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S.V.K.P. & Dr. K.S. RAJU ARTS & SCIENCE COLLEGE

(Autonomous)

Recognized by UGC as "College with Potential for Excellence"
Accredited by NAAC with "A" Grade
(Affiliated to ADIKAVI NANNAYA UNIVERSITY - Recognised by Govt. of Andhra Pradesh)
PENUGONDA-534 320, West Godavari District., (A.P.)

I Semester Syllabus (w.e.f. 2019-20 Admitted Batch)

PHYSICS

(For Mathematics Combinations)

PAPER I: MECHANICS& PROPERTIES OF MATTER

Work load: 60 hrs per semester 4 hrs/week

UNIT-I (10 hrs)

1. Vector Analysis

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field with derivations and physical interpretation. Vector integration (line, surface and volume), Statement and proof of Gauss and Stokes theorems. (Additional Topic – Statement and proof of Green's theorem).

UNIT-II (10 hrs)

2. Mechanics of particles

Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions, Concept of impact parameter, scattering cross-section, Rutherford scattering-derivation. .
(Additional Topic – Multistage Rocket, Work Energy Theorem).

UNIT-III (16 hrs)

3. Mechanics of Rigid bodies

Definition of rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum, Euler equations and its applications, precession of a top, Gyroscope, precession of the equinoxes.

4. Mechanics of continuous media

Elastic constants of isotropic solids and their relations, Poisson's ratio and expression for Poisson's ratio in terms of y, n, k. Classification of beams, types of bending, point load, distributed load, shearing force and bending moment, sign conventions.

UNIT-IV (12hrs)

5. Central forces

Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force.Derivation of Kepler's laws.Motion of satellites, idea of Global Positioning System (GPS).

UNIT-V (12 hrs)

6. Special theory of relativity

Galilean relativity, absolute frames. Michelson-Morley experiment, negative result.Postulates of special theory of relativity.Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation.

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SEMESTER II (w.e.f. 2019-20 Admitted Batch)
B.Sc PHYSICS
Paper II:Waves & Oscillations
(For Maths Combinations)
Work load: 60 hrs per semester 4 hrs/week

UNIT-I (12 hrs)

1. Simple Harmonic oscillations

Simple harmonic oscillator and solution of the differential equation-Physical characteristics of SHM, torsion pendulum-measurements of rigidity modulus, compound pendulum measurement of 'g', Principle of superposition, beats, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies. Lissajous figures and it's uses. (Additional Topic – Frequency of a Spring taking it's mass into consideration).

UNIT-II (12 hrs)

2. Damped and forced oscillations

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with un-damped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance and velocity resonance.

UNIT-III (10 hrs)

3. Complex vibrations

Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw tooth wave, simple problems on evolution of Fourier coefficients.

UNIT-IV (17hrs)

4. Vibrating strings: 8 hrs

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics. Energy transport and transverse impedance.(Additional Topic: Laws of Tranverse waves of vibrating strings.)

5. Vibrations of bars: 9 hrs

Longitudinal vibrations in bars-wave equation and its general solution. Special cases (i) bar fixed at both ends (ii) bar fixed at the midpoint (iii) bar fixed at one end. Tuning fork.

UNIT-V (9 hrs)

6. Ultrasonics: 9hrs

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

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III Semester Syllabus (w.e.f. 2019-20 Admitted Batch)

PHYSICS

(For Mathematics Combinations)

PAPER III: WAVE OPTICS

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

UNIT-I (8 hrs.)

1. Aberrations:

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

UNIT-II (14 hrs.)

2. Interference

Principle of superposition – coherence-temporal coherence and spatial coherence-conditions for interference of light. Fresnel's biprism-determination of wavelength of light –change of phase on reflection. Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (cosine law) – colors of thin films-

Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light. Michelson interferometer, Determination of wavelength of monochromatic light using Newton's rings and Michelson Interferometer.

Additional inputs– Michelson Interferometer -Types of fringes

UNIT-III (14 hrs.)

3. Diffraction

Introduction, distinction between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction –Diffraction due to single slit-Fraunhoffer diffraction due to double slit-Fraunhoffer diffraction pattern with N slits (diffraction grating).Resolving power of grating, Determination of wavelength of light in normal incidence and minimum deviation methods using diffraction grating,

Fresnel's half period zones-area of the half period zones-zone plate-comparison of zone plate with convex lens-difference between interference and diffraction.

Additional inputs: Polygon law

UNIT-IV (10 hrs.)

4. Polarization:

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

UNIT-V (14 hrs.)

5. Lasers and Holography:

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

6. Fiber Optics:

Introduction- different types of fibers, rays and modes in an optical fiber, fiber material, principles of fiber communication (qualitative treatment only), advantages of fiber optic communication.

