wave with a precise wavelength (momentum) does not possess a precise location and vice versa.
2. Such uncertainties in conjugate measurable properties and the consequences there of, constitute the essential content of quantum mechanics.
3. Elementary quantum mechanics is the focus of this course.
4. This course provides an understanding of the formalism and language of non-relativistic quantum mechanics.
5. This course will be helpful in understanding the concepts of time-independent perturbation theory and their applications to physical situations.

Course Outcomes:

1. The students will be able to formulate and solve problems in quantum mechanics using Dirac representation.
2. The students will be able to grasp the concepts of spin and angular momentum, as well as their quantization and addition rules.
3. The students will be familiar with various approximation methods applied to atomic, nuclear and solid-state physics.
4. This course is organized in such a way that a student at the end, is skilled enough to understand the advance level Quantum Mechanics.

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UNIT-I: Failures of classical physics, Origin of Quantum theory, the Conceptual aspect: Modifications needed to the classical concepts of particles and Waves (Wave Particle Duality), Interpretations of Quantum mechanics, Applications of uncertainty principle, Principle of superposition - Wave packets, Schrodinger Wave Equation, wave function interpretation, Problems and admissibility conditions, probability current density, expectation value, Ehrenfest theorem, stationary states.

UNIT-II: Bracket notation, orthonormal functions, linear operators and their properties, Hermitian operator, Schmidt orthogonalization, Postulates of quantum mechanics, simultaneous measurability of observables, commutator algebra, equation of motion of an operator (Schrodinger representation), Momentum representation - Dirac delta function and properties.

UNIT-III: One dimensional problem - Particle in a potential well with (i) infinite walls, (ii) finite walls. Potential step, Potential Barrier. Linear Harmonic Oscillator (Schrodinger method). Free particle. Particle moving in a spherically symmetric potential, spherical harmonics, radial equation. Eigen values and Eigen functions of rigid rotator, hydrogen atom, Hydrogenic orbitals, angular momentum operators, commutation relations, Eigen values and Eigen functions of L^2, L_Z, L_+ and L_- operators, spin angular momentum, general angular momentum.

UNIT-IV: Time- independent perturbation theory for **(i)** non-degenerate systems and application to ground state of helium atom., effect of electric field on the ground state of hydrogen, spin orbit coupling (ii) degenerate systems, application to linear stark effect in hydrogen. Variation method and its application to helium atom, exchange energy and low-lying excited states of helium atom. WKB method, barrier penetration.

UNIT – V: Hidden variables, EPR paradox, Bell's theorem, the problem of measurement, time evaluation of a system, discrete or continuous, Q bits and quantum logic gates. (B. H. Bransden and C. J. Joachain; Richard Liboff.

Text Book:

1. Quantum Mechanics - E. Merzbacher

Reference Books:

1. Quantum Mechanics - G. Aruldhas
2. Quantum Mechanics - G. S. Chaddha
3. Quantum Mechanics - B. H. Bransden and C. J. Joachain
4. Quantum Mechanics - R. D. Ratna Raju
5. Quantum Mechanics - Richard Liboff
6. Quantum Mechanics - Ghatak and Lokanathan
7. Quantum Mechanics - Gupta Kumar Sharma
8. Quantum Mechanics - Mathews and Venkatesan
9. Quantum Chemistry - Ira N. Levine
10. Quantum Mechanics - Nouredine Zettili

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Model Question Paper
Andhra University
M.Sc. Degree Examination
Physics

First Semester
P 102 – Introductory Quantum Mechanics
(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit
All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Derive the Schrodinger wave equation.
   b) Obtain an expression for Probability Current Density.

(OR)

2. a) State and prove Ehrenfest's theorem.
   b) Show that stationary states probability current density is constant in time.

Unit – II

3. a) State the postulates of Quantum Mechanics.
   b) Write the properties of Hermitian Operator.

(OR)

4. a) Define Dirac Delta function and write its properties.
   b) Derive the equation of motion for an operator.

Unit – III

5. a) Derive the equation for a one-dimensional particle in a potential well with infinite walls.
   b) Obtain Eigen values and Eigen functions of rigid rotator.

(OR)

6. a) Show that L^2 and L_z Commute.
   b) Obtain Eigen values and Eigen functions for these operators.

Unit – IV

7. a) Discuss time independent perturbation theory.
   b) Obtain expression for the first order correction to energy.

(OR)

8. a) Discuss the principle of Variation method and its application to helium atom.
   b) What is meant by WKB Approximation?

