JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)

"A" Road, Churchgate, Mumbai - 400 020, India.

Affiliated to
University of Mumbai

Program : B.Sc.

Proposed Course: Chemistry

Semester III

Credit Based Semester and Grading System (CBCS) with effect from the academic year 2020 -21

Academic year 2020-2021

Semester III			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SCHE301	Principles of Physical & Analytical Chemistry I	3	3
SCHE302	Principles of Inorganic Chemistry I	3	3
SCHE303	Principles of Organic Chemistry I	3	3
SCHE3PR	Practical Course work in Chemistry III	2.5	9

Course: SCHE301	**Principles of Physical & Analytical Chemistry I (Credits: 3 Lectures/Week: 3)** **<u>Course description:</u>** **Thermodynamics, Electrochemistry, General Analytical Chemistry**	
	Objectives: ➢ To learn the theoretical principles of thermodynamics and its various applications ➢ To understand the concept of conductivity including its measurement ➢ To understand concepts involved in electrolytic cells and their applications. ➢ To study various photochemical reactions. ➢ To equip the learner on selecting a method of analysis and acceptability of the results	
	Learning Outcomes ➢ Learner is capable of applying the concepts of thermodynamics to spontaneity of reaction and predict the direction of movement of reaction based on the chemical potential. ➢ Learner is able to conceptualize and infer from the conductance measurements of solutions and the factors affecting conductivity. ➢ Learner is able to extrapolate the learning of electrolytic cells to industrial process involving purification of metals, electroplating etc. ➢ Learner is introduced to analytical methods and is able to select a method based on parameters.	
Unit I	**Unit – I: Chemical Thermodynamics & Electrochemistry** **1. Chemical Thermodynamics:** **a) Free Energy Functions** i. Helmholtz Free Energy ii. Gibb's Free Energy iii. Variation of Gibb's free energy with Pressure and Temperature. iv. Change in free energy for ideal gases **b) Gibbs-Helmholtz equation** **c) Thermodynamics of Open System** i. Partial Molal Properties ii. Chemical Potential - its variation with Pressure and Temperature iii. Gibb's Duhem equation **d) Concept of Fugacity, Activity and Activity coefficient** **e) van't Hoff's reaction isotherm and van't Hoff's reaction isochore** (Numerical expected) **2. Solutions of Electrolytes:** **a) Recapitulation of Electrolytic conductance** i. Difference between electrolytic and electronic conductors	**15 L** **8 L** **7L**

	ii. Measurement of conductance – conductivity cell iii. Specific, molar and equivalent conductance, variation of equivalent conductance with concentration: weak and strong electrolytes iv. Debye-Huckel theory of strong electrolytes **b) Kohlrausch's law of independent migration of ions** **c) Applications of conductance measurements** i. Determination of degree of ionization and ionization constant of weak electrolyte ii. Solubility and solubility product of sparingly soluble salts (Numerical expected)	
Unit II	**Unit – II: Electrochemistry & Photochemistry** **1. Electrochemistry:** **a) Electrochemical conventions, Classification of electrochemical cells –Galvanic & Electrolytic cells, Reversible and irreversible cells.** **b) Nernst equation for cell emf and for single electrode potential and its importance (**Derivation & Numerical problem expected) **c) Types of electrodes** v. Indicator electrodes vi. Reference electrodes **d) Standard electrode potential, electrochemical series** **e) Cell representation and cell reactions.** **f) Application of e.m.f. measurements** Determination of thermodynamic parameters of reversible cell- ΔG, ΔH,ΔS and equilibrium constant (Numericals expected) **2. Photochemistry** **a) Laws of Photochemistry:** Grotthus –Draper law, Stark-Einstein's law of photochemical equivalence**.** **b) Quantum yield and its determination using actiometer,** Primary and secondary photochemical reactions, Reasons for high and low quantum yields**.** **c) Photochemical reactions:** Combination of H_2 & Cl_2, Dissociation of HI and HBr. **d) Photochemical processes :** Fluorescence, Phosphorescence, Chemiluminescence, photochemical smog, formation and depletion of ozone layer in stratosphere.	**15 L** **8 L** **7 L**

