ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

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Atmakur (V), Mangalagiri (M), Guntur-522 503, Andhra Pradesh
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REVISED SYLLABUS OF B.SC. PHYSICS
(FOR NON-MATHEMATICS COMBINATIONS)
UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021

PROGRAMME: THREE-YEAR B.Sc.

(Physics for Non-Mathematics Combinations)

(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities & Model Q.P.)

For Fifteen Courses of 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

AP STATE COUNCIL OF HIGHER EDUCATION

RevisedB.Sc. PHYSICS SYLLABUS UNDER CBCS

[For Non-Mathematics combinations]

w.e.f. 2020-21 (Revised in May 2020)

First Semester

Course I: Mechanics, Waves and Oscillations

Practical Course I (Lab-1)

Second Semester

Course II: Wave Optics

Practical Course II (Lab-2)

Third Semester

Course III: Heat and Thermodynamics

Practical Course III (Lab-3)

Fourth Semester

Course IV: Electricity, Magnetism and Electronics

Practical Course IV (Lab- 4)

Course V:Modern Physics

Practical Course V (Lab-V)

B.SC. PHYSICS COURSE STRUCTURE UNDER CBCS

Year	***Semester***	***Course***	***Title of the Course***	***Marks***	***No.of Hrs/Week***	***No.of Credits***
I	I	I	Mechanics, Waves and Oscillations	100	4	03
			Practical Course- I	50	2	02
	II	II	Wave Optics	100	4	03
			Practical Course – II	50	2	02
II	III	III	Heat and Thermodynamics	100	4	03
			Practical Course – III	50	2	02
	IV	IV	Electricity, Magnetism and Electronics	100	4	03
			Practical Course – IV	50	2	02
		V	Modern Physics	100	4	03
			Practical Course –V	50	2	02
Total No. of Courses : **05 (Five)**						

B.Sc. PHYSICS SYLLABUS UNDER CBCS

I YEAR B.Sc. -I SEMESTER

[2020-21 Batch onwards]

Course I: MECHANICS,WAVES AND OSCILLATIONS

(For Non-Maths Combinations)

Work load: 60 hrs per semester **4 hrs/week**

Course outcomes:

On successful completion of this course, the students will be able to:

- *Understand the Newton's laws of motion and the law of conservation of linear momentum and its application to rocket motion, the concepts of concepts of impact parameter, scattering cross section and Distinguish between elastic and inelastic collisions.*
- *Formulate the rotational kinematic relations, learn the working principle of gyroscope and its applications and explain the precessional motion of a freely rotating symmetric top.*
- *Analyse the general characteristics of central forces and the application of Kepler's laws to describe the motion of planets and satellite in circular orbit through the study of law of Gravitation.*
- *State the postulates of Special theory of relativity and its consequences such as length contraction, time dilation, relativistic mass and mass-energy equivalence.*
- *Understand the phenomena of simple harmonic motionand the distinction between undamped, damped and forced oscillations and the concepts of resonance and quality factor with reference to damped harmonic oscillator.*
- *State the laws of transverse vibrations in a stretched string and their verification using a*

  sonometer and learn the formation of harmonics and overtones in a stretched string.
- *Acquire knowledge onUltrasonic waves, their production and detection and their applications in different fields.*

UNIT-I:

1. Mechanics of Particles(06 hrs)

Review of Newton's Laws of Motion, Conservation of linear momentum, Collisions, Elastic and inelastic collisions, Collisions in one and two dimension, Rocket propulsion, Impact parameter, Scattering cross-section, Rutherford scattering (No derivation-Qualitative ideas only)

2.Mechanics of Rigid body: (06hrs)

Rigid body, Rotational kinematic relations, Rotational kinetic energy and moment of inertia,Angular momentum, Torque, Relation between torque and angular momentum, Conservation of angular momentum, Illustrations, Gyroscopic motion (No derivation - Qualitative ideas only), Precession of the equinoxes.

UNIT-II:

3. Central forces: (12hrs)

Central force-Definition& examples, General Characteristics of Central forces, Conservative nature of central forces, Planetary motion-Kepler's laws (Statements & Explanation), Deduction of Newton's law of gravitation from Kepler's law, Geostationary Satellite Motion, Uses of communication satellites,Basic idea of Global Positioning System (GPS) and their applications.

