COURSE OF STUDY AND SCHEME OF EXAMINATION OF DIPLOMA VOCATIONAL IN ELECTRICAL EQUIPMENT MAINTENANCE
LEVEL V

S No	Subject	Subject Code	Period per week			Scheme of Examination					Total Marks	Credit
						Theory			Practical			
			L	T	P	ELE	CT	TA	EPE	TA		
		(A) Academic Part General Education										
1	MATHEMATICS	991551(14)	5	1	-	100	10	10	-	-	120	12
2	PHYSICS	991552(15)	3	1	-	70	10	10	-	-	90	08
3	CHEMISTRY	991553(11)	3	1	-	70	10	10	-	-	90	08
4	PHYSICS LAB	991561(15)	-	-	2	-	-	-	30	10	40	04
5	CHEMISTRY LAB	991562(11)	-	-	2	-	-	-	30	10	40	04
		(B) Vocational Part Vocational Education										
6	ELECTRICAL EQUIPMENT MAINTENANCE	991563(24)	-	-	17	-	-	-	600	20	620	34
	TOTAL		11	3	**21**	**240**	**30**	**30**	**660**	**40**	**1000**	**70**

L-Lecture, T-Tutorial P- Practical, ELE-End Level Exam, EPE-End Practical Exam, CT-Class Test, TA-Teachers Assessment

Assuming Total Duration 30 Weeks
Per Week 35 Periods One hour each

One Credit would mean equivalent of 15 period of 60 minutes each for Theory,Workshop/Labs and Tutorial.

SYLLABUS FOR MATHEMATICS

DIPLOMA VOCATIONAL IN ELECTRICAL EQUIPMENT MAINTENANCE
LEVEL : V
BRANCH DISCIPLINE : ELECTRICAL EQUIPMENT MAINTENANCE

TEACHING & EXAMINATION SCHEME:

S No	Subject	Subject Code	Period per week			Scheme of Examination					Total Marks	Credit
						Theory			Practical			
			L	T	P	ELE	CT	TA	EPE	TA		
01	**Theory**	**991551(14)**	5	1	-	100	10	10	-	-	120	12

DISTRIBUTION OF MARKS AND HOURS:

S. No.	Unit	*Topic*	No. of Hours/ Periods	Marks Allotted
1.	Unit I	**GEOMETRY : PLANE AND SOLID**		
		SECTION A	40	15
		SECTION B	40	20
2.	Unit II	**CALCULUS**		
		SECTION A	35	20
		SECTION B	25	15
3.	Unit III	**ALGEBRA AND TRIGONOMETRY**		
		SECTION A	20	15
		SECTION B	20	15
TOTAL			**180**	**100**

COURSE CONTENT:

Paper-I : GEOMETRY : PLANE AND SOLID

SECTION-A

Pair of Straight Lines :

Joint equation of pair of straight lines and angle between them, Condition of parallelism and perpendi1cularity, Joint equation of the angle bisectors, Joint equation of lines joining origin to the intersection of a line and a curve.

Circle :

General equation of circle, Circle through intersection of two lines, Tangents, normals, chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of midpoint, angle of intersection and orthogonality, power of a point w.r.t. circle, radical axis, coaxial family of circles, limiting points.

Conic :

General equation of a conic, tangents, normals, chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of mid-point, diameter. Conjugate diameters of ellipse and hyperbola, special properties of parabola, ellipse and hyperbola, conjugate hyperbola, asymptotes of hyperbola, rectangular hyperbola.

SECTION-B

Transformation of Axes in two Dimensions :

Shifting of origin, rotation of axes, invariants, reduction of general second degree equation

into standard forms by transformation, identification of curves and to find other parameters, tracing of conics.

