BASIC PHYSICAL CHEMISTRY
EC502

Lecture : 3 Year:II
Tutorial : 1 Part: I
Practical : 3

Course Objective:
To familiarize the student with basic principle of physical chemistry which can be applied in chemical engineering.

1. **Atomic Structure (wave mechanical concept)** **(5 hours)**
   - 1.1 de Broglie equation, Group and phase velocity, Heisenberg's uncertainty principle and its applications
   - 1.2 Wave function and its significance, Schrodinger wave equation; Quantum tunneling, particle in 1D box
   - 1.3 Quantum numbers and ground state electron configuration of elements

2. **Thermodynamics** **(5 hours)**
   - 2.1 Adiabatic expansion of an ideal gas (TV-relation, PV-relation and PT relation), comparison between isothermal and adiabatic expansion, work done in reversible adiabatic expansion, Joule"s Thomson effect.
   - 2.2 Second law of thermodynamics, Heat Engine and Efficiency, Reversible and Irreversible process, Internal combustion Engine, Entropy and its physical significance.
   - 2.3 Free energy and work function, criteria of spontaneity and equilibrium in terms of entropy and free energy,
   - 2.4 Third law of thermodynamic, Gibbs Helmholtz equation and Clapeyron-Calusius equation

3. **Nuclear chemistry** **(3 hours)**
   - 3.1 Types of radiation, Fajans-Soddy displacement law, Disintegration series
   - 3.2 Rate of decay, Half-life, Units of radioactivity, radioactive dating, law of successive disintegration, radioactive equilibrium, age determination - dating by C^{14}.
   - 3.3 Nuclear binding energy, Fission & fusion, Nuclear chain reaction, Nuclear energy

4. **Theory of dilute Solution** **(3 hours)**
   - 4.1 Colligative properties, lowering of vapor pressure (Raoults law). Elevation of boiling point, depression of freezing point, osmotic pressure.
   - 4.2 Colligative properties of electrolyte.

5. **Principle of Titration** **(4 hours)**
   - 5.1 Volumetric titration
   - 5.2 Conductivity of electrolyte, solubility products of sparingly soluble salts conductometric titration
   - 5.3 pH and pH scale, determination of pH using glass, quinhydrone and antimony-antimony oxide electrodes, Potentiometric titration

6. **Colloids** **(3 hours)**
   - 5.1 Lyophilic and lyophobic sols or colloids, dialysis, Tyndall effect
   - 5.2 Electrophoresis, gold number
   - 5.3 Cleansing action of detergents, emulsion, gel, determination of molecular weight of macromolecules.

7. **Chemical Kinetics** **(5 hours)**
   - 7.1 Rate of reaction, order of reaction, integrated rate equation for zero, first, second and third order reaction
   - 7.2 Rate constant, half-life period, measurement of order of reaction, study of kinetic of two reactions (hydrolysis & saponification)
   - 7.3 Factors affecting rate of reaction, Arrhenius equation

8. **Physical Properties & chemical constitution** **(8 hours)**
   - 8.1 Surface tension and chemical constitution, viscosity and chemical constitution
   - 8.2 Rheochor, parachor and dipole moment
   - 8.3 Optical activity and chemical constitution, Magnetic properties (para and dia)
   - 8.4 Electromagnetic spectrum, molecular energy levels
   - 8.5 Rotational, vibrational and electronic energy
   - 8.6 IR, UV-Visible, Raman, NMR, Mass spectroscopy

9. **Photochemistry and electrocatalysis** **(4 hours)**
   - 9.1 Photochemical reaction, laws of photochemistry
   - 9.2 Quantum yield, photosynthesized reactions, electrocatalyst
   - 9.3 Photo physical process, fluorescence, phosphorescence, chemiluminescence

10. **Surface chemistry** **(3 hours)**
   - 10.1 Adsorption; types and mechanism
   - 10.2 Adsorption isotherms; Freundlich and Langmuir
   - 10.3 Application of adsorption
   - 10.4 Ion-exchange adsorption and its application

11. **Separation methods** **(2 hours)**
   - 11.1 Solvent extraction
   - 11.2 Chromatography (TLC, column, GC-MS, HPLC)

References:

1. Maron & Prutton, "Principles of Physical Chemistry, The Macmillan Company
2. Arun Bahl, B. S. Bahl & G.D. Tuli "Essential of Physical Chemistry", S. Chand Publication, New Delhi

Practical:

1. To study the kinetics of the oxidation of iodides by persulphate solution using iodine clock method (3 hours)
2. To find out the strength of ammonia solution by titrating against acetic acid solution using pH meter (3 hours)
3. To determine the critical micelle concentration of soap (3 hours)
4. To calculate the molecular weight of high polymer by means of viscosity measurement (3 hours)
5. To determine the concentration of acetic acid by titration with ammonium hydroxide conductometrically (3 hours)
6. To prepare the salt bridge and to determine the concentration of Cl^- ion in KCl solution by potentiometric titration (6 hours)
7. To determine water equivalent and the heat of neutralization of strong acid (HCl) and strong base (NaOH) (6 hours)

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below. There can be slight variation in the questions according to the respective tutor.

Unit	Chapter	Topics	Marks
1	1 & 2	all	**16**
2	3, 4 & 5	all	**16**
3	6 & 7	all	**16**
4	8	all	**16**
5	9, 10 & 11	all	**16**
Total			**80**

BIOCHEMISTRY
EC501

Lecture : 3 Year : II
Tutorial : 1 Part : I

Course Objective:
To familiarize the student with basic principle of biochemistry which can be applied in chemical engineering.

1. Biomolecules (7 hours)

1.1 Structure, classification, physical and chemical properties of carbohydrates, proteins, amino acid, lipids, and Vitamins in biochemical aspects.
1.2 Structure and function of purine and pyrimidine nucleotides, codons, sequencing and organization of genome, mutation.
1.3 Structural composition of deoxyribonucleic acid (DNA), Biosynthesis of DNA (replication) and protein (translation).
1.4 Type of ribonucleic acids (RNA) and structures, biosynthesis of RNA (transcription).

2. Microbial Biochemistry (2 hours)

2.1 Structural composition of gram positive and gram negative bacteria, structures and characteristics of bacterial protein toxin.
2.2 Viruses and their life cycles (lytic and lysogeny).

3. Molecular genetics (4 hours)

3.1 Gene, primer, Polymerase chain reaction (PCR).
3.2 Gene cloning, plasmid and recombinant plasmid, process of gene expression, protein preparation and its purification.
3.3 Introduction of transgenic animals and plants, scopes of molecular genetics.

4. Biochemical Techniques: (3hours)

4.1 Principle and applications of centrifugation techniques, gel filtration chromatography, gel electrophoresis.
4.2 Gene transfer methods: electroporation and particle gun.
4.3 X-ray diffraction techniques and MALDI-TOF technique.

5. Enzymes: (10 hours)

5.1 Introduction, classifications and reactions, structure of enzymes.
5.2 Isolation, purification and functions of enzymes, enzyme assay and activity.
5.3 Coenzymes and cofactors, isoenzymes, pro-enzymes, multienzyme complexes and tandom enzymes.
5.4. Regulation of enzyme activity: effects of pH, substrate, enzyme concentration, temperature, cofactor and additives.
5.5 Mechanism of enzyme action, enzyme specificity, active sites, covalent modification.
5.6 Kinetics of catalyzed reaction, Michaelis-Menten equation and its limitation, Briggs Haldane relationship.
5.7 Inhibition of enzymes, immobilized enzyme and microbial cell, applications of enzymes in clinical, foods, agriculture and environment.

6. Metabolism: Concept of metabolism (7 hours)

6.1 Carbohydrate Metabolism: Carbohydrates source, glycolysis, HPM shunts, TCA cycle, glycogenolysis, glycogen synthesis, glyoxylate cycle.
6.2 Amino acid Metabolism: nutritional and metabolic importance of amino acids, catabolism of amino acids, anabolic metabolism of few individual amino acids, urea cycle and metabolic diseases.
6.3 Lipid Metabolism: Concept of lipid metabolism, nutritional importance, biosynthesis and degradation of simple and complex lipids, metabolism regulation, abnormalities in lipid metabolism.