UNIT-III:

4. Relativistic Mechanics (12 hrs)

Inertial and Non-inertial reference frames-Galilean relativity; Special theory of relativity-Statements of the two basic postulates- (Elementary treatment and application only) Lorentz transformation equations (No derivations); length contraction; time dilation; addition of velocities;Einstein's mass –energy equation

UNIT-IV:

5. Undamped, Damped and Forced Oscillations (12hrs)

Simple harmonic motion, Characteristics of SHM, Equation of motion and solution, Combination of Simple harmonic motions along a line and perpendicular to each other-Lissajous figures& uses, Damped vibrations: Explanation and examples, Distinction between damped and undamped vibrations, Forced vibrations: Explanation and examples, Resonance,

examples – Sharp resonance and Flat resonance, Sharpness of resonance, Q-factor, Volume Resonator- Determination of frequency of a given tuning fork.

UNIT-IV:

6. Wave motion :(06hrs)

Progressive waves-Equation of a progressive wave, Velocity of transverse waves in elastic media, Standing waves, overtones and harmonics, Sonometer-Verification of laws of transverse vibrations in a stretched string, Phenomenon of beats (qualitative ideas only).

7. Ultrasonics :(06hrs)

Ultrasonics, properties, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics, Applications of ultrasonic waves.

REFERENCE BOOKS:

- BSc Physics, Vol.1 -Telugu Academy, Hyderabad
- Physics for Biology and Premedical Students –D.N. Burns & SGG Mac Donald
- Unified Physics Vol.I- Mechanics,Waves and Oscillations; Jai PrakashNath&Co.Ltd., Meerut.
- Properties of Matter - D.S. Mathur, S.Chand& Co, New Delhi ,11thEdn., 2000
- Properties of Matter - Brijlal&Subrmanyam, S.Chand&Co. 1982
- Waves and Oscillations- S. Badami, V. Balasubramanian and K. Rama Reddy, Orient Longman.
- Waves and Oscillations- N. Subramaniyam and Brijlal, Vikas Publishing House Private Limited.

Practical Course 1: Mechanics, Waves and Oscillations

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

Course outcomes (Practicals):

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

- *perform experiments on Properties of matter such as the determination of moduli of elasticity viz., Young's modulus, Rigidity modulus of certain materials; Surface tension of water , Coefficient of viscosity of a liquid , Moment of inertia of some regular bodies by different methods and compare the experimental values with the standard values.*
- *determine the acceleration due to gravity at a place using Compound pendulum and Simple pendulum.*
- *notice the difference between flat resonance and sharp resonance in case of volume resonator and sonometer experiments respectively.*
- *verify the laws of transverse vibrations in a stretched string using sonometer and comment on the relation between frequency, length and tension of a stretched string under vibration.*
- *demonstrate the formation of stationary waves on a string in Melde's string experiment.*

Minimum of 6 experiments to be done and recorded

1. Young's modulus of the material of a bar (scale) by uniform bending
2. Young's modulus of the material a bar (scale) by non- uniform bending
3. Surface tension of a liquid by capillary rise method
4. Viscosity of liquid by the flow method (Poiseuille's method)
5. Bifilar suspension –Moment of inertia of a regular rectangular body.
6. Fly-wheel -Determination of moment of inertia
7. Rigidity modulus of material of a wire-Dynamic method (Torsional pendulum)
8. Volume resonator experiment
9. Determination of 'g' by compound/bar pendulum
10. Simple pendulum- normal distribution of errors-estimation of time period and the error of the mean by statistical analysis
11. Determination of the force constant of a spring by static and dynamic method.

12. Coupled oscillators
13. Verification of laws of vibrations of stretched string –Sonometer
14. Determination of frequency of a bar –Melde's experiment.
15. Study of a damped oscillation using the torsional pendulum immersed in liquid-decay constant and damping correction of the amplitude.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

- Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
- Student seminars (on topics of the syllabus and related aspects (individual activity))
- Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
- Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity)
- Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)

GENERAL

- Group Discussion
- Visit to Research Stations, Science Museum Centres to understand the basic principles of mechanics with live examples.
- Visit to and related industries
- Study the rate of flow of water in water works department in local municipality.