Polar Co-ordinates :
Polar equation of a line, circle, conics, equations of chords, tangents and normals only.
Transformation of Axes in three Dimensions :Shifting of origin, rotation of axes.
Sphere :
Section of a sphere and a plane, spheres through a given circle, intersection of a line and a sphere, tangent line, tangent plane, angle of intersection of two spheres and condition of orthogonality, power of a point w.r.t. a sphere, radical planes, radical axis, radical center, coaxial family of spheres, limiting points.
Cylinder :
Cylinder as a surface generated by a line moving parallel to a fixed line and through a fixed curve, different kinds of cylinders such as right circular, elliptic, parabolic and hyperbolic cylinders in standard forms, enveloping cylinders.
Cone :
Cone with a vertex at the origin as the graph of a homogeneous equation of second degree in x, y, z, cone as a surface generated by a line passing through a fixed curve and a fixed point outside the plane of the curve, reciprocal cones, right circular and elliptic cones, right circular cone as a surface of revolution obtained by rotating the curve in a plane about an axis, enveloping cones.
Equations of ellipsoid, hyperboloid and paraboloid in standard form, tangent planes and normals.

Paper-II : CALCULUS

SECTION-A
Properties of Real Numbers :
Order property of real numbers, bounds, l.u.b. and g.l.b. order completeness property of real numbers, archimedian property of real numbers.
Limits :definition of the limit of a function, basic properties of limits, infinite limits.
Continuity : Continuous functions, types of discontinuities, continuity of composite functions, continuity of $|f(x)|$, sign of a function in a neighborhood of a point of continuity,intermediate value theorem, maximum and minimum value theorem.
Hyperbolic, inverse hyperbolic functions of a real variable and their derivatives, successive differentiation, Leibnitz's theorem.
Mean Value Theorems :Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, their geometric interpretation and applications, Taylor's theorem, Maclaurin's theorem with various forms of remainders and their applications.
Curvature : Curvature of a curve at a point, radius of curvature of Cartesian, parametric, polar curves and for implicit equations, evolute and involute, chord of curvature.

SECTION-B
Indeterminate forms, Asymptotes, Concavity, Convexity and points of inflexion, Multiple points, Tracing of curves (Cartesian and parametric co-ordinates only).
Integral Calculus :
Integration of hyperbolic and inverse hyperbolic functions, Reduction formulae, Application of definite integral, Quadrature, Rectification, Volumes and Surfaces of solids of revolution (Cartesian co-ordinates only).

PAPER- III : ALGEBRA AND TRIGONOMETRY

SECTION-A

Relation between sides and trigonometric ratios of the angles of a triangle, Circum-circle, incircle,ex- circles of a triangle and their radii, Orthocentre, and centroid. De'Moiver's theorem, application of De'Moiver's theorem including primitive nth root of unity. Expansions of sin n Ø, cos n Ø, sinn Ø, cosn Ø (n εN). The exponential, logarithmic, direct and inverse circular and hyperbolic functions of a complex variable.

Euclid's algorithm, synthetic division, roots and their multiplicity. Complex roots of real polynomials occur in conjugate pairs with same multiplicity. Relation between roots and coefficients. Transformation of equations. Descartes' Rule of Signs.

SECTION-B

Solution of cubic and bi-quadratic equations, Cardan's method of solving a cubic, discriminant and nature of roots of real cubic, trigonometric solutions of a real cubic with real roots. Descartes' and Ferrari's method for a bi-quadratic. Hermitian and Skew-Hermitian matrices, linear dependence of row and column vectors, row rank, column rank and rank of a matrix and their equivalence. Theorems on consistency of a system of linear equations (both homogeneous and non-homogeneous). Eigen-values, eigenvectors and characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding inverse of a matrix.

Recommended Textbooks.

