

ST.PHILOMENA'S COLLEGE (AUTONOMOUS), MYSURU

(AFFILIATED TO UNIVERSITY OF MYSORE)

REACCREDITED BY NAAC WITH A GRADE

Three-year six semesters Choice Based Credit System (CBCS) with Learning Outcome Based Curriculum framework (LOCF) And Continuous Assessment & Grading Pattern (CAGP) Undergraduate Programme Under Autonomous Structure

Programme- B.Sc.

The academic year 2018-19 onwards

DEPARTMENT OF PHYSICS

VISION AND MISSION OF THE COLLEGE

VISION:

The college is guided by the visionary zeal of providing value- based education to everyone irrespective of religion, caste, creed or sex by which the character is formed, intellect is explained and one can stand on his/her feet.

MISSION:

To transform young men and women who come to learn not from books, but also from life and to share the experience of working and playing together, this inculcates life skills to become good citizens with integrity and discipline.

Programme Educational Objectives (PEO)

| PEO-01 | Graduates will be able to master and display competency and leadership to |
|--------|--|
| | become successful professionals, employees and entrepreneurs or pursue higher |
| | education and research. |
| PEO-02 | Graduates will be able to demonstrate the commitment towards professional |
| | ethics, gender sensitivity, preservation of environment and sustainable |
| | development. |
| PEO-03 | Graduates will continue to learn and advance their careers through activities such |
| | as participation in professional organizations, attainment of professional |
| | certification and seeking higher education. |
| | |
| | |

Programme Outcome (PO):

| PO-01 | Disciplinary Knowledge: The BSc. graduates will acquire the knowledge with facts and figures related to pure and applied sciences. Understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life. |
|-------|---|
| PO-02 | Students learn two languages along with three major subjects. At the end of the programme, the students would have developed reading, writing, speaking, interpretive and composition skills. They would be able to communicate with others using appropriate media; confidently share one's views and express themselves |
| PO-03 | Research Related Skills: The BSc. students will acquire the skills in handling scientific instruments, planning and performing in laboratory experiments. |

| PO-04 | Ethics: The BSc. students will be imbibed ethical, moral and social values in |
|-------|---|
| | personal and social life leading to highly cultured and civilized personality. |
| PO 05 | Problem Solving: The BSc. graduates will develop the ability to analyze and |
| FO-03 | solve Course-related problems and also the ability to evaluate situations and react |
| | responsibly to communicate, cooperate and lead a team among peers and others. |
| | Critical Thinking: The qualities of a science student – observation, precision, |
| PO-06 | analytical mind, logical thinking, clarity of thought and expression, systematic |
| | approach, qualitative and quantitative decision making are enhanced. |
| PO-07 | Social Interaction: The BSc. graduates shall appreciate the role of science in |
| | society; and its personal, social and global importance. |
| | Analytical Skills: The graduates will master the skills of observations and |
| PO-08 | drawing logical inferences from the scientific experiments. Analyzed the given |
| | scientific data critically and systematically and the ability to draw the objective |
| | conclusions. |
| PO-09 | Environment and Sustainability: Graduates will be able to understand the issues |
| | of environment and work towards sustainable development. |
| PO-10 | Employability: After completing the programme, graduates will have the |
| | competency to be employed or to be an entrepreneur. |
| DO 11 | Leadership Quality: In the graduation programme students are inculcated moral |
| PO-11 | and ethical values, managerial skills, adoptability, problem solving, taking |
| | initiative, decision making, risk taking to make them confident leaders. |

Programme Specific Outcomes (PSO)

| PSO- | After the completion of BSc programme by studying | Cognitive |
|--------|--|-----------|
| No | PCM/PME/PMC the students will be able to | level |
| PSO-01 | Develop critical thinking and skills for problem solving leading to scientific attitudes and initiate research. They will be able to develop experimental and data analysis skills through a wide range of experiments in the practical laboratory. | apply |
| PSO-02 | Develop analytical skills and problem solving skills required for the application of chemical principles. They will be able to perform scientific experiments skillfully by application of procedural knowledge. | Analysis |
| PSO-03 | Integrate modern techniques (Maxima, Scilab, etc.) with the knowledge of Mathematics for solving problems in the relevant areas. They will be able to apply the acquired principles and knowledge of mathematical sciences to execute work to manage projects in multidisciplinary areas. | Evaluate |

| PSO-04 | To understand and analyse the principles and working of different electronic systems. Thereby they will be able to offer real time and efficient solutions problems that are directly or indirectly related to Electronics and will contribute towards the development of society. | Apply |
|--------|--|---------|
| PSO-05 | Identify, Analyze the computing requirements of a problem and Solve them using computing principles. They will be able to Design and Evaluate a computer based system, components and process to meet the specific needs of applications in Computer knowledge. | Analyse |

| | Mapping of | Mission of the College wi | ith PEO |
|------------|------------|---------------------------|--------------|
| Mission | PEO-1 | PEO-2 | PEO-3 |
| Mission -1 | ✓ | \checkmark | \checkmark |

| | | I | Mapping | g of PEO | s with P | rogram | ne Outo | comes (P | 0) | | |
|-------|-------------|-------------|-------------|-------------|----------|-------------|-------------|--------------|------|-------|-------|
| PEO | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 |
| No. | | | | | | | | | | | |
| PEO-1 | | √ | ✓ | | ✓ | | | | | ~ | ~ |
| PEO-2 | ~ | | | ~ | | | | | √ | | |
| PEO-3 | | | | | | ~ | ✓ | \checkmark | | | |

Preamble:

In this course, the aim is to provide a solid foundation in various aspects of physics, to show a broad spectrum of modern trends in physics, to develop experimental, computational and mathematical skills of students. The syllabi are framed in such a way that it bridges the gap between the pre university and post graduate levels of physics by providing a complete and more logical framework of basic physics. The systematic and planned curricula from first year to the third year shall motivate and the students for pursuing higher studies in physics encourage research activities and become self-reliant.

Objective:

> By the end of the First year, the students would have

attained an understanding in basic Mechanics, Properties of Matter, Heat and Thermodynamics.

• developed their experimental and data analysis skills through a wide range of experiments in the practical laboratories.

By the end of the Second year, the students would have

• been introduced to powerful tools for tackling wide range of topics in Waves, Acoustics, Optics, Electricity and Electromagnetism.

• become familiar with additional relevant mathematical techniques like Fourier series.

• Further developed their experimental skills through a series of experiments which illustratesmajor themes of the lecture courses.

> By the end of the Third year, the students would have

• covered a range of topics in areas of physics like Atomic and Molecular Spectra, Wave Mechanics, Nuclear Physics, Astrophysics, Nuclear and Condensed Matter Physics.

• been introduced to Special theory of Relativity, Solid State Physics, Analog and Digital Electronics.

• been exposed to almost all branches of physics and has experience of independent work such as presentations, seminars and project work.

DEPARTMENT OF PHYSICS

GENERAL SCHEME FOR TEACHING AND EVALUATION

Discipline Specific Core (DSC) or Hard Core (HC) Papers.

| | | | | | | _ | Ν | Iax. Ma | rks |
|----------|---|------|-------------|--|-----------------------------|--|------------------|-------------------------|-------------|
| | | | | al | 1 | tical | The | eory/Pra | ctical |
| Semester | Title of the Paper | TYPE | Course Code | Teaching Hours per WeekTheory/ Practi | Credits Theor; Practical | Exam Duration in Hours Theory/ Prac | Theory/Practical | I A Theory/Practical | Total Marks |
| | Paper-I | | | | | | | | |
| I | Title: Mechanics and Properties of Matter | DSC | MA590 | 03 | 03 | 03 | 50 | 20 | |
| | Practical Paper-I Title: Mechanics and Properties of Matter | DSC | MA592 | 03 | 1.5 | 03 | 20 | 10 | 100 |
| | Paper-II Title: Heat and Thermodynamics | DSC | MB590 | 03 | 03 | 03 | 50 | 20 | |
| II | Practical Paper- II Title: Heat And | DSC | MB592 | 03 | 1.5 | 03 | 20 | 10 | 100 |
| III | Properties of Matter Paper-III Title: Waves, Acoustics and Optics | DSC | MC590 | 03 | 03 | 03 | 50 | 20 | |
| | Practical Paper-III Title: Acoustics and Optics | DSC | MC592 | 03 | 1.5 | 03 | 20 | 10 | 100 |
| | Paper-IV Title: Electricity and Electromagnetism | DSC | MD590 | 03 | 03 | 03 | 50 | 20 | |
| IV | Practical Paper- IV Title: Electricity | DSC | MD592 | 03 | 1.5 | 03 | 20 | 10 | 100 |

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| | Paper-V Title: Modern Physics-I | DSC | ME606 | 03 | 03 | 03 | 70 | 30 | |
|----|---|-------|-------|----|-----|----|-----|-----|------|
| | Paper-VI Title: Condensed Matter andNuclear Physics | DSC | ME610 | 03 | 03 | 03 | 70 | 30 | 300 |
| v | Practical Paper-V Title: Modern Physics-I | DSC | ME608 | 03 | 1.5 | 03 | 35 | 15 | |
| | Practical Paper-VI Title: Condensed Matter and Nuclear Physics | DSC | ME612 | 03 | 1.5 | 03 | 35 | 15 | |
| | Paper-VII Title: Modern Physics-II | DSC | MF610 | 03 | 03 | 03 | 70 | 30 | 300 |
| | Paper-VIII Title: Analog and Digital Electronics | DSC | MF592 | 03 | 03 | 03 | 70 | 30 | |
| VI | Practical Paper-VII Title: Modern Physics-II | DSC | MF612 | 03 | 1.5 | 03 | 35 | 15 | |
| | Practical Paper- VIII Title: Analog and Digital Electronics | DSC | MF600 | 03 | 1.5 | 03 | 35 | 15 | |
| | | DSE 1 | | 02 | 02 | 02 | 30 | 20 | 100 |
| | | DSE 2 | | 02 | 02 | 02 | 30 | 20 | |
| | | | | | 40 | - | 760 | 340 | 1100 |