Additional inputs: Numerical aperture

REFERENCE BOOKS:

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

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IV Semester Syllabus (w.e.f. 2019-20 Admitted Batch)

PHYSICS

(For Mathematics Combinations)

PAPER IV: THERMODYNAMICS AND RADIATION PHYSICS

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

UNIT-I (10 hrs.)

1. Kinetic theory of gases

Introduction –Deduction of Maxwell's law of distribution of molecular speeds, experimental verification. Transport phenomena – Mean free path - Viscosity of gases-thermal conductivity-diffusion of gases.

Additional inputs: Average velocity, most probable velocity, RMS velocity

UNIT-II (12 hrs.)

2. Thermodynamics

Introduction- Isothermal and adiabatic process- Reversible and irreversible processes-Carnot's engine and its efficiency-Carnot's theorem-Second law of thermodynamics. Kelvin's and Claussius statements-Entropy, physical significance –Change in entropy in reversible and irreversible processes-Entropy and disorder-Entropy of Universe–Temperature-Entropy (T-S) diagram and its uses - Change of entropy of a perfect gas- change of entropy when ice changes into steam.

Additional inputs – Zeroth Law of Thermodynamics, First law of Thermodynamics- applications, Thermodynamic scale of temperature.

UNIT-III (12 hrs.)

3. Thermodynamic potentials and Maxwell's equations

Thermodynamic potentials-Derivation of Maxwell's thermodynamic relations-Clausius-Clayperon's equation-Derivation for ratio of specific heats-Derivation for difference of two specific heats for perfect gas. Joule Kelvin effect-expression for Joule Kelvin coefficient for perfect and Vander Waal's gas.

UNIT-IV (12 hrs.)

4. Low temperature Physics

Introduction-Joule Kelvin effect-Porous plug experiment - Joule expansion-Distinction between adiabatic and Joule Thomson expansion-Expression for Joule Thomson cooling-Liquefaction of helium Kapitza's method-Adiabatic demagnetization - Production of low temperatures -applications of substances at low temperature-effects of chloro and fluoro carbons on ozone layer.

Additional inputs: Working principle of refrigerator and Air conditioner

UNIT-V (14 hrs.)

5. Quantum theory of radiation

Blackbody-Ferry's black body-distribution of energy in the spectrum of black body-Wein's displacement law, Wein's law, Rayleigh-Jean's law-Quantum theory of radiation-Planck's law-Measurement of radiation-Types of pyrometers-Disappearing filament optical pyrometer-experimental determination – Angstrompyroheliometer-determination of solar constant, Temperature of Sun.

REFERENCE BOOKS:

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

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III B.Sc.: Physics Semester-V SYLLABUS

Paper V(A) - Electricity, Magnetism and Electronics

Credits: 03 w.e.f (2019-2020) Batch **3Hour/Week**

Total Hours : 45

UNIT-I (9 hrs)

1. **Electric field intensity and potential:**
   Gauss's law statement and its proof- Electric field intensity due to (1) Uniformly charged sphere and (2) an infinite conducting sheet of charge. Electrical potential – equipotential surfaces- potential due to i) a point charge, ii) charged spherical shell .
   Additional Inputs: Deduction of Coulomb's law from Gauss law.
2. **Dielectrics:**
   Electric dipole moment and molecular polarizability- Electric displacement D, electric polarization P –relation between D, E and P- Dielectric constant and susceptibility. Boundary conditions at the dielectric surface.

UNIT-II (9 hrs)

3. **Electric and magnetic fields**
   Biot-Savart's law, explanation and calculation of B due to long straight wire, a circular current loop and solenoid – Hall effect – determination of Hall coefficient and applications.
4. **Electromagnetic induction**
   Faraday's law-Lenz's law- Self and mutual inductance, coefficient of coupling, calculation of self inductance of a long solenoid, energy stored in magnetic field. Transformer - energy losses - efficiency.
   Additional Inputs: Betatron.

UNIT-III (9 hrs)

5. **Alternating currents and electromagnetic waves**
   Alternating current - Relation between current and voltage in LR and CR circuits, vector diagrams, LCR series and parallel resonant circuit, Q –factor, power in ac circuits.
6. **Maxwell's equations**
   Idea of displacement current - Maxwell's equations (integral and differential forms) (no derivation), Maxwell's wave equation (with derivation). Pointing theorem (statement), production of electromagnetic waves (Hertz experiment).

UNIT-IV (9 hrs)

7. **Basic electronics:**
   PN junction diode, Zener diode, I-V characteristics, PNP and NPN transistors, CB, CE and CC configurations – Relation between α, β and γ - transistor (CE) characteristics , Transistor as an amplifier.

UNIT-V (9 hrs)

8. **Digital electronics**

Number systems - Conversion of binary to decimal system and vice versa. Binary subtraction (2's complement methods). Laws of Boolean algebra - DeMorgan's laws-statement and proof, Basic logic gates, NAND and NOR as universal gates, exclusive-OR gate, Half adder and Full adder.