	Unit – III: Instrumental Methods-I	**15 L**
Unit III	**1. Basic Concepts in Instrumental Methods** **a) Relation between Analyte, Stimulus and measurement of change in the observable property** **b) Block Diagram of an Analytical instrument** **c) Types of Analytical Instrumental methods on the basis of:** i. Optical interactions (e.g. Spectrometry: UV-Visible, Polarimetry) ii. Electrochemical interactions (e.g. Potentiometry, Conductometry) iii. Thermal interactions (e.g. Thermogravimetry) **2. Spectrometry** **a) Interaction of electromagnetic radiation with matter:** i. Absorption ii. Emission spectroscopy **b) Basic Terms:** Radiant Power, Absorbance, Transmittance, Monochromatic light, Polychromatic light, Wavelength of maximum absorbance, Absorptivity and Molar Absorptivity **c) Beer's Law and Lambert's Law** i. Statement of Beer's Law and Lambert's Law ii. Combined Mathematical Expression of Beer-Lambert's Law iii. Validity of Beer-Lambert's Law iv. Deviations from Beer-Lambert's Law (Real deviations, Instrumental deviations & Chemical deviations) (Numerical problems expected on Beer-Lambert's Law) **d) Block Diagrams Instrumentation for absorption spectroscopy:** i. Single and double beam Colorimeters ii. Single and double beam Spectrophotometers (Principle, Construction and Working-details of Components expected i.e. Source, Sample holder, Filters/Monochromators, Detectors such as Photomultiplier tube)	**5 L** **10L**

References:

Unit – I and II

1. Puri,Sharma, Pathania, Principles of Physical Chemistry, 46th Edition,Vishal Publishing Co.(Chapter 17&25)
2. Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
3. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
4. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry CengageLearning India Pvt.Ltd., New Delhi (2009).
5. Mahan, B.H. University Chemistry 3rd Ed. Narosa Publications (1998).
6. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co., NewYork (1985).
7. K.L.Kapoor A textbook of Physical Chemistry3rd Ed. vol.1,2Macmillan Publishing Co., NewDelhi (2001)
8. Atkins P. W., and Paula J. De, *Physical Chemistry*, 10th ed., Oxford University, 12 press (2014).

Unit III

1. Skoog,Holler,Nieman,Principles of Instrumental Analysis,5th Edition Harcourt Brace college publishers (ch.1)
2. D. A. Skoog, D.M.West, F.J.Holler, Fundamantal Analytical Chemistry, 7th Ed.(1996)
3. G.D.Christian, Analytical Chemistry, 6th Ed., John Wiley &Sons, New York, (2003).
4. J.G.Dick, Analytical Chemistry, International Student'sEdition, McGraw Hill,Kogakusha Limited, New Delhi, (1973).
5. Chatwal, Gurdeep R., Anand, Sham K., Instrumental Methods of Chemical Analysis, 2nd ed.(1984)
6. Willard, Merritt, Dean, Settle, Instrumental Methods of Analysis,7 th Edition,United states,(1988)

Semester III – Theory

Course: SCHE302	**Principles of Inorganic Chemistry I (Credits: 3 Lectures/Week: 3)** **Course description:** **Chemical bonding, Chemistry of p-block elements, classical methods of analysis**	
	Objectives: ➢ To understand the principles of chemical bonding and the fundamental concepts of hybridisation and resonance ➢ To have an in-depth understanding of wave mechanical principles of VBT and MOT ➢ To understand the physical and chemical properties of some important compounds of group 13, 14 and 15 ➢ To study the industrial process involved in the manufacture of important inorganic chemicals ➢ To study the classical methods involved in analysis namely volumetry and gravimetry	
	Learning Outcomes: ➢ Learner is capable of explaining experimental observations based on the bonding theories and also is able to make prediction of various experimental observables ➢ Learner is able to correlate abstract wave mechanical principles to account for various experimental observations ➢ Learner is equipped with a range of dynamic physical and chemical properties of p block elements ➢ Learner is able to understand the requirements for an industrial setup of manufacture of inorganic chemicals ➢ Learner is acquainted with the types of classical methods of analysis, its applications and limitations	
Unit I	**Chemical Bonding: Non-Directional & Directional bonding: Orbital approach** **1. Non-Directional Bonding: Ionic Bond** i. Conditions for the Formation of Ionic Bond ii. Types of Ionic Crystals iii. Radius Ratio Rules (trigonal) iv. Lattice Energy: Definition & consequences of lattice enthalpy (thermal stability of carbonates, oxidation states & solubility) v. Borne-Lande Equation vi. Kapustinski Equation vii. Born-Haber Cycle (Numerical expected)	**15 L** **6 L**