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

- The oral and written examinations (Scheduled and surprise tests)
- Practical assignments and laboratory reports
- Individual and group project reports
- Efficient delivery using seminar presentations
- Viva voce interviews.

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B.Sc. PHYSICS SYLLABUS UNDER CBCS

I YEAR B.Sc.-II SEMESTER

[2020-21 Batch onwards]

CourseII: WAVE OPTICS

(For Non-Maths Combinations)

Work load: 60 hrs per semester **4 hrs/week**

Course outcomes:

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

- *Explain about the different aberrations in lenses and discuss the methods of minimizing them.*
- *Understand the phenomenon of interference of light and its formation in Lloyd's single mirror Thin films and Newton's rings.*
- *Distinguish between Fresnel's diffraction and Fraunhoffer diffraction and observe the diffraction patterns in the case of single slit and the diffraction grating.*
- *Describe the construction and working of zone plate and make the comparison of zone plate with convex lens.*
- *Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity.*
- *Comprehend the basic principles of laser and fibre optic communication and their applications.*

UNIT –I: Geometric optics **(12 hrs)**

Aberrations in lenses-Chromatic Aberration-Achromatic Combination of lenses-Monochromatic defects-Spherical aberration-Astigmatism; Coma; Curvature and Distortion-Minimizing aberration.

UNIT-II:Interference **(12 hrs)**

The superposition principle, Condition for Interference, Classification of Interferences methods-Young's double slit experiment-Theory, Intensity in interference pattern- Phase change on reflection ; Lloyd's single mirror; Interference due to plane parallel wedge shaped

films, Colours in thin films-Newton rings, Determination of wavelength of light using Newton's rings.

UNIT-III:Diffraction (12 hrs)

Fresnel and Fraunhoffer diffraction phenomena, Differences between interference and diffraction, Fraunhoffer diffraction of single Slit;Diffraction grating- Determination of wavelength of light using diffraction grating (Normal incidence and Minimum deviation); Resolving power; Rayleigh's criterion –limits of resolution for telescopes and microscope,Zone plate-construction and its comparison with convex lens

UNIT-IV: Polarization (12 hrs)

Polarized light: Production of plane polarized light by reflection, Double refraction; Brewster's law; Malus law; Nicol prism; Nicol prism as polarizer and analyzer- Quarter wave plate, Half wave plate- Production and detection of plane, circularly and elliptically polarized light, Optical activity, determination of specific rotation by Laurent's half shade polarimeter

UNIT V: Lasers& Fiber Optics(12 hrs)

Lasers-characteristics; Stimulated and Spontaneous emission, Population inversion, Laser principle, Ruby laser, He-Ne laser, Applications of lasers

Introduction to fibres,Different types of fibres, Principles of fiber communication (qualitative treatment only), Advantages of optical fibre communication

REFERENCE BOOKS

- BSc Physics, Vol.2, Telugu Academy, Hyderabad
- Physics for Biology and Premedical Students –D.N. Burns & SGG Mac Donald
- Unified Physics Vol.II, Optics and Thermodynamics,*JaiPrakashNath&Co.Ltd., Meerut*.
- Optics, AjoyGhatak, Tata Mc Graw-Hill.
- Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
- Introduction of Lasers – Avadhanulu, S.Chand& Co.
- Principles of Optics- BK Mathur, Gopala Printing Press, 1995

Practical Course II: Wave Optics

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

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

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)

2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams)
4. Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity)
5. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)

GENERAL

1. Group Discussion
2. Visit to Research Stations/laboratories and related industries
3. Others

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Individual and group project reports,
4. Efficient delivery using seminar presentations,
5. Viva voce interviews.

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B.Sc. PHYSICS SYLLABUS UNDER CBCS

II YEAR B.Sc. -III SEMESTER

[2020-21 Batch onwards]

Course-III: HEAT AND THERMODYNAMICS

(For Non-MathsCombinations)

Work load: 60 hrs per semester **4 hrs/week**

Course outcomes:

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

- *Develop an understanding on the concepts of Thermodynamics, Thermoelectricity, Low temperature Physics and Quantum theory of Radiation.*
- *Develop critical understanding of concept of Thermodynamic potentials and formulation of Maxwell's equations.*
- *Get familiarized with the principles of Seebeck effect, Thomson effect and Peltier effect.*
- *Understand the different methods of production of low temperatures and study the applications of substances at low temperatures.*
- *Examine the nature of black body radiations.*

UNIT-I:Kinetic theory of Gases: **(12 Hrs)**

Kinetic theory of gases- Assumptions-Pressure of an ideal gas; molecular interpretation of temperature- Maxwell's law of distribution of molecular speeds (no derivation); experimental verification; Zeroth law of thermodynamics, Measurement of temperature- Platinum resistance thermometer, Thermoelectric thermometer.

