Class-XII
(E) TECHNICAL GROUP

61. ELEMENTS OF MECHANICAL ENGINEERING

Theory Paper	**Time : 2 Hours**	**Max. Marks : 15**
Practical Paper	**Time : 3 Hours**	**Max. Marks : 35**
		CCE : 25
		Total Marks : 75

THEORY
Structure of Question Paper

The question paper will comprise of three parts (Part-I, Part-II and Part-III). The question paper will be evenly distributed from the prescribed syllabus.

Part-I will consist of four objective type questions carrying one mark each and it will be compulsory. The answer of each question should not exceed more than one sentence.

Part-II will consist of four short answer type question carrying three marks each. Candidate will attempt any two questions out of these. A question may have two and more parts. The answer of each question should not be more than one page of the answer sheet.

Part-III will consist of two questions carry five marks each. Candidate will attempt any one question out of these. A question may have two and more parts. The answer of each question should not be more than two pages of the answer sheet.

SYLLABUS

1. Measuring Devices: Linear measurements. (i) Engineer's scale (ii) Vernier callipers (iii) Micrometer (outside and inside), its construction and working.
2. Engineering Materials : Metals and their classification, Ferrous and non-ferrous metals, Description of ferrous metals such as pig iron, wrought iron and carbon steel.
3. Heat Treatment: Such as Hardening, Tempering, Case hardening, Annealing (short notes).
4. Lathe Work: Power transmission with reference to belt and gear derive system, cutting speed and its calculation; Operations on lathe such as Facing, Plain turning, Step turning; Taper, Threading (external), Knurling and Drilling.
5. Welding: Study of acetylene gas generators (Low pressure), Study of different welding joints such as butt joint, lap joint and T-joint.
6. Pipe and pipe fitting: Classification of pipes, Criteria for selection of pipe, Utility of pipe fitting, Various types of pipe fitting and their sketches.

PRACTICAL
Structure of Question Paper

The distribution of marks will be as follows:

1. Viva-Voce   5 marks
2. Note-book/sessional work   5 marks
3. Actual performance   25 marks

(a)   Minor Practical

Three practical will be set from the practical No. 1,2,3,4,5,6. The candidate will choose any two from these. The examiner will ask the student to perform any one from the two chosen by him.

(b)   Minor Practical

Four practical will be set from the practical No. 2,3,4,5,6. The candidate shall choose any three from these. The examiner will ask the student to perform any two from the three chosen by him.

SYLLABUS

1. To measure the diameter of metal piece by vernier callipers.
2. To measure the diameter of metal piece by micrometer.
3. Engaging lead to cut external N-thread.
4. Change of gears for thread cutting.
5. Practice the following operations on lathe machine.
   (i) Facing   (ii) Plain turning   (iii) Stepturning   (iv) knurling
6. Practice in welding (left ward and right ward)
   (Preparation of atleast two jobs wherever applicable)

62. ELEMENTS OF ELECTRICAL ENGINEERING

Theory Paper   Time : 2 Hours   Max. Marks : 15
Practical Paper   Time : 3 Hours   Max. Marks : 35
                                                          CCE : 25
                                                  Total Marks : 75

THEORY
Structure of Question Paper

The question paper will comprise of three parts (Part-I, Part-II and Part-III). The question paper will be evenly distributed from the prescribed syllabus.

Part-I will consist of four objective type questions carrying one mark each and it will be compulsory. The answer of each question should not exceed more than one sentence.

Part-II will consist of four short answer type question carrying three marks each. Candidate will attempt any two questions out of these. A question may have two and more parts. The answer of each question should not be more than one page of the answer sheet.

Part-III will consist of two questions carry five marks each. Candidate will attempt any one question out of these. A question may have two and more parts. The answer of each question should not be more than two pages of the answer sheet.

SYLLABUS

1. Safety precautions
2. Earthing of electrical installation.
3. Different types of Fuse and their use.
4. Relays : Characteristics of relays: their construction and operation.
5. Kirchoff's 1st law and 2nd law.
6. Construction and working principle of induction motor.
7. Heating effect of current.
8. Batteries ; Construction and working; Charging of batteries.

PRACTICAL
Structure of Question Paper

The distribution of marks will be as follows:
1. Viva-Voce   5 marks
2. Note-book/sessional work   5 marks
3. Actual performance   25 marks

There will in all be four practical in the question paper. Every practical will carry 12½ marks. The student will choose any three practical from these. The examiner will ask the student to perform any two from the three chosen by him.

SYLLABUS

1. Earthing of tubewell motor.
2. Replacement of different fuses.
3. Testing the relay for serviceability.
4. To verify the network of Kirchoff's 1st and 2nd law.
5. To perfom non-load and block rotar test.
6. Replacement of the heating element of Hot plate, oven, electric automatic press.
7. (i) Charging of the batteries.
   (ii) To find the internal resistance of the battery.