Discipline Specific Elective (DSE) or Soft Core (SC)

| | | | | | ⁷ eek | I | n ical | Max The | k. Mark ory/Pra | s actical |
|---------|----------------------------|-------------|------|-----------|---|-----------------------------|---------------------------------------|------------------|-------------------------|--------------|
| SL. NO. | Title of the Paper | Course Code | TYPE | Semesters | Teaching Hours per W Theory/ Practical | Credits Theory/ Practica | Exam Duration i Hours Theory/Pract | Theory/Practical | I A Theory/Practical | Total Marks |
| | Electrical Circuits | M59Y02 | DSE | | | | | | | |
| | and Network | | | II | 2 | 2 | 02 | 30 | 20 | 50 |
| 1 | Skills. | | | to | | | | | | |
| | Basic | M59Y01 | DSE | IV | | | | | | |
| 2 | Instrumentation | | | | 2 | 2 | 02 | 30 | 20 | 50 |
| | Skills | | | | | | | | | |
| 3 | Astrophysics | M59Y03 | DSE | V | 2 | 2 | 02 | 30 | 20 | 50 |
| | Photonics | M59Y04 | DSE | to | | | | 20 | 20 | |
| 4 | | | | VI | 2 | 2 | 02 | 50 | 20 | 50 |
| 5 | Renewable | M59Y05 | DSE | | 2 | 2 | 02 | 30 | 20 | 50 |
| | Energy | | | | | | | | | |

First Semester- Theory Paper-1 Title of Paper: MECHANICS AND PROPERTIES OF MATTER Course Duration: 16 weeks with 3 hours of instruction per week - 48 hours Marks- Theory - 50 + Internal Assessment - 20 = 70

Course Objectives:

- 1. To understand the importance of frames of reference
- 2. To gain knowledge in the concepts of gravitation.
- 3. To understand the significance of mass distribution and axis of rotation in moment of Inertia.
- 4. To understand elastic properties of solids.
- 5. To understand the properties of liquids and acquire knowledge of basic forces in fluids at rest in motion.

| | Course Learning Outcome: | | | | | | |
|--------|--|-----------------|--|--|--|--|--|
| CO | After the completion of this course the student will be able to | Cognitive level | | | | | |
| CO -01 | Differentiate between inertial and non-inertial frames. | Analyse | | | | | |
| CO -02 | Apply conservation laws in gravitation | Apply | | | | | |
| CO -03 | Measure moment of inertia of various bodies | Evaluate | | | | | |
| CO -04 | Identify the materials suitable for different uses. | Understand | | | | | |
| CO -05 | Differentiate between the streamline and turbulent flow of liquids | Analyse | | | | | |
| | and reason out the effects of liquids while flowing | | | | | | |

Part -A

| UNIT-1 | |
|--|--------------|
| 1.1 Motion of a point particle: Point mass, The position vector $\mathbf{r}(t)$ of a moving point | 4hrs |
| particle and its cartesian components. Velocity and acceleration as the vector derivatives. | |
| Derivative of a planar vector of a constant magnitude. Radial and transverse component of | |
| velocity and acceleration for arbitrary planar motion, deduction of results for uniform | |
| circular motion –centripetal force. | |
| 1.2 Frames of reference: Inertial reference frames with examples. Uniform rectilinear | 6hrs |
| motion in an inertial frame - Galilean transformation equation. The Galilean principle of | |
| relativity. Motion in a non-inertial reference frame - uniformly accelerated rectilinear | |
| motion. Concept of fictitious force - illustration -plumbline accelerometer and freely | |
| falling lift. Qualitative discussion of centrifugal force, coriolis force and earth as non- | |
| inertial frame. | |
| | |
| | |
| UNIT-2 | |
| UNIT-2 2.1 Rigid body dynamics: Moment of inertia and radius of gyration. Expression for | 6hrs |
| UNIT-22.1 Rigid body dynamics: Moment of inertia and radius of gyration. Expression for kinetic energy of a rigid body, the angular momentum. Statement of the theorems of | 6hrs |
| UNIT-2 2.1 Rigid body dynamics: Moment of inertia and radius of gyration. Expression for kinetic energy of a rigid body, the angular momentum. Statement of the theorems of parallel and perpendicular axes. Calculation of the moment of inertia of rectangular | 6hrs |
| UNIT-2 2.1 Rigid body dynamics: Moment of inertia and radius of gyration. Expression for kinetic energy of a rigid body, the angular momentum. Statement of the theorems of parallel and perpendicular axes. Calculation of the moment of inertia of rectangular lamina, circular lamina and solid cylinder. Theory of the compound pendulum-derivation | 6hrs |
| UNIT-2 2.1 Rigid body dynamics: Moment of inertia and radius of gyration. Expression for kinetic energy of a rigid body, the angular momentum. Statement of the theorems of parallel and perpendicular axes. Calculation of the moment of inertia of rectangular lamina, circular lamina and solid cylinder. Theory of the compound pendulum-derivation of period, inter-changeability centres of oscillation and suspension. | 6hrs |
| UNIT-2 2.1 Rigid body dynamics: Moment of inertia and radius of gyration. Expression for kinetic energy of a rigid body, the angular momentum. Statement of the theorems of parallel and perpendicular axes. Calculation of the moment of inertia of rectangular lamina, circular lamina and solid cylinder. Theory of the compound pendulum-derivation of period, inter-changeability centres of oscillation and suspension. UNIT-3 | 6hrs |
| UNIT-2 2.1 Rigid body dynamics: Moment of inertia and radius of gyration. Expression for kinetic energy of a rigid body, the angular momentum. Statement of the theorems of parallel and perpendicular axes. Calculation of the moment of inertia of rectangular lamina, circular lamina and solid cylinder. Theory of the compound pendulum-derivation of period, inter-changeabilityof centres of oscillation and suspension. UNIT-3 3.1 Elasticity: Hooke's law. Moduli of elasticity. Relation between elastic constants- | 6hrs 8hrs |
| UNIT-2 2.1 Rigid body dynamics: Moment of inertia and radius of gyration. Expression for kinetic energy of a rigid body, the angular momentum. Statement of the theorems of parallel and perpendicular axes. Calculation of the moment of inertia of rectangular lamina, circular lamina and solid cylinder. Theory of the compound pendulum-derivation of period, inter-changeabilityof centres of oscillation and suspension. UNIT-3 3.1 Elasticity: Hooke's law. Moduli of elasticity. Relation between elastic constants-Poisson's ratio- limiting values. Work done in stretching, elastic potential energy. Bending | 6hrs 8hrs |
| UNIT-2 2.1 Rigid body dynamics: Moment of inertia and radius of gyration. Expression for kinetic energy of a rigid body, the angular momentum. Statement of the theorems of parallel and perpendicular axes. Calculation of the moment of inertia of rectangular lamina, circular lamina and solid cylinder. Theory of the compound pendulum-derivation of period, inter-changeabilityof centres of oscillation and suspension. UNIT-3 3.1 Elasticity: Hooke's law. Moduli of elasticity. Relation between elastic constants-Poisson's ratio- limiting values. Work done in stretching, elastic potential energy. Bending moment. Theoryof light single cantilever. I-section girders. Torsion-derivation of couple | 6hrs 8hrs |

| Part-B | |
|--|--|
| UNIT-4 | |
| 4.1 Conservation of Linear Momentum: Conservation of linear momentum for a | |
| system of two particles, rocket motion in a uniform gravitational field-expression for | 6hrs. |
| the instantaneous velocity of a single stage rocket (with and without gravity), multi- | |
| stage rockets(qualitative), elastic and inelastic collisions, elastic head on collision, | |
| elastic oblique collision in laboratory frame. Illustrations. | |
| 4.2 Conservation of Angular momentum: Review of angular momentum and torque. | 5 hrs |
| Relation between them. Law of conservation of angular momentum. Motion of particle | |
| in a central forcefield (motion is in a plane, angular momentum is conserved, areal | |
| velocity is constant- derivation). Newton's law of gravitation (statement) - Kepler's | |
| laws of planetary motion – derivation using Newton's law of gravitation. | |
| 4.3 Conservation of energy: Conservative and non-conservative forces with | 5 hrs |
| examples, conservation of energy in a conservative force field-applications (i) vertical | |
| oscillations of loadedlight spiral spring (ii) calculation of escape velocity in the | |
| gravitational field of the earth. Conditions for a geo-stationary satellite. Basic idea of | |
| Global Positioning System (GPS). | |
| UNIT-5 | |
| 5.1 Viscosity: Stream line and turbulent flows, expression for critical velocity, | |
| Reynold's number and its significance, coefficient of viscosity, terminal velocity. | 4 hrs |
| Stoke's law (no derivation) – derivation for terminal velocity of small ball falling | |
| through viscous fluid. Variation of viscosity of liquid with temperature and pressure. | |
| 5.2 Surface tension: Surface energy and definition of surface tension. Factors | 4 hrs |
| affecting surface tension, applications of surface tension. Pressure inside a curved | |
| liquid surface-derivation. Surface tension of liquid by drop weight method – | |
| derivation. Surface tension of mercury by Quincke's method-Theory. | |
| Books for reference: | |
| Properties of Matter, S. Chand Publications: Brijlal and Subramanyam. | |
| Refresher course in Physics Vol 1, S. Chand Publications: C.L Arora. | |
| Mechanics & Properties of matter, S. Chand Publications: S.R Shankar Narayan. | + |
| | ــــــــــــــــــــــــــــــــــــــ |

| | Books for further reference: |
|----|---|
| 1. | Mechanics. J.C: Upadhyaya. |
| 2. | Physics, Part –I: Halliday and Resnick. |
| 3. | Vol. 1- Mechanics.: Berkeley Physics. |
| 4. | Mechanics/Elements of properties of matter: D.C. Mathur. |
| 5. | Classical Mechanics 2003 University Press India (P) Ltd: K. N. Srinivasa Rao. |
| 6. | Classical Mechanics: Vernon D Barger and Martin G Olsson, Tata McGraw Hill. |
| 7. | Physics for degree students B.Sc. First year: C.L Arora, P.S Hemne, S Chand & Co. |

FIRST SEMESTER – PRACTICAL Practical- I MECHANICS AND PROPERTIES OF MATTER Course duration: 16 weeks with 3 hours of laboratory work per week

Marks - End semester examination - 20 + IA - 10 [Record - 05 + Practical Test - 05] = 30