Unit – V

9. a) What is EPR Paradox?
   b) State and explain the Bell's theorem.

(OR)

10. a) Give an account on Q bits.
    b) Explain in detail the quantum logic gates.

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M.Sc. Degree Examination **SYLLABUS**

Physics

First Semester

P 103 – Mathematical Methods of Physics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To provide students the ability to hone the mathematical skills necessary to approach problems in advanced physics courses.
2. To expose the students towards the fascinating world of complex analysis.
3. To make the students learn about special functions essential in solving physics problems.
4. To make them understand about Fourier series and Fourier transforms.
5. To expose the students, get acquainted with the various numerical methods.
6. To make them understand about tensor analysis.

Course Outcomes:

1. The students will be able to understand and apply the mathematical skills to solve quantitative problems in the study of Physics.
2. Will enable students to apply integral transform to solve mathematical problems of interest in Physics.
3. The students will be able to use Fourier transforms as an aid for analyzing experimental data.
4. The students should be able to formulate and express a physical law in terms of tensors, and simplify it by use of coordinate transforms.

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Unit I: Complex Variables

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy's integral theorem- Cauchy's integral formulae-multiply connected region- problems, Infinite series-Taylor's theorem- Laurent's Theorem-Problems, Cauchy's Residue theorem- evaluation of definite integrals-problems.

Unit II: Beta, Gamma Functions &Special Functions

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals

Special Functions- Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial, Bessel Function -Generating function-recurrence relations - Rodrigue's formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics.

Unit III: Laplace Transforms & Fourier series, Fourier Transforms

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties- evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heaviside expansion method-Convolution method-complex inversion formula method-application to differential equations.

Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave, Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem.

Unit IV: Numerical Methods

Linear and non- linear curve fitting, least square fitting, Chi – square test, Errors of Coefficients. Solutions of algebraic and transcendental equations-Bisection method-method of successive approximations-method of false position Iteration method-Newton Rapson method Simultaneous linear algebraic equations-Gauss elimination method-Gauss Jordan Method-Matrix inversion method-Jacobi method – Gauss-Seidel method.

Interpolation with equal intervals-Finite differences-Newton Forward & Backward Interpolation formulae, Interpolation with unequal internals-Newton's divided difference formula-Lagrange interpolation formula Numerical Integration-General Quadrature Formula-Trapezoidal rule -Simpson's 1/3 rule & 3/8 rule. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

Unit V: Tensor Analysis

Introduction, Transformation of Co-ordinates, Contravariant, Covariant and Mixed tensors, Addition, Subtraction, Contraction, Multiplication, Quotient Law, Symmetric and Anti Symmetric tensors, The

line element, Fundamental Tensors, Covariant differentiation, Christoffel Symbols, Curvature tensor, Riemann curvature, Application of Tensors.

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Text Books:

1. Mathematical Methods of Physics - G. Arfken
2. Mathematical Physics - Satya Prakash
3. Complex Variables - Murray R Spiegel - Schaum's outline series
4. Mathematical Physics - B.S. Rajput
5. Laplace n Fourier Transforms - Goyal & Gupta
6. Introductory methods of Numerical analysis - S. S. Sastry
7. Fundamentals of Mathematical Statistics - S C Gupta & V K Kapoor
8. Tensor Calculus – A Concise Course - Barry Spain

Reference Books:

1. Numerical Methods - V. N. Vedamurthy & N. Ch. S. N. Iyengar
2. Mathematical Methods - B. D. Gupta
3. Special Functions - Gupta & Sharma
4. Integral Transforms - M. D. Raisinghanna
5. Integral Transforms - Goyal & Gupta
6. Fundamentals of Statistics - S C Gupta
7. Probability and Statistics - Murray R Spiegel - Schaum's outline series
8. Tensor Calculus - David C Kay – Schaum 's outline series

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Model Question Paper
Andhra University
M.Sc. Degree Examination
Physics

First Semester
P 103 – Mathematical Methods of Physics
(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit
All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) State and prove the Taylor's theorem.
   b) Prove that $H_n^1(x) = 2nH_{n-1}(x)$.

(OR)

2. a) State and prove the necessary and sufficient condition for the function to be analytic in a region R.
   b) Show that $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2+1)^2(x^2+2x+2)} = 7\pi/50$.

Unit – II

3. a) Starting from the generating function of Laguerre polynomial, Obtain the differential equation satisfied $L_n(x)$.
   b) Define Rodrigue's formula.