UNIT-II: Thermodynamics : **(12 Hrs)**

First law of thermodynamics, work done in isothermal and adiabatic changes ,Reversible and irreversible process, Carnot's cycle, Carnot's theorem; Second law of thermodynamics, Kelvin's and Claussius statements; Entropy, physical significance; Change in entropy in reversible and irreversibleprocesses,Entropy and disorder-Entropy of universe.

UNIT-III: Low temperature Physics: (12 Hrs)

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), Principle of refrigeration,Practical applications of substances at low temperatures.

UNIT-IV: Measurement, Laws and Theories of Radiation: (12 Hrs)

Black body,Ferry's black body, Distribution of energy in the spectrum of Black body,Kirchoff's law, Wein's displacement law, Stefan-Boltzmann's law and Rayleigh-Jean's law (Statements only), Planck's radiation formula (no derivations), Types of pyrometers, Disappearing filament optical pyrometer and its working; Solar constant and its determination using Angstrom pyroheliometer, Estimation of surface temperature of Sun.

UNIT-V: Thermoelectricity :(12 Hrs)

Seebeck effect, Variation of thermoemf with temperature; Thermo electric series; Measurement of thermoemf using potentiometer, Law of intermediate metals and intermediate temperatures - Peltier effect, Thomson effect; Thermoelectric diagrams and their uses, Thermoelectric power; Applications of thermoelectric effects.

REFERENCE BOOKS

- BSc Physics, Vol.2, Telugu Academy, Hyderabad
- Physics for Biology and Premedical Students –D.N. Burns & SGG Mac Donald
- Unified Physics Vol.II, Optics and Thermodynamics,JaiPrakashNath&Co.Ltd., Meerut.
- Heat and Thermodynamics, N.Subramanyam and L.Brijlal, S.Chand& Co.
- Electricity and Magnetism, N.Subramanyam and L.Brijlal, S.Chand& Co.
- University Physics, HD Young, MW Zemansky, FW Sears, Narosa Publishers, New Delhi

Practical Course-III :Heat and Thermodynamics

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

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

- *Perform basic experiments in thermal Physics, such as, determinations of Stefan's constant, coefficient of thermal conductivity, variation of thermo-emf of athermocouple with temperature difference at its two junctions, calibration of a thermocouple and Specific heat of a liquid.*

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. Thermoemf- 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.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

- MEASURABLE
    1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
    2. Student seminars (on topics of the syllabus and related aspects (individual activity)
    3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
    4. Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity)

5. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))
6. General
7. Group Discussion
8. Visit to Research Stations and related industries
9. Others

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Problem-solving exercises,
3. Observation of practical skills,
4. Individual and group project reports,
5. Efficient delivery using seminar presentations,

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B.Sc. PHYSICS SYLLABUS UNDER CBCS

II YEAR B.Sc. -IV SEMESTER

[2020-21 Batch onwards]

Course IV: ELECTRICITY, MAGNETISM AND ELECTRONICS

(For Non-Maths Combinations)

Work load: 60 hrs per semester **4 hrs/week**

Course outcomes:

On successful completion of this course, the students will be able to:

- *Develop an understanding on the concepts of Electricity, Magnetism and Electronics and their applications.*
- *Understand the Gauss's law in electrostatics and the concepts of electric potential, equipotential surfaces and the classifications of dielectric materials.*
- *Distinguish between magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.*
- *Comprehend the role and importance of Faraday's laws and Lenz 's law in electromagnetic induction.*
- *Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.*
- *Understand theKirchoff's laws and its application to Wheatstone's bridge*
- *Disseminate the fundamentals of digital electronics and principles of p-n junction diodes and transistors.*

UNIT-1:

1. Electric field and Potential (12 Hrs)

Coulomb's law ; Electric field and Electric lines of force, Electric flux; Gauss's law statement and its proof; Deduction of Coulomb's law from Gauss's law, Applications of Gauss Law: Electric field intensity due to (i) Uniformly charged sphere (ii) an infinite conducting sheet of charge (No Derivation- qualitative ideas only); Electrical potential;Equipotential surfaces with examples;Potential due to electric dipole.