63. ELEMENTS OF ELECTRONICS ENGINEERING

Theory Paper	**Time : 2 Hours**	**Max. Marks : 15**
Practical Paper	**Time : 3 Hours**	**Max. Marks : 35**
		CCE : 25
		Total Marks : 75

THEORY
Structure of Question Paper

The question paper will comprise of three parts (Part-I, Part-II and Part-III). The question paper will be evenly distributed from the prescribed syllabus.

Part-I will consist of four objective type questions carrying one mark each. The answer of each question should not exceed more than one sentence.

Part-II will consist of four short answer type question carrying three marks each and it will be compulsory. Candidate will attempt any two questions out of these. A question may have two and more parts. The answer of each question should not be more than one page of the answer sheet.

Part-III will consist of two questions carry five marks each. Candidate will attempt any one question out of these. A question may have two and more parts. The answer of each question should not be more than two pages of the answer sheet.

SYLLABUS

1. **Modulation :-** Introduction, need of modulation, types with wave shapes, side bands production in A.M. and F.M. Phase modulation, classification of A.M.

   Methods :- Typical circuit of A.M. modulators and their descriptions.

2. **Detection: -** Introduction, needs of diction, Square law diode detection, grid leak detectors, linear diode detection, anode bend detection.
   Types of Video detectors and their typical circuits, Phase shift discriminators, Ratio detectors, Unifiers and their detailed descriptions.

3. **Oscillators :-** Introduction, requirements, various types, detailed circuit description of Hartley and colpits oscillators, Multi Vibrators-Classification, Astable and Biastable multivibrators and their detailed descriptions.
   Amplifiers:- Introduction, A.F. and Power amplifiers, Push-pull amplifier and their circuit descriptions, feedback.
   Amplifiers:- Voltage Feedback Amp., R.C. Coupled amplifier with voltage inverse feed back, feed back amp, Characteristics Tuned voltage and power amplifiers, OP-Amps (Operational Amps), their functions and uses.

PRACTICAL
Structure of Question Paper

The distribution of marks will be as follows:

1.	Viva-Voce	5 marks
2.	Note-book/sessional work	5 marks
3.	Actual performance	25 marks

(a) **Major Practical:**
The examiner shall set any three practicals from the practical Nos. 1,2,3,4,11,13,14. The candidate shall choose any two from these. The examiner will ask the student to perform any one from the two chosen by him.

(b)   Minor Practical:
The examiner shall set any three practicals from the practical Nos. 5,6,7,8,9,10 & 12. The candidate shall choose any two from these. The examiner will ask the student to perform any one from the two chosen by him

SYLLABUS

1.   To construct an oscillator.
2.   To wire an A.P. amplifier.
3.   To wire a circuit from a given blue print.
4.   Stage description of an A.M. Radio-Receiver.
5.   Fault finding in different stages of a Radio-Receiver.
6.   Tuning of a Radio-Receiver with the help of signal generation.
7.   Study of selectivity in a Radio-Receiver.
8.   Study of sensitivity in a Radio-Receiver.
9.   Study of fidelity in a Radio-Receiver.
10.   Stage description of a T.V. Receiver.
11.   Fault finding in different stages of a T.V. Receiver.
12.   Study of E.H.T. stage of a T.V. Receiver.
13.   Verification of basic truth tables.
14.   To construct a Flip-Flop circuit.

Books suggested for Reading:-
1.   Applied Electronics: by G.K. Mithal.
2.   Simple Television: by Milton S. Kiver.

64. ELEMENTS OF BUILDING CONSTRUCTION

Theory Paper   **Time : 2 Hours**   **Max. Marks : 15**
Practical Paper   **Time : 3 Hours**   **Max. Marks : 35**
                                                                       CCE : 25
                                                             Total Marks : 75

THEORY
Structure of Question Paper

The question paper will comprise of three parts (Part-I, Part-II and Part-III). The question paper will be evenly distributed from the prescribed syllabus.

Part-I will consist of four objective type questions carrying one mark each. The answer of each question should not exceed more than one sentence.

Part-II will consist of four short answer type question carrying three marks each and it will be compulsory. Candidate will attempt any two questions out of these. A question may have two and more parts. The answer of each question should not be more than one page of the answer sheet.

Part-III will consist of two questions carry five marks each. Candidate will attempt any one question out of these. A question may have two and more parts. The answer of each question should not be more than two pages of the answer sheet.

