St. Aloysius College (Autonomous), Jabalpur

DEPARTMENT OF PHYSICS

SYLLABUS 2021-22

B. Sc. I Year

** **Those who opt Physics as a major subject they will study both the papers (Theory and Experiments) and Those who opt for Physics as a minor/ elective subject, they will study only Paper-II (Theory and Experiments).**

Paper –I

Thermodynamics and Statistical Physics

Course Code: S1PHYS1T

Pre-requisite: To study this course, a student must have had the subject Physics in 12th class.

Max. Marks: 25+75

Min. Passing Marks: 33

Credit Value: 4

Course Objectives (Cob)

The objectives of the course are:

	Course Objectives	Cognitive Level
COb-I	To understand the basic concepts of thermodynamics and to have an idea about conversion of heat in to work.	U, R, E
COb-II	To learn the idea of entropy, Maxwell's relation and their applications.	U, Ap, R, E
COb-III	To apply the principles of probability in distribution of particles in various systems and to calculate thermodynamic probability. To create basic ideology of phase space, microstate, macrostate.	R, U, An, Ap, E,C

COb-IV	To provide insight of postulates of statistical physics. To learn the different types of statistical distribution (which particles follow which statistics and why).	R , U, An, Ap, E, R
COb-V	To know the important contributions of various physicist in the field of Physics	U,R

Course Outcome(COt)

	Course Outcomes	Cognitive Level
COt-I	Learner will be able to build and make use of Basic concepts of thermodynamics & Maxwell's thermodynamic relations.	U, R, E
COt-II	Learner will be able to outline the idea about Micro and Macro states, Ensembles, Statistical Probability and Phase Space.	R, U, An , Ap, E
COt-III	Learner will be able to create the idea of partition function and distribution function for classical and quantum statistics.	R , U , Ap, An, E
COt-IV	Learner will be able to construct/imagine the Specific Contributions of Physicists in Various branches of Physics	U, C

COb-Course Objective; COt – Course Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

UNIT-I

Historical background & Laws of Thermodynamics

1. **Historical background:** **[12 Lectures]**
   - **1.1.**A brief historical background of thermodynamics and statistical Physics in the context of India and Indian culture, Contribution of S.N Bose in thermodynamics & Statistical physics.
2. **Laws of thermodynamics:**
   - **2.1.**Thermodynamical system and thermodynamical coordinates, Thermal equilibrium, Zeroth Law of thermodynamics, The concept of path function and point function, Work done by and on the system.

2.2. First law of thermodynamics ,Internal energy as a state function, Reversible and irreversible change, Heat engine and its efficiency, Carnot's cycle, Carnot's engine and its efficiency, Carnot's theorem, Otto engine, Otto cycle, Diesel engine, Diesel cycle.

2.3. Second law of thermodynamics, Statement of Kelvin-Planck and Clapeyron, Absolute scale of temperature: Zero of absolute scale, Size of degree, Identity of perfect gas scale and absolute scale.

Keywords/Tags : Thermodynamics, Internal energy, Heat engine, Absolute scale.

UNIT-II

Entropy [12 Lectures]

1. Concept of entropy, Clausius theorem, Entropy as a point function, Change in entropy in reversible and irreversible processes.
2. Change in entropy of an ideal gas, Change in entropy when two liquids at different temperatures are mixed(or two bodies at different temperatures are kept in contact).
3. Principle of increase of entropy, Change in entropy of the universe in an irreversible process, Disorder and heat death of universe.
4. Physical Significance of entropy, Temperature-entropy (T-S) diagram, third law of thermodynamics.

Keywords/Tags: Reversible process, Entropy, Ideal gas.

UNIT-III

Thermodynamic potentials and Kinetic theory of gases [12 Lectures]

1. **Thermodynamic potentials and its application:**
   - **1.1** Thermodynamic potentials, Thermal equilibrium, Internal energy, Helmholtz free energy, Enthalpy and Gibbs free energy.
   - **1.2** Derivation of Maxwell's relations from thermodynamic potentials, Gibbs-Helmholtz equation, Thermodynamic energy equation for ideal and van der Waal gas.
   - **1.3** TdS equation, Derivation of expressions for C_p-C_v and their special cases for ideal and Van der Waal gases, derivation of the expression $E_s/E_t=C_p/C_v$.
   - **1.4** Clausius-Clapeyron latent heat equation, Temperature change in adiabatic process, Principle of refrigeration, Joule-Thomson effect, Cooling by adiabatic demagnetization, Production and measurement of very low temperatures.
2. **Kinetic theory of gases :**
   - **1.1.**Behavior of a real gas and its derivation from an ideal gas, Virial equation, Andrews experiment on CO_2 gas.