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III B.Sc.: Physics Semester-V

Paper V(B) – MODERN PHYSICS

No. of Credits: 03 W.e.f (2019-2020) Batch **3 Hour/Week**

Total Hours : 45

UNIT-I (9 hrs)

1. **Atomic and molecular physics**

Introduction –Drawbacks of Bohr's atomic model. Vector atom model and Stern-Gerlach experiment - quantum numbers associated with it. L-S and j- j coupling schemes. Zeeman effect(Definition only) -Raman effect, hypothesis, Stokes and Anti Stokes lines. Quantum theory of Raman effect. Experimental arrangement – Applications of Raman effect.

Additional Inputs: Paschen-back effect (basic idea).

UNIT-II (9 hrs)

2. **Matter waves & Uncertainty Principle**

Matter waves, de Broglie's hypothesis - wavelength of matter waves, Properties of matter waves - Davisson and Germer experiment – Heisenberg's uncertainty principle for position and momentum (x and p) & Energy and time (E and t).

UNIT-III (9 hrs)

3. **Quantum (wave) mechanics**

Basic postulates of quantum mechanics-Schrodinger time independent and time dependent wave equations-derivations. Physical interpretation of wave function. Eigen functions, Eigen values. Application of Schrodinger wave equation to particle in one dimensional infinite box.

UNIT-IV(9 hrs)

4. **General Properties of Nuclei**

Basic ideas of nucleus -size, mass, charge density (matter energy), binding energy, magnetic moment, electric moments. Liquid drop model and Shell model (qualitative aspects only) - Magic numbers.

Additional Inputs: Nuclear forces.

5. **Radioactivity decay**

Alpha decay: basics of α-decay processes. Theory of α-decay, Gamow's theory, Geiger Nuttal law.β-decay, Energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis.

UNIT-V (9 hrs)

6. **Crystal Structure**

Amorphous and crystalline materials, unit cell, Miller indices, reciprocal lattice, types of lattices, diffraction of X-rays by crystals, Bragg's law, experimental techniques, Laue's method. Superconductivity

Introduction - experimental facts, critical temperature - critical field - Meissner effect – Isotope effect - Type I and type II superconductors - applications of superconductors.

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III B. Sc. Physics : Semester-VI Elective

PAPER VI (C): RENEWABLE ENERGY

No. of Credits: 03 W.e.f (2019-2020) Batch **3 Hour/Week**
Total Hours: 45

UNIT-I (9 hrs)

1. **Introduction to Energy:** Definition and units of energy, power, Forms of energy, Energy flow diagram to the earth. Role of energy in economic and social development.
Additional inputs: Conventional energy sources.

2. **Environmental Effects:** Environmental degradation due to energy production and utilization, air and water pollution, depletion of ozone layer, global warming, biological damage due to environmental degradation.

UNIT-II (9hrs)

3. **Global Energy Scenario:** Energy consumption in various sectors, energy resources, coal, oil, natural gas, nuclear and hydroelectric power.

4. **Indian Energy Scene:** Energy resources available in India, urban and rural energy consumption, nuclear energy - promise and future, energy as a factor limiting growth, need for use of new and renewable energy sources.

UNIT-III (9hrs)

5. **Solar energy:** Solar energy, Spectral distribution of radiation, solar water heating system, Applications, Solar cooker. Solar cell, Types of solar cells.

6. **Wind Energy:** Introduction, Principle of wind energy conversion, Components of wind turbines, Operation and characteristics of a wind turbine, Applications of wind energy.

UNIT-IV (9hrs)

7. **Ocean Energy:** Introduction, Principle of ocean thermal energy conversion, Tidal power generation, Tidal energy technologies, Energy from waves.

8. **Hydrogen Energy:** History of hydrogen energy - Hydrogen production methods - Electrolysis of water, Uses of hydrogen as fuel.
Additional inputs: Hydrogen safety – Problems of hydrogen transport and distribution.

UNIT-V (9 hrs)

9. **Bio-Energy**

Energy from biomass – Sources of biomass – Conversion of biomass into fuels – Energy through fermentation – Pyrolysis, gasification and combustion – Aerobic and anaerobic bio-conversion – Properties of biomass – Properties and characteristics of biogas.

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III B. Sc. Physics : Semester-VI

Cluster Paper-VI (C1) Solar Thermal and Photovoltaic Aspects

W.e.f (2019-2020) Batch

No. of Credits: 03
3Hour/Week
Total Hours: 45

UNIT-I (9 hrs)

1. Basics of Solar Radiation: Structure of Sun, Solar constant, Concept of Zenith angle and air mass, Definition of declination, hour angle, solar and surface azimuth angles; Direct, diffuse and total solar radiation, Solar intensity measurement –pyroheliometer.