SYLLABUS

Materials
(i)   Revision of syllabus of 11th class.
(ii)   Stone : Selection, characteristics, Dressing of stones.
(iii) Pointing
(iv)   Ply-wood

Construction

Foundation : Testing of soil for foundation: types of foundation-simple stepped, Raft, Grillage & well foundation.
Masonry :   Bonds: English, Flemish, stretcher Bond, Heading Bond, Diagonal Bond.
             Technical terms in stone masonry and types of stone Masonry.
             Lintels, Slab, Beam.
Stairs :   Technical Terms, Types of stairs only.
Surveying : Typed of Surveying – Chain surveying.
             Toolstand Equipments, Principles of Surveying, Field boo obstacles in chain surveying.
Levelling : Technical Terms
             Description of Dumpy level and leveling staff.
             How to set Dumpy level.
             How to take reading to find out difference in Elevation between two points.

PRACTICAL

Structure of Question Paper

The distribution of marks will be as follows:

1. Viva-Voce   5 marks
2. Note-book/sessional work   5 marks
3. Actual performance   25 marks

      (a)   **Major Practical**
           This will be about preparation of drawing of simple building.
      (b)   **Minor Practical-I**
           This will be based upon the Unit-III i.e. use of tools.
      (c)   **Minor Practical-II**
           This will be based upon the Unit-IV & V i.e. leveling/surveying.

SYLLABUS

(i) How to draw Plan, Elevation of single Room.
(ii) One Room set (Room/Kitchen/Bath/Varanda).
(iii) Carpentry joint: Crossed Joint, Halving Joint, Bevelled half Joint.
(iv) Chain Surveying : Folding/Unfolding of chain, tape, setting of surveying station.
(v) Leveling : Setting of Dumpy level.
    Taking if difference of Elevation of two ppoints.

65. ENGINEERING DRAWING

Theory Paper	**Time: 2 Hours**	**Max. Marks : 15**
Practical Paper	**Time: 3 Hours**	**Max. Marks : 35**
		CCE : 25
		Total Marks : 75

THEORY
Structure of Question Paper

The question paper will consist of two Units:

Unit-I   **7 marks**

It will consist of 5 questions. The question paper will comprise of three parts (Part-I, Part-II and Part-III). The question paper will be evenly distributed from the prescribed syllabus.

Part-I   will consist of one objective type question carrying one mark and it will be compulsory. The answer of each question should not exceed more than one sentence.

Part-II will consist of two short answer type question carrying two marks each. Candidate will attempt any one questions out of these. Question may have two and more parts. The answer of each question should not be more than one page of the answer sheet.

Part-III will consist of two questions carry four marks each. Candidate will attempt any one question out of these. Question may have two and more parts. The answer of each question should not be more than two pages of the answer sheet.

Unit II   **8 marks**

It will consist of 6 questions. The question paper will comprise of three parts (Part-I, Part-II and Part-III). The question paper will be evenly distributed from the prescribed syllabus.

Part-I   will consist of two objective type question carrying one mark and it will be compulsory. The answer of each question should not exceed more than one sentence.

Part-II will consist of two short answer type question carrying two marks each. Candidate will attempt any one questions out of these. Question may have two and more parts. The answer of each question should not be more than one page of the answer sheet.

Part-III will consist of two questions carry four marks each. Candidate will attempt any one question out of these. Question may have two and more parts. The answer of each question should not be more than two pages of the answer sheet.

PRACTICAL
Structure of Question Paper
The distribution of marks will be as follows:

1.	Note-book/sessional work	5 marks
2.	Unit I	15 marks
3.	Unit II	15 marks

There will be 4 questions regarding constructions, each of 7½ marks in each part. The questions may consist of more than one part. The candidates will be required to do any two questions from each part.

SYLLABUS
(Both for theory and Practical)

In theory paper questions based upon simple definitions and about elementary knowledge of various topics will be asked, while practical paper will consist of drawing of constructions.

Machine Drawing: Unit-I

Theory : 7 marks
Practical : 15 marks

I   Isometric scale; isometric projections drawn to isometric scales, isometric projection of regular plane figures such as square, pentagon, hexagon and circle, right geometric solids such as cube, prisms, pyramids, cone, cylinder and sphere, hemisphere, frustum of solids.

II   Isometric projections from given orthographic projection of the simple objects, V-block, brackets, Plummer block. Orthographic projections (including sectional views) from given isometric views of the above objects.

III   Interpretation of orthographic views of simple machine blocks. Also free hand sketches of the items mentioned in the above units from memory.

Note : 1. Students are expected to prepare a minimum of five plates of half imperial size on the above units.
         2. It is desirable that students are made familiar with both First angle & Third angle projections.

Machine Drawing: Unit-II

Theory : 8 marks
Practical : 15 marks

I   Drawing to scale, nomenclature and standard profiles of screw threads-v-threads (metric and B.S.W.) and square threads, representation of internal and external threads, bolts : studs, hexagon and square nuts and washer with standard dimensions, various types of machine screw with standard dimensions, types of bolt head and nuts. Types of rivet heads; snap, pan, countersunk (flat and round, single rivetted lap joint with dimensions).

