SYLLABUS

(Under National Education Policy – 2020)

Major Course - Physics

Bachelor of Science Program - First Year

(Semesters I & II)

(*To be effective from Academic Year 2023-24)*

PREAMBLE:

This syllabus of the Major Course – Physics is to be implemented for Semesters 1 and 2 of the First Year of the Bachelor of Science Program of the Hyderabad Sind National Collegiate University from the Academic Year 2023-24. It is based on the guidelines and credit system outlined in the National Education Policy – 2020 as adopted by the HSNCU.
The theory courses of both semesters include only core topics of Physics which are essential for the study of discipline specific elective courses such as Astrophysics, Engineering Physics, Nuclear Physics and Medical Physics to be offered to the Learner in the later semesters. With this aim the Learner is introduced to topics from Mathematics with emphasis on their application to physical situations as well as topics from Classical Mechanics such as Newton's laws of Motion, concept of reference frames, work and energy, from Electricity and Magnetism the concept of electric and magnetic fields, complex impedance and basic theorems required to analyze, simplify and build electrical circuits and from Waves and Oscillations - superposition of harmonic oscillations and wave motion.
The practical courses give the Learner an experiential insight of the theory course. Besides this a few experiments are added that will train them to operate basic instruments commonly used in undergraduate Physics laboratories.

Semester I

Theory Course

Course Code: PHY101B **Total Credit: 3**

COURSE OBJECTIVE:

1. To teach about differentiation of vector functions, about line, surface and volume integration and about orthogonal curvilinear coordinate systems.
2. To introduce statistical concepts such as random variables, mean, variance and the probability distributions commonly used in physics. To teach about first and second order linear ordinary differential equations.
3. To teach about fundamentals of dynamics in classical physics and about work and energy and relation between them.

COURSE OUTCOME:

1. Will be introduced to vector differential operator Del and the Laplacian, gradient of scalar functions, divergence and curl of vector functions and their physical interpretation, important vector identities and concept of field in physics

   Will learn about flux of a vector field, important vector integration theorems – Divergence and Stokes' theorems

   Will study about the spherical and cylindrical coordinate systems and express gradient, divergence, curl and Laplacian in these coordinates

2. Will learn about the Binomial, Gaussian and Poisson distribution of random variables

   Will be able to set up linear ordinary first and second order differential equations to study physical situations and obtain their solutions

3. Will learn about reference frames, Newton's laws of motion, Galilean transformation, Galilean invariance and Newtonian relativity

   Will learn about work, force and energy and their relation

Unit	Content	No. of Hours
1	**1. Vector Differentiation, Vector Integration & Curvilinear Coordinates:** 1.1 **Recapitulation:** Scalar Product, Vector Product, Triple Products, Scalar and Vector fields. 1.2 **Vector Differentiation:** Del Operator, Gradient of a Scalar Field and its Physical Interpretation, Divergence and Curl of a Vector Field and their Physical Interpretation, Vector Identities, Laplace Operator 1.3 **Vector Integration:** Notion of Infinitesimal Line, Surface and Volume Elements, Line, Surface and Volume Integrals, Flux of a Vector field, Divergence Theorem, Stokes' Theorem (no rigorous proof needed) 1.4 **Curvilinear Coordinates:** Orthogonal Curvilinear Coordinates, Gradient, Divergence, Curl and Laplacian in Spherical and Cylindrical Coordinate Systems	15
2	**2. Probability & Linear Ordinary First order and Second Order Differential Equations:** **2.1 Probability** Random Variables, Mean and Variance, Probability Distribution Functions - Binomial, Gaussian and Poisson distribution. **2.2 Linear Ordinary First Order Differential Equations:** Introduction to Differential Equations, Linear, Ordinary First Order Differential Equation and its Solution, Application to DC Series LR and CR Circuits. **2.3 Linear Ordinary Second Order Differential Equations:** Linear Ordinary Homogeneous Second Order Differential	15

	Equation with Constant Coefficients, General Solution, Statement of Uniqueness Theorem for Initial Value Problems. Second Order Nonhomogeneous Differential Equation with Constant Coefficients and its Solution, Application to DC Series LCR Circuit.	
3	**3. Fundamentals of Dynamics & Work and Energy:** **3.1 Fundamentals of Dynamics:** Reference Frames - Inertial / Noninertial frames, Newton's Laws of Motion, Projectile Motion in a Uniform Gravitational Field, Galilean Transformation, Galilean Invariance, Newtonian Relativity Principle **3.2 Work and Energy:** Work and Kinetic Energy Theorem, Conservative and Nonconservative Forces, Potential Energy, Force as a Gradient of Potential Energy, Work and Potential Energy, Work done by Conservative Forces, Principle of Conservation of Energy.	15