	2. Directional Bonding:	**9 L**
	a) Valence Bond Theory i. Introduction and basic terms ii. Interaction between two hydrogen atoms and the potential energy diagram of the resultant system iii. Corrections applied to a system of two hydrogen atoms- Formation of H_2 iv. Bonding in Polyatomic Species 1. Energetics of hybridization 2. Types of hybrid orbitals- *sp*, sp^2, sp^3, sp^3d, sp^3d^2 3. Equivalent and non-equivalent hybrid orbitals 4. Bent's rule	
	b) Molecular Orbital Theory i. Comparison of Atomic and Molecular Orbitals ii. Linear combination of atomic orbitals to give molecular orbitals: (LCAO-MO approach for diatomic homonuclear molecules) iii. Wave mechanical treatment for molecular orbitals (H_2^+) iv. MOT of homonuclear diatomic molecules; v. Bond order & magnetic properties (H_2 to Ne_2) vi. Molecular Orbital Theory, Bond Order & Magnetic property for O_2, O_2^+, O_2^-, O_2^{2-}, O_2^{2+} vii. Molecular Orbital Theory of heteronuclear diatomic molecules (HCl, CO, NO)	
	Unit – II: Chemistry of p-Block elements	**15 L**
Unit II	a. Trends in periodic properties: Electronic configuration, atomic and ionic size, metallic/non-metallic character, melting point, ionization enthalpy, electron gain enthalpy, electronegativity, Oxidation states, Catenation, Allotropy of C, P, S.	**2L**
	b. Inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.	**1 L**
	c. Trends in chemical reactivity:	
	i. Acidic/basic nature: 1. Acid, amphoteric and basic character of oxides and hydroxides (Group 13) 2. Relative strengths of trihalides (Group 13) - effect of back bonding 3. Relative strength of oxoacids of halogens	**3 L**
	ii. Structure, bonding, preparation and properties: 1. Hydrides: hydrides of Group 13, Group 14, Group 15 (EH_3 where E = N, P, As, Sb, Bi), Group 16 and Group 17. 2. Occurrence, Structure and inertness of SiO_2 3. Oxides: oxides of nitrogen, phosphorus, sulphur and chlorine	**7 L**

	4. Oxoacids: oxoacids of nitrogen, phosphorus and chlorine, peroxoacids of sulphur 5. Halides: halides of silicon and phosphorus d. Synthesis of Ammonia by Haber-Bosch Process and Sulphuric acid by Contact Process	**2L**
Unit III	**UNIT III: Classical method of Analysis** **a) Titrimetric Methods** i. Terms involved in titrimetric methods of analysis Comparison of volumetry and Titrimetry ii. Conditions suitable for titrimetry iii. Tools of Titrimetry 1. Graduated glassware and its Calibration 2. Standard solutions (Primary and Secondary standards in Titrimetry) iv. Calculations in Titrimetry v. Types of titrimetry 1. Principle, method and indicators used 2. Neutralization titrations (Acidimetry, alkalimetry) 3. Redox titrations (Iodometry, Iodimetry) 4. Precipitation titrations 5. Complexometric titrations **b) Neutralization Titrations** i. Concept of pH and its importance in Neutralization Titrations ii. End point and Equivalence point of Neutralization titrations iii. Determination of End point: 1. With indicators causing colour change 2. By potentiometry (change in potential) 3. By conductometry (change in conductance) iv. Construction of titration curve (on the basis of change in pH): 1. Titration of strong acid-weak base 2. Titration of strong base-weak acid **c) Gravimetric Analysis** i. General Introduction to Gravimetry ii. Types of Gravimetric Methods iii. Precipitation Gravimetry: 1. Steps involved in precipitation gravimetric analysis 2. Conditions for precipitation 3. Completion of precipitation 4. Role of Digestion, Filtration, Washing, Drying Ignition of precipitate. 5. Applications of Gravimetric Analysis: (A) Determination of sulfur in organic compounds; (B) Estimation of Nickel in Cu-Ni alloy	**15 L** **4 L** **5 L** **6 L**