II   Types of keys: sunk key, taper key, feather key, woodruff key, splines and key ways, Also free hand sketches of items mentioned in Unit Nos. I and II.

III   Sectional assembly of the following:
         Sold muff coupling and unprotected flange coupling, solid cast iron pulley (upto 20 mm dia), cone pulley, flange pipe joint, footstep bearing, journal bearing, turnbuckle bracket, cotter joint for circular rod.

Note : 1 Students are expected to prepare a minimum of five plates of half imperial size on the above units spread over the concerned portion.
         2 It is desirable that students are made familiar with both First-angle and Third-angle projections.

66. MATHEMATICS

Time: 3:00 hrs

Theory: 50 Marks
CCE: 25 Marks
Total: 75 Marks

1.   All Questions are Compulsory.
2.   Q. 1 will consist of eight parts and each part will carry 1 Mark.
3.   Q. 2 to Q. 10 each will be of 3 Marks.
4.   Q. 11 to Q. 13 i.e. three questions each will be of 5 marks.
5.   There will be no overall choice. There will be an internal choice in any four questions of 3 marks each and two questions of 6 marks each (Total of 5 internal choices).
6.   Use of Calculator is not allowed.

SYLLABUS

1   Relations and Functions:
Types of relations: Reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, composite functions, inverse of a function. Binary operations.

2   Inverse Trigonometric Functions:
Definition, Range, Domain, Principal value branches. Graphs of inverse trigonometric functions. Elementary properties of inverse trigonometric functions.

3   Matrices:
Concept, notation, order, equality, types of matrices, zero matrix, transpose of a matrix, symmetric and skew symmetric matrices. Addition, multiplication and scalar multiplication of matrices, simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). Concept of elementary row and column operations. Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

4   Determinants:
Determinant of a square matrix (up to 3×3 matrices), properties of determinants, minors, cofactors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equation by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

5   Continuity and Differentiability:
Continuity and Differentiability, derivative of composite functions, chain rule, derivative of inverse trigonometric functions, derivative of implicit function. Concepts of exponential and logarithmic functions. Derivatives of $\log_e{}^x$ and e^x. Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretations.

6   Applications of Derivatives
Applications of derivatives: rate of change, increasing/decreasing functions, tangents and normal, approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real life situations).

7   Integrals:
Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, only simple integrals of the type:

$$\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}, \int \frac{dx}{ax^2 + bx + c}$$

$$\int \frac{(px + q)}{ax^2 + bx + c} dx, \int \frac{(px + q)}{\sqrt{ax^2 + bx + c}} dx, \int \sqrt{a^2 \pm x^2} dx \text{ and } \int \sqrt{x^2 - a^2} dx$$

$$\int \sqrt{ax^2 + bx + c} \, dx \text{ and } \int (px + q)\sqrt{ax^2 + bx + c} \, dx$$

to be evaluated.

Definite integrals as a limit of a sum. Fundamental Theorem of Calculus (without proof).Basic properties of definite integrals and evaluation of definite integrals. .

8   Applications of the Integrals:

Applications in finding the area under simple curves, especially lines, areas of circles/parabolas/ellipses (in standard form only), area between the two above said curves (the region should be clearly identifiable).

9   Differential Equations:

Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type:

$$\frac{dy}{dx} + Py = Q$$

where P and Q are functions of x or constant.

$$\frac{dx}{dy} + Px = Q$$

where P and Q are functions of y or constant

10   **Vectors:**

Vectors and scalars, magnitude and direction of a vector. Direction cosines/ratios of vectors. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors, scalar triple product.

11   Three-dimensional Geometry:

Direction cosines/ ratios of a line joining two points. Cartesian and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes, (iii) a line and a plane. Distance of a point from a plane.

12   Linear Programming:

Introduction, definition of related terminology such as constraints, objectives function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P problems, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constrains)

13   Probability:

Multiplication theorem on probability. Conditional probability, independent events, total probability, Baye's theorem, Random variable and its probability distribution, mean and variance of haphazard variable. Repeated independent (Bernoulli) trials and Binomial distribution.

67. PHYSICS

Time: 3 Hours

Theory : 35 Marks
Practical: 15 Marks
C.C.E. : 25 Marks
Total : 75 Marks

STRUCTURE OF QUESTION PAPER (THEORY)

1. There will be one theory paper comprising of 17 questions. The student has to attempt total 13question out of 17 as per the directions given below:
2. Question no. 1 to 5 will be of one mark each.
3. Question no.6 to 14 will be of three marks each. Candidate can attempt any 5 questions out of 9 questions.
4. Question no.15 to 17 will be of five marks each. There will be internal choice in them.
5. Distribution of marks over different dimensions of the paper will be as follows.