1) Mathematics Part I - Textbook for Class XI, NCERT Publication
2) Mathematics Part II - Textbook for Class XII, NCERT Publication
3) Applied Maths I & II Deepak Pbs
4) Engineering Mathematics B.S.Garewal

SYLLABUS FOR PHYSICS

DIPLOMA VOCATIONAL IN ELECTRICAL EQUIPMENT MAINTENANCE

LEVEL : V

BRANCH DISCIPLINE : ELECTRICAL EQUIPMENT MAINTENANCE

TEACHING & EXAMINATION SCHEME:

SNo	Subject	Subject Code	Period per week			Scheme of Examination					Total Marks	Credit
						Theory			Practical			
			L	T	P	ELE	CT	TA	EPE	TA		
1	**Theory**	**991552(15)**	3	1	-	70	10	10	-	-	90	08
2	**Practical**	**991561(15)**	-	-	2	-	-	-	30	10	40	04
	Total		3	1	2	70	10	10	30	10	130	12

DISTRIBUTION OF MARKS & HOURS:

S. No.	Unit	*Topic*	No. of Hours/ Periods	Marks Allotted
1.	Unit I	Mechanics, Oscillations and Properties of Matter		
	1.1	Mechanics	15	07
	1.2	Oscillation	15	10
	1.3	Motion of charged particals in electric & magnetic fields	15	07
	1.4	Properties of matter	10	07
2.	Unit II	Course 2: Electricity, Magnetism and Electromagnetic Theory.		
	2.1	Mathematical Background	10	10
	2.2	Electrostatics	15	07
	2.3	Electric currents (steady & alternating)	10	07
	2.4	Magnetostatics	15	07
	2.5	Time varying fields & Electromagnetic Waves	15	08
TOTAL			**120**	**70**

Course Content:

Unit 1: MECHANICS, OSCILLATIONS AND PROPERTIES OF MATTER

1. 1 Mechanics :

Uniformly rotating frame; centripetal acceleration, Coriolis force and its applications. Center of mass, equation of motion, conservation of linear and angular momenta, conservation of energy, elastic and inelastic collisions.

Rigid body motion, rotational motion, moments of inertia and their products, principal moments and axes.Euler's equations.

1.2 Oscillations :

Harmonic oscillations, differential equation and its solution, kinetic and potential energy,Compound pendulum, Oscillations of two masses connected by a spring.

Superposition of two simple harmonic motions of the same and different frequencies

along the same line, Lissajous figures. Damped harmonic oscillators, power dissipation, quality factor, examples, driven harmonic oscillator, transient and steady states, power absorption, resonance in systems.

1.3 Motion of charged particles in electric and magnetic fields

E as accelerating and deflecting field-CRO, sensitivity, fast CRO, Linear accelerator.
Transverse B field; 180 a deflection, mass spectrograph or velocity selector.
Mutually perpendicular E and B fields-velocity selector, its resolution.
Parallel E and B fields; positive ray parabolas, discovery of isotopes, elements of mass spectrography, principle of magnetic focusing (lens).

1.4 Properties of matter

Elasticity, Hooke's law, bending moments and shearing forces.
Equations of continuity for fluids, Euler's equation, Bernaulli'stheorm, viscous fluids, streamline and turbulent flow. Poiseulle's law.Capillary tube flow.
Surface tension and surface energy, wetting.

Unit 2: ELECTRICITY, MAGNETISM AND ELECTROMAGNETIC THEORY

2. 1 Mathematical Background

Functions of two and three variables, partial derivatives, geometrical interpretation of partial derivatives of functions of two variables. Total differential of a function of two and three variables, higher order derivatives, applications. Repeated integrals of a function of more than one variables, definition of a double and a triple integral, evaluation of double and triple integrals as repeated integrals, change of variables of integration, Jacobian applications.

2.2 Electrostatics

Coulomb's law in vacuum expressed in vector forms, dipole and quadrupole fields.
Work done on a charge in an electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Electric potential , $\mathbf{E} = -\nabla\phi$, , torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application for finding E for symmetric charge distributions,. Screening of E field by a conductor, capacitors, electrostatic field energy. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, displacement vector D.

2.3 Electric Currents (steady and alternating)

Steady current, current density J, Kirchoff's law and analysis of multiloop circuits, rise and decay of current in LR and CR circuits, decay constants, transients in LCR circuits, AC circuits, complex numbers and their applications in solving AC circuit problems, complex impedance and reactance, series and parallel resonance, Q factor

2.4 Magnetomstatics

Force on a moving charge; Lorentz force equation and definition of 8, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio. Biot and Savart's Law, calculation of H order in simple geometrical situations, Ampere's Law
V.B = 0, V x B = f.!0 J, field due to a magnetic dipole.