(OR)

4. a) Obtain the relation between Beta and Gamma functions
   b) Evaluate the value of Gamma (1/2).

Unit – III

5. a) State and explain Laplace and Inverse Laplace transforms.
   b) Evaluate the Inverse Laplace transform of $\frac{7}{s^2-9} + \frac{5}{s-7} + \frac{1}{2s^{3/2}}$.

(OR)

6. a) Starting form Fourier series obtain the Fourier integral.
   b) Find the Fourier series for function defined by

$f(x) = -\pi$ if $-\pi<x<0$
$f(x) = x$ if $0<x<\pi$.

Unit – IV

7. a) Explain Newton – Raphson method to evaluate the roots of an equation.
   b) Using Bisection method, find the root of the equation $x^3 - x^2 - 1 = 0$

(OR)

8. a) Discuss the Gauss elimination method for solving a system of simultaneous linear equations.
   b) Solve the following equations using Gauss – Seidel method.

$$2x + y + z = 10$$
$$3x + 2y + 3z = 18$$
$$x + 4y + 9z = 16$$

Unit – V

9. a) Explain in detail the Symmetric and Anti-Symmetric tensors?
   b) Write the applications of Tensors.

(OR)

10. a) Give an account on Christoffel Symbols
    b) Define Riemann curvature and write its properties.

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SYLLABUS

M.Sc. Degree Examination
Physics

First Semester

P 104 – Electronic Devices and Circuits
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To make the students familiar about the concepts of components used in various electronic devices.
2. To make the students learn and understand the basics of analogue electronics.
3. To develop an understanding of fundamentals of electronics in order to deepen the understanding of electronic devices that are part of the technologies that surround us.

Course Outcomes:

1. The students will be able to use techniques for analyzing analogue electronic circuits and formulate the concepts of semiconductor devices, microwave devices, operational amplifier circuits and electronic measurements, instrumentation and experimental methods.
2. At the end of this course, the students will be able to understand the fundamentals behind analog devices.

UNIT-I: Semiconductor Devices
Tunnel diode, Photo Diode, Solar Cell, LED, Silicon Controlled Rectifier (SCR), Uni Junction Transistor (UJT), Field Effect Transistor (JFET & MOSFET), CMOS.

UNIT-II: Microwave Devices
Varactor Diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron, Gunn Diode, Magnetron, CFA, TWT, BWO, IMPATT, TRAPATT, APD, PIN Diode, Schottky Barrier Diode.

UNIT-III: Operational Amplifier (OP AMP)
The ideal Op Amp – Practical inverting and Non inverting Op Amp stages, Op Amp Architecture – differential stage, gain stage, DC level shifting, output stage, offset voltages and currents. Virtual ground. Operational Amplifier parameters- input offset voltage, input bias current, Band width, Common Mode Rejection Ratio (CMRR), Slew Rate. Op Amp open loop gain configuration, Differential amplifier, Inverting and Non-inverting amplifiers. Op-amp with negative feedback- effect of feedback on closed loop gain input resistance, output resistance, bandwidth and output offset voltage - voltage follower.

UNIT-IV: OP AMP Applications

Summing amplifier, Integrator, Differentiator Voltage to Current converter, Current to Voltage converter, Logarithmic Amplifier, Instrumentation Amplifier.

Oscillators – Phase shift oscillator, Wien-Bridge Oscillator

Special applications – Monostable and Astable multivibrators using 555, Schmitt Trigger, Voltage Controlled Oscillator (VCO), Phase Locked Loop (PLL), IC 723 Voltage regulator.

UNIT – V: Electronic Measurements, Instrumentation and Experimental Methods

Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors Transducers (temperature, pressure, vibration, optical, and particle detectors) Measurement and control. Signal conditioning and recovery, Impedance matching, Amplification, Filtering and noise reduction, Shielding and grounding.