LEARNING OUTCOMES	MARKS	PERCENTAGE OF MARKS
KNOWLEDGE	15	43%
UNDERSTANDING	15	43%
APPLICATION	5	14%
Total	35	100%

8. Use of un-programmable calculator is allowed. The log tables can be used.
9. Total weightage of numerical will be 20%

UNIT WISE DISTRIBUTION OF MARKS

Unit No.	Title	Marks
UNIT-I	Electrostatics	7
UNIT-II	Current Electricity	4
UNIT-III	Magnetic effects of current and magnetism	6
UNIT-IV	Electromagnetic Induction & current	4
UNIT-V	Electromagnetic waves	2
UNIT-VI	Optics	9
UNIT-VII	Dual nature of matter	2
UNIT-VIII	Atoms and Nuclei	3
UNIT-IX	Electronics devices	3
UNIT-X	Communication Systems	2
	Total Marks	35

SYLLABUS
THEORY

Unit 1 : Electrostatics

Electric Charges; and their Conservation, Coulomb's law-force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution.

Electrical field, electric field due to a point charge, electric-field lines; electric dipole, electric field due to a dipole; torque on a dipole in uniform electric field.

Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (Field inside and outside).

Electric potential, potential **difference,** electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field.

Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor, Van de Graaf generator.

Unit II: Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current: Ohm's law, electrical resistance. V-1 characteristics (linear and non linear), electrical energy and power, electrical resistivity and conductivity. Carbon resistors, colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance.

Internal resistance of a cell, potential difference and emf of cell, combination of cells in series and in parallel.

Kirchhoff's laws and simple applications. Wheatstone bridge, meter bridge.

Potentiometer-principle and its applications to measure potential difference and for comparing emf of two cells, measurement of internal resistance of a cell.

Unit III : Magnetic Effects of Current and Magnetism

Concept of magnetic field. Oersted's experiment;

Biot-savart law and its application to current carrying circular loop.

Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids.

Force on a moving charge in uniform magnetic and electric fields. Cyclotron.

Force on a current-carrying conductor in a uniform magnetic field Force between two parallel current-carrying conductors, definition of ampere. Torque experienced by a current loop in uniform magnetic field; moving coil galvanometers- its current sensitivity and conversion to ammeter and voltmeter.

Current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole moment of a revolving electron. Magnetic field intensity due to a magnetic dipole (Bar magnet) along its axis and perpendicular to its axis. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements, Para-, dia-and ferro-magnetic substances with examples, Electromagnets and factors affecting their strengths. Permanent magnets.

Unit IV: Electromagnetic Induction and Alternating Currents

Electromagnetic induction, Faraday's laws, induced emf and current, Lenz's Law, Eddy currents: Self and mutual inductance.

Alternating current, peak and rms value of alternating current/voltage; reactance and impedances; LC oscillations, (qualitative treatment only), LCR series circuit resonance; power in AC circuit, wattless current.

AC generator and transformer.

Unit-V : Electromagnetic Waves

Need for displacement current, Electromagnetic waves and their characteristics (qualitative ideas only). Transverse nature of electromagnetic waves.

Electromagnetic spectrum (Radio waves, Radio-microwaves, infra-red, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

Unit-VI Optics

Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications, optical fibers, refraction at spherical surfaces, lenses, thin lens formula, lens-maker's formula. Magnification, power of a lens, combination of thin lenses in contact, combination of lens and mirror. Refraction and dispersion of light through a prism.

Scattering of light-blue colour of the sky and reddish appearance of the sun at sunrise and sunset.

Optical instruments: - Human eye, image formation and accommodation, correction of eye defects (myopia, hypermetropia) using lenses. Microscopes and astronomical tetescopes (reflecting and refracting) and their magnifying powers.

Waves optics : wave front and Huygens' Principle, reflection and refraction of plane wave at a plane surface using wave fronts. Proof of laws of reflection and refraction using Huygens 'Principle. Interference. Young's double hole experiment and expression for fringe width, coherent sources and sustained interference of light. Diffraction due to a single slit, width of central maximum. Resolving power of microscopes and astronomical telescopes. Polarisation, plane polarised light - Brewster's law, uses of plane polarised light and Polaroids.

Unit-VII Dual nature of Matter and Radiation

Photoelectric effect, Hertz and Lenard's observations'; Einstein's photoelectric equation, particle nature of light.

Matter waves-wave nature of particles, de Broglie relation. Davission-Germer experiment (experimental details should be omitted, only conclusion should be explained).

Unit-VIII Atoms & Nuclei

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model, energy levels, hydrogen spectrum.

Composition and size of nucleus, atomic masses, isotopes, isobars; isotones. Radioactivity- alpha, beta and gamma particles/rays and their properties; radioactive decay law. Mass-energy relation, mass-defect; binding energy per nucleon and its variation with mass number; nuclear fission and fusion,

Unit-XI Electronic Devices

Energy bands in solids (qualitative idea only) conductor, insulators and Semiconductors; semiconductor Diode-1-V characteristics in forward and reverse bias, diode as a rectifier, 1-V characteristics of LED, photodiode, solar cell and Zener diode, Zener diode as a voltage regulator. Junction transistor, transistor action; characteristics of a transistor: transistor as an amplifier (common emitter configuration) and oscillator, Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.