1.2. Critical constant, Continuity of the liquid and gaseous state, Vapor and gas state, Boyle temperature, Van der Waals equation for real gas, Values of critical constants, Laws of the corresponding state.

Keywords/ Tags: Potential, Enthalpy, Adiabatic, Real gas, Critical constant.

UNIT –IV

Classical Statistics [12 Lectures]

1. Probability, Distribution of N particles in two identical boxes, Probability of occurrence of either event, probability of composite events, Weightage probability.
2. Probability distribution and its narrowing with the increase in number of particles, Expression for average properties Constraints, Accessible and non-accessible microstates.
3. Ensemble theory(Micro-canonical, canonical and Grand canonical) ,Macro and micro states with examples, Principle of equal a prior probability, Concept of phase space.
4. Boltzmann Canonical distribution law: Application : average energy of one-dimensional harmonic oscillator.
5. Derivation of law of equipartition of energy from statistics, Equilibrium between two system in thermal contact and β parameter, Statistical interpretation of entropy and relation $S = k \log W$.
6. Boltzmann partition function and derivation of expression for internal energy, Helmholtz free energy, Enthalpy and Gibbs free energy.

Keywords/ Tags: Probability, micro states, Ensemble theory, Partition function

UNIT –V

Quantum Statistics [12 Lectures]

1. Indistinguishability of particles and its consequences, Maxwell-Boltzmann statistics (Classical Statistics): , Maxwell-Boltzmann distribution law of velocity and speed, , Maxwell-Boltzmann statistics and its distribution law.
2. Quantum statistics: Bose –Einstein statistics and distrtibution law, Derivation of Planck's radiation law from B-E statistics, Rayleigh-Jeans law, Wein's displacement law and stefan's law.
3. Fermi-Dirac statistics and its distribution law, Explanation of free electron theory, Fermi level and Fermi energy.
4. Comparison between the Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics.

Keywords/ Tags: Indistinguishability, velocity distribution, Fermi Level.

Learning Resources:

Suggested Readings:

1. Zemansky M. W & Dittman R., " Heat and Thermodynamics" , Tata McGraw Hill.
2. Sears and Salinger, " Thermodynamics, Kinetic Theory and Statistical Thermodynamics" Narosa.
3. Garg and Ghosh " Thermal Physics" , Tata McGraw Hill.
4. Subrahmanyam, Brij Lal and Hemne, " Heat Thermodynamics and Statistical Physics" S. Chand.

Digital resources:

Suggested equivalent online courses:

1. **https://www.edx.org/course/thermodynamics Thermodynamics course.**

Mode of Evaluation: Digital Assignments, Quiz ,Class test /Quarterly Exam/Half Yearly Exam, Final(end of the year) examination.

**** Question paper must contain Numerical/conceptual questions of 10 marks.**

List of Experiments

No. of Practical hours: 30

Credit:2

1. Determination of the mechanical equivalent of heat by Callendar & Barne's method.
2. Determination of efficiency of electrical Kettle with variable voltages.
3. Determination of temperature coefficient of a resistance using platinum resistance thermometer.
4. Determination of electromotive force of a thermocouple.
5. Determination of thermal conductivity of a bad conductor by Lee's disc method.
6. Verification of Newton's law of cooling.
7. Determination of the ratio of specific heat of air by Clement-Desorme's method.
8. Determination of specific heat of a liquid with the help of Newton's law of cooling**.**
9. Determination of the coefficient of thermal conductivity of a metal by Searle's method.
10. Determination of thermal conductivity of the rubber using calorimeter.
11. Determination of mechanical equivalent of heat (J) using Joule calorimeter.
12. Determination of Stefan's constant using thermocouple.
13. Study of statistical distribution and determination of standard deviation with the help of black and white dice.