Text Books:

1. Integrated Electronics - Jacob Millman & C.C. Halkies
2. Op. Amps and Linear Integrated Circuits - Ramakant A.Gayakwad
3. Electronic Communication Systems - George Kennedy
4. Electronic Instrumentation and measurement techniques – W D Cooper & A D Helfric
5. A course in electrical and electronic measurements and instrumentation – A K Sawhney
6. Electronic Instrumentation - H S Kalsi

Reference Books:

1. Microelectronics - Jacob Millman & Arvin Grabel
2. Electronic Devices and Circuits - G.K. Mithal
3. Electronic devices and circuit theory - Robert Boylested & Louis Nashlsky
4. Electronic Principles - AP Malvino & J Bates
5. Micro Electronics - Sedra and Smith
6. Linear Integrated Circuits - D Roy Choudhury & Shail Jain
7. Introduction to electronic devices - Micheal Shur
8. Semi-Conductor Electronics - A.K.Sharma
9. Anlog and Digital Electronics - Nagarath
10. Op-amps and Linear Integrated Circuits - D. Mahesh Kumar
11. Electronic instrumentation and measurements – David A Bell
12. Modern Electronic Instrumentation and Measurement Techniques –A D Helfric & W DCooper
13. Electronic Measurements and Instrumentation - Oliver and Cage

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Model Question Paper
Andhra University
M.Sc. Degree Examination
Physics

First Semester
P 104 – Electronic Devices and Circuits
(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit
All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Describe the working principle of FET Amplifier
   b) Explain its characteristics.

(OR)

2. a) Give the construction and characteristics of SCR
   b) Show how an SCR can be used to control power in a circuit.

Unit – II

3. a) Describe the working of Reflex Klystron
   b) Explain its Characteristics.

(OR)

4. a) Describe the working principle of Magnetron
   b) Explain why magnetron is called as CFA.

Unit – III

5. a) Explain in detail the characteristics of an ideal op-amp.
   b) Explain the terms differential gain and DC level shifting.

(OR)

6. a) Discuss in detail the important parameters of an operational amplifier.
   b) Describe the method of their measurement.

Unit – IV

7. a) Draw the circuit diagram of a Voltage Controlled Oscillator (VCO).
   b) Discuss its operation and applications.

(OR)

8. a) Describe the working principle and necessary theory of a Wein Bridge Oscillator using Op – Amp.
   b) What is meant by Phase Locked Loop?

Unit – V

9. a) Explain briefly the error analysis measurement?
   b) Explain the propagation of errors.

(OR)

10. a) Explain What is meant by signal conditioning?
    b) Give an account on recovery and impedance matching in a measurement system.

SYLLABUS

M.Sc. Degree Examination
Physics

First Semester

P 105 – Modern Physics Laboratory - 1
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. The aim of this laboratory course is to make the students perceive some of the fundamental laws of Physics through experiments.

Course Outcomes:

1. At the end of this laboratory course, the students will be capable of handling sophisticated instruments besides learning the Physics concepts behind these experiments.

LIST OF EXPERIMENTS

1. Atomic Spectrum of Sodium
2. Atomic Spectrum of Zinc
3. Rydberg's Constant using Grating
4. Raman Spectrum of Carbon Tetrachloride
5. Specific Charge of an Electron using Thomson's Method
6. Determination of Planck's Constant

Reference Books:

1. Advanced Practical Physics, B.L. Worsnop & H.T. Flint.
2. A Text Book of Practical Physics, I.Prakash & Ramakrishna.
3. Practical Physics, Geeta Sanon, R. Chand & Co.Publishers.
4. Advanced Practical Physics, S P Singh, Pragati Prakashan.
5. Practical Physics, Gupta & Kumar, Pragati Prakashan.
6. An Advanced Course in Practical Physics, D Chattopadhyay & P C Rakshit. Central Pub.

SYLLABUS

M.Sc. Degree Examination
Physics

First Semester

P 106 – Electronics Laboratory - 1
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To make the students familiar with analog electronic components.
2. To provide hands-on experience to the students to make them familiar with the working and handling of the analog electronic devices and circuits.

Course Outcomes:

1. At the end of this laboratory, the students will be skilled enough to handle and understand the use of analog devices.

LIST OF EXPERIMENTS

1. FET Amplifier (BFW 10/11)
2. Negative Feedback Amplifier (BC 147)
3. Colpitts Oscillator (BF 194)
4. Phase Shift Oscillator (BC 147)
5. Astable Multivibrator (BF 194)
6. Op. Amp. Characteristics (IC 741)

Reference Books:

1. The Art of Electronics, P. Horowitz & W. Hill.
2. Microelectronics, J. Millman & A. Grabel.
3. Electronic Devices and Circuits, Schaum's Outline Series, J.J. Cathey.
4. Basic *Electronics*: *A Text-Lab Manual*, Paul Zbar & Albert P Malvino**.**
5. Experiments in Electronics, S V Subrahmanyam.
6. Operational Amplifiers & Linear ICs, S V Subrahmanyam.