2.5 Time Varying Fields and Electromagnetic Waves

Electromagnetic induction, Faraday's law, electromotive force $\varepsilon = \int E.dr,$, integral and differential forms of Faraday's law, mutual and self inductance, transformers, energy in a static magnetic field. The wave equation satisfied by E and B, plane electromagnetic waves in vacuum, Poynting's vector, Faraday effect.

PRACTICALS **60 hours**

(Any 15 experiments with at least 1 from each group from the lists of 7 groups given below.)

1 Mechanics, Oscillations and Properties of Matter

1. 1 Mechanics

1. Study of laws of parallel and perpendicular axes for moment of inertia.
2. Study of conservation of momentum in two dimensional oscillations.

1.2 Oscillations

1. Study of a compound pendulum
2. Study of damping of a bar pendulum under various mechanics
3. Study of oscillations under a bifilar suspension
4. Potential energy curves of a 1-Double system and oscillations in it for various amplitudes
5. Study of oscillations of a mass under different combinations of springs

1.3 Properties of Matter

1. Study of bending of a cantilever or a beam
2.Study of torsion of a wire (static and dynamic methods)
3. Study of flow of liquids through capillaries
4. Determination of surface tension of a liquid by different methods
5. Study of viscosity of a fluid by different methods

2 Electricity, Magnetism and Electromagnetic Theory

2. 1 Electrostatics

1. Characteristics of a ballistic galvanometer
2. Setting up and using an electroscope or electrometer

2.2 Moving Charges and Magnetostatics

1. Use of a vibration magnetometer to study a field
2. Study of B field due to a current
3. Measurement of low resistance by Carey-Foster bridge or otherwise
4. Measurement of inductance using impedance at different frequencies
5. Measurement of capacitance using impedance at different frequencies
6. Study of decay of currents in LR and RC circuits
7. Response curve for LCR circuit and resonance frequency and quality factor

2.3 Varying Fields and Electromagnetic Theory

1. Sensitivity of a cathode-ray oscilloscope
2. Characteristics of a choke
3. Measurement of inductance
4. Study of Lorentz force
5. Study of discrete and continuous LC transmission lines

3 Computer Programming I

1. Elementary Fortran programs, flowcharts and their interpretation
2. To print out all natural even/odd numbers between given limits
3. To find maximum, minimum and range of a given set of numbers
4. To compile a frequency distribution and evaluate moments such as mean; standard deviation etc.
5. To evaluate sum of finite series and the area under a curve
6. To find the product of two matrices
7. To find a set of prime numbers and Fibonacci series
8. Motion of a projective using computer simulation
9. Numerical solution of equation of motion
10. Motion of particle in a central force field
11. To find the roots of a quadratic equation

Recommended Textbooks.

1. Physics, Class XI, Part -I & II, Published by NCERT.
2. Physics, Class XII, Part -I & II, Published by NCERT
3. Applied Physics S.P.Paranjpey
4. Engineering Physics, Gaur & Gupta

SYLLABUS FOR CHEMISTRY

DIPLOMA VOCATIONAL IN ELECTRICAL EQUIPMENT MAINTENANCE
LEVEL : V
BRANCH DISCIPLINE : ELECTRICAL EQUIPMENT MAINTENANCE

TEACHING & EXAMINATION SCHEME:

S No	Subject	Subject Code	Period per week			Scheme of Examination					Total Marks	Credit
						Theory			Practical			
			L	T	P	ELE	CT	TA	EPE	TA		
1	Theory	991553(11)	3	1	-	70	10	10	-	-	90	08
2	Practical	991562(11)	-	-	2	-	-	-	30	10	40	04
	Total		3	1	2	70	10	10	30	10	130	12

DISTRIBUTION OF MARKS & HOURS:

S. No	Unit	*Topic*	No. of Hours/ Periods	Marks Allotted
1.	Unit I	**Inorganic Chemistry – I**		
		I Atomic Structure	07	05
		II Periodic Properties	07	04
		III Chemical Bonding	14	06
		IV p-Block Elements	07	04
		V Chemistry of Noble Gases	07	04
2.	UnitII	**Organic Chemistry – I**		
		I Structure and Bonding	06	02
		II Mechanism of Organic Reactions	07	03
		III Stereochemistry of Organic Compounds	07	04
		IV Alkanes and Cycloalkanes	07	04
		V Alkenes, Cycloalkenes, Dienes and Alkynes	08	05
		VI Arenes and Aromaticity	04	03
		VII Alkyl and Aryl Halides	02	03
3.	Unit III	**Physical Chemistry – I**		
		I Mathematical Concepts	07	03
		II Gaseous States	07	03
		III Liquid State	04	03
		IV Solid State	04	04
		V Colloidal State	07	04
		VI Chemical Kinetics and Catalysis	08	06
TOTAL			**120**	**70**

Course Content

UNIT I Inorganic Chemistry – I

I Atomic Structure

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of ψ and ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d orbitals.

II Periodic Properties

Atomic and ionic radii, ionization energy, electron affinity and electronegativity - definition, methods of determination or evaluation, trends in periodic table.

III Chemical Bonding

A. Covalent Bond - Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shelf electron pair repulsion (VSEPR) theory to NH_3, H_3O^+ , SF_4 , CIF_3, ICl_2^- and H_2O . MO theory, homonucfear and heteronuclear (CO and NO) diatomic molecules, mutt(center bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.
B. Ionic Solids - ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids.
C. Weak Interactions - Hydrogen bonding, van der Waals forces

IV p-Block Elements

Comparative study (including diagonal relationship) of groups 13-17 elements, hydrides of boron-diborane and higher boranes, borazine, fuJlerenes, carbides, fluorocarbons, silicates(structural principle).

V Chemistry of Noble Gases

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

UNIT II Organic Chemistry – I

I Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

II Mechanism of Organic Reactions

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagentselectrophiles
and nucleophiles.Types of organic reactions. Energy considerations.
Reactive intermediates - carbocations, carbanions, free radicals, Carbones, arynes and nitrenes (with examples).

III Stereochemistry of Organic Compounds

Concept of isomerism.Types of isomerism.
Optical isomerism - elements of symmetry, molecular chirality, enantiomers, stereogenic contra, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythrodiastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.
Relative and absolute configuration, sequence rules, D&L and R&S systems of nomenclature.
Geometric isomerism –Basic Concept

IV Alkanes and Cycloalkanes

IUPAC nomenclature of branched and unbranched alkanes, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes.
Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.
Cycloalkanes - nomenclature, methods of formation, chemical reactions.

V Alkenes, Cycloalkenes, Dienes and Alkynes

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration.The

Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes.
Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilfc and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidationwith $KMnO_4$.Polymerization of alkenes.
Methods of formation, conformation and chemical reactions of cycloalkenes.
Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Diels-Alder reaction.
Nomenclature, structure and bonding in alkynes. Methods of formation.Chemical reactions of alkynes, acidity of alkynes.Mechanism of electrophilic and nucleophilic addition reactions.

VI Arenes and Aromaticity

Nomenclature of benzene derivatives.The aryl group.Aromatic nucleus and side chain.
Structure of benzene: molecular formula and Kekule structure. Stability and carboncarbonbond
lengths of benzene, resonance structure, MO picture.
Aromaticity: the Huckel rule, aromatic ions.
Aromatic electrophitic substitution - general pattern of the mechanism, role of s- and Pcomplexes.
Frfedel-Crafts reaction. Activating and deactivating substituents,orientation and ortho/para ratio. Birchreduction.
Methods of formation and chemical reactions of alkylbenzenes

VII Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions.
Mechanisms of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactionswith energy profile diagrams.
Polyhalogen compounds: chloroform, carbon tetrachloride.
Methods of formation of aryl halides, nuclear and side chain reactions.