References:

Unit I & II

1. Principles of Inorganic Chemistry, B.R. Puri, L.R Sharma, K.C. Kalia, Vishal Publishing, (2017).
2. Concise Inorganic Chemistry, J.D. Lee, Wiley India, 5th Edition (2009)
3. Inorganic Chemistry, J.E. Huheey, E.A. Keiter, R.L. Keiter, Pearson Education, 4th edition (2005)
4. Satya Prakash, G.D. Tuli, R.D. Madan, S.K. Basu *Advanced Inorganic Chemistry*, S.Chand Publication.(Reprint 2011)

Unit III

1. Principles of Instrumental analysis, D. A. Skoog, 5th edition, Chapters: 24& 25 Page nos: 549 – 580.
2. Vogel's Text book of quantitative chemical analysis,5th edition.[Chapter 13 (pg. no. 519-527) & chapter 15 (pg. no. 548-590)]
3. Analytical Chemistry by Gary Christian,5th edition, chapters 11 &12, pg.nos. 299-370
4. Analytical Chemistry by Gary D. Christian, Purnendu K. Dasgupta, Kevin A. Schug, 7th Ed. (2013)

Course: SCHE303	**Principles of Organic Chemistry -I (Credits: 2 Lectures/Week: 3)** **<u>Course description:</u>** **Functional group chemistry of alkyl and aryl halogenated and oxygenated organic compounds, Chemistry of Carbonyl compounds and Polymer chemistry.**	
	Objectives: ➢ To describe the reactions of halogenated and oxygenated organic compounds of aliphatic and aromatic hydrocarbons ➢ To predict the reactivity and stereochemistry of halogenated and oxygenated organic compounds ➢ To understand the theory of organic polymers and their applications ➢ To reproduce the chemistry of carbonyl compounds involving the preparation and reactions of aldehydes and ketones ➢ To predict the reactivity of the carbonyl group of aldehydes and ketones based on the nature of substrate and reaction conditions	
	Learning Outcomes: ➢ Learner is able to link the spot tests for various functional groups done in the laboratory with the characteristic reactions of functional groups. ➢ Learner is thorough with the structures of various organic polymers and their properties & functions in day to day life. ➢ Learner is equipped with the knowledge of recycling of plastics by physical and chemical methods to curb the growing plastic menace. ➢ Learner can apply the reactions of carbonyl compounds towards synthesis of commercially important compounds using the rich carbonyl chemistry.	
Unit I	**Unit I: Functional group chemistry of organic compounds containing halogen & oxygen** **1. Arenes and aryl halides** **a) Linear and angular arenes and alkyl arenes and their applications.** i. Preparation of alkyl arenes: Friedel Crafts alkylation (mechanism expected) ii. Applications, and limitations. Use of olefins and alcohols for generation of carbocations. iii. Reactions: side chain oxidation; ring vs side chain halogenation **b) Haloarenes** i. Reactivity of aryl halides towards nucleophilic substitution ii. Mechanism of nucleophilic aromatic substitution: iii. Addition-Elimination (SN_{Ar}); Elimination-Addition (Benzyne) iv. Effect of substituents on SN_{Ar} reaction of haloarenes v. Applications of haloarenes – Grignard Reagents, Preparation of Biphenyls (Ullmann reaction)	**15 L** **2 L** **4 L**