2. Radiative Properties and Characteristics of Materials: Kirchoff's law – Relation between absorptance, emittance and reflectance; Selective Surfaces - preparation and characterization, Types and applications; Anti-reflective coating.

UNIT-II (9 hrs)

3. Flat Plate Collectors (FPC) : Description of flat plate collector, Liquid heating type FPC, Energy balance equation, Efficiency, Temperature distribution in FPC, Definitions of fin efficiency and collector efficiency, Evacuated tubular collectors.
Additional inputs: Classification of Concentrating Collectors.

Unit-III (9 hrs)

4. Solar photovoltaic (PV) cell: Physics of solar cell –Type of interfaces, homo, hetero andschottky interfaces, Photovoltaic Effect, Equivalent circuit of solar cell, Solar cell output parameters, Series and shunt resistances and its effect on cell efficiency; Variation of efficiency with band-gap and temperature.

UNIT-IV (9 hrs)

Solar PV systems: Solar cell module assembly – Steps involved in the fabrication of solar module, Module performance, I-V characteristics, Modules in series and parallel, Module protection –Solar PV system and its components, PV array, inverter, battery and load.

UNIT-V (9 hrs)

Solar thermal applications: Solar hot water system (SHWS), Types of SHWS, Standard method of testing the efficiency of SHWS; Passive space heating and cooling concepts, Solar desalinator and drier, Solar thermal power generation.
Additional inputs: Solar PV applications.

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III B. Sc. Physics : Semester-VI

Cluster Paper-VI (C2) - Wind, Hydro and Ocean Energies

No. of Credits: 03 W.e.f (2019-2020) Batch **3 Hour/Week**

Total Hours: 45

UNIT-I (9hrs)

1. Introduction: Wind generation, meteorology of wind, world distribution of wind, wind speed variation with height, wind speed statistics, Wind energy conversion principles; General introduction; Types and classification of WECS; Power, torque and speed characteristics.

UNIT-II (9hrs)

2. Wind Energy Conversion System: Aerodynamic design principles; Aerodynamic theories; Axial momentum, blade element; Rotor characteristics; Maximum power coefficient.

Additional inputs: Wind turbine design considerations.

UNIT-III (9hrs)

3. Wind Energy Application: Wind pumps: Performance analysis, design concept and testing; Principle of wind energy generation; Wind energy in India; Environmental Impacts of Wind farms.

Additional inputs: Economics of wind energy utilization.

UNIT-IV (9hrs)

4. Small Hydropower Systems: Overview of micro, mini and small hydro systems; Hydrology; Elements of pumps and turbine; Selection and design criteria of pumps and turbines; Site selection; Speed and voltage regulation.

UNIT-V (9hrs)

5. Ocean Thermal, Tidal and Wave Energy Systems: Ocean Thermal - Introduction, Technology process, Working principle, Electricity generation methods from OCET, Advantages and disadvantages, Applications of OTEC.

6. Tidal Energy - Introduction, Origin and nature of tidal energy, Wave Energy – Introduction, Basics of wave motion, Power in waves, Wave energy conversion devices, Advantages and disadvantages, Applications of wave energy.

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III B. Sc. Physics : Semester-VI

Cluster Paper-VI (C3) - Energy storage devices

W.e.f (2019-2020) Batch

No. of Credits : 03

3 Hour/Week

Total Hours: 45

UNIT-I (9 hr)

1. Energy Storage: Need of energy storage; Different modes of energy storage, Flywheel storage, Electrical and magnetic energy storage: Capacitors,electromagnets; Chemical Energy storage: Thermo-chemical, photo-chemical, electro-chemical, Hydrogen for energy storage.

Additional inputs: Fossil fuels and synthetic fuels.

UNIT-II (9 hrs)

2. Electrochemical Energy Storage Systems: Batteries: Primary, Secondary, Lithium, Solid-state and molten solvent batteries; Leadacid batteries; Nickel Cadmium Batteries; Advanced Batteries. Role of carbon nano-tubes inelectrodes.

UNIT-III (9 hrs)

3. Magnetic and Electric Energy Storage Systems: Superconducting Magnet Energy Storage(SMES) systems; Capacitor and battery: Comparison and application; Super capacitor.

Additional inputs: Applications of Electrochemical Double Layer Capacitor (EDLC).

UNIT-IV (9 hrs)

4. Fuel Cell: Fuel cell definition, difference between batteries and fuel cells, fuel cell components, principle and working of fuel cell, performance characteristics, efficiency, Advantages and disadvantages of fuel cell.

UNIT-V (9 hrs)

5. Types of Fuel Cells: Classification, Alkaline fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell; solid oxide fuel cell, proton exchange membrane fuel cell, applications of fuel cells.