Unit-X Communication Systems

Elements of a communication system (block diagram only); bandwidth of signals (speech, TV and digital data); bandwidth of transmission medium- Propagation of electromagnetic waves in the atmosphere, Sky and space wave propagation. Need for modulation. Production and detection of an amplitude modulated wave.

STRUCTURE OF PAPER (PRACTICAL)

Time : 3 hrs.   **Total : 20 Marks**

Two experiment	10
Record of Activities	2
Viva on Activities	3
Record of Experiments	2
Viva of Experiments	3
Total	20

PRACTICALS SYLLABUS

Experiments

1. To determine resistance per cm of a given wire by plotting a graph of potential difference versus current.

2. To find resistance of a given wire using meter bridge and hence determine the specific resistance of its material.
3. To verify the laws of combination (series/parallel) of resistance using a meter bridge.
4. To compare the emf of two given primary cells using potentiometer.
5. To determine the internal resistance of given primary cell using potentiometer.
6. To determine resistance of a galvanometer by half-deflection method and to find its figure of merit.
7. To convert the given galvanometer of known resistance and figure of merit into an ammeter and voltmeter of desired range and to verify the same.
8. To find the frequency of the A.C. mains with a sonometer.
9. To find the value of v for different values of u in case of a concave mirror and find their focal length.
10. To find the focal length of a convex lens by plotting graphs between u and v or between 1/u and I/v.
11. To find the local length of a convex mirror, using a convex lens.
12. To find the focal length of a concave lens, using a convex lens.
13. To determine angle of minimum deviation for a given prism by plotting a graph between angle of incidence and angle of deviation.
14. To draw the I-V characteristic curve of a p-n junction in forward bias and reverse bias.
15. To draw the characteristic curve of a zener diode and to determine its reverse breakdown voltage.
16. To study the characteristics of a common-emitter npn or pnp transistor and to find out the values of current and voltage gains.
17. To determine the reflective index of a glass slab using a traveling microscope.
18. To find refractive index of a liquid by using (i) Concave mirror. (ii) Convex lens and plane mirror.

Activities
1. To measure the resistance and impedance of an inductor with or without iron core.
2. To measure resistance, voltage (AC/DC), current (AC) and check continuity of a given circuit using multimeter.
3. To assemble a household circuit comprising three, bulbs, three (on/off) switches, a – fuse and a power source.
4. To assemble the components of a given electrical circuit.
5. To study the variation in potential drop with length of a wire for a steady current.
6. To draw the diagram of a given open circuit comprising at least a battery, resistor rheostat, key ammeter and volt meter. Mark the components that are not connected in proper order and correct the circuit and also the circuit diagram.
7. To study effect of intensity of light (by varying distance of the source) on an D.R.
8. To identify a diode, an LED, a transistor and 1C, a resistor and a capacity from mixed collection of such items.
9. Use of multimeter to (i) identify base of transistor, (ii) distinguish between npn ad pnp type transistors, (iii) see the unidirectional flow of current in case of a diode and an LED. iv) Check whether a given electronic component (e.g. diode, transistor or IC) is in working order.
10. To observe refraction and lateral deviation of a beam of light incident obliquely on a glass stab.
11. To observe polarization of light using two Polaroids.
12. To observe diffraction of light due to a thin slit.
13. To study the nature arid size of the image formed by (i) convex lens (ii) concave mirror, on a screen by using a candle and a screen (for different distances of the candle from the lens/mirror).

14. To obtain a lens combination with the specified focal length by using two lenses from the given set of lenses.

69. CHEMISTRY

Time: 3 Hours

Theory : 35 Marks
Practical : 15 Marks
C.C.E. : 25 Marks
Total : 75 Marks

STRUCTURE OF QUESTION PAPER (Theory)

1   There will be one theory paper comprising of 17 questions. The student has to attempt total 13question out of 17 as per the directions given below:
2   Question no. 1 to 5 will be of one mark each.
3   Question no.6 to 14 will be of three marks each. Candidate can attempt any 5 questions out of 9 questions.
4   Question no.15 to 17 will be of five marks each. There will be internal choice in them.
5   Distribution of marks over different dimensions of the paper will be as follows.