14. Determination of the temperature coefficient of a resistance with the help of Carey-Foster bridge.
15. Determination of the critical constant of a gas/vapour.

Other experiments of the same difficulty level may be added.

Student needs to perform at least 10 experiments.

Learning Resources:

Suggested Readings:

1. Indu Prakash , Ram Krishna and A.K.Jha, " A text book of practical physics", Vol.1, Kitab Mahal.
2. Worsnop and Flint, "Advance practical physics ", Asia Publications.
3. Advanced Practical Physics (Vol. 1 & Vol. 2) B.Ghosh and K.G.Mazumder, Sreedhar Publ.
4. Practical Physics ,G. L. Squires, Cambridge University press

Paper –II

Mechanics and General Properties of Matter

Course Code: S1PHYS2T

Pre-requisite: To study this course, a student must have had the subject Physics in 12th class.

Max. Marks: 25+75

Min. Passing Marks: 33

Credit Value: 4

Course Objectives (Cob)

The objectives of the course are:

	Course Objectives	Cognitive Level
COb-I	To develop required mathematical skills and to impart knowledge about various mathematical tools employed to study and solve problems in various fields of physics	U, R, E
COb-II	To study general parameters like velocity, acceleration forces, angular momentum, and effect of forces in different frames of references, Gravitational field and potential and scattering	U, Ap, R, E
COb-III	To study the concept of stress/strain and in its relation to force/displacement. To determine axial forces, shear forces and bending moments in relation to rigid bodies. Concept of Simple, Periodic & Harmonic Oscillation.	R, U, An, Ap, E
COb-IV	To acquire knowledge of Moment of Inertia for various regular bodies. To study, viscosity, surface tension and Bernoulli's theorem	R , U, An, Ap, E, R
COb-V	To introduce students to the concept of special theory of relativity and its consequences	Ap, E, C

Course Outcome (COt)

	Course Outcomes	Cognitive Level
COt-I	The learner will use various mathematical tools employed to study and solve problems in various fields of physics	U, R, E
COt-II	Learner will be able to understand concepts of Gradient, Divergence and Curl and their applications, recall Laws of motion and to build fundamentals of Mechanics, Significance of Kepler's Laws of Planetary Motion & Importance of Collisions	R, ,U, Ap, An, R, E
COt-III	Learner will be able to understand the concept of Elasticity and various elastic moduli, Concept of Simple, Periodic & Harmonic Oscillation.	R, U, An, Ap, E
COt-IV	Learner will be able to extend the concept of Translational and Rotational Dynamics and their application. Learner will be able to evaluate the Moment of inertia about a given axis of symmetry for different uniform mass distributions. Principles of fluid flow and the equations governing fluid dynamics such as equation of continuity, Bernoulli's Theorem etc.	R , U , Ap, An, E
COt-V	Learner will be able to understand the concept of special theory of relativity and its consequences	Ap, E, C

Cob-Course Objectives ;COt – Course Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

UNIT-I

Historical background and Mathematical Physics

1. **Historical background [12 Lectures]**

1.1.A brief historical background of mathematics and mechanics in the context of India and Indian culture.

1.2. A brief biography of Varahamihira and Vikram Sarabhai with their major contribution to science and society.

2. Mathematical Physics

2.1. Scalar and vector fields, Gradient of a scalar field and its physical significance.

2.2. Vector Integral: Line integral, surface integral and volume integral, Divergence of a Vector field and its physical significance, Gauss divergence theorem.

2.3. Curl of a vector field and its physical significance, Stokes and Green's theorem, Numerical problems based on the above topics.

Keywords/Tags: Scalar field, Vector field, Vector integral, Gradient, Divergence, Curl.

UNIT-II

Mechanics of Rigid and deformable bodies

1. 1. Rigid body mechanics: [12 Lectures]

1.1. System of particles and concept of Rigid body, Torque, Centre of mass: position of the centre of mass ,Motion of the centre of mass, Conservation of linear & angular momentum with examples, Systems of variable mass : Single stage and multistage rocket, Conveyor belt - hopper.

1.2. Rotatory motion and concept of moment of inertia, Theorems on moment of inertia: theorem of addition, theorem of perpendicular axis, theorem of parallel axis, Calculation of moment of inertia of rectangular lamina, disc, solid cylinder, solid sphere.