7. Metabolites: (3 hours)

7.1 Definition of metabolites, type of metabolites, production of metabolites in batch and continuous fermentation.
7.2 Antibiotics, sources of antibiotics, mechanism of action of antibiotics, hybrid antibiotics, DNA antibiotics interaction.

8. Agricultural biochemistry (4 hours)

8.1 Introduction of plant growth promoting rizobacteria (PGPR), effects of PGPR on plant physiology and growth, induced systemic resistance, biocontrol of plant pathogens, bio-fertilization.

8.2 Sources and chemical structures of some PGPR-based metabolites such as antibiotics, volatile organic compounds, hydrolytic enzymes, siderophores, surfactins and their agricultural applications.

9. Biofuel & biochemicals: (5 hours)

9.1 Concept of biofuels and biochemicals, different between biofuels and petroleum-based gasoline, biomass and their conversion into biofuels and biochemicals.

9.2 Study about the biosynthetic pathway of some important biofuels such as bioethanol, 2, 3-butanediol and biochemical lactic acid.

Reference Books

1. Gene cloning and DNA analysis, An Introduction, 6th Edition by BROWN T.A.
2. Lehninger Principle of Biochemistry, 4th edition by Nelson D. L. and Michel M. Cox.
3. Plant Growth Promoting Rhizobacteria (PGPR): Prospects for Sustainable Agriculture by Sayyed R. Z, Reddy M.S. and Sarjiya A.
4. Fundamentals of Biochemistry: Life at the Molecular Level by Donald V. and Judith G. V.
5. Secondary metabolites, 2nd Edition by Ramawat K.G and Merillon J.M.
6. Biotechnology of Antibiotics and Other Bioactive Microbial Metabolites, 1993 rd Edition by Lancini G. and Lorenzetti R.
7. Introduction to Biofuels, 1st Edition by Mousdale D. M.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below. There can be slight variation in the questions according to the respective tutor.

Unit	Chapter	Topics	Marks
1	1 & 2	all	**16**
2	3 & 4	all	**16**
3	5	all	**16**
4	6 & 7	all	**16**
5	8 & 9	all	**16**
Total			**80**

CHEMICAL PROCESS CALCULATION
EC 504

Lecture : 4	**Year: II**	**F. M. 80**
Tutorial : 1	**Part: I**	**P. M. 32**

Course Objective:

i. To learn conversion of units.
ii. To develop material balances, and energy balances for open, closed, steady-state, and unsteady state systems and to apply them to chemical processes.
iii. To learn calculation of the physical properties of ideal and real gases.
iv. To understand phase diagrams, phase rule, and humidity.

1. Introductory Concepts **(14 hours)**

1.1 Role of Chemical Engineers
1.2 System of units, conversion of units, and dimensional consistency
1.3 Significant figures and validation of results
1.4 Mole and molecular weight
1.5 Choosing a basis for calculation
1.6 Density, specific gravity, and concentration
1.7 Temperature, pressure, hydrostatic head, and flow rate

2. Material Balances **(10 hours)**

2.1 Introduction to material balances
2.2 Method of using Polymath
2.3 General strategy for solving material balance problems
2.4 Material balance problems that do not involve chemical reactions
2.5 Stoichiometry and terminology for reaction systems
2.6 Species mole balances
2.7 Elemental material balances
2.8 Material balances for combustion systems

3. Ideal and real gases **(6 hours)**

3.1 Ideal gases
3.2 Real gas: equations of state
3.3 Real gas: compressibility charts
3.4 Real gaseous mixtures

4. Multiphase Equilibrium **(10 hours)**

4.1 Introduction
4.2 Phase diagrams and the phase rule
4.3 Single – component two-phase systems
4.4 Two – component gas/single – component liquid systems
4.5 Two – component gas/two – component liquid systems
4.6 Multicomponent vapor – liquid equilibrium

5. Energy Balances **(8 hours)**

5.1 Terminology associated with energy balances
5.2 Types of energy to be included in energy balances
5.3 Energy balances without chemical reaction

6. Energy Balances with chemical reactions **(8 hours)**

6.1 Standard heat of formation
6.2 Heat of reaction
6.3 Integration of heat of formation and sensible heat
6.4 Heat of combustion

7. Humidity (Psychrometric) charts **(4 hours)**

7.1 Terminology
7.2 Humidity chart
7.3 Applications of humidity chart

References:

1. D. M. Himmelblau, J. B. Riggs, "Basic Principles and Calculations in Chemical Engineering," Prentice Hall PTR.
2. R. M. Felder, R. W. Rousseau, "Elementary Principles of Chemical Processes," John Willey & Sons.
3. G. V. Reklaitis, D. R. Schneider, "Introduction to Material and Energy Balances," John Wiley & Sons.
4. O. A. Hougen, K. M. Watson, "Chemical Processes Principles," John Wiley & Sons.
5. T. G. Hicks, N. P. Chopey, "Handbook of Chemical Engineering Calculations," McGraw – Hill Professional Publishing.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Chapter	Topics	Marks
1	1	all	16
2	2	all	16
3	3	all	8
4	4	all	16
5	5	all	8
6	6 & 7	all	16
Total			80

FLUID MECHANICS
EC 503

Lecture : 4	**Year: II**	**F. M. 80**
Tutorial : 1	**Part: I**	**P. M. 32**
Practical : 1.5		

Course Objective:

i. To understand basic concept of fluid mechanics and its application for solving basic engineering problems.
ii. To provide knowledge about the selection and design of fluid flow systems in process industry.

1. Introduction: Fluid mechanics **(4 hours)**

1.1 Units and dimensions
1.2 Dimensional analysis
1.3 Concept of fluids and fluid properties
1.4 Fluid statics
1.5 Pressure concept
1.6 Hydrostatic equilibrium
1.7 Manometers

2. Fluid-flow phenomena **(11 hours)**

2.1 Velocity field, velocity gradient and rate of shear
2.2 Newtonian and Non-Newtonian fluid
2.3 Viscosity
2.4 Reynolds number and transition from laminar to turbulent flow
2.5 Eddy viscosity
2.6 Flow in boundary layers
2.7 Laminar and turbulent flow in boundary layers
2.8 Boundary layer formation in straight tubes
2.9 Boundary layer separation and wake formation

3. Basic equations of fluid flow **(7 hours)**

3.1 Mass balance, average velocity, mass velocity
3.2 Momentum balance
3.3 Bernoulli equation and its correction factors
3.4 Mechanical energy equation
3.5 Pump work in Bernoulli equation
3.6 Angular momentum equation

4. Flow of incompressible fluids **(12 hours)**

4.1 Shear stress distribution in a cylindrical tube
4.2 Skin friction, wall shear, and friction factor
4.3 Laminar flow of newtonian and non-newtonian fluids
4.4 Average velocity, kinetic-energy factor, and momentum correction factor
4.5 Turbulent flow
4.6 Relation between maximum velocity and average velocity
4.7 Effect of roughness
4.8 Friction factor
4.9 Friction loss from sudden expansion and contraction of cross section of pipes
4.10 Effect of fitting and valves

5. Flow of compressible fluids **(5 hours)**

5.1 Basic relations
5.2 Processes of compressible flow
5.3 Flow through variable area conduits

6. Flow past immersed bodies **(4 hours)**

6.1 Drag, and drag coefficients
6.2 Drag coefficient of typical shapes
6.3 Form drag, and streamlining
6.4 Stagnant point

7. Fluidization in chemical engineering **(5 hours)**

7.1 Conditions for fluidization
7.2 Minimum fluidization velocity
7.3 Types of fluidization
7.4 Applications of fluidization

8. Transportation and measurement of fluids (12 hours)

8.1 Pipe, fittings, and valves
8.2 Stuffing boxes and mechanical seals
8.3 Pumps
8.4 NPSH and its application in chemical engineering
8.5 Classification of positive displacement pumps
8.6 Centrifugal pump theory
8.7 Fans, blowers, and compressors
8.8 Measurement of flowing fluids
8.9 Venturi meter, orifce meter, and rotameter

References:

1. W. L. McCabe, J. C. Smith, P. Harriott, "Unit Operations of Chemical Engineering", McGraw Hill Inc.
2. F. A. Holland, R. Bragg, "Fluid flow for Chemical Engineers", Butterworth & Heinemann.
3. F. M. White, "Fluid Mechanics", McGraw – Hill.
4. N. Nevers, "Fluid Mechanics for Chemical Engineers", McGraw – Hill.
5. Y. A. Çengel, J. M. Cimbala, "Fluid Mechanics: Fundamentals and Applications", McGraw – Hill.
6. P. J. Pritchard, J. C. Leylegian, "Fox and McDonald's Introduction to Fluid Mechanics", John Wiley & Sons, Inc.
7. R. K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications.
8. J. M. Coulson, J. F. Richardson, J. R. Backhurst, J. H. Harker, "Chemical Engineering" Vol – I, Butterworth – Heinemann, Elsevier.