UNIT III-Physical Chemistry – I

I Mathematical Concepts

(A) Mathematical Concepts

Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like k_x, e_x, x_n, sin x, log x; maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions; permutations and combinations. Factorials. Probability.

II Gaseous States

Postulates of kinetic theory of gases, deviation from ideal behavior, van def Waals equation of state.
Critical Phenomena : PV isotherms of real gases, continuity of states, the isotherms of vander Waals equation, relationship between critical constants and van der Waals constants,the law of corresponding states, reduced equation of state.
Molecular velocities: Root mean square, average and most probable velocities. Qualitativediscussion of the Maxwell's distribution of molecular velocities, collision number,meanfree path and collision diameter. Liquification of gases (based on Joule-Thomson effect).

III Liquid State

Intermolecular forces, structure of liquids (a qualitative description).
Structural differences between solids, liquids and gases.
Liquid crystals: Introduction.

IV Solid State

Definition of space lattice, unit cell.

Laws of crystallography - (i) Law of constancy ofinterfaciaf angles (ii) Law of rationalityofindices (iii) Law of symmetry. Symmetry elements in crystals.

X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl and CsCl (Laue's method and Powder method.

V Colloidal State

Definition of colloids, classification of colloids.

Solids in liquids (sols): properties - kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number.

Liquids in liquids (emulsions): types of emulsions, preparation. Emulsifier.

Liquids in solids (gels): classification, preparation and properties, inhibition, general

VI Chemical Kinetics and Catalysis

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction - concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo order, half life and mean life. Determination of theorder of reaction - differential method, method of integration, method of half life period andisolation method.

Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis).

Catalysis, characteristics of catalysed reactions, classification of catalysis, miscellaneous examples.

PRACTICAL **60 Hours**

Inorganic Chemistry

Semimicro Analysis - cationanalysis,.separation and identification of ions from Groups I,II, III, IV, V and VI. Anion analysis.

Organic Chemistry

Determination of melting point

Naphthalene 80 – 82^{o}, Benzoic acid 121.6 -122^{o}

Urea 152.5 – 133^{o}, Succinic acid 184.5-185^{o}

Determination of boiling points(any two)

Ethanol 78^{o}, Cyclohexane 81.4^{o}, Toluene 110.6^{o}, Benzene 80^{o}

Mixed melting point determination

Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)

Distillation

Simple distillation of ethanol-water mixture using water condenser

Distillation of nitrobenzene and aniline using air condenser

Crystallization (any two)

Concept of induction of crystallization

Phthafic acid from hot water (using fluted filter paper and stemless funnel)

Acetanilide from boiling water

Naphthalene from ethanol

Benzoic acid from water
Decolourisation and crystallization using charcoal
Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration.
Crystallization and decolorisation of impure naphthalene (l00 g of naphthalene mixed with 0.3g of Congo Red using 19 decolorising carbon) from ethanol.
Qualitative Analysis
Detection of extra elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

PHYSICAL CHEMISTRY
Chemical Kinetics
1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
Distribution Law
To study the distribution of iodine between water and CCI_4.
Viscosity, Sur/ace Tension
1. To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.
2. To determine the percentage composition of `a given binary mixture by surface tension method (acetone & ethyl methyl ketone).
OR
Simultaneous measurements of surface tension and viscosity with Survismeter.

Recommended Textbooks.
1. Chemistry Part -I, Published by NCERT.
2. Chemistry Part -II, Published by NCERT.
3. Applied Chemistry, Jain & Jain

SYLLABUS FOR VOCATIONAL TRAINING

DIPLOMA VOCATIONAL IN ELECTRICAL EQUIPMENT MAINTENANCE
LEVEL : V
BRANCH DISCIPLINE : ELECTRICAL EQUIPMENT MAINTENANCE
TEACHING & EXAMINATION SCHEME:

S No	Subject	Subject Code	Period per week			Scheme of Examination					Total Marks	Credit
						Theory			Practical			
			L	T	P	ELE	CT	TA	EPE	TA		
1	**Practical**	**991563(24)**	-	-	17	-	-	-	600	20	620	34
	Total				17	-	-	-	600	20	620	34