2. Mechanics of deformable bodies:

2.1. Hook's law, Young's modulus, Bulk modulus, Modulus of rigidity and Poisson's ratio, Relationship between various elastic moduli.

2.2. Possible values of Poisson's ratio, Finding Poisson's ratio of rubber in the laboratory, Torsion of a cylinder, Strain energy of twisted cylinder.

2.2. Finding the modulus of rigidity of the material of a wire by Barton's method, Torsional pendulum and Maxwell's needle, Searle's method to find Y,ηand σ of the material of wire, Bending of beam, Cantilever, Beam supported at its ends and loaded in the middle.

Keywords/Tags: Rigid body, Centre of mass, Moment of inertia, Poisson's ratio.

UNIT-III
Fluid mechanics

1. Surface Tension: **[12 Lectures]**

1.1 Inter- molecular forces and potential energy curve, force of cohesion and adhesion.

1.2 Surface tension, Explanation of surface tension on the basis of intermolecular forces, Surface energy, Effect of temperature and impurities on surface tension, Daily life application of surface tension.

1.3 Angle of contact, The pressure difference between the two sides of a curved liquid surface, Excess pressure inside a soap bubble ,Capillarity, determination of surface tension of a liquid –capillary rise method, Jaeger's method .

2. Viscosity:

2.1. Ideal and viscous fluid, Streamline and turbulent flow, Equation of continuity, Rotational and irrotational flow, Energy of a flowing fluid, Euler's equation of motion of a non-viscous fluid and its physical significance.

2.2 .Bernoulli's theorem and its applications(Velocity of efflux, shapes of wings of airplane, Magnus effect, Filter pump, Bunsen's burner)

2.3. Viscous flow of a fluid, Flow of liquid through a capillary tube, Derivation of Poiseuille's formula and limitations, Stoke's formula, Motion of a spherical body falling in a viscous fluid.

Keywords/Tags: Inter-molecular force, Surface tension, Angle of contact, Capillarity, Viscosity, Euler's equation, Poiseuille's formula.

UNIT-IV

Gravitational potential and central forces

1. Gravitational potential: **[12 Lectures]**

1.1 Conservative and non-conservative force field, Conservation of energy in motion under the conservative and non-conservative forces, Potential energy.

1.2 Conservative force, Conservation of energy, Gravitational potential and gravitational potential energy, Gravitational potential and intensity of gravitational field due to a uniform spherical shell and a uniform solid sphere.

1.3 Gravitational self-energy, Gravitational self-energy of a uniform spherical shell and a uniform solid sphere.

2. Central forces :

2.1 Motion under Central forces, Conservative characteristics of central forces.

2.2 The motion of a two particles system in central force, Concept of reduced mass, Reduced mass of positronium and hydrogen.

2.3 Motion of particle in an inverse-square central force, Motion of celestial bodies and derivation of Kepler's laws

2.4 Elastic and inelastic scattering (elementary idea).

Keywords/Tags: Conservative force field, Gravitational potential, Gravitational self-energy, Central force, reduced mass, Scattering.

UNIT-V

Relativistic Mechanics and Astrophysics

1. Relativistic Mechanics: **[12 Lectures]**

1.3. Frame of references, Galilean transformation, and Michelson-Morley experiment.

1.4. Postulates of special theory of relativity, Lorentz Transformation, Simultaneity and order of events, Length contraction, Time dilation, Relativistic transformation of velocities, Variation of mass with velocity.

1.5. Mass-energy equivalence and its experimental verification.

2. Astrophysics

2.1 Introduction to the universe, Properties of the Sun, Concept of Astronomical Distance.

2.2 Life cycle of stars, Chandrasekhar Limit, H-R diagram, Red giant star, White dwarf star, Neutron star, Black hole.

2.3 Big Bang Theory (elementary idea).

Keywords/Tags: Transformation, Mass-energy equivalence, Astronomical distance, Chandrasekhar limit, Black hole.