Course Objectives

1. To develop experimental skills

2. To perform a wide range of experiments in the practical laboratory.

| Course Learning Outcome: | | |
|--------------------------|--|--------------------|
| CO | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Calculate moment of inertia of a body of any shape. | Evaluate |
| CO -02 | Calculate surface tension and coefficient of viscosity of liquids. | Evaluate |
| CO -03 | Perform experiments to assess the strength of materials | Evaluate |

| | Any Nine of the following experiments |
|-----|---|
| 1. | Bar pendulum: Determination of the acceleration due to gravity and the radius of gyration by graphical method. |
| 2. | Spiral spring: Determination of the acceleration due to gravity and the unknown mass by graphical method. |
| 3. | Fly wheel: Determination of the moment of Inertia of a fly wheel. |
| 4. | Drop-weight method: Determination of the surface tension of a liquid. |
| 5. | Drop- weight method: Interfacial tension between two liquids. |
| 6. | Stokes' method: Determination of coefficient of viscosity of a viscous liquid. |
| 7. | Single cantilever: Determination of Young's modulus of the given material. |
| 8. | Searle's double bar: Determination of Young's modulus, the rigidity modulus and the Poisson's ratio of the given material. |
| 9. | Torsional pendulum: Determination of moment of inertia of an irregular body. |
| 10. | Elastic Collision: Verification of law of conservation of linear momentum and the law of conservation of kinetic energy. |

Second Semester- Theory Paper-II Title of Paper: HEAT AND THERMODYNAMICS Course Duration: 16 weeks with 3 hours of instruction per week Marks – Theory - 50 + Internal Assessment -20 = 70

Course Objectives:

1. To study kinetic molecular theory of gases to predict the physical properties of gases at the molecular level.

2. To understand heat transfer through a solid. Study Planck's quantum theory of radiation

3. To gain knowledge of the methods of attaining low temperature.

4. To study Maxwell's thermodynamic relations and applications of the laws of thermodynamics.

| СО | After the completion of this course the student will be able to | Cognitive level |
|--------|---|--------------------|
| CO -01 | Derive expression for critical constants and analyse its significance. | Analyse |
| CO -02 | Apply Planck's quantum theory of radiation. | Apply |
| CO -03 | Differentiate between principles and methods to produce low temperature, liquefy air. | Analyse |
| CO -04 | Develop thermodynamic relations connecting entropy, enthalpy and free energy. | Create |

| Part-A | |
|--|-------|
| UNIT-1 | |
| 1.1Kinetic theory: Maxwell's law of distribution of molecular velocity (no derivation)- | Shre |
| its interpretation. Calculation of mean velocity, most probable velocity and RMS | 01115 |
| velocity. Degrees of freedom. Principle of equipartition of energy based on kinetic | |
| theory of gases, expression for internal energy of gas (U=3/2 RT-derivation using | |
| pressure equation). Mean free path-definition and expression (no derivation). Real gases. | |
| Andrews's isothermals for carbon di oxide -graph, its explanation and interpretation- | |
| critical isothermal-definition of critical constants. Derivation of critical constants using | |
| Van derWaal's equation of state. | |
| UNIT-2 | |
| 2.1 Thermal conductivity: Equation of flow of heat through a solid bar. Determination | 26.00 |
| of thethermal conductivity of bad conductor by Lee and Charlton method. | SHIS |

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| 2.2 Radiation: Planck's quantum theory of radiation, induced and spontaneous emission of radiation. Derivation of Planck's law of radiation using Einstein's A and B coefficients. Deductionof Rayleigh-Jeans' law, Stefan's law and Wien's displacement law from Planck's law. | 5hrs |
|--|------|
| UNIT-3 | |
| 3.1 Low temperature physics: Ideal and real gases. Joule Thomson effect-Porous plug | 8hrs |
| experimentand its theory (explain why heating and cooling of gas takes place). Joule | |
| Thomson expansion- expression for the temperature of inversion, inversion curve. | |
| Relation between Boyle temperature, temperature of inversion and critical temperature | |
| of gas (mention of relations only). Principle of regenerative cooling. Liquefaction of air | |
| by Linde's method. Adiabatic demagnetization. | |
| Application of low temperature physics. | |

| Part-B | |
|--|------|
| UNIT-4 | 5hrs |
| 4.1 Thermodynamics: Review of basic concepts, Carnot's theorem, thermodynamic scale | |
| of temperature and its identity with perfect gas scale. Clausius-Clapeyron first latent heat | |
| equation (derivation) - effect of change of pressure on melting point of a solid and boiling | |
| point of a liquid. | |
| 4.2 Thermodynamic potentials: Internal energy, enthalpy, Helmholtz function, Gibbs | |
| function, relations among these functions, Gibbs- Helmholtz equations. | 4hrs |
| 4.3 Maxwell's thermodynamic relations: Derivation of Maxwell's thermodynamic | |
| relations, Tds equations, internal energy equations, heat capacity equations. Change of | 7hrs |
| temperature during adiabatic process using Maxwell's relations. | |
| UNIT-5 | |
| 5.1 Entropy: The concept of entropy, Change of entropy in reversible and irreversible | |
| cycles. Entropy and non-available energy. Principle of increase of entropy - Clausius | 8hrs |
| inequality. Entropy and II law of Thermodynamics, Entropy of ideal gas, T-S diagram, | |
| probability and entropy - | |
| Boltzmann relation, Concept of absolute zero and the third law of thermodynamics. | |

| | Books for reference: |
|----|---|
| 1. | Heat and Thermodynamics and Statistical Physics, S Chand Publications: Brijlal, Subramanyam, P.S.Hemne. |
| 2. | Heat and thermodynamics. S. Chand Publications: S.R Shankaranarayan. |
| 3. | Refresher course in Physics Vol. 1 S. Chand Publications: C.L Arora. |
| | Books for further reference: |
| 1. | Heat and Thermodynamics: Brijlal and Subramanyam. |
| 2. | Heat and Thermodynamics: J.B. Rajam. |
| 3. | Heat: D.S. Mathur. |
| 4. | Physics Part-I: Halliday and Resnick. |
| 5. | Introduction to statistical Mechanics 1981, McGraw Hill: B B Laud. |
| 6. | Heat and Thermodynamics. 7th Edition Mc.Graw Hill: R.H Dittaman and M.W Zemansky. |
| 7. | Statistical Physics 1988 Wiley Eastern: K Huang. |
| 8. | Concepts in thermal physics: S.J Blundell,K.M Blundell .Oxford university. |
| 9. | Thermodynamics: S.C Guptha. |

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SECONDSEMESTER – PRACTICAL

Practical- II HEAT AND PROPERTIES OF MATTER

Course duration: 16 weeks with 3 hours of laboratory work per week

Marks - End semester examination - 20 + IA - 10 [Record - 05 + Practical Test - 05] = 30

Course Objectives:

1. To develop experimental and data analysis skills through a wide range of experiments in the practical laboratory.

| Course Learning Outcome | | |
|-------------------------|---|--------------------|
| СО | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Compute moduli of materials to identify strength of a given object. | Evaluate |
| CO -02 | Analyse statistical data to compute standard deviation in Gaussian distribution | Analyse & Evaluate |

| | Any NINE of the following experiments: |
|-----|---|
| 1. | Verification of Gaussian distribution and calculation of standard deviation - Monte Carlo experiment. |
| 2. | Specific heat by cooling-graphical method. |
| 3. | Determination of thermal conductivity of a bad conductor by Lee-Charlton method. |
| 4. | Verification of Stefan-Boltzmann law using a meter bridge or a potentiometer. |
| 5. | Determination of boiling point of a liquid by using a platinum resistance thermometer. |
| 6. | Determination of Young's modulus by dynamic method. |
| 7. | Determination of rigidity modulus using a torsional pendulum. |
| 8. | Determination of Young's modulus by Koenig's method. |
| 9. | Determination of rigidity modulus by the static-torsion method. |
| 10. | Determination of Young's modulus by the method of uniform bending. |

THIRD SEMESTER – THEORY Paper – III Title of paper: WAVES, ACOUSTICS AND OPTICS Course duration – 16 Weeks with 03 hours of instruction per week

- 48hrs

Marks - Theory - 50 + Internal Assessment - 20 = 70Course Objectives:

1. To analyse complex waves, Understand the concepts of simple harmonic motion.

- 2. To understand different aspects of waves and their applications.
- 3. To study physical optics.
- 4. To understand defects of lenses and rectification.

| Course Learning Outcome | | |
|-------------------------|--|-----------------|
| СО | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Apply Fourier theorem to analyse complex waves. | Evaluate |
| CO -02 | Distinguish between damped and forced vibrations and identify condition for resonance. | Analyse |
| CO -03 | Analyse patterns due to interference and diffraction and types of polarized light and its application | Analyse |
| CO -04 | Identify the different types of aberrations and achromatism | Understand |

| Part -A | |
|--|------|
| | |
| UNIT-1 | |
| 1.1 Analysis of complex waves: Fourier series-examples of square wave and saw | |
| tooth wave. | 3hrs |
| 1.2 Superposition of simple harmonic motions: Lissajous figures - graphical and | 6hrs |
| analytical method (1:1 and 1:2 ratio) and their uses. Equations for damped vibration | |
| and forced vibration-solution in exponential form, resonance-expression for | |
| amplitude and phase at resonance. Examples of forced and resonant vibrations. | |
| UNIT-2 | |
| 2.1 Progressive waves: Waves in one dimension. Differential equation of wave motion. Relation | |
| between amplitude and intensity. Expression for velocity of progressive waves in a medium. | 6hrs |
| Newton's formula, Laplace's correction. Longitudinal vibrations in a rod. Expression for frequency | |
| of vibration of a stretched string- harmonics. Velocity of sound in a rod - Kundt's tube experiment. | |
| | |