Self-Learning topics (Unit wise)

Unit	Topics
1	Scalar product, vector product, triple products, scalar and vector fields.
2	Introduction to differential equations
3	Conservative and nonconservative forces

References:

1. Vector Analysis, M R Spiegel, Schaum's Outline, 2nd edition, 2009
2. Mathematical Methods in the Physical Sciences, Mary L Boas, Wiley India, 3rd edition
3. Introduction to Mathematical Physics, Charlie Harper, PHI Learning
4. Electricity and Magnetism, Chattopadhyay and Rakshit, New Central Book Agency (P) Ltd. 9th Rev edition, 2011
5. Fundamentals of Physics, Halliday & Resnick, Walker, 10th edition, 2013Wiley Eastern
6. Concepts of Physics, H C Verma, 2023 Edition, Bharti Bhavan
7. Mechanics, D S Mathur, revised by P S Hemne, 2000 edition, S Chand

Practical Course

Course Code: PHY101D **Total Credit: 1**

COURSE OBJECTIVE:

1. To experimentally verify application to physical situations of the mathematical and statistical methods and concepts included in the theory syllabus.
2. To train the learner in the use, limitations, accuracy and operation of instruments frequently used in undergraduate Physics laboratories.

COURSE OUTCOME:

1. The Learner will see the Gaussian distribution of intensity of LASER light and note the practical limitations of ideal light sources. Learner will be able to set up differential equations in some experiments, solve them and practically verify these solutions.
2. Will be trained to operate various measuring instruments, learn about their accuracy, versatility and limitations. Will learn to do error analysis of experiments.
3. The Learner will also be trained in a few experimental techniques such as soldering.

CONTENTS	No. of Hours
1. LASER Beam Profile and Gaussian Distribution 2. Application of First Order Differential Equation-Series LR circuit 3. Application of First Order Differential Equation- Series CR circuit 4. Application of Second Order Differential Equation to SHM -Spring Mass Oscillator 5. Comparative study of Meter Scale, Vernier Calipers, Micrometer Screw Gauge and Spherometer 6. Use of Travelling Microscope: Determination of Radius of Capillary 7. Determination of Angle of Prism using Spectrometer 8. Error analysis 9. (a) Soldering a Circuit consisting of a DC Power Supply connected to a Resistive Potential Divider Network (b) Use of DMM to measure the resistance values and the voltage across various resistances and comparing these with expected values 10. Use of CRO	2 hours per Experiment

References:

1. Advanced Practical Physics, B. L. Worsnop and H.T. Flint, 2021, Khosla Publishing House

2. Introduction to Mathematical Methods, Charlie Harper, PHI Learning

3. Electricity and Magnetism, Chattopadhyay and Rakshit, New Central Book Agency (P) Ltd. 9th Rev edition, 2011

NOTE:

1. The Learner is expected to perform all experiments given in the syllabus and keep a record of them in a Journal. The journal must be examined by the Teacher – in – Charge periodically and certified by the Head of Department at the end of the Course failing which the Learner will not be permitted to appear for the Practical Examination.

However, the HOD may issue a 'Journal Lost Certificate' if he/she is satisfied that the Learner has satisfactorily completed all experiments. The Learner possessing such a certificate may be allowed to appear for the Practical Examination.

Semester II

Theory Course

Course Code: PHY102B **Total Credit: 3**

COURSE OBJECTIVE:

1. Will learn to use superposition principle to obtain the resultant of two collinear as well as two perpendicular harmonic oscillations and. Will be taught important aspects of wave motion.
2. Will learn about electric and magnetic fields, Gauss' law, Biot Savart law and Ampere's law and about electromagnetic induction
3. Will learn about ac circuits and network theorems

COURSE OUTCOME:

1. Learning to use the superposition principle to find the resultant of collinear and perpendicular harmonic oscillations will be useful in the study of optical phenomena such as interference, diffraction, polarization and in the study of beats and Lissajous figures. Study of wave motion will give an idea of various ways in which waves travel through media and different types of velocities associated with waves.
2. In unit 2 they will get an in-depth insight into electrostatics and magnetostatics and the important laws associated with them. They will also learn about the laws associated with electromagnetic induction.
3. In unit 3 they will be introduced to complex reactance, complex impedances and the important phenomenon of resonance. Also, they will learn about various network theorems which will enable them to simplify and analyse electrical circuits.