Learning Resources:

Suggested Readings:

1) Spiegel M. R., "Vector Alalysis : Schaum Outline Series " , McGraw Hill Education,2017.
2) Mathur D. S., "Mechanics ", S.Chand, 2012.
3) Mathur D. S., "Properties of Matter ", Shyamlal Charitable trust, New Delhi.
4) Ghatak A. K., Goyal I. C., and Chua S. J. "Mathematical Physics", Laxmi Publications Private Limited, 2017.
5) Hans and Puri , "Mechanics " Tata McGraw Hill

6) Sears and Zeemansky, “University Physics”, Pearson Education.
7) Kleppner and Kolenkov ,” An Introduction to Mechanics” Tata McGraw Hill.
8) Resnick and Halliday “Fundamentals of Physics”, 1966.

Digital resources:

Suggested equivalent online courses:

1. **https://nptel.ac.in/courses/115/103/115103036/** Mathematical Physics by Dr. Saurabh Basu, IIT, Guwahati.
2. **https://nptel.ac.in/courses/115/106/115106090/** Mechanics, Heat, Oscillations and Waves by Prof. V. Balakrishanan, IIT, Chennai.

Mode of Evaluation: Digital Assignments, Quiz, Class test /Quarterly Exam/Half Yearly Exam, Final(end of the year) examination.

**** Question paper must contain Numerical/conceptual questions of 10 marks.**

List of Experiments

No. Of Practical hours: 30

Credit:2

1. Determination of Young’s modulus, modulus of rigidity and Poisson’s ratio of material of wire using Searle’s method.

2. Determination of Young’s modulus of material of a metallic bar by bending of beam method.

3. Determination of acceleration due to gravity (g) using Bar pendulum.

4. Determination of acceleration due to gravity (g) using Kater’s reversible pendulum.

5. Determination of modulus of rigidity of a rod with the help of Barton’s apparatus.

6. Determination of coefficient of viscosity of liquid using Poiseuille’s method.

7. Determination of moment of inertia of a fly wheel about its axis of rotation.

8. Determination of the moment of inertia of a given body (irregular body) with the help of inertia table.

9. Verification of the theorem of parallel/perpendicular axes of moment of inertia.

10. Determination of modulus of rigidity of material of wire with the help of Maxwell's needle.

11. Determination of Young's modulus of a rod using Cantilever method.

12. Determination of modulus of rigidity of material of wire with the help of torsional pendulum.

13. Determination of force constant of a spring.

14. Determination of Poisson's ratio of rubber.

15. Determination of surface tension of a liquid by Jaeger's method.

16. Determination of Young modulus of brass bar using Flexural Vibration.

17.Determination of coefficient of viscosity of a given liquid by Stoke's method.

Other experiments of the same difficulty level may be added.
Student needs to perform at least 10 experiments.

Learning Resources:

Suggested Readings:

1. Indu prakash , Ram Krishna and A.K.Jha, " A text book of practical physics", Vol.1, Kitab Mahal.
2. Worsnop and Flint, "Advance practical physics ", Asia Publications.
3. Advanced Practical Physics(Vol. 1 & Vol. 2) B.Ghosh and K.G.Mazumder, Sreedhar Pub.
4. Practical Physics ,G. L. Squires, Cambridge University press

Paper – (Open elective)

Non-Conventional Energy Sources

Course Code: S1-PHYS2G

Pre-requisite: Open to all.

Max. Marks: 25+75

Min. Passing Marks: 33

Credit Value: 4

UNIT-I

Introduction to non-conventional energy sources [12 lectures]

1. Classification of energy resources, Consumption trend of primary energy resources, Importance of non-conventional energy resources.
2. Energy chain, Common form of energy, Limitations of non-conventional energy resources.
3. Salient features of non-conventional energy resources, Environmental aspect of energy.
4. World energy status, Energy scenario in India.

Keywords/ Tags: Energy resources, Energy chain, Non-conventional energy.

UNIT-II

Solar Energy

[12 lectures]

1. The sun as a source of energy, solar radiation at the Earth's surface.
2. Photo-thermal applications: Solar collectors, solar drying, solar cooker (box type), solar distillation, solar water heating systems, solar thermo-mechanical system.
3. Photovoltaic system : Photovoltaic principle, Basic photovoltaic system for power generation , Solar cells, Types of solar cells, Concentrator cells, Sun-tracking systems, Limitations and environmental aspect of cells.
4. Photovoltaic applications: Solar cell Panels, Solar light, solar pump, solar power plants, Solar cell in transportation, solar refrigeration and air conditioning.