| 2.2 Transducers: Types of transducers, dynamic microphone and loudspeaker-construction, working and their characteristics, piezo electrical transducer. | 3hrs | |
|--|---------|-------|
| UNIT-3 3.1 Interference: Review of basic concepts. Coherent sources. Interference by division of wave front and division of amplitude. Fresnel's biprism. Lloyd's mirror (theory, construction and action). Thin films of uniform thickness-reflected light only. Newton's rings-determination of λ and R. Interference at a wedge- expression for fringe width for normal incidence. Michelson's interferometer - Measurement of λ and d λ . | 6hrs | |
| Part -B | | |
| UNIT-4 4.1 Velocity of light: Kerr effect. Determination of velocity of light by Kerr cell method | | 2hrs |
| 4.2 Optical Instruments: Defects of lenses-mention of monochromatic and chromatic types, explanation of spherical and chromatic types-condition for minimum spherical aberration- statement. Achromatic combinations of lenses. Huygen's and Ramsden's eye pieces. Resolving power of spectroscope (qualitative). | 2 | 4hrs |
| UNIT-5 | | |
| 5.1 Diffraction: Fresnel and Fraunhofer diffraction. Explanation of rectilinear propagation of light. Theory of the zone plate, comparison with a convex lens. Fresnel diffraction at a straight edge. Fraunhofer diffraction at a single slit. Transmission | | 8hrs |
| grating-theory for the case of normal incidence. Resolving power and dispersive power of plane grating. | r | |
| 5.2 Polarization: Double refraction in uniaxial crystals. Huygen's theory. Positive and negative crystal. Principal refractive indices. Huygen's constructions of O and E wave fronts in a uniaxial crystal- for normal incidence and optic axis in the plane of incidence a) parallel to the refracting surface b) perpendicular to the refracting surface c) inclined to the refracting surface. Retarding plates-quarter wave plate and half wave plate-derivation of expression. Production and analysis of linearly, circularly and elliptically | ce 1 | 10hrs |
| polarized light. Optical activity-Fresnel's theory, Rotatory polarization. Application of polarized light. Elementary idea of babinet compensator. | | |

| | Books for reference: |
|----|---|
| 1. | Optics: Brijlal and Subramanya. |
| 2. | Optics: Satyaprakash. |
| 3. | Text book of sound: N. Subramanyam and Brijal. |
| 4. | Electrical measurements & measuring instruments: N.V Surya |
| | Narayana. |
| | Books for further reference: |
| 1. | Sound: Khanna and Bedi. |
| 2. | Optics: D.N. Vasudeva. |
| 3. | Optics: B.K. Mathur. |
| 4. | Optics: Jenkins and white. |
| 5. | Fundamentals of Physics: Halliday Resnik Walker 8th Edition. |
| 6. | Waves and oscillations: Brijlal and Subramanyam. |
| 7. | Waves and oscillations: S.K Guptha and S.P Verma 3rd Edition. |
| 8. | Electronic instrumentation: H.S Kalsi Tata Mc Graw Hill. |

Third Semester-Practical Practical -III Acoustics and optics Course duration: 16 weeks with 3 hours of laboratory work per week Marks - End semester examination - 20 + IA - 10 [Record - 05 + Practical Test - 05] = 30

Course Objectives:

1. To develop experimental and data analysis skills through a wide range of experiments in the practical laboratory.

| Course Learning Outcome | | |
|-------------------------|---|--------------------|
| со | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Apply concept of interference, diffraction and polarization to determine various | Evaluate |
| | parameters of electromagnetic radiation. | |
| CO -02 | Identify conditions for resonance. | Understand |
| CO -03 | Analyse waveforms using cathode ray oscilloscope. | Analyse |
| | | |
| | Any NINE of the following experiments: | I |
| 1. | Newton's rings: Determination of radius of curvature of a plano convex lens. | |
| 2. | Biprism: Determination of the wavelength of a monochromatic light source. | |
| 3. | Sonometer: Determination of frequency of AC. | |
| 4. | Helmholtz resonator: Determination of the frequency of a tuning fork. | |
| 5. | Diffraction grating: Determination of wavelength of the given light source (Minimum | |
| | deviation method). | |
| 6. | Diffraction at a straight wire: Determination of the diameter of a wire. | |
| 7. | Cauchy's constants: Determination of Cauchy's constants using a spectromete | r. |
| 8. | Polarization: Determination of specific rotation of sugar solution using a pola | rimeter. |
| 9. | CRO: Determination of voltage and Frequency. | |
| 10. | Air wedge: Determination of thickness of a thin paper/wire. | |
| 11. | de-Sauty bridge: Determination and verification of law of capacitances. | |

FOURTH SEMESTER – THEORY Paper – IV Title of Paper: ELECTRICITY AND ELECTROMAGNETISM Course duration – 16 Weeks with 03 hours of instruction per week - 48hrs

Marks-Theory - 50 + Internal Assessment - 20 = 70

Course Objectives:

- 1. To study about static electric charge.
- 2. To study responses of passive elements to ac circuits.
- 3. To study the construction and working of galvanometers.
- 4. To gain knowledge about Maxwell's equations and EM waves.

| Course | Learning Outcome | |
|--------|---|--------------------|
| СО | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Determine parameters associated with static electric charge. | Evaluate |
| CO -02 | Analyse the behavior of L,C and R in ac circuits | Analyse |
| CO -03 | Construct different types of galvanometers | Create |
| CO -04 | Predict the relation between electric field and magnetic field using Maxwell's equations | Understand |

Part -A

| UNIT-11.1 Electrostatics: Mechanical force and electric pressure on a charged surface. The path traced by a charged particle in an electric field. The attracted disc electrometer-construction, theory and applications. | 5 hrs |
|--|-------|
| 1.2 Electrical measurement: C.R.O- construction and working, Measurement of voltage and frequency using a C.R.O. | 2 hrs |

| UNIT-2 2.1 Alternating current: Response of LR and CR circuits to sinusoidal voltages | |
|--|-------|
| (discussion using the 'j' symbol). LCR circuits-series and parallel resonance- half power frequency, band width, sharpness of resonance and Q factor. Power in electrical circuits- power factor. Wattless current, wattmeter. Maximum power transfer theorem with proof | 9 hrs |
| (discussion using the 'j' symbol). | |
| UNIT-3 | |
| 3.1 Applications of ac circuits: Anderson's bridge, Maxwell's bridge, de-Sauty bridge, Robinson'sbridge. | 5hrs |
| 3.2 Filters: High-pass and low-pass filters with LR and CR combinations. Expression for cut-off frequency-derivation. Band pass filter (qualitative). | 3hrs |

| Part B | |
|--|-----------|
| UNIT-4 | 4 hrs |
| 4.1 Galvanometers: Moving coil ballistic galvanometer-construction, theory, damping | |
| correction, current and charge sensitivity. Helmholtz double coil galvanometer-Theory. | |
| 4.2 Thermo-electricity: The thermocouple-thermoelectric series. Variation of thermo | 4 hrs |
| emf with temperature of hot junction-neutral, inversion temperature, thermoelectric | |
| power-definition. Seebeck, Peltier and Thomson effects and their coefficients. | |
| Thermodynamic theory of thermo electric effect. The law of intermediate metals and the | |
| law of intermediate temperatures. | |
| UNIT-5 | |
| 5.1 Electromagnetism: Scalar and vector fields. The gradient of a scalar field. The | 4 hrs |
| divergence and curl of a vector field. The physical significance of gradient, the | • • • • • |
| divergence and curl. Statement of theorems of Gauss and Stokes. | |
| 5.2 Electromagnetic theory: Equation of continuity, Maxwell's modification of | 10hrs |
| Ampere's circuital law, Displacement current. Setting up of Maxwell's field equations- | |
| free space and in isotropic dielectric medium. Electromagnetic wave propagation | |
| through vacuum and isotropic dielectric medium. Energy density, Poynting theorem | |
| (proof), Poynting vector (definition). Plane monochromatic electromagnetic wave- | |

| Helmholtz equation, transverse nature, intrinsic impedance(free space and dielectric). | |
|--|-------|
| 5.3 Production of electromagnetic waves: Accelerated charges and oscillating dipole. | 2 hrs |
| Hertz experiment, radiation loss. Synchrotron radiation. | |

| | Books for reference: |
|----|--|
| 1. | Electricity and magnetism: Duggal and Chabbra. |
| 2. | Electricity and magnetism: Brijlal and Subramanyam. |
| 3. | Electricity and magnetism: D.C. Tayal. |
| 4. | Under Graduate Physics, Volume 11: A.B. Bhattacharya, R Bhattacharya. |
| | Books for further reference: |
| 1. | Introduction to electrodynamics, third edition: D.J. Griffiths. |
| 2. | Electricity and Magnetism: D.N. Vasudeva. |
| 3. | Electricity and magnetism: K.K. Tewari. |
| 4. | Electromagnetics, Wiley Eastern limited, New Delhi: B B Laud. |
| 5. | Engineering Electromagnetics, 6 th Edition Tata Mcgraw Hill, New Delhi: W H Hayt, J A Buck. |
| 6. | Fundamentals of Phyics: Halliday Resnik Walker 8th Edition. |
| 7. | Introductory circuit analysis: Robert Boylestad. |

FOURTH SEMESTER – PRACTICAL Practical - IV ELECTRICITY Course duration: 16 weeks with 3 hours of laboratory work per week Marks - End semester examination - 20 + IA - 10 [Record - 05 + Practical Test - 05] = 30

Course Objectives:

1. To develop experimental and data analysis skills through a wide range of experiments in the practical laboratory

| Course Learning Outcome | | |
|-------------------------|---|-----------------|
| СО | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Design circuits with passive components to determine resonance | Create |
| | frequency and cut off frequency | |
| CO -02 | Perform experiments with Ballistic galvanometer. | Analyse |

| | Any NINE of the following experiments: |
|-----|---|
| 1. | Anderson's Bridge: Determination of the self-inductance of the coil. |
| 2. | BG: High resistance by leakage using BG. |
| 3. | $\mathbf{B}_{\mathbf{H}}$ using Helmholtz double coil galvanometer and potentiometer. |
| 4. | LCR series circuit: Determination of resonance frequency, L and band width. |
| 5. | Low pass filter: Determination of cut-off frequency. |
| 6. | High pass filter: Determination of cut-off frequency. |
| 7. | Mutual inductance between two coils by absolute method. |
| 8. | LCR parallel circuit: Determination of resonance frequency, L and band width. |
| 9. | Series RC circuit: To study the variation of X_C with frequency and determination of 'C'. |
| 10. | CRO : Phase measurement, determination of resonance frequency and L in a series LCR circuit. |
| 11. | Series RL circuit: To study the variation of X_L with frequency and determination of 'L'. |

FIFTH SEMESTER – THEORY Paper – V Title of paper: MODERN PHYSICS – I Course Duration: 16 weeks with 03 hours per week - 48 hours