LEARNING OUTCOMES	MARKS	PERCENTAGE OF MARKS
KNOWLEDGE	15	43%
UNDERSTANDING	15	43%
APPLICATION	5	14%
Total	35	100%

6   There will be no question of the objective type such as Yes/No, tick/cross, fill in the blanks, multiple choice, true/false etc.
7   Use of un-programmable calculator is allowed. The log tables can be used.
8   Total weightage of numerical will be 20%

UNITWISE DISTRIBUTION OF MARKS

SR.NO	UNIT	TOTAL MARK
1	Solid state	03
2	Solutions	02
3	Electro-chemistry	02
4	Chemical-kinetics	01
5	Surface chemistry	02
6	General principles &process of isolation of elements	01
7	p-block elements	06
8	d &f-block elements	06
9	Coordination number	01
10	Haloalkanes &Haloarenes	03
11	Alcohol, Phenols &Ether	03
12	Aldehyde, Ketons & Carbooxalic acids	01
13	Organic compounds containg Nitrogen compounds	01
14	Biomolecules	01
15	Polymers	01
16	Chemistry in everyday life	01
	TOTAL QUESTIONS &TOTAL MARKS	**T.Q=17** **T.M=35**

Total Question in paper =17 including 3 choice questions

SYALLBUS
THEORY

Unit 1: Solid, State

Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea), unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids packing efficiency, voids, number of atoms per unit cell in a cubic unit cell, points defects, electrical and magnetic properties. Band theory of metals, conductors, semiconductors and insulators and n and p type semiconductors.

Unit II: Solutions

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties - relative lowering of vapour pressure, Raoults Law, elevation of B.P., depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass. Vant Hoff factor.

Unit III: Electrochemistry

Redox reactions; conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Kohlrausch's Law, electrolysis and laws of electrolysis (elementary idea) dry cell-electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, fuel cells; corrosion. Relation between Gibbs Energy change and EMF of cell.

Unit IV: Chemical Kinetics

Rate of a reaction (average and instantaneous), factors affecting rates of reaction; concentration, temperature, catalyst; order and molecularity of a reaction: rate law and specific rate constant, integrated rate equations and' half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment). Activation Energy, Arrhenious equation.

Unit V: Surface Chemistry

Absorption physiorption and chemisorption; factors affecting adsorption of gases on solids; catalysis; homogenous and heterogeneous, activity and selectivity; enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophillic, lyophobic, multimolecular and macromolecular/colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsion-types of emulsions.

Unit VI: General Principles and Processes of Isolation of Elements

Principles and methods of extraction – concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminum, copper, zinc and Iron.

Unit VII: p-Block Element

Group 15 elements : General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen - preparation, properties and uses; compounds of nitrogen- preparation and properties of ammonia and nitric acids, oxides of nitrogen (structure only); Phosphorous-allotropic forms; compounds of phosphorous preparation and properties of phosphine, halides (PCl_3, PCl_5) and oxoacids (elementary idea only).

Group16 elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; dioxygen; preparation, properties and uses; classification of oxides; Ozone. Sulphur - allotropic forms; compounds of sulphur preparation, properties and uses of sulphur dioxide, sulphuric acid, industrial process of manufacture, properties and uses, oxoacids of sulphur (structures only).

Group 17 elements: (General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens;

preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structures only).

Group 18 elements: General introduction, electronic configuration. Occurrence, trends in physical and chemical properties, uses.

Unit-VIII   d and f Block Elements

General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals-metallic character, ionization, enthalpy, oxidation states, ionic radii, colour, catalytic properties, magnetic properties, interstitial compounds, alloy formation. Preparation and properties of $K_2Cr_2O_7$, and KM_nO_4.

Lanthanoids   - electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and consequences.   .

Actenoids - Electronic configuration, oxidation states.

Unit-IX Coordination Compounds

Coordination compounds - introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, bonding; Werner's theory VBT, CFT, Isomerism (structure and stereo) importance of coordination compounds (in qualitative analysis, extraction of metals and biological systems).

Unit-X   Haloalkanes and Haloarenes.

Haloalkanes:
Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions, optical rotation.

Halearenes:
Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only)

Uses and environmental effects of - dichloromethane, trichlromethane, tetrachloromethane, iodoform, freons, DDT.

Unit –XI   Alcohols, Phenols and Ethers

Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses, with special reference to - methanol and ethanol.

Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.

Ethers: Nomenclature, methods of preparation, physical and chemical properties, uses.

Unit-XII   Aldehydes, Ketones aml Carboxylic Acids

Aldehydes and Ketones: Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.

Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

Unit-XIII   Organic compounds containing Nitrogen

Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines.

Cyanides and Isocyanides - will be mentioned at relevant places in context.

Dizonium Salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

Unit-XIV   Biomolecules

Carbohydrates - Classification (aldoses and ketoses), monosaccaharides (glucose and fructose), oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); importance

Proteins - Elementary idea of amino acids, peptide bond, polypeptides proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.

Vitamins: Classification and functions.

Harmones: Elementary idea (excluding structure)

Nucleic Acids: DNA & RNA   .