Keywords/ Tags: Solar radiation, Photo-thermal, Photovoltaic, Solar cells.

UNIT-III

Biomass Energy

[12 lectures]

1. Biomass resources, Biomass conversion technology, Biomass generation.
2. List of factors affecting bio-digestion, Working of biogas plant (with block diagram), Biogas from plant waste.
3. Methods of obtaining energy from Biomass, Thermal gasification of biomass.
4. Biomass energy programme in India, Biodiesel production from non-edible oil seeds.

Keywords/ Tags: Biogas, Biomass, Thermal gasification, Bio-digestion.

UNIT-IV
Wind Energy

[12 lectures]

1. Concept of wind, Origin of wind climate, Wind profile, Limitations of extracted power from a wind turbine.
2. Wind resource map and site identification, Land requirement.
3. Wind turbine setting, Wind turbine aerodynamics, Wind turbine type: Upwind and downwind turbines, Blade count, Constant and variable speed wind turbines, Onshore and offshore wind turbines.
4. Wind turbine rotor, working of wind turbine, Drag principle, Lift principle.
5. Effect of wind turbine on environment, Wind energy storage, Wind energy program in India.

Keywords/ Tags: Wind climate, Wind energy, Wind turbine.

UNIT-V
Geothermal and Ocean Energy

[12 lectures]

1. Geothermal Energy: Origin and distribution of geothermal energy, Types of geothermal resources, Analysis of geothermal resources.
2. Exploration and development of geothermal energy.
3. Advantages and disadvantage of geothermal energy, Possibilities and limitations.
4. Ocean Energy: Tidal energy- origin and nature of tidal energy, Environmental impact, Energy and power in waves, Advantages and dis advantages of wave energy.
5. Ocean thermal energy, Ocean thermal conservation technology (OTEC), Environmental impact.

Keywords/ Tags: Geothermal Energy, Ocean Energy, Tidal Energy, OTEC.

Learning Resources:

Suggested Readings:

1. Rai G. D., “Non-conventional energy sources”, Khanna Publishers.
2. Rai G. D., “Solar energy utilization”, Khanna Publishers.
3. Sukhatme S. P. and Nayak J. K., “Solar energy: Principles of thermal collection and storage”, Tata McGraw Hill Publications.
4. Khan B. H., “Non-conventional energy resources”, McGraw Hill Publications.

Digital Resources:

1. **https://mnre.gov.in** Ministry of New and Renewable Energy**.**

Suggested equivalent online courses:

1. **https://nptel.ac.in/cources/121/106/121106014/** By Prof. Pratap Haridoss, IIT, Chennai.

Mode of Evaluation: Digital Assignments, Quiz, Class test /Quarterly Exam/Half Yearly Exam, Final (end of the year) examination.

V1-EEQ-ELCT

Electrical Technology

Vocational Course

Credit Value- 4 (2 T+2 P)

Pre requisite: To study this course, a student must have had the subject Science in class 10^{th}.

[30 hrs]

Course Learning Outcomes	**On completion of this course , learners will be able to :** • To understand maintenance of electrical equipment • Able to safe himself from any electrical shock • Able to work in Service centre to repair latest useful domestic and office use equipment.

UNIT-I [15 Lectures]

1) **Current Electricity:**
   Electricity as a source of energy, definition of resistance, voltage, current, power ,Energy and their units, relation between electrical, mechanical and thermal units, factors affecting resistance of a conductor, temperature coefficient of resistance, difference between AC and DC voltage and current.
2) **DC Circuits:**
   Ohm's law, series-parallel resistance circuits, calculation of equivalent resistance, Kirchhoff's laws and their applications.
3) **Electric Cell:**
   Primary cell, wet cell, dry cell, batteries, series and parallel connections of cells, lead acid cell, discharging and recharging of cells, common charging methods, preparation of electrolyte, care and maintenance of secondary cells.
4) **Heating and Lighting effects of current:**
   Joule's law of electric heating and its domestic applications, heating efficiency, lighting effect of electric current, filaments used in lamps, and gaseous discharge lamps, their working and applications.
5) **Capacitor:**
   Capacitor and its capacity, concept of charging and discharging of capacitors, types of capacitors and their use in circuits, series and parallel connections of capacitor, energy stored in capacitor.