Marks-Theory-70 +Internal Assessment-30 = 100

Course Objectives:

1. To provide in depth study of atomic and molecular spectra

2. To study the principle and applications of LASER

3. To understand the limitations of Newtonian mechanics and familiarize with the development of quantum mechanics

4. To understand the basic nucleus and nuclear properties

5. To study astronomical objects and related phenomena.

| Course Learning Outcome | | |
|-------------------------|--|--------------------|
| CO | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Analyze atomic and molecular spectra and predict the effect of | Analyze |
| | magnetic and electric field on atoms | |
| CO -02 | Understand the basic working principles of laser and analyse its | Understand |
| | working. | |
| CO -03 | Solve Schrödinger equation | Evaluate |
| CO -04 | Predict the occurrence and decay process of radioactivity. | Analyze |
| CO -05 | Understand stellar dynamics and evolution; | Understand |

St. Philomena's College (Autonomous) Mysuru. B.Sc. Physics CBCS Syllabus 2018-19 onwards.

| Part-A | |
|---|--------|
| UNIT-1 | 3hrs |
| 1.1The Electron: Determination of e/m of an electron by Thomson's method. Determination of the charge of the electron by Millikan's oil drop method. | |
| 1.2 Atomic Spectra: A qualitative account of Sommerfeld's relativistic atomic model. Excitation and ionization potentials - Frank-Hertz experiment. Vector model of an atom- electron spin- space quantisation. Magnetic moment of an electron due to its orbital motion. Stern-Gerlach experiment. Spin-orbit interaction and the fine structure of spectral lines. Quantum numbers and selection rules. Pauli's exclusion principle, electronic configuration of atoms. Brief mention of LS and JJ coupling for multi electron atoms. | 8hrs |
| 1.3 Zeeman effect : Explanation of the normal Zeeman effect on the basis of vector atom model. Expression for the Zeeman shift and experimental details | 3hrs |
| UNIT-2 | 3hrs |
| 2.1 Molecular spectra: Rotation, vibration and electronic spectra of molecules – | |
| associated quantum numbers and selection rules. Theory of pure rotation spectra. | |
| 2.2 The Raman effect: Experiment, quantum theory - intensity and polarization of | 3hrs |
| Raman lines, applications. | |
| 2.3 Lasers: Induced absorption, spontaneous emission and stimulated emission, metastable state - population inversion. Three level laser, The He-Ne laser. Properties of laser light. Laser application - medical, industrial. | 4hrs |
| Part-B | |
| UNIT-3 3.1 Wave mechanics: Failure of classical mechanics in the microscopic domain. de Broglie's concept of matter waves. The Davisson and Germer experiment. Heisenberg's uncertainty principle - the gamma ray microscope, application of uncertainty principle. Setting up of the time- independent and time-dependent Schröedinger equations. Born's interpretation of the wave function.Solution of the time-dependent Schröedinger equation for particle in one-dimensional box and its eigen-values. Mention of energy eigen-values for one-dimensional simple harmonic application and non- point energy. | 9 hrs. |
| oscinator and zero-point energy. | |

St. Philomena's College (Autonomous) Mysuru. B.Sc. Physics CBCS Syllabus 2018-19 onwards.

| UNIT-4 | |
|--|--------|
| 4.1 The nucleus: Neutron- discovery and properties. The proton-neutron hypothesis. Nuclear forces and their characteristics. Yukawa's theory (qualitative). | 2 hrs. |
| 4.2 Radioactive decay: Successive disintegration, radioactive equilibrium, radioactive | 7 hrs. |
| series.Range and energy of alpha particle and its measurement. Theory of alpha decay | |
| (qualitative). Geiger-Nuttal law. Beta Decay - Pauli's neutrino hypothesis, K-electron | |
| capture, internal conversion, nuclear isomerism. | |
| UNIT-5 | |
| 5.1 Astrophysics: The Harvard classification of stars. Luminosity of star-stellar distances, | |
| stellar magnitudes. H-R diagrams. Mass-luminosity relation (qualitative). Structure of sun. | 6 hrs. |
| Stellar evolution - Chandrashekar limit, red giants, white dwarfs, neutron stars, black holes | |
| and quasars, | |
| Expanding Universe- Hubble's law, Big bang theory (qualitative). | |

| | Books for reference: |
|----|--|
| 1. | Modern Physics, 12th ed S. Chand & Co: R. Murugeshan and K.Sivaprasath. |
| 2. | Modern Physics, 12th ed S. Chand & Co: R. Murugeshan and K. Sivaprasath. |
| 3. | Atomic and Nuclear Physics: A.B.Gupta, New Central Book Agency Pvt.Ltd. |
| 4. | Introduction to Astrophysics: Baidyanath Basu. |

| | Books for further reference: |
|----|---|
| 1. | Fundamentals of Modern Physics, 8th ed: Duggal and Chabra. |
| 2. | Concepts of modern physics, 6th edition, Tata Mcgraw Hill, New Delhi: A Beiser. |
| 3. | Nuclear Physic, 5th ed, Himalaya Publishing House: D.C Tayal. |
| 4. | Nuclear Physics, S. Chand & Co: S.N. Ghoshal. |
| 5. | Nuclear Physics, Narosa Publishing House: Irving Kaplan. |
| 6. | Lasers: A.K. Ghatak. |
| 7. | Lasers and non linear Optics: B B Laud 1995 Wiley Eastern. |
| 8. | Atomic and Molecular Spectra and Lasers: A.K. Saxena. |
| 9. | Quantum Mechanics- A text book for UG: M. C Jain. |

FIFTH SEMESTER – Theory Paper VI Title of paper: CONDENSED MATTER AND NUCLEAR PHYSICS Course duration – 16 Weeks with 03 hours of instruction per week - 48Hrs

Marks-Theory-70 +Internal Assessment-30 = 100

Course Objectives:

- 1. To study scattering of X-rays, types of X-ray spectra and basic ideas of crystal structure and X-ray diffraction.
- 2. To study properties, examples and applications of nano materials
- 3. To study basics of condensed matter physics
- 4. To study nuclear models, accelerators and detectors
- 5. To study cosmic rays and elementary particles.

| Course Learning Outcome | | |
|-------------------------|--|--------------------|
| СО | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Distinguish between types of X-ray spectra, identify crystal structure. | Analyse |
| CO -02 | Understand the behaviour of nano particles and usage. | Understand |
| CO -03 | Deduce the relation between specific heat capacity and temperature and arrive at the limitations, analyse behaviour of high temperature superconductors. | Evaluate |
| CO -04 | Analyze the functionality of accelerators and detectors. | Analyse |
| CO -05 | Understand behaviour of cosmic rays and elementary particles and its interaction with matter. | Understand |

| Part-A | |
|---|--------|
| UNIT-1 1.1 X-rays: Bragg's law and the Bragg spectrometer. A brief mention of the different types of crystals. Miller indices, structure of NaCl and KCl crystals. Continuous x-ray spectra, Duane and Hunt limit. Characteristic x-ray spectra. Moseley's law and its significance. Compton effect- expression for Compton shift. | 8 hrs. |
| 1.2 Nano particles: Introduction. carbon nanotubes, properties. Application to medicine basic principles of drug delivery, toxic effects of nano particles. | 3 hrs. |
| UNIT-2 2.1 Dielectric properties: Dielectric materials and its properties, methods of determining dielectric constant for solids and liquids. | 3 hrs. |
| 2.2 Specific heat of solids: Dulong and Petit's law and its limitations. Einstein's theory of specificheat. Debye's theory of specific heat. | 3 hrs. |
| 2.3 Superconductivity: Elementary ideas and experimental facts. Meissner effect. Critical magneticfield. Applications of superconductivity. A qualitative account of high temperature superconductors. BCS theory (qualitative). | 5 hrs. |
| 2.4 Liquid Crystals: Symmetry, structure and classification of liquid crystals, polymorphism in thermotrophics. Applications. | 2 hrs. |
| Part -B | |
| UNIT-3 3.1 Mass spectrographs: Theory of Dempster's and Aston's mass spectrograph. | 3 hrs. |
| 3.2 Nuclear reactions: Q-value. Threshold energy of an endoergic reaction. Reactions induced by proton, deuteron and α -particles. Application of nuclear energy in medicine and industry (qualitative). | 3 hrs. |

| Unit-4 | | |
|---|--|--------|
| 4.1 Nuclear Models : Liquid-drop model. Semi-empirical mass formula. Shell model and magic numbers. | | 4 hrs. |
| 4.2 Acce Proton sy | lerators: Cockcroft-Walton voltage multiplier. LINAC, Cyclotron, Betatron, nchrotron, Electron synchrotron. | 6 hrs. |
| 4.3 Nucle detector. | ear Detectors: G.M.Counter, Bubble chamber. Principle of semiconductor | 3 hrs |
| UNIT-5 | | |
| 5.1 Cosn Cosmic 1 | nic Rays : Discovery, Primary and secondary cosmic rays- their composition. rayshowers. Origin of cosmic rays. | 3 hrs. |
| 5.2 Elementary particles : Particles and anti-particles. Classification of particles. Mention of the basic interactions in nature and conservation laws. A qualitative introduction to quarks (quark model). | | 2hrs. |
| | Books for reference: | |
| 1. | Modern Physics, 12th ed S. Chand & Co: R. Murugeshan and K. Sivaprasath. | |
| 2. | Atomic and Nuclear Physics: A.B.Gupta, New Central Book Agency Pvt.Ltd. | |
| 3. | Solid State Physics: S.O. Pillai. | |
| | Books for further reference: | |
| 1. | Introduction to solid state physics: J.B. Blackmore. | |
| 2. | Nuclear Physics: Kaplan Irving. | |
| 3. | Solid State physics: A. J. Dekkar. | |
| 4. | Concepts of Physics: B.L. Cohen. | |
| 5. | Concepts of Modern Physics, 6th edition, Tata Mcgraw Hill, New Delhi.K.S: Arthur Beiser. | |

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FIFTH SEMESTER – PRACTICAL Practical - V MODERN PHYSICS – I Course duration: 16 weeks with 03 hours of laboratory work per week Marks - End semester examination -35 + IA -15 [Record - 05 + Practical Test - 10] = 50

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Course Objectives:

1 To develop experimental and data analysis skills through a wide range of experiments in the practical laboratory.

| Course Learning Outcome | | |
|-------------------------|---|--------------------------|
| СО | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Determine specific charge of an electron. | Evaluate |
| CO -02 | Use GM counter to carry out experiments | Apply |
| CO -03 A | Understand the principle of renewable energy sources and make measurements with it. | Understand & Evaluate |

| | Any NINE of the following experiments: |
|-----|--|
| 1. | Ionization potential of xenon. |
| 2. | The e/m of an electron using a bar magnet. |
| 3. | Estimation of mass of an electron by Millikan's oil drop method. |
| 4. | Determination of wavelength of laser light. |
| 5. | Verification of inverse square law for gamma-rays. |
| 6. | Absorption coefficient of gamma-rays. |
| 7. | Cockroft-Walton Voltage multiplier. |
| 8. | Verification of maximum power transfer theorem. |
| 9. | Plank's constant using photo cell. |
| 10. | VI Characteristics of Solar cell. |
| 11. | Determination of dielectric constant of liquid/solid. |

FIFTH SEMESTER – PRACTICAL Practical - VI CONDENSED MATTER AND NUCLEAR PHYSICS Course duration: 16 weeks with 03 hours of laboratory work per week. Marks – End semester examination -35 + IA -15 [Record-05 Practical Test-10] = 50

Course Objectives:

1. To develop experimental and data analysis skills through a wide range of experiments in the practical laboratory

| Course Learning Outcome | | |
|-------------------------|---|--------------------|
| СО | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Explore various application of GM counter | Understand |
| CO -02 | Design universal logic gate with IC | Create |
| CO -03 | Calculate parameters of devices by analysing their characteristics. | Evaluate |

| Any NINE of the following experiments | |
|---------------------------------------|--|
| 1. | Determination of range of electron in Al using GM counter. |
| 2. | Triode Characteristics. |
| 3. | LDR characteristic. |
| 4. | Laser-Interference. |
| 5. | Half-life of K 40. |
| 6. | Universal logic gates using IC 7400. |
| 7. | Energy gap of a semi conductor. |
| 8. | Characteristics of GM tube. |
| 9. | Study of X-ray photograph -determination of inter planar distance. |
| 10. | VI Characteristics of LED and determination of Planck's constant. |
| 11. | Universal gate using IC 7402. |

SIXTH SEMESTER – THEORY Paper VII Title of paper: MODERN PHYSICS – II Course duration: 16 weeks with 03 hours of instructions per week - 48 hours Marks - Theory-70 + Internal Assessment – 30 = 100

Course Objectives:

1.To study the special theory of relativity to establish the relationship between space and time.

2. To understand the three basic statistics

3 To provide in depth study of semiconductors and its application

| Course Learning Outcome | | |
|-------------------------|---|---------------------------|
| CO | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Establish that the laws of physics are invariant (that is, identical) in all inertial frames of reference and prove the nonexistence of hypothetical ether. | Understand and Analyse |
| CO -02 | Compare Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics and derive it's outcomes | Analyse |
| CO-03 | Design circuits with semiconductor devices. | Create |

| Part- A | |
|---|--------|
| UNIT -1 | |
| 1.1 Special theory of relativity: Michelson-Morley experiment and its outcome. Basic postulates of theory of relativity. Lorentz transformation (no derivation). The Lorentz-Fitzgerald contraction, time dilation. Relativistic transformation of velocity, frequency and wave number. Velocity addition theorem. The relativity of simultaneity. Einstein's mass variation formula and the energy equation $E = mc^2$. The energy-momentum relation. The principle of equivalence. | 9 hrs. |
| UNIT -2 | |

| 2.1 Statistical ideas in physics: The Maxwell-Boltzmann, Bose-Einstein and | |
|--|--------|
| Fermi-Dirac energy distribution formulae (no derivation)-a qualitative comparison | |
| of the three distribution formulae. | |
| 2.2 Free electron theory of metals: Classical theory. Expression for electrical | 4 hrs. |
| conductivity- Ohm's law. Weidman-Franz law, quantum theory of free electrons in | |
| metals, statement of number of available energy states between E and E+dE. | |
| Expression for the Fermi-energy and average energy, effect of temperature on Fermi | |
| energy. | |
| UNIT-3 | |
| 3.1 Electrical properties: Hall effect and magneto resistance. Expression for Hall | |
| coefficient.(metals and semiconductors). | 3 hrs. |
| 3.1 Band theory of solids: Concept of bands in solids, intrinsic and extrinsic | 6 hrs. |
| semiconductor. Derivation of the expression for electrical conductivity, derivation of | |
| expression for carrier concentration and electrical conductivity of intrinsic | |
| semiconductors. Expression for the energy-gap of semiconductor. | |

| Part- B | |
|---|--------|
| UNIT-4 4.1 Semiconductor Devices: Review of basic concepts-PN junction diode. Bridge rectifier using diodes - expression for ripple factor and efficiency. Filters. Special purpose diodes - varactor, Zener diode and its use as a shunt voltage regulator. | 4 hrs. |
| 4.2 Diode applications: Positive, negative and biased clippers and clampers. | 3 hrs. |
| 4.3 Transistor: Review of basic concepts, Load line analysis of transistor in CE mode, dc loadline and Q point. Voltage divider biasing for CE mode-stabilization and stability factor (qualitative). | 4 hrs. |
| UNIT-5 5.1 Transistor Amplifiers: Multistage transistor amplifier - Two stage transistor RC coupled amplifier- mathematical analysis, frequency response curve, half power frequencies and bandwidth. | 4 hrs. |
| 5.2 Multivibrators: Transistor astable multivibrator, transistor monostable multivibrator. | 2 hrs. |
| 5.3 Oscillators: The feedback concept-positive and negative feedback, effect of negative feedback on gain stability, bandwidth, noise, input and output impedance (no derivation). Barkhausen criteria for oscillation. Types of oscillators - Hartley oscillator, phase shift oscillator -expression for frequency and condition for oscillation (no derivation), crystal oscillator (qualitative). | 4 hrs. |
| 5.4 Logic circuits : Construction of AND, OR and NOT logic gates using diodes and transistors. Symbols and discussion of truth table using Boolean expression for NOR, NAND and XOR logic gates. | 3 hrs. |

| | Books for reference: |
|----|--|
| 1. | Modern Physics, 12th ed S. Chand & Co: R. Murugeshan and K. Sivaprasath. |
| 2. | Atomic and Nuclear Physics: A.B.Gupta, New Central Book Agency Pvt.Ltd. |
| 3. | Solid State Physics: S.O. Pillai. |
| 4. | Principles of Electronics: V.K. Mehta. |

| | Books for further reference: |
|-----|--|
| 1. | Special theory of relativity: Resnick. |
| 2. | Special relativity: A.P French. |
| 3. | Electronic principles, Fifth edition: Malvino. |
| 4. | Introduction to solid state physics: C. Kittel. |
| 5. | Solid State physics: A. J. Dekkar. |
| 6. | Introduction to solid state physics: J.B. Blackmore. |
| 7. | Digital Fundamentals: Floyd 2000 III Edition UBS. |
| 8. | Digital principles and application: Donal P. Leach, Albert Paul Malvino and Gautam Saha. |
| 9. | Principles of electronic devices and circuits: B. L theraja and R. S Sedha. |
| 10. | Fundamentals of Digital Circuits: A. Anand Kumar. |

SIXTH SEMESTER – THEORY Paper VIII

Title of paper: ANALOG AND DIGITAL ELECTRONICS

Course duration: 16 weeks with 03 hours of instructions per week - 48 hours

Marks – Theory -70 +Internal Assessment- 30 = 100

Course Objectives:

- 1. To study methods to simplify complex dc network.
- 2.To study transistor devices and op amp for various applications.
- 3. To study concepts of AM and FM with application in Radio, TV and Other Communication System
- 4. To study Boolean algebra and its application to digital circuits.
- 5. To study IC and memory devices.

| Course | Learning Outcome | |
|---------|--|---------------------|
| со | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Apply network theorems to simplify complex dc network. | Apply |
| CO -02 | Design and construct various circuits with transistors and op amp. | Create & Analyse |
| CO -03 | Compare AM and FM and understand types of communication. | Understand |
| CO -04 | Convert between various number system and carry out logic operations. | Apply |
| CLO -05 | Describe types of fabrication of IC's and classify various memory devices. | Analyse |

| Part -A | |
|---|--------|
| UNIT-1 | |
| 1.1 Network Theorems: Thevenin's theorem, Norton's Theorem, application to the analysis of decircuits. | 4 hrs. |
| 1.2 Transistor devices: FET, UJT – working and their characteristics. | 3 hrs. |
| 1.3 Amplifiers : h parameters, ac equivalent circuit of a transistor in terms of h parameters. Derivation of the expressions for voltage gain, current gain, power gain, input resistance and output resistance of a single stage CE amplifier. | 4 hrs. |
| 1.4 Operational amplifiers: Basic differential amplifier, op-amp and its characteristics, concept of virtual ground, inverting and non inverting amplifiers. op-amp as adder, integrator and differentiator (derivation). | 4 hrs. |
| UNIT-2 | |
| 2.1 Radio and TV Communication: Review of basic concepts of amplitude modulation, Frequency modulation-expression for frequency modulated wave for a single sinusoidal modulating signal, band width of FM. Elements of TV transmission, scanning types, composite video signal and its components, Vidicon camera-working. TV standards. Elements of TV reception- Block diagram (Monochrome). Basics of colour television. | 6 hrs. |
| 2.2 Other Communication System: Principle of microwave and satellite communication, mobile communication- cellular telephony. | 3 hrs. |

| Part- B | |
|--|--------|
| UNIT-3 | |
| 3.1 Number system and Boolean Algebra: Binary and Hexadecimal number systems. | 4 hrs. |
| Conversion between decimal, binary and hexadecimal. Binary addition, binary subtraction | |
| using one's and two's complements. De Morgan's theorem, Boolean equation and its | |
| realization using basic gates. | |
| 3.2 Combinational and Sequential circuits: NAND and NOR as universal gates, half | 4 hrs. |
| adder, fulladder using basic gates and XOR gates. RS and JK flip flop (clocked version). | |
| UNIT-4 | |
| 4.1 IC logic gates: TTL and CMOS gates - their characteristics. | |
| | 3 hrs. |
| 4.2 Integrated circuits: Types, fabrication of components on monolithic IC. | 4 hrs. |
| UNIT-5 | |
| 5.1 Analog to Digital Converters: counter comparator ADC, successive approximation | |
| type ADC | 3 hrs. |
| 5.2 Digital to Analog Converters: Weighted resistor DAC, Resistor ladder DAC. | 3 hrs. |
| 5.3 Memory devices: Memory terminologies, volatile and non-volatile memory, static and | 3 hrs. |
| dynamic RAM. Magnetic, optical and ferroelectric memory. | |

| | Books for reference: |
|----|--|
| 1. | Introductory circuit analysis: Robert Boylestad. |
| 2. | Electronics: V.K. Mehta. |
| 3. | Fundamentals of Digital Circuits: A. Anand Kumar |
| 4. | Digital principles and applications: Malvino and Leach. |
| 5. | Monochrome and Colour Television, Wiley eastern Ltd, New Delhi: Gulati RR. |

| | Books for further reference: |
|----|--|
| 1. | Electronic devices and circuits, Prentice hall of India ltd, New Delhi: Alan Motttershead. |
| 2. | Electronic principles, Fifth edition: Malvino. |
| 3. | Electronic Communication Systems: Kennedy George, Tata Mcgraw Hill. |
| 4. | Communication Electronics: Deshpande Etal. |
| 5. | Modern Digital Electronics: R P Jain. |