Practical:

1. To observe laminar, transitional and turbulent pipe flow. (3h)
2. To find pressure drop through valves, determine friction factor for pipes. (3h)
3. To investigate the validity of the Bernoulli equation when applied to the steady flow of water in a converging or a diverging duct. (3h)
4. To determine the hydrostatic thrust acting on a plane surface immersed in water. (3h)
5. To determine the co-efficient of velocity of two small orifices, and contraction of a small orifice. (3h)
6. Determine the co-efficient of discharge with outflow under constant and varying head. (3h)
7. To determine the surface profile of a free vortex and forced vortex. (3h)

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Chapter	Topics	Marks
1	1 & 3	all	16
2	2	all	16
3	4	all	16
4	5, 6 & 7	all	16
5	8	all	16
Total			80

ENGINEERING MATHEMATICS III
SH 501

Lecture : 3 **Year : II**
Tutorial : 2 **Part : I**
Practical : 0

Course Objective:

To round out the students' preparation for more sophisticated applications with an introduction to linear algebra, Fourier series, Laplace Transforms, integral transformation theorems and linear programming.

1. Determinants and Matrices (11 hours)

1.1. Determinant and its properties
1.2. Solution of system of linear equations
1.3. Algebra of matrices
1.4. Complex matrices
1.5. Rank of matrices
1.6. System of linear equations
1.7. Vector spaces
1.8. Linear transformations
1.9. Eigen value and Eigen vectors
1.10. The Cayley-Hamilton theorem and its uses
1.11. Diagonalization of matrices and its applications

2. Line, Surface and Volume Integrals (12 hours)

2.1. Line integrals
2.2. Evaluation of line integrals
2.3. Line integrals independent of path
2.4. Surfaces and surface integrals
2.5. Green's theorem in the plane and its applications
2.6. Stoke's theorem (without proof) and its applications
2.7. Volume integrals; Divergence theorem of Gauss (without proof) and its applications

3. Laplace Transform (8 hours)

3.1. Definitions and properties of Laplace Transform
3.2. Derivations of basic formulae of Laplace Transform
3.3. Inverse Laplace Transform: Definition and standard formulae of inverse Laplace Transform
3.4. Theorems on Laplace transform and its inverse
3.5. Convolution and related problems
3.6. Applications of Laplace Transform to ordinary differential equations

4. Fourier Series (5 hours)

4.1. Fourier Series
4.2. Periodic functions
4.3. Odd and even functions
4.4. Fourier series for arbitrary range
4.5. Half range Fourier series

5. Linear Programming (9 hours)

5.1. System of Linear Inequalities in two variables
5.2. Linear Programming in two dimensions: A Geometrical Approach
5.3. A Geometric introduction to the Simplex method
5.4. The Simplex method: Maximization with Problem constraints of the form "≤"
5.5. The Dual: Maximization with Problem Constraints of the form "≥"
5.6. Maximization and Minimization with mixed Constraints. The two- phase method
(An alternative to the Big M Method)

References:

1. S. K. Mishra, G. B. Joshi, V. Parajuli, "Advance Engineering Mathematics", Athrai Publication.
2. E. Kreszig, "Advance Engineering Mathematics", Willey, New York.
3. M.M Gutterman and Z.N.Nitecki, "Differential Equation, a First Course", Saunders, New York.

Evaluation Scheme

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Chapter	Topics	Marks
1	1	1.1 to 1.8	**16**
2	1	1.9 to 1.11	**16**
	2	2.1 to 2.4	
3	2	2.5 to 2.7	**16**
	3	3.1 to 3.2	
4	3	3.3 to 3.6	**16**
	4	4.1 to 4.3	
5	4	4.4 to 4.5	**16**
	5	all	
Total			**80**

COMMUNICATION ENGLISH
SH 502

Lecture : 3 **Year: III**
Tutorial : 1 **Part:II**
Practical : 2

Course Introduction

This course is designed for the students of engineering with the objective of developing all four skills of communication applicable in professional field.