UNIT-II [15 Lectures]

1) Electromagnetic effect:

Permanent magnets and electromagnets, their construction and use, polarities of electromagnet and rules of finding them Faraday's law of electromagnetic induction, dynamically induced emf its magnitude and direction, static induction, self-induced e.m.f., its magnitude and direction, inductance and its unit, mutually induced e.m.f., its magnitude and direction, Energy stored in inductor.

Force acting on a current carrying conductor in magnetic field, its magnitude and direction, torque produced on a current carrying coil in magnetic field, principles and construction of dynamo. AC and DC motor, construction and working of single phase motor, principle of transformer and its type.

2) AC circuits:

Generation of A.C voltage, its generation and wave shape, cycle, frequency, peak value(maximum value), average value, instantaneous value, R.M.S value from, crest factor, phase, phase difference, power factor, A.C series circuits with (i) resistance and inductance (ii) resistance and capacitance and (iii) resistance inductance and capacitance, Q factor of RLC series circuits.

Practical [60 hrs]

1) Manufacturing of series lighting.
2) Study about safety measure and tools.
3) Fan repairing and its study.
4) Mixer repairing and its study.
5) Geezer repairing and its study.
6) Cooler repairing and its study.
7) Invertor repairing and its study.
8) Electrical iron repairing and its study.
9) Electric kettle repairing and its study.
10) Induction cooker repairing and its study.
11) Water purifier repairing and its study.
12) Solar panel repairing and its study.
13) Study of MCB, ELCB.
14) To find out unknown resistance.

Other experiments of the same difficulty level may be added.

Project/ Field Trip: Student will visit Electrical Equipment Service Centres.

Learning Resources

Suggested Readings:

1) Tata McGraw Hill,2004, Electric Circuits, Schaum's Outline series, Nasar S.A.
2) Nahvi M and Edminister J, Electrical Circuits, Schaum's Outline Series, Tata McGraw Hill 2005.
3) Chakrabarti A., Circuit Theory, Dhanpat Rai & Co.
4) Tharaja B L., A Textbook of Electrical Technology Volume 1. S Chand 2005.
5) Mehta V K., Mehta Rohit, Principle of Electrical Engineering, S Chand 2005.
6) Gupta J B., Text book of Electrical Technology, SK Kalaria and sons, 2012.
7) Kulshreshtra D C., Basic Electrical Engineering McGraw Hill first edition.
8) Mittal A K, Electrian Trade Theory, Arihant Publications.
9) Mittal A K, Workshop calculation and Science , Arihant Publications.
10) S K Dhiman S K Trade Practical RP Publications.
11) Garg Sambhav Workshop calculation and Science, Neelkanth Publications.

Online courses/Resources:

1) National Digital Library- https://ndl.iitkgp.ac.in/
2) Lectures- https://ocw.mit.edu.index.htm
3) Video- https://www.youtube.com.c.mitcw.search/query=circuit/020theory
4) https://nptel.ac.in/courses/108/108/10810876

V1-ELE-ELXT

ELECTRONIC TECHNOLOGY

Vocational Course **Credit Value- 4(2T+2P)**

Pre-requisite- 10+2 with science **30 hrs**

Course Learning Outcomes	**After studying this course, the student will be able to** • Carry out the testing procedure of basic electrical components and circuits by making use of different test instruments. • Define the procedure of making Printed Circuit Board(PCB) • Understand the concepts and principles used in Radio/Audio/Video Systems. • Understand the devices used in communication system and learn the art of their maintenance. • Test different electronic components such as Resistors, Capacitors, Inductors, Diodes and Transistors. • Test the quality of electronic circuits used in day-to-day life. • Locate the fault at component level and at the advanced circuit Level.

UNIT-I [8 Lectures]

1 Electronic Fundamentals & Concept of CRO:

i) Brief history of development of electronics.

ii) Applications of electronics

iii) Electronic passive components; Resistors, Capacitors and Inductors

iv) Electronic active components with their names and symbols

v) Overview of Cathode Ray Oscilloscope (CRO),Block diagram of CRO, Measurement of voltage, phase difference and frequency using CRO.

vi) CRO applications.