SIXTH SEMESTER – PRACTICAL Practical – VII MODERN PHYSICS - II

Course duration: 16 Weeks with 3 Hours of laboratory work per week Marks – End semester examination -35 + IA - 15 [Record-05 +Practical Test-10] = 50

-

Course Objectives:

1. To develop experimental and data analysis skills through a wide range of experiments in the practical laboratory.

| Course | Learning Outcome | |
|--------|--|---------------------|
| СО | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Apply network theorems to simplify complex dc network. | Apply |
| CO -02 | Design and construct various circuits with transistors and op amp. | Create & Analyse |
| CO -03 | Compare AM and FM and understand types of communication. | Understand |
| CO -04 | Convert between various number system and carry out logic operations. | Apply |
| CO -05 | Describe types of fabrication of IC's and classify various memory devices. | Analyse |

| | Any NINE of the following experiments: |
|-----|--|
| 1. | Positive and Negative clippers using diodes. |
| 2. | Zener diode as a shunt voltage regulator. |
| 3. | Characteristics of transistor in CE mode. |
| 4. | CE amplifier – Determination of band width and mid frequency gain. |
| 5 | Construction and verification of AND, OR and NOT logic gates using transistors. |
| 6. | Astable multivibrator – Determination of duty cycle and frequency. |
| 7. | Amplitude modulation and demodulation. |
| 8 | Negative feedback CE amplifier- Determination of band width and mid frequency gain |
| 9. | Hartley oscillator – Determination of frequency of oscillation. |
| 10. | Bridge Rectifier – Determination of ripple factor with and without C and pi section filters. |
| 11. | Fermi energy of copper. |
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SIXTH SEMESTER – PRACTICAL Practical – VIII ANALOG AND DIGITAL ELECTRONICS Course duration: 16 Weeks with 3 Hours of laboratory work per week Marks – End semester examination – 35 + IA - 15 [Record-05 +Practical Test-10] = 50

Course Objectives:

1.To develop experimental and data analysis skills through a wide range of experiments in the practical laboratories.

| Course Learning Outcome | | |
|-------------------------|---|--------------------|
| СО | After the completion of this course the student will be able to | Cognitive level |
| CO -01 | Design analog and digital circuit for various applications. | Create |
| CO -02 | Construct analog and digital circuit for various applications. | Analyse |

Any NINE of the following experiments

| 1. | Verification of Thevenin's Theorem. |
|-----|---|
| 2. | A study of Characteristics of FET. |
| 3. | Phase shift Oscillator. |
| 4. | Characteristics of Photodiode. |
| 5. | RS and JK Flip Flop. |
| 6. | UJT characteristics. |
| 7. | Full Adder- Construction and verification. |
| 8. | Study of op-amp inverting and non-inverting dc amplifier. |
| 9. | 3 bit DAC using R-2R ladder network. |
| 10. | Frequency response of op-amp inverting amplifier. |
| 11 | UJT Relaxation Oscillator. |

SOFT CORE (SC)

Title of paper: ELECTRICAL CIRCUITS AND NETWORK SKILLS

Course duration: 16 weeks with 02hours of instructions per week Marks - Theory 30 + Internal Assessment – 20

32 hrs.

Objectives

To prepare the students to have a basic knowledge in the design and analysis of electrical circuits
To enable the students to design and trouble shoot the electrical circuits, networks and appliances through hands on mode.

| UNIT-1 | |
|--|--------|
| 1.1 Units of measurement, scientific notation, conversion between system of units. | 2 hrs. |
| 1.2 Basic electricity principles: Current, voltage, resistance and power. | 2 hrs. |
| 1.3 Types of resistors -Wire wound resistance, carbon composition resistor, colour coding and | 4hrs. |
| standard resistance values. Demonstration of measuring resistance with colour code and | |
| verification using multimeter. | |
| UNIT-2 | |
| 2.1 Ohm's law, resistivity, limitations of Ohm's law, temperature dependence of resistivity. | 3hrs. |
| Demonstration of Ohm's law. | |
| 2.2 Series circuits: Combination of resistors - series and parallel, Kirchoff's current and | 5hrs. |
| voltage laws, demonstration of determination of current using Kirchoff's laws. | |
| UNIT-3 | |
| 3.1 DC sources - concept of a voltage source, ideal voltage source, practical voltage source, | 3 hrs. |
| internal resistance of a voltage source, circuit symbols. | |
| 3.2 current source - concept, ideal and practical current source, circuit symbols. | 2 hrs. |
| 3.3 Source conversion - voltage source to current source, current source into voltage. | 2 hrs. |
| UNIT-4 | |
| 4.1 Branch current method. | 3 hrs. |
| 4.2 Mesh current analysis. | 3 hrs. |
| 4.3 Nodal analysis. | 3 hrs. |

| | Books for reference: | |
|----|--|--|
| 1. | A text book in Electrical Technology - B L Theraja - S Chand & Co. | |
| 2. | A text book of Electrical Technology - A K Theraja | |

SOFT CORE (SC) Title of paper: BASIC INSTRUMENTATION SKILLS Course duration: 16 weeks with 02 hours of instructions per week-Marks -Theory 30 + Internal Assessment- 20 = 50 32 hrs

Objectives:

- To enable the students to understand the concept of basic measurements using different basictools and familiarize with devices like DMM, CRO, LCR Bridges etc.
- The working of electrical equipment under AC/DC conditions.

| UNIT-1 | |
|---|--------|
| 1.1 Introduction: Measuring units. Scientific notation, conversion between systems of units. | 2 hrs. |
| 1.2 Familiarization with meter scale, vernier caliper, screw gauge and their utility. | 2 hrs. |
| 1.3 Demonstration of use of vernier caliper and screw gauge - to measure dimension of solid | 6 hrs. |
| block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet. | |
| UNIT-2 | |
| 2.1 Basic characteristics of measuring devices: accuracy, precision, errors, linearity, hysteresis, | 3 hrs. |
| resolution and scale readability, threshold, repeatability, reliability and maintainability, spam, | |
| dynamic accuracy and calibration. | |
| 2.2 Multimeter: Principles of measurement of dc voltage and dc current, ac voltage and ac | |
| current, resistance. Demonstration of usage of multimeter. | |
| UNIT-3 | |
| 3.1 CRO - Oscilloscope: Block diagram. | 2 hrs. |
| 3.2 Oscilloscope probes, measurement of voltage, frequency and phase by oscilloscope. | 5 hrs. |
| Demonstration of use of CRO. | |
| UNIT-4 | |
| 4.1 Measurement of R, L and C in LCR bridge. | |
| 4.2 Demonstration of soldering of electrical circuits. | |
| | |

| | Books for reference: | |
|----|---|----|
| 1. | Text book in electrical technology, S. Chand publications: B.L- Thereja. | |
| 2. | Measurement and Instrumentation Principles", Elsevier (Butterworth Heinmann-2008): Alan | S. |
| | Morris. | |
| 3. | Introductory circuit analysis: Robert Boylestad. | |

SOFT CORE (SC) Title of paper: ASTROPHYSICS Course duration: 16 weeks with 02hours of instructions per week-Marks -Theory - 30 + Internal Assessment – 20 = 50 32 hrs

Objectives:

- To present a survey of astronomical science including highlights of modern explorations inastronomy.
- To understand the formation and characteristics of solar system
- Usage of telescope, the Sun and its properties are studied, and understanding of Big Bangcosmology..

| UNIT-1 | |
|--|--------|
| 1.1 Astronomical scales: Astronomical distance, mass and time; scales; brightness, radiant flux | 2 hrs. |
| and luminosity. | |
| 1.2 Measurement of astronomical quantities: astronomical distances, stellar radii, masses of | 4 hrs. |
| stars, stellar temperature. Measurement of apparent solar time, mean solar time, equation of | |
| time, calendar the Julian date and its importance in astronomical observation. | |
| 1.3 Basic parameters of stars - determination of distance by parallax method; brightness, radiant | 3hrs |
| flux and luminosity, apparent and absolute magnitude scale. | |
| UNIT-2 | |
| 2.1 Stars: Surface or effective temperature, and colour of a star. Intrinsic temperature of a star. | 3hrs |
| Expression for average temperature, core temperature and core pressure of a star based on the | |
| linear density model of a star. | |
| 2.2 Stellar characteristics: Spectral classification, Edward Charles Pickering classification (i.e., | 3 hrs. |
| OBAFGKM), Harvard sequence and Yerke's luminosity classification. | |
| 2.3 Size (radius) of a star. Expression for radius using Stefan-Boltzmann law. Spectral | 5hrs |
| signature of elements present in the stellar atmosphere. Mass luminosity relationship and | • |
| expression for | |
| lifetime of a star. Color index HD classification and HR diagram. | |

| UNI | T-3 | |
|---|--|----------|
| 3.1 The stellar evolution. The evolutionary track of stars - Protostars, premain sequence stars, | | 4 hrs. |
| mair | main sequence stars. Evolution of a star to white dwarf stage through red giant stage. | |
| 3.2 5 | Supernova explosion. Formation of a pulsar or neutron star and black hole (qualitative). | 2 hrs. |
| UNI | T-4 | |
| 4.1 Cosmology: Basic assumptions and limitations of cosmology; Expansion of the Universe 4 hrs. and its evidence; Hubble's Law: Big bang theory and thermal history of the Universe. Size and age of the Universe. 4 hrs. | | |
| 4.2 Numerical analysis in astrophysics. | | 2 hrs. |
| | Books for reference: | |
| 1. | Modern Physics: R.Murugeshan and Er.Kirithiga Sivaprasath, Carroll B W, and Ostlie D A. | |
| 2. | Modern Astrophysics, 2nd Edn: Addison-Wesley (2007). | |
| 3. | Introductory Astronomy and Astrophysics, 4th Edn., Saunders College Publishing (2009): Zeilik M andGregory S A,. | |
| 4. | An Introduction to Astronomy, 1st Edn., University Science Books (1982): Shu F, The Physical Universe. | |
| 5. | Fundamental Astronomy, 4th Edn., Springer (1987): Karttunen H, Kr¨oger P, Oja H, Poutane Donner K J. | en M and |

SOFT CORE (SC) Title of paper: RENEWABLE ENERGY PHYSICS Course duration: 16 weeks with 02 hours of instructions per week Marks-Theory 30+Internal Assessment-20 =50 32 hrs.