Unit-XV   Polymers

Classification - natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers; natural and synthetic like polythene, nylon, polyesters, bakelite, rubber. Biodegradable and Non- Biodegradable Polymers.

Unit-XVI   Chemistry in everyday life :

1.   Chemicals in medicines analgesic, transquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

2.   Chemicals in food- preservatives, artificial sweetening agents. Elementary idea of antioxidents.

3.   Cleansing agents   - soaps and detergents, cleansing action.

STRUCTURE OF QUESTION PAPER (PRACTICAL)

Time: 3.00 hrs.   **Marks: 20**

Volumetric Analysis	6
Mixture Analysis	5
Content based Experiment	5
Class record & viva	4
Total Marks	20

PRACTICAL SYLLABUS

A.   Surface Chemistry

(a)   Preparation of one lyophilic and one lyophobic sol.

Lyophilic sol - starch, egg albumin and gum.

Lyophobic sol - aluminum hydroxide, ferric hydroxide, arsenious sulphide.

(b)   Study of the role of emulsifying in stabilizing the emulsions of different oils.

B.   Chemical Kinetics

(a)   Effect of concentration and temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid.

(b)   Study of reaction rates of any one of the following:-

(i) Reaction of iodide ion with hydrogen peroxide at room temperature using different concentration of iodide ions.

(ii) Reaction between potassium iodate, KIO_3, and sodium sulphite: ($Na_2 SO_3$) using starch solution as indicator (clock reaction).

C.   Thermochemistry

Any one of the following experiments

i)   Enthalphy of dissolution of copper sulphate or potassium nitrate.

ii)   Enthalphy of neutralization of strong acid (HCl) and strong base (NaOH)

iii)   Determination of enthalpy change during interaction (Hydrogen bond formation) between acetone and chloroform.

D.   Electrochemistry

Variation of cell potential in $Zn/Zn^{+2}IICu^{+2}/Cu$ with change in concentration of electrolytes ($CuSO_4$ or $ZnSO_4$ at room temperature.

E.   Chromatography

i)   Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of R_f values.

ii)   Separation of constituents present in an inorganic mixture containing two cations only (constituents having wide difference in R_f, values to be provided).

F.   Determination of concentration/morality of KMnO₄, solution by titrating it against a standard Solution of :   .
   (i)   Oxalic acid.
   (ii)   Ferrous ammonium sulphate.
        (Students will be required to prepare standard solutions by weighing themselves).

G.   Preparation of Inorganic Compounds
   i)   Preparation of double salt of ferrous ammonium sulphate or potash alum.
   ii)   Preparation of potassium ferric oxalate.

H.   Preparation of Organic Compounds
   Preparation of any two of the following compounds
        i)   Acetanilide
        ii)   Di-benzal acetone
        iii)   p-Nitroacetanilide,
        iv)   Aniline yellow òr 2-Napthol aniline dye.
        v)   Iodoform

I.   Test for the functional groups present in organic compounds:
   Unsaturation, alcoholic, pheholic, aldehydic, ketonic, carboxylic and amino (primary) groups.

J.   Study of carbohydrates, fats and proteins in pure form and detection of their presence in given food stuffs.

K.   Qualitative analysis
   Determination of one catiop and one anion in a given salt.

   Cations - Pb^{2+}, Cu^{2+}, As^{3+}, Al^{3+}, Fe^{3+}, M_n^{2+}, Zn^{2+}, Co^{2+}, Ni^{2+}, $Ca^{2+'}$, Sr^{2+}, Ba^{2+}, Mg^{2+}, NH_4^+

   Anions - Co_3^{2-}, S^{-2}, SO_3^{2-}, NO_2^{-1}, NO_3^{-1}, Cl^-, Br^-, I^{-1}, PO_4^{3-}, $C_2O_4^{2-}$, CH_2COO^-

   (Note: Insoluble salts excluded)

PROJECT

   Scientific investigations involving laboratory testing and collecting information from other sources.

A few suggested Projects
1.   Study of presence of oxalate ions in guava fruit at different stages of   ripening.
2.   Study of quantity of casein present in different samples of milk.
3.   Preparation of soyabean milk and its comparison with the natural milk with respect to curd formation, effect of temperature etc.
4.   Study of the effect of potassium bisulphate as food preservative under various conditions (temperature, concentration, time etc,)
5.   Study of digestion of starch by salivary amylase and effect of PH and temperature on it.
6.   Comparative study of the rate of fermentation of following material wheat flour. gram flour, Potato juice, carrot juice etc.
7.   Extraction of essential oils present in saunf (aniseed), Ajwain (carum) illaichi (cardamom).
8.   Study of common food adulterants in fat, oil, butter, sugar, turmeric powder, chilli powder and pepper.

Note: Any investigatory project, which involves about 10 periods of work, can be chosen with the approval of the teacher.

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