	2. Compounds containing oxygen – Phenols & epoxides **a) Phenols** i. Applications of phenols ii. Preparation of phenols from: a) Haloarenes b) Aromatic sulphonic acids c) Isopropyl and 2-butyl benzene by hydroperoxide method iii. Physical properties: H-bonding – Types and effects on physical properties (w.r.t. o- and p-nitrophenol) iv. Acidity of phenols a) Comparison of acidity of alcohols and phenols b) Effect of substituents on the acidity of phenols v. Reactivity of Phenol vs Phenoxide ion vi. Reactions of phenols: a. Salt formation b. Williamson's synthesis c. O-alkylation, O-acylation, O-benzoylation (Schotten-Baumann reaction) d. Halogenation, Nitration e. Fries rearrangement f. Claisen rearrangement **b)** Epoxides a. Methods of preparation: moist silver oxide, peracids b. Ring opening reactions of epoxides (regioselectivity)	**7 L** **2 L**
Unit II	**Unit – II: Chemistry of carbonyl compounds** **a) Preparation of carbonyl compounds** i. Oxidation of alcohols using PCC ii. Hydration of alkynes iii. Grignard reagent (esters & nitriles) iv. Rosenmund reaction v. Gatterman Koch formylation vi. Friedel-Craft acylation **b) Structure & reactivity** i. Comparison of reactivity of: aldehydes & ketones; aromatic & aliphatic carbonyls ii. Acidity of alpha hydrogen iii. Keto-enol tautomerism & mechanism of acid & base catalysed enolisation	**15 L** **2 L** **3 L**

	c) Nucleophilic reactions i. General mechanism & reactions with: $NaHSO_3$, HCN, RMgX, ROH, NH_2G derivatives	**3 L**
	d) Reactions due to presence of alpha hydrogen i. Modifications of Aldol condensation (Knoevenagel & Claisen-Schmidt condensation) ii. Haloform reaction ii. Haloform reaction	**4 L**
	e) Reactions due to absence of alpha hydrogen i. Canizzaro's reaction ii. Benzoin condensation	**2 L**
	f) Reduction i. Using hydride reducing agents ii. MPV reduction iii. Clemmensen's reduction iv. Wolff-Kishner reduction	**1 L**
Unit III	**UNIT III: Polymer Science** **This unit will comprise of two aspects:** **I. Classroom learning - Theoretical aspects of polymer science** **II. Project-based learning – Industry visits, Surveys, etc**	**15 L**
	a) **Introduction:** Concept of monomer, polymer, polymerization reaction, degree of polymerization. Number average molecular weight, Weight average molecular weight. Polydispersity index.	**2 L**
	b) **Classification** of polymers on the basis of: **i.** Origin (Natural and Synthetic), **ii.** Type of monomers in a polymeric chain (Homopolymer and Copolymer) **iii.** Physical Properties of polymers (Plastics, Thermoplastics, Thermosets, Fibres, Resins, Elastomers).	**1 L**
	c) **Polymerization reactions:** Addition and condensation polymerization with examples. Mechanism of cationic, anionic and free radical addition polymerization.	**3 L**
	d) **Stereochemistry:** Tacticity, Metallocene-based Ziegler Natta polymerization of alkenes.	**1 L**

	e) **Preparation and applications of the following:** i. Thermosetting plastics – Phenol-formaldehyde, Polyurethanes ii. Thermosoftening – PVC, polythene iii. Fabrics (natural and synthetic) - Acrylic, polyamido and polyester iv. Rubbers (natural and synthetic) – Buna S, Chloroprene, Neoprene; Vulcanization of rubber	**4 L**
	f) **Polymerization techniques** i. Solution polymerization ii. Emulsion polymerization iii. Suspension polymerization iv. Bulk polymerization	**2 L**
	g) **Polymer Additives:** Plasticizers, Stabilizers, fillers	**1 L**
	h) **Frontiers in Polymer Science:** Introduction to liquid crystal polymers, Biodegradable and conducting polymers with examples.	**1 L**
	II. Project – Experiential learning - Students are to be taken for a field/industry visit to learn about various aspects of polymer technologies. They are to be made aware of the menace of indiscriminate use of plastics and its possible remedial measures in any one of the following forms: surveys, awareness campaigns, write-ups in blogs/social media platforms, presentations, skits, flash mobs, etc to create such awareness in society.	