Unit	Content	No. of lectures
1	**1. Superposition of Harmonic Oscillations & Wave Motion:** **1.1 Superposition of Two Collinear Harmonic Oscillations:** Linearity and Superposition Principle, Superposition of Two Collinear Oscillations having Equal Frequencies and Different Frequencies, Beats. **1.2 Superposition of Two Perpendicular Harmonic Oscillations:** Graphical and Analytical Methods, Lissajous Figures with Equal and Unequal Frequencies and their Use. **1.3 Wave Motion:**	15

	Plane and Spherical Waves, Transverse and Longitudinal Waves, Plane Progressive (travelling) Waves and Stationary Waves, Wave Equation and its Solution, Particle, Wave and Phase Velocities	
2	**2. Electrostatics and Magnetostatics:** **2.1 Electric Field:** Electric Field Lines, Electric Flux, Gauss' Law and its Applications **2.2 Magnetic Field:** Steady Currents, Magnetic field due to Steady Currents, Biot Savart Law and its application to an Infinite Straight Wire carrying a Steady Current, Ampere's Law **2.3 Electromagnetic Induction:** Faraday's Law, Lenz's Law, Self and Mutual Induction	15
	3. A. C Circuits & Network Theorems: **3.1 AC Circuits** AC Circuits, Complex Reactance and Impedance, Series LCR Circuit – Resonance, Power Dissipation, Bandwidth and Quality Factor, Parallel LCR Circuit. **3.2 Network Theorems:** Ideal Constant Voltage and Constant Current Sources, Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Reciprocity Theorem, Maximum Power Transfer Theorem, Application of these Theorems to DC Circuits.	

Self-Learning topics (Unit wise)

Unit	Topics
1	Lissajous Figures with Equal and Unequal Frequencies and their Use
2	Faraday Law & Lenz' Law
3	AC Circuits, Complex Reactance and Impedance

References:

1. Waves and Oscillations, R N Chaudhuri, New Age International (P) Ltd. Reprint 2005.
2. Introduction to Electrodynamics, David J Griffiths, 4th ed, 2017, Cambridge University Press
3. Electricity and Magnetism, Chattopadhyay and Rakshit, New Central Book Agency (P) Ltd. 9th Rev edition, 2011

Practical Course

Course Code: PHY102D **Total Credit: 1**

COURSE OBJECTIVE:

1. To experimentally study Lissajous figures, verify Melde's law and to generate, using Lorentz magnetic force law, waves on a stretched string.
2. To verify the network theorems, study about complex reactance and impedances and about the phenomenon of resonance

COURSE OUTCOME:

1. The Learner will learn how to use Lissajous figures to determine unknown frequencies, to use waves on a stretched string to determine a frequency of the source.
2. Will learn to simplify and analyse dc circuits applying various network theorems, learn to determine the reactance and impedance in an ac circuit and about resonance in a series LCR circuit

CONTENTS	No. of Hours
1. To determine an unknown frequency using Lissajous figures 2. To determine the frequency of a tuning fork by Melde's experiment and verify λ-T^2 law 3. Determination of frequency of AC Mains using waves on a stretched string 4. Verification of Thevenin's Theorem 5. Verification of Norton's Theorem 6. Verification of Maximum Power Transfer Theorem 7. LR circuit-Measurement of Complex Reactance and Impedance 8. CR circuit- Measurement of Complex Reactance and Impedance 9. LCR Series Circuit and Resonance 10. Verification of Reciprocity Theorem	2 hours per experiment

References:

1. Advanced Practical Physics, B. L. Worsnop and H.T. Flint, 2021, Khosla Publishing House

2. Electricity and Magnetism, Chattopadhyay and Rakshit, New Central Book Agency (P) Ltd. 9th Rev edition, 2011

NOTE:

1. The Learner is expected to perform all experiments given in the syllabus and keep a record of them in a Journal. The journal must be examined by the Teacher – in – Charge periodically and certified by the Head of Department at the end of the Course failing which the Learner will not be permitted to appear for the Practical Examination.

