COURSE WISE BREAKUP

Third Year Sixth Semester

THEORY

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-352	INORGANIC CHEMISTRY	03	100
CHEM-362	ORGANIC CHEMISTRY	03	100
CHEM-372	PHYSICAL CHEMISTRY	03	100
CHEM-312	ANALYTICAL CHEMISTRY	03	100
CHEM-332	BIOCHEMISTRY	03	100

PRACTICALS

COURSE CODE	TITLE	CREDIT HOURS	MARKS
CHEM-352	INORGANIC CHEMISTRY	01	25
CHEM-362	ORGANIC CHEMISTRY	01	25
CHEM-372	PHYSICAL CHEMISTRY	01	25
CHEM-312	ANALYTICAL CHEMISTRY	01	25
CHEM-332	BIOCHEMISTRY	01	25

- **Total Credits of the Semester = 16 (theory 12 & practicles 04 credits)**
- **Maximum Marks = 500 (theory 400 & practicles 100 marks)**

3rd Year; 6th Semester

Title of the Course: **INORGANIC CHEMISTRY** Code: **CHEM-352**

Credit Hours: **03** Marks: **100**

Objective of the Program

After completing this program students will be able to learn the following:

1. Chemistry of Lanthanides, their purification and properties.
2. Chemistry of actinide and their characteristics.
3. Chemistry of metal carbonyls their synthesis structure and properties.

Chemistry of f-Block Elements

(i) Lanthanides: Electronic structure and position in the periodic table, Lanthanide's contraction, oxidation states, spectral and magnetic properties, general characteristics, occurrence, extraction and general principles of separation, complexes and uses.

(ii) Actinides: Electronic structure and position in the periodic table, oxidation states, general characteristics, half life and decay law.

Acceptor Complexes

Mononuclear and polynuclear metal carbonyls: the eighteen electron rule as applied to metal carbonyls; rationalization of molecular structure; evaluation of structures based on spectroscopic evidences; chemistry of metal carbonyls and their derivatives (nitosyls, halides and hydrides

3rd Year; 6th Semester

Title of the Practical: **INORGANIC CHEMISTRY** Code: **CHEM-352**

Credit Hours: **01** Marks: **25**

1. Semi-micro analysis and Separation of cations in a mixture by paper chromatography.
2. Redox