References:

1. Morrison, R. T.; Boyd, R. N. (2012). *Organic Chemistry*. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. (2012). *Organic Chemistry (Volume 1)*. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Solomons, T.W.G. (2009).*Organic Chemistry*,John Wiley & Sons, Inc.
4. Ahluwalia, V.K.; Parashar, R.K. (2006) *Organic Reaction Mechanisms.* Narosa Publishing House.
5. Mukherji; Singh; Kapoor. (2002) *Reaction Mechanisms in Organic Chemistry.* Mc Millan
6. Mc Murry, J.E. (2013). Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition.
7. Kalsi, P. S. (1990) Textbook of Organic Chemistry 1st Ed. New Age International (P) Ltd. Pub.
8. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P. (2012) Organic Chemistry. Oxford University Press.

Course: SCHE3PR	**Practical Course work in Chemistry-III (Credits: 2.5 Practicals/Week: 3)**

Objectives:

- To understand the application of measurement of conductance for weak electrolytes
- To understand and learn the handling of photometer for coloured solutions
- To determine the formation of precipitate under different pH conditions
- To learn the technique associated with gravimetric analysis and quantitatively calculate the percentage weight of the complex formed
- To perform one-step synthesis of organic compounds
- To identify the type and separate the components of a binary mixture based on physical methods

Learning Outcomes:

- Learner is able to correlate the values of conductance with the strength of electrolytes and also use conductivity measurements for titrimetric analysis.
- Learner is able to handle basic analytical instruments independently.
- Learner is able to set up one step organic reactions including calculations for theoretical and percentage yields, and purification technique of recrystallisation used in organic chemistry.
- Learner is equipped with the use of classical method of gravimetry for quantitative analysis of analyte.

PRACTICAL – I

1. Instrumental Experiments

a. To verify Ostwald's dilution law for a weak acid conductometrically
b. To determine the dissociation constant of a weak acid conductometrically.
c. To determine standard EMF and standard free energy of Daniel Cell photometrically.
d. To determine the amount of HCl in given sample potentiometrically using quinhydrone electrode.
e. To determine solubility and solubility product of sparingly soluble salt conductometrically.
f. To determine λ_{max} and molar extinction coefficient (ε) of potassium permanganate colorimetrically.

2. Non-Instrumental Experiments

a. To determine the energy of activation for acid catalyzed hydrolysis of methyl acetate

3. Chemical Calculations

a. Formality, mole fraction, dilution of solutions
b. Interconversion between different concentration units
c. Concept of millimoles, milliequivalents
(Numerical expected)

PRACTICAL – II

1. **Qualitative analysis:** (at least 6 mixtures to be analyzed with interfering radicals and typical combinations)
   Cations: Pb^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Cu^{2+}, Cd^{2+}, Fe^{2+}, Ni^{2+}, Mn^{2+}, Mg^{2+}, Al^{3+}, Cr^{3+}, K^{+}, NH_4^{+})
   Anions: CO_3^{2-}, S^{2-}, SO_3^{2-}, NO^{2-}, NO^{3-}, Cl^{-}, Br^{-}, I^{-}, SO_4^{2-}, BO_4^{3-}, $C_2O_4^{2-}$ PO_4^{3-})

2. **Gravimetric analysis:**
   a. Gravimetric estimation of Nickel (II) as Ni-DMG and calculation of percentage error
   b. Gravimetric estimation of barium ions using K_2CrO_4 as precipitant and calculation of percentage error

PRACTICAL – III

1. Preparation of Organic Derivatives

a) Preparation of β-naphthylbenzoate from β-naphthol
b) Preparation of cyclohexanone oxime from cyclohexanone
c) Preparation of iodoform from acetone
d) To prepare 4-bromoacetanilide from acetanilide
e) To prepare hippuric acid from glycine
f) To prepare 5-nitrosalicylic acid from salicylic acid
g) To prepare hydroquinone diacetate from hydroquinone
h) To prepare benzoic acid from ethyl benzoate

(Minimum 5)

*Students are expected to record the M.P of purified product.

Evaluation Scheme

A. Evaluation scheme for Theory courses

I. Continuous Assessment (C.A.) - 40 Marks

(i) C.A.-I: Test – 20 Marks of 40 mins. duration

(ii) C.A.-II: Assignment/ Poster/Worksheets for 20 marks

II. Semester End Examination (SEE)- 60 Marks

B. Evaluation scheme for Practical courses

I. Semester End Examination (SEE)