Objectives:

- To know about the conventional energy resources and their effective utilization.
- To acquire the knowledge of modern energy conversion technologies.
- To be able to identify available renewable energy resources and techniques to utilize themeffectively.
- To know the energy demand of the world, nation and available resources to fulfil thedemand.

| 2 hrs. |
|--------|
| 3 hrs. |
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| 8 hrs. |
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| 4 hrs. |
| |
| 3 hrs. |
| |
| 8 hrs. |
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| 4 hrs. |
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| | Books for reference: |
|----|--|
| 1. | J.T. MacMillan, R. Morgan & R.B.Murray: Enregy Resources, 2 nd Edition. |
| 2. | S.P.Sukhatme: Solar Energy Principles&Thermal Collection &Storage, 2 nd Edition, Tata. |
| 3. | McGraw Hill, New Delhi. |
| 4. | G.D.Rai: Solar Energy Utilization, 5 th Edition, Khanna Publishers, New Delhi. |
| 5. | G.D.Rai: Non-Conventional Energy sources, 4 th Edition, New Delhi. |
| 6. | Green: Solar Cells. |
| 7. | E.W.Golding: The Generation of Electricity (by wind). |
| 8. | L L Freris: Wind energy conversion systems, Prentice hall, New York. |
| 9 | Chetan Singh Solanki: Solar Photovoltaics, 2 nd Ed. Fundamentals Technologies and Applications. |

SOFT CORE (SC) Title of paper: PHOTONICS Course duration: 16 weeks with 02 hours of instructions per week Marks -Theory 30 + Internal Assessment- 20 =50

32 hrs.

Objectives:

- •To understand the basic principles and properties of laser.
- •To study the types of laser, laser diodes, Photo detectors, solar cell and wave guides
- •The usage of opto-electronics in the information technology and fabricating opto-electronic devices and LED in detail.

| UNIT -1 | |
|---|---------|
| 1.1 LASERS: | |
| Basic principles, properties of laser light, coherence-spatial and temporal, divergence. | 2 hrs. |
| 1.2 Types of Lasers: Nd -YAG, CO ₂ and Dye lasers – construction and principles of working. | 4 hrs. |
| 1.3 Laser Diodes: Lasing conditions and gain in a semiconductor, selective amplification and | 8 hrs. |
| coherence, Materials for laser diodes, quantum well lasers, surface emitting lasers, | |
| characterization and modulation of lasers. | |
| UNIT-2 | |
| 2.1 Optoelectronics: Introduction: Optoelectronics in the information technology, | 4hrs. |
| optoelectronic devices, optoelectronic materials - liquid crystals, semiconductors, ceramics, | |
| polymers and optical fibers. | |
| 2.2 Photo Detectors: Specifications, types - junction photodiodes, avalanche photodiodes, | 4hrs. |
| CCDphoto detectors, comparison of different detectors. | |
| UNIT-3 | |
| 3.1 Optical Fiber: Types, optical fiber functions. Light propagation, optical power, velocity of | 10 hrs. |
| propagation, critical angle, acceptance angle, numerical aperture, mode of propagation, index | |
| profile. Single mode step-index optical fiber, multimode step - index fiber, graded index fibers | |
| advantages and disadvantages, energy losses in optical fiber, Bit rate, dispersion and optical | |
| bandwidth, absorption and scattering. | |

| | Books for reference: |
|----|--|
| 1. | John Wilson and John Hawkes: Optoelectronics, an introduction - 3rd Edition, Prentice Hall 1998, |
| 2. | J Singh: Optoelectronics an introduction to materials and devices, McGraw Hill New York. |
| 3. | P Bhattacharya: Semiconductor optoelectronic devices, Prentice hall international, 1997. |
| 4. | KR Nambiar: Lasers- principles, Types and applications, New age international, New Delhi. |
| 5. | Wayne Tomaal: Electronic Communication Systems-Fundamentals through advanced- 5th editionPearson education, New Delhi. |
| 6. | Dennis Roddy and John Coolen: Electronic Communication, 4th edition, Pearson education, New |
| | Delhi. |

SUBJECT – PHYSICS BLUE PRINT -*Choice Based Credit Scheme* (CBCS) -2018 OnwardsFor Semesters – I, II, III and IV (DSC or HARD CORE)

Time – 03 hours

Part - A

Max. Marks – 60

3x4 = 12

| | Answer any SIX questions | 6x2 = 12 | |
|----|--|---|---------|
| 1. | | | 2 marks |
| 2. | Concept/ understanding/ application basedshort | | 2 marks |
| 3. | answer questions to be set. | | 2 marks |
| 4. | | Totally eight questions to be set with at least one question | 2 marks |
| 5. | | from each unit. | 2 marks |
| 6. | | | 2 marks |
| 7. | | | 2 marks |
| 8. | | | 2 marks |

Part- B Answer any THREE questions

| 9 | | | 4 mark |
|-----|--|--------------------------------|--------|
| 10. | Theory or short derivations to be set. | Totally four questions to be | 4 mark |
| 11. | | set with at least one question | 4 mark |
| 12. | | from each part of the | 4 mark |
| | | syllabus. | |

Part-C

| Answer any THREE questions $3x4 = 12$ | | | |
|---------------------------------------|---|------------------------------|--------|
| 13. | Numerical problems/application oriented questions | | 4 mark |
| 14. | to be set. | Totally four questions to be | 4 mark |
| 15. | | set with at least one | 4 mark |
| 16. | | question from each part of | 4 mark |
| | | the syllabus. | |

Part-D

| | Answer any FOUR questi | ons $4x6 = 2$ | 24 |
|-----|---|-----------------------------|---------|
| 17. | | Totally six questions to be | 6 marks |
| 18. | | set with at least one | 6 marks |
| 19. | Long answer/derivation basedquestions to be | questionfrom each unit. | 6 marks |
| 20. | set. | | 6 marks |
| 21. | | | 6 marks |
| 22. | | | 6 marks |

For Semesters – V and VI (DSC or HARD CORE)

Time – 03 hours

Part - A

| | Answer any NINE questions | | 9x2 = 18 |
|-----|--|-----------------------------|----------|
| 1. | | | 2 marks |
| 2. | | | 2 marks |
| 3. | | | 2 marks |
| 4. | Concept/ understanding/ application basedshort | Totally ten questions to be | 2 marks |
| 5. | answer questions to be set. | set with at least one | 2 marks |
| 6. | | question from each unit. | 2 marks |
| 7. | | | 2 marks |
| 8. | | | 2 marks |
| 9. | | | 2 marks |
| 10. | | | 2 marks |

Part -B

| | Answer any FOUR questions | | 4x4 = 16 |
|-----|--|----------------------------|----------|
| 11. | Theory or short derivations to be set. | Totally five questions to | 4 marks |
| 12. | | be set with at least one | 4 marks |
| 13. | | question from each part of | 4 marks |
| 14. | | the syllabus. | 4 marks |
| 15. | | | 4 marks |

Part-C

| Answer any THREE questions | | | 3x4= 12 |
|----------------------------|---|------------------------------|---------|
| 16. | Numerical problems/application oriented | Totally four questions to be | 4 marks |
| 17. | questions to be set. | set with at least one | 4 marks |
| 18. | | question from each part of | 4 marks |
| 19. | | the syllabus. | 4 marks |

Part-D

| Answer any FOUR questions | | 4 | x6= 24 |
|---------------------------|---|-----------------------------|---------|
| 20. | Long answer/derivation based questions to | Totally six questions to be | 6 marks |
| 21. | be set. | set with at least one | 6 marks |
| 22. | _ | question from each unit. | 6 marks |
| 23. | _ | | 6 marks |
| 24. | _ | | 6 marks |
| 25. | | | 6 marks |

| Time –02 Hours | | Max. M | arks – 30 |
|---------------------------|--------------------------------|------------------------------|-----------|
| Part - A | | | |
| Answer any five questions | | 5x2 = 10 Marks | |
| 1. | Concept/ understanding/ | Questions to be set with at | 2 marks |
| | application based short answer | least one question from each | |
| | questions to be set | unit of the syllabus. | |
| 2. | 1 | | 2 marks |
| | | | |
| 3. | | | 2 marks |
| 4. | | | 2 marks |
| 5. | | | 2 marks |
| 6. | | | 2 marks |

SOFT CORE From Semester II Onwards

Part- B

| Answer any FOUR questions | | 4 x 5 =20 Marks | |
|---------------------------|--|---------------------------|----------|
| | Short answer/ long answer/ derivation | At least one question | |
| 7. | based /Numerical problems/ application | fromeach unit must be | 05 Marks |
| 8. | oriented questions to be set. | set. | 05 Marks |
| 9. | | Question in this part may | 05 Marks |
| 10. | | contain sub divisions a, | 05 Marks |
| 11. | | b. | 05 Marks |