However, the HOD may issue a 'Journal Lost Certificate' if he/she is satisfied that the Learner has satisfactorily completed all experiments. The Learner possessing such a certificate may be allowed to appear for the Practical Examination.

Scheme of Examination

A) Internal Assessment: (Total Marks: 40)

1. **Self-Learning Evaluation: (Marks: 15)**

Learner will either give a PowerPoint presentation or a Video Presentation of the topics marked for self – study in each unit of the theory course

2. **Practical Assessment: (to be conducted out of 50 marks and reduced to out of 25 marks)**

Particulars	**Max Marks Allotted**
Experiment	40
Journal	05
Viva	05
Total	50
Reduced Total	25

B) Semester End Examination: Theory Assessment: (Total Marks: 60)

1. A Question Paper consisting of 4 Main Questions as per the following pattern:

Q1 – pertaining to unit 1

A. Attempt ANY ONE:

(i) …. (10 marks)

Or

(ii)

B. Attempt ANY ONE:

(i) …. (05 marks)

Or

(ii)

Q2 – pertaining to unit 2

A. Attempt ANY ONE:

(i) …. (10 marks)

Or

(ii)

B. Attempt ANY ONE:

(i) …. (05 marks)

Or

(ii)

Q3 – pertaining to unit 3

A. Attempt ANY ONE:

(i) …. (10 marks)

Or

(ii)

B. Attempt ANY ONE:

(i) …. (05 marks)

Or

(ii)

Q4 – pertaining to units 1, 2 & 3

A. Answer in Brief: …. (10 marks)

(i)

(ii)

(iii)

(iv)

(v)

B. Fill in the Blanks: …. (05 marks)

(i)

(ii)

(iii)

(iv)

(v)

SYLLABUS

(Under National Education Policy – 2020)

Vocational Course - Physics

Bachelor of Science Program – First Year

(Semester I & II)

(To be effective from Academic year 2023-24)

Preamble: This syllabus is a part of the B.Sc. Program in Physics of the Hyderabad and Sind National Collegiate University to be taught in Semesters 1 and 2 from the academic year 2023-24 onwards.

This syllabus aims to provide adequate skills, correlate between various concepts of theory and practicals / demonstration.

These are practical courses of both the semesters comprising of Applied Optics and Electronics are devoted to vocational course in Physics.

Semester I
Title: Applied Optics

Course Code: PHY103D **Total Credit: 1**

COURSE OBJECTIVE:

This lab will provide an opportunity of to explore the correlation between theory and practical / demonstration.

COURSE OUTCOME:

After completion of the course students will be able to demonstrate various concepts of Applied Optics.

Practical List

CONTENTS	No. of Lectures
1. Characteristics of LDR 2. I-V characteristics of LED 3. To find the width of the wire or width of the slit using diffraction pattern 4. Wavelength of LASER beam using diffraction grating 5. Determination of the grating radial spacing of the Compact Disc (CD) by reflection grating 6. Refractive index of a liquid using total internal reflection 7. Photovoltaic Cell 8. Input output characteristics of a phototransistor	15

References:

1. Textbook of optics, N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, S Chand
2. A course of Experiments with with He-Ne LASER: R.S. Sirohi, 2nd edition, Wiley Eastern Ltd

Semester II
Title: Electronics

Course Code:PHY104D **Total Credit: 1**

COURSE OBJECTIVE:

This lab will provide an opportunity of to explore the correlation between theory and practical / demonstration.

COURSE OUTCOME:

After completion of the course students will be able to corelate theory concepts with practical.

Practical List

CONTENTS	No. of Lectures
1. Bridge rectifier- Load regulation 2. Bridge rectifier with C-filter-Load regulation 3. Bridge rectifier with voltage regulator -Load regulation 4. LM 317 - constant voltage source 5. NAND gate as a building block 6. OMAMP- Inverting amplifier 7. OPAMP- Non-inverting amplifier 8. Wein's Bridge oscillator using OPAMP	15

References:

1. Electronic Principles, Albert P. Malvino, David J. Bates, Pattrick E. Hoppe, 9th edition, Mc Graw Hill
2. Principles of Electronics, V.K. Mehta, Rohit Mehta, S. Chand and Company

NOTE:

1. The Learner is expected to perform all experiments given in the syllabus and keep a record of them in a Journal. The journal must be examined by the Teacher – in – Charge periodically and certified by the Head of Department at the end of the Course failing which the Learner will not be permitted to appear for the Practical Examination.