UNIT-II:

2. Capacitance and Dielectrics(12 Hrs)

Electric capacitance ; Principle of condenser, Capacity of a parallel plate capacitor with and without dielectric; Energy stored in a capacitor, Electric dipole moment; Di-electrics and examples, Types of dielectrics;Effect of electric field on dielectrics; Electric displacement D, electric polarization P, Dielectric constant, Permeability & Susceptibility (Definitions only); Relation between D,E and P

UNIT-III:

3. Current Electricity(12 Hrs)

Electric current and current density, drift velocity; Relationship between current density and drift velocity, Electrical resistance and resistivity, conductivity, Ohm's law and its limitations; Kirchhoff's laws –Statements and explanations; Application of Kirchhoff's laws to Wheatstone bridge, sensitivity of Wheatstone bridge

UNIT-IV:

4. Electromagnetism: (12 Hrs)

Biot-Savart's law-Explanation; Application of Biot-Savart's law to circular coil carrying current (No derivation-qualitative treatment only) ; Ampere's law ; Force on (i) charged particles and (ii) current carrying conductor in the magnetic field, Hall effect and its applications.

5. Electromagnetic induction: Faraday's laws of electromagnetic induction, Lenz's law,Phenomena of Self inductionand Mutual induction, Self inductance of a long solenoid, Transformer-Principle and working; Energy stored in a magnetic field

UNIT-V:

6. Basic Electronics: (06Hrs)

PN junction diode and its V-I characteristics, Half and full wave rectifiers (working-qualitative ideas only); Action of filters- L-type and π- type filters; Transistors- PNPand NPN transistors& their working; CE, CC and CB Configurations, CE transistor –Input and output characteristics, Transistor as an amplifier.

7. Digital Electronics: (06 Hrs)

Number system, conversion of binary to decimal and vice versa, De Morgan's theorems Statements& Proofs; Basic Logic gates and their verification of truth tables, NAND and NOR gates as universal gates, Half and Full adders.

REFERENCE BOOKS

- B.Sc., Physics, Vol.3, Telugu Academy, Hyderabad
- Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath – S. Chand & Co.
- Electricity and Magnetism, Brijlal and Subramanyam. RatanPrakashanMandir.
- Principles of Electronics, V.K. Mehta, S.Chand& Co.,
- Digital Principles and Applications, A.P. Malvino and D.P.Leach, McGrawHill Edition.

Practical Course IV: Electricity, Magnetism and Electronics

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

Course outcomes (Practicals):

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

- *measure the current sensitivity and figure of merit of a moving coil galvanometer.*
- *observe the resonance condition in LCR series and parallel circuits.*
- *learn how a sonometer can be used to determine the frequency of AC-supply.*
- *observe the variation of magnetic field along the axis of a circular coil carrying current using Stewart and Gee's apparatus.*
- *understand the operation of PN junction diode, Zener diode and a transistor and their V-I characteristics.*
- *construct the basic logic gates, half adder and full adder and verify their truth tables. Further, the student will understand how NAND and NOR gates can be used as universal building blocks.*

Minimum of 6 experiments to be done and recorded:

1. Figure of merit of a moving coil galvanometer.
2. LCR circuit series/parallel resonance, Q factor.
3. Determination of ac-frequency –Sonometer.
4. Verification of Kirchoff's laws and Maximum Power Transfer theorem.
5. Field along the axis of a circular coil carrying current-Stewart & Gee's apparatus.
6. PN Junction Diode Characteristics
7. Zener Diode –V-I Characteristics
8. Zener Diode as a voltage regulator
9. Transistor CE Characteristics- Determination of hybrid parameters
10. Logic Gates- OR, AND,NOT and NAND gates. Verification of Truth Tables.
11. Verification of De Morgan's Theorems.
12. Construction of Half adder and Full adders-Verification of truth tables

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity)
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams)
4. Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity)
5. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)
6. General
7. Group Discussion
8. Visit to Research Stations and related industries
9. Others

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Practical assignments and laboratory reports,
3. Observation of practical skills,
4. Efficient delivery using seminar presentations,
5. Viva voce interviews.

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B.Sc. PHYSICS SYLLABUS UNDER CBCS

II YEAR B.Sc. -IV SEMESTER

[2020-21 Batch onwards]

CourseV: MODERN PHYSICS

(For Non-Maths Combinations)

Work load: 60 hrs per semester **4 hrs/week**

Course outcomes:

On successful completion of this course, the students will be able to:

- *Develop an understanding on the concepts of Atomic and Modern Physics, basic elementary quantum theory and nuclear physics.*
- *Develop critical understanding of concept of Matter waves and Uncertainty principle.*
- *Get familiarized with the phenomenon of photoelectriceffect and Compton effect*
- *Examine the basic properties of nuclei, characteristics of Nuclear forces, salient features of Nuclear models and different nuclear radiation detectors.*
- *Classify Elementary particles based on their mass, charge, spin, half life and interaction.*
- *Increase the awareness and appreciation of superconductors and their practical applications.*
- *Develop an understanding on the nanomaterials, their properties and applications.*
- *Conduct experiments using skills appropriate to the units*

UNIT-I:

1. Atomic and Molecular Physics:(12 hrs)

Bohr's theory of Hydrogen atom ; Spectral series of Hydrogen atom and energy levels, Elementary ideas of Sommerfeld elliptical theory, Vector atom model-Quantum numbers associated with vector atom model; Zeeman effect –Experimental arrangement,Paschen-Back effect and Stark effect (Elementary ideas only); Raman effect, Quantum theory of Raman effect; Experimental arrangement to observe Raman effect and its applications.

UNIT-II :

2. Fundamentals of Quantum theory:(12 hrs)

Inadequacy of classical physics, spectral radiation, Plank's quantum theory, Photoelectric effect; Experimental demonstration, Laws of photoelectric emission- Threshold frequency and work function; Einstein's Photoelectric equation and its verification by Millikan's experiment ; Compton effect (no derivation) and its experimental verification

UNIT-III:

3. Matter Waves and Uncertainty principle (12 hrs)

Dual nature of radiation- de Broglie's theory of matter waves, expression for wavelength, Properties of matter waves, Davisson and Germer experiment on electron diffraction – Discussion of results, Wave velocity and group velocity.

Heisenberg's uncertainty principle for position and momentum (x and p), energy and time (E and t); Experimental illustrations of uncertainty principle, Complementary principle of Bohr.

UNIT-IV:

4. Nuclear Physics (12 hrs)

Nuclear Structure: General Properties of Nuclei, Mass defect, Binding energy; *Nuclear forces*: Characteristics of nuclear forces; Nuclear Models: Liquid drop model, The Shell model, Magic numbers; *Nuclear Radiation detectors*: G.M. Counter, Cloud chamber, Solid State detector; *Elementary Particles*: Elementary Particles and their classification

UNIT-V:

5. Nanomaterials:(7hrs)

Nanomaterials – Introduction, Electron confinement-Size effect-Surface to volume ratio;

Classification of nano materials– (0D, 1D, 2D); Examples: CNT, Graphene, nano wires; Distinct properties of nano materials (Mention-*mechanical, optical, electrical, and magnetic properties*); Applications of nanomaterials

6. Superconductivity: (5 hrs)

Superconductivity: Introduction ;Experimental facts, critical temperature , critical field, Meissner effect ; Isotope effect ; Type I and type II superconductors ; BCS theory (Elementary ideas only) ;Applications of superconductors

REFERENCE BOOKS

- B.Sc Physics, Vol.4, Telugu Academy, Hyderabad.
- Molecular Structure and Spectroscopy by G. Aruldhas. Prentice Hall of India, New Delhi.
- Physics for Biology & Premedical Students –D.N. Burns & SG Mac Donald, Addison Wiley.
- S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publ.Co.)
- K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology(PHI Learning Priv.Limited).
- Nano materials, A K Bandopadhyay. New Age International Pvt Ltd (2007)
- Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, BaldevRaj,BBRath and J Murday- Universities Press-IIM

Practical CourseV: Modern Physics

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

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

- *measure charge of an electron ande/m value of an electron by Thomson method.*
- *understand how the Planck's constant can be determined using Photocell and LEDs.*
- *study the absorption of α-rays and β-rays, Range of β-particles and the characteristics of GM counter*
- *determine the Energy gap of a semiconductor using thermistor and junction diode.*

Minimum of 6 experiments to be done and recorded:

1. e/m of an electron by Thomson method.
2. Determination of Planck's Constant (photocell).
3. Verification of inverse square law of light using photovoltaic cell.
4. Determination of the Planck's constant using LEDs of at least 4 different colours.
5. Determination of work function of material of filament of directly heated vacuum diode.
6. Study of absorption of α-rays.
7. Study of absorption of β-rays.
8. Determination of Range of β-particles.
9. Determination of M & H.
10. Analysis of powder X-ray diffraction pattern to determine properties of crystals.
11. Energy gap of a semiconductor using junction diode.
12. Energy gap of a semiconductor using thermistor
13. GM counter characteristics

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity)
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams)
4. Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity) Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)

GENERAL

1. Group Discussion
2. Visit to Research Stations and related industries
3. Others

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Practical assignments and laboratory reports,
3. Observation of practical skills,
4. Individual and group project reports,
5. Efficient delivery using seminar presentations,
6. Viva voce interviews.

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NOTE:

1. The duration of the examination for each theory course is 3.00 hrs.
   The duration of each practical examination is 3 hrs with 50 marks

2. Each course in theory is of 100 marks and practical course is of 50 marks.
   - Semester End University Examination in Theory Course: 75 marks [External evaluation]
   - Mid-Semester Examination in Theory Course at the college level: 25 marks [Internal evaluation]

3. The University (external) examination for both Theory and Practical shall be conducted at the end of each Semester.

4. In each semester the evaluation in Practical courses shall be done by an external examiner appointed by the University.
   There shall not be Internal valuation in any semester end practical examinations.

5. The candidate shall prepare and submit at the time of practical examination a certified Record based on the practical course with a minimum of **6** experiments from each semester.

6. Numerical Problems must be solved at the end of every chapter of all Units.

7. The minimum passing marks in each theory course is 40 (External:30 and Internal:10)
   The minimum passing marks in each Practical/Lab course is 20.

8. The teaching work load per week for semesters I to IV is 4 hours for theory course and 2 hours for all laboratory (practical) courses.

9. Visits to industry, national research laboratories, and scientific exhibitions should be encouraged.

10. The syllabus for Practical courses is same for both Mathematics and Non-Mathematics combinations.

11. The marks distribution for the Semester End practical examination is as follows:

(i)	*Formula/ Principle / Statement with explanation of symbols and*	05
(ii)	*Diagram/Circuit Diagram / Tabular Columns ... ...*	10
(iii)	*Setting up of the experiment and taking readings/Observations*	10
(iv)	*Calculations (explicitly shown) + Graph + Result with Units...*	10
(v)	*Viva-voce ... ...*	05
(vi)	*Class Records (to be valued at the time of practical*	10
	Total Marks :	**50**

B.Sc. PHYSICS

[For Non-Mathematics combinations]

w.e.f. 2020-21 (Revised in May 2020)

MODEL QUESTION PAPER COMMON FOR ALL FIVE THEORY COURSES

Time: 3 hrs *Max marks: 75*

SECTION-A

(Essay Type Questions) *Marks*: 5x10M = 50M

Answer All questions with internal choice from each Unit

1. Essay type question from Unit-I

   Or

   Essay type question from Unit-I

2. Essay type question from Unit-II

   Or

   Essay type question from Unit-II

3. Essay type question from Unit-III

   Or

   Essay type question from Unit-III

4. Essay type question from Unit-IV

   Or

   Essay type question from Unit-IV

5. Essay type question from Unit-V

   Or

   Essay type question from Unit-V

SECTION-B

(Short Answer Type Questions) *Marks*: 5x5M = 25M

Answer any five out of the following ten questions

6. Short answer type question from Unit-I
7. Short answer type question from Unit-I
8. Short answer type question from Unit-II
9. Short answer type question from Unit-II
10. Short answer type question from Unit-III
11. Short answer type question from Unit-III
12. Short answer type question from Unit-IV
13. Short answer type question from Unit-IV
14. Short answer type question from Unit-V
15. Short answer type question from Unit-V

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SUBJECT EXPERTS

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