Course Objectives:
To make students able to:

a. comprehend reading materials both technical and semi-technical in nature
b. develop grammatical competence
c. write notice, agenda, minutes
d. write proposals
e. write reports
f. write research articles
g. listen and follow instruction, description and conversation in native speakers' accent
h. do discussion in group, deliver talk and present brief oral reports

Unit I: Reading **(15 hours)**

1. **Intensive Reading** (8 hours)
   1.1. Comprehension
   1.2. Note-taking
   1.3. Summary writing
   1.4. Contextual questions based on facts and imagination
   1.5. Interpreting text
2. **Extensive Reading** (5 hours)
   2.1. Title/Topic Speculation
   2.2. Finding theme
   2.3. Sketching character
3. **Contextual Grammar** (2 hours)
   3.1. Sequence of tense
   3.2. Voice
   3.3. Subject-Verb agreement
   3.4. Conditional Sentences
   3.5. Preposition

Unit II: Introduction to technical writing process and meeting **(4 hours)**

1. Editing, MLA/APA (2 hours)
   1.1. Composing and editing strategies
   1.2. MLA and APA comparison
2. Writing notices with agenda and minutes (2 hours)
   2.1. Introduction
   2.2. Purpose
   2.3. Process

Unit III: Writing Proposal **(6 hours)**

1. Introduction
1.1 Parts of the proposal
   1.1.1. Title page
   1.1.2. Abstract/Summary
   1.1.3 Statement of Problem
   1.1.4. Rationale
   1.1.5. Objectives
   1.1.6. Procedure/Methodology
   1.1.7. Cost estimate or Budget
   1.1.8. Time management/Schedule
   1.1.9. Summary
   1.1.10. Conclusion
   1.1.11. Evaluation or follow-up
   1.1.12. Works cited

Unit IV: Reports **(18hours)**

1.1. Informal Reports (6 hours)
   1.1.1. Memo Report
      1.1.1.1. Introduction
      1.1.1.2. Parts
   1.1.2. Letter Report
      1.1.2.1. Introduction
      1.1.2.2. Parts
1.2. Project/Field Report (3 hours)
   1.2.1. Introduction
   1.2.2. Parts
1.3. Formal report (9 hours)
   1.3.1. Introduction
   1.3.2. Types of Formal Reports
      1.3.2.1. Progress Report

1.3.2.2. Feasibility Report
1.3.2.3. Empirical/ Research Report
1.3.2.4. Technical Report

1.3.3. Parts and Components of Formal Report

1.3.3.1. Preliminary section
1.3.3.1.1. Cover page
1.3.3.1.2. Letter of transmittal/Preface
1.3.3.1.3. Title page
1.3.3.1.4. Acknowledgements
1.3.3.1.5. Table of Contents
1.3.3.1.6. List of figures and tables
1.3.3.1.7. Abstract/Executive summary

1.3.3.2. Main Section
1.3.3.2.1. Introduction
1.3.3.2.2. Discussion/Body
1.3.3.2.3. Summary/Conclusion
1.3.3.2.4. Recommendations