DISTRIBUTION OF MARKS & HOURS:

CHAPTER NO.	CHAPTER NAME	HOURS
01	Safety precautions	55
02	Earthing & House Wiring	65
03	Rewinding of AC/DC Motors	150
04	Repair of Electrical Power Tools	150
05	Maintenance of Batteries	90
	TOTAL	510

COURSE CONTAINED:

CHAPTER 1: Safety Precaution

Safety Precautions

General safety tools & equipment
Safety equipment available with electrician while working on live electrical installation

CHAPTER 2: Earthing & House Wiring

ISI rules related to wiring
Diagram & system used in domestic wiring installation
Earthing – types
Earthing domestic installation
IE rule for Energy meter Installation

CHAPTER 3 Rewinding of AC/DC Motors

Knowledge about Single phase & three phase supply
Introduction of rewinding insulating material used
Terminology used in single phase & three phase winding like pole pitch, coil pitch etc
Method of stripping the old winding & preparing the winding former & the coils
Preparation of winding data for given motors
Procedure followed for rewinding of all kind of electric motors like single phase A/C motors, pump motors, ceiling fan motors, table fan motors, washing machine motor etc.
Various methods used of inserting coil into the slots
Preparation of winding table, connection diagram, winding diagram for given motors

Test to be done after rewinding, impregnation methods of winding

CHAPTER 4: Repairs of Electrical Power Tools

Classification of single phase motors – parts, construction & working of single phase motors
Classification of electrical power tools as per their application like hand drilling machine, angle grinder, rotary hammer, sander/polisher, blower, heavy duty cutter, portable cut off saw etc.
Trouble shooting technique in electrical power tools – like insulation testing armature defects, field winding, stator winding defects, noisy operation bearing problem, carbon brush changing, turning the commutator surface.
Symptoms & causes of motor troubles – preventive & breakdown maintenance

CHAPTER 5: Maintenance of Batteries

Construction a lead acid battery
How to keep lead acid battery health
Recharging of battery
Check the condition of battery, reading of hydrometer
Preparation of electrolyte & chemical effect
Battery chargers & its applications
Precautions to be taken while operations

PRACTICAL EXPERIENCES

1. Study about safety precautions
2. Common hand tools, their uses, care & maintenance.
3. Identifying the wiring accessories aa per symbols
4. Carryout the wiring in PVC casing & capping as per layout
5. Carryout pipe earthing& plate earthing
6. Carryout domestic installation testing
7. List the conducting & insulating materials used in motor winding
8. Testing the motor before declaring for rewinding
9. Prepare the winding former & the coils
10. Method of stripping the old winding & preparing the winding former & the coils
11. Method of inserting coil in the slots
12. Making end connections of winding
13. Testing the motor after rewinding
14. Impregnation methods of winding
15. Dismantling & reassembling of single phase motors like permanent capacitors, capacitor start induction run, capacitor start capacitor run

16. Dismantling & reassembling of universal motors
17. Dismantling & reassembling of electrical power tools used like hand drilling machine, angle grinder, heavy duty mini grinder, heavy duty cutter
18. Dismantling & reassembling of electrical power tools rotary hammer, marble cutter, sander/polisher, blower, portable cut off saw etc
19. Trouble shooting in hand tools testing of insulation, armature defects, capacitor testing,
20. Replacing carbon brush after bedding
21. Testing the protective devices
22. Preventive maintenance of hand tools, overhauling, changing defective parts etc.
23. Preparation of electrolyte
24. Preparation of cells & arrangements of cells
25. Assembling of battery
26. Charging/ recharging of battery
27. Care & preventive maintenance of battery

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1. Electrical Appliances Anwani, J.M. R.B. Publications, New Delhi
2. Basic Electrical Engineering Mittal, V.N. Tata McGraw-HillNew Delhi
3. Electrical Installation Maintenance & testing Qureshi M.F, Deepak pbs.