2) Voltage and Current:

i) Resistance, Ohm's law, V-I Characteristic curve, different types of Resistors, Capacitors, Inductors.

ii) Voltage and Current sources, Symbols and Graphical representation.

iii) Overview of AC, DC, cells and batteries.

UNIT-II [10 Lectures]

Basics of Semiconductor

1. Semiconductor materials. Energy band structure of Insulators, Metals and Semiconductors, properties of semiconductors.

2. Intrinsic & Extrinsic semiconductor, N-type and P-type semiconductor, Drift current, Diffusion current and Total current, Mobility of charges, Effects of temperature On Conductivity of semiconductor

3. PN junction diode, depletion layer, potential barrier, Forward & Reverse bias, V-I Characteristic, Effects of temperature, Resistance levels. Breakdown in Junction diode, Zener diode, Photo diode LED Types and applications of diode.

4. Diode as a rectifier, Half wave and full wave rectification, Voltage multipliers, Zener diode as voltage Regulator

UNIT-III [12 Lectures]

Bipolar Junction Transistor

1. Transistor's terminals and symbols.

2. Construction and operation of NPN and PNP transistors, Biasing of BJT.

3. CB, CE and CC configuration, Characteristics and transistor parameters for CB, CE, CC configuration.

4.Introduction to FET, JFET, MOSFET, CMOS and their characteristics.

Transistor Amplifier and Applications

1. Introduction, Single and Multistage amplifiers, General amplifier characteristics, Feedbacks in amplifier,

2. Introduction to Sinusoidal Oscillators, Oscillatory circuit and types of oscillators.

3. Special information - (Introduction to Thyristors, diode, SCR, DIAC&TRIAC).

Practical [60 hrs]

1. Study of current and voltage measurement using Ammeter and Voltmeter.

2. Study of current and voltage measurement using Galvanometer.

3. Study of current, voltage and resistance measurement using Multimeter.

4. Study of voltage amplifier.

5. Study of working principle of Signal Generator and measurement of amplitude, time period and frequency of signal using Oscilloscope.

6. Study of V-I Characteristic of Diode.

7. Study of V-I Characteristic of Zener Diode and use of Zener Diode as a voltage regulator.

8. Study of Half wave rectifier with and without filter circuit.

9. Study of Fullwave rectifier with and without filter circuit.

10. Study CE configuration for NPN and PNP transistors and measurement of voltage and current gain.

11. Study CB configuration for NPN and PNP transistors and measurement of voltage and current gain.

12. Study CC configuration for NPN and PNP transistors and measurement of voltage and current gain.

13. Design and test diode as a switch with the help of LED using Bread Board.

14. Design and test series and parallel combination of resistances using Bread Board.

15. Design and test Half wave rectifier using a bread board.

16. Design and test Full wave rectifier using a bread board.

17. Design of 7segment display using LED and bread board.

Other experiments of the same difficulty level may be added.

Project/ Field trip: - As per Requirement of Syllabus.

Learning Resources:

Text Books, Reference Books, Other resources

1.Malvino Albert & Bates David J. "Electronic Principles" TMH Publication.

2. Boylested Robert L. & Nashelsky Louis, "Electronics Devices and Circuits", Pearson Pub.

3. Mehta V.K. & Mehta Rohit, "Principles of Electronics". S. Chand.

4. Thareja B. L, "Basic Electronics Solid State", S. Chand.

5. Sedha R. S. "A Text book of Electronic Devices and Circuits", S. Chand.

6. Sahdev S. K. "Electronic Principles". Dhanpat Rai & Company.

7. Zabar "Basic Electronics- A text lab manual", McGraw Hill India.

Suggestive digital platforms web links:

1. https://onlinecourses.nptel.ac.in/noc19_ee44/preview

2. https://www.nielit gov.in/aurangabad/content/certificate-course-printed-circuit-board-design analysis-and-manufacturing-technique

3. https://onlinecourses.nptel.ac.in/noc21_ee55/preview

4. https://nptel.ac.in/courses/122/106/122106025/