1.3.3.3. Documentation
1.3.3.3.1. Notes (Contextual/foot notes)
1.3.3.3.2. Bibliography
1.3.3.3.3. Appendix

Unit V: Writing Research Articles **(2 hours)**

1.4. Introduction
1.5. Procedures

Language lab		30 hours
Unit I: Listening		12 hours
Activity I	General instruction on effective listening, factors influencing listening, and note-taking to ensure ttention. (Equipment Required: Laptop, multimedia, laser pointer, overhead projector, power point, DVD, video set, screen)	2 hours
Activity II	Listening to recorded authentic instruction followed by exercises. (Equipment Required: Cassette player or laptop)	2 hours
Activity I I I	Listening to recorded authentic description followed by exercises. (Equipment Required: Cassette player or laptop)	4 hours
Activity IV	Listening to recorded authentic conversation followed by exercises (Equipment Required: Cassette player or laptop)	4 hours
Unit II: Speaking		18 hours
Activity I	General instruction on effective speaking ensuring audience's attention, comprehension and efficient use of Audio-visual aids. (Equipment Required: Laptop, multimedia, laser pointer, DVD, video, overhead projector, power point, screen)	2 hours
Activity II	Making students express their individual views on the assigned topics (Equipment Required: Microphone, movie camera)	2 hours
Activity III	Getting students to participate in group discussion on the assigned topics	4 hours
Activity IV	Making students deliver talk either individually or in group on the assigned topics (Equipment Required: Overhead projector, microphone, power point, laser pointer multimedia, video camera, screen)	8 hours
Activity V	Getting students to present their brief oral reports individually on the topics of their choice. (Equipment Required: Overhead projector, microphone, power point, laser pointer multimedia, video camera, screen)	2 hours

Evaluation Scheme

Units	Testing Items	No. of Questions	Type of Questions	Marks Distribution	Total Marks	Remarks
I	Reading	3	For grammar = objective and for the rest = short	2 Short questions 5+5 Interpretation of text 5 Note + Summary 5+5 Grammar 5	30	For short questions 2 to be done out of 3 from the seen passages, for interpretation an unseen paragraph of about 75 words to be given, for note + summary an unseen text of about 200to 250 to be given, for grammar 5 questions of fill up the gaps or transformation type to be given
II	Introduction to technical writing process and meeting	3	MLA/APA = objective, Editing and Meeting = short	MLA/APA = 4 Editing = 5 Meeting = 5	14	For APA/MLA 4 questions to be given to transform one from another or 4 questions asking to show citation according to APA/MLA technique, For meeting minute alone or notice with agendas to be given
III	Proposal Writing	1	Long	10	10	A question asking to write a very brief proposal on any technical topic to be given
IV	Report writing	2	Informal report = short, Formal report = long	Informal report = 6 Formal report = 10	16	A question asking to write very brief informal report on technical topic to be given, for formal report a question asking to write in detail on any three elements of a formal report on technical topic to be given
V	Research article	1	Long	10	10	A question asking to write a brief research article on technical topic to be given

Evaluation Scheme for Lab

Units	Testing items	No. of Questions	Type of questions	Marks Distribution	Remarks
I	Listening • instruction • description • conversation	2	objective	5+5	listening tape to be played on any two out of instruction, description and conversation followed by 10multiple choice type or fill in the gaps type questions
II	Speaking • group/round table discussion • presenting brief oral report • delivering talk	2	subjective	Round table discussion 5, talk or brief oral report =10	Different topics to be assigned in groups consisting of 8 members for group discussion and to be judged individually, individual presentation to be judged through either by talk on assigned topics or by brief oral reports based on their previous project, study and field visit.

Prescribed books

1. Adhikari, Usha, Yadav, Rajkumar, Yadav, Bijaya, ; " A Course book of Communicative English", Trinity Publication, 2012.
2. Adhikari, Usha, Yadav, Rajkumar, Shrestha, Rup Narayan ; "Technical Communication in English", Trinity Publication, 2012.

(Note: 50 marks excluding reading to be covered on the basis of first book and reading part (i.e. 30 marks) to be covered on the basis of second book)

3. Khanal, Ramnath, "Need-based Language Teaching (Analysis in Relation to Teaching of English for Profession Oriented Learners)", Kathmandu: D, Khanal.
4. Konar, Nira, "Communication Skills for Professional", PHI Learning Private Limited, New Delhi.
5. Kumar, Ranjit, "Research Methodology", Pearson Education.
6. Laxminarayan, K.R, "English for Technical Communication", Chennai; Scitech publications (India) Pvt. Ltd.
7. Mishra, Sunita et. al. , "Communication Skills for Engineers", Pearson Education First Indian print.
8. Prasad, P. et. al , "The functional Aspects of Communication Skills", S.K. Kataria & sons.
9. Rutherfoord, Andrea J. Ph.D, "Basic Communication Skills for Technology", Pearson Education Asia.
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11. Reinking A James et. al, "Strategies for Successful Writing: A rhetoric, research guide, reader and handbook", Prentice Hall Upper Saddle River, New Jersey.
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