However, the HOD may issue a 'Journal Lost Certificate' if he/she is satisfied that the Learner has satisfactorily completed all experiments. The Learner possessing such a certificate may be allowed to appear for the Practical Examination.

Scheme of Examination

Practical Assessment: (to be conducted out of 50 marks and reduced to out of 25 marks)

Particulars	**Max Marks Allotted**
Experiment	40
Journal	05
Viva	05
Total	50
Reduced Total	25

SYLLABUS

(Under National Education Policy – 2020)

Generic Elective / Interdisciplinary

(Offered by Physics Department to F.Y.B.A. and F.Y.B.Com. students)

(Astronomy)

Bachelor of Science Program – First Year

(Semester I & II)

(To be effective from Academic year 2023-24)

Preamble: This syllabus is a part of the Bachelor Program (Generic Elective / Interdisciplinary) of the Hyderabad and Sind National Collegiate University to be taught in Semesters I and II from the academic year 2023-24 onwards.

This syllabus aims to provide adequate skills, training and knowledge to the students which enhance their thinking and application abilities.

The theory courses of both semesters comprising of Introduction to Astronomy and Solar system are devoted to Physics.

The detailed syllabus in each theory course is designed to introduce basic knowledge of the respective course to learners.

Semester I
Title: Astronomy

Course code:PHY101C **Total Credit:2**

COURSE OBJECTIVE:

1. To provide students comparative study of different branches of Astronomy
2. To understand the difference between stars, planets, comets and galaxies.

COURSE OUTCOME:

After completion of the course students will be able:

1. to identify different branches of Astronomy
2. to differentiate between stars, planets, comets and galaxies

Unit	Content	No. of Lectures
1	**Introduction to Astronomy** Definition of Astronomy, Branches of Astronomy, Early Cosmological beliefs and shift to scientific world view	**15**
2	**History and Development of Astronomy** Indian Astronomy, brief introduction to planets, stars , comets and galaxies, origin of the Universe, cosmic time and scale of Universe	**15**

References:

1. An Introduction to Astrophysics:- Baidyanath Basu, PrenTice-Hall India
2. Astronomy:- ANDREW FRAKNOI, DAVID MORRISON, SIDNEY C. WOLFF, Openstax
3. A Textbook of Astronomy and Astrophysics:- Mohit Kumar Sharma, Sureshchandra, Wiley
4. An Introduction to Astronomy and Astrophysics by Pankaj Jain, CRC Press
5. Cosmos by Carl Sagan
6. A Brief History of Time by Stephen Hawkings

Semester II
Title: Solar System

Course code:PHY102C **Total Credit:2**

COURSE OBJECTIVE:

1. to understand the concept of solar system and planetary system
2. To understand the difference between stars, planets, comets and galaxies.

COURSE OUTCOME:

After completion of the course students will be able:

1. to explain the position of solar system in the planetary system.
2. to describe stars, planets, comets and dust in details.

Unit	Content	No. of Lectures
1	**Formation and Evolution of solar system** Overview of our planetary system, structure and composition of planetary system, formation, structure and composition of solar system.	**15**
2	**Small Solar System bodies -Asteroids, Comets and dust** Formation, composition, characteristics and types of Asteroids, Meteroids and comets, formation, cosmic dust in space – an overview	**15**

References:

1. An Introduction to Astrophysics:- Baidyanath Basu, PrenTice-Hall India
2. Astronomy:- ANDREW FRAKNOI, DAVID MORRISON, SIDNEY C. WOLFF, Openstax
3. A Textbook of Astronomy and Astrophysics:- Mohit Kumar Sharma, Sureshchandra, Wiley
4. An Introduction to Astronomy and Astrophysics by Pankaj Jain, CRC Press

Scheme of Examination

A) Internal Assessment: (Total Marks: 20)

1. Assignment -15 marks
2. Attendance - 05 Marks

B) Semester End Examination: Theory Assessment: (Total Marks: 30)

Question Paper consisting of 3 Main Questions as per the following pattern:

Q1 – pertaining to unit 1 and 2

Attempt ANY FIVE: …. (10 marks)

(i)

(ii)

(iii)

(iv)

(v)

(vi)

Q2 – pertaining to unit 1

Attempt ANY TWO: …. (10 marks)

(i)

(ii)

(iii)

(iv)

Q3 – pertaining to unit 2

Attempt ANY TWO: …. (10 marks)

(i)

(ii)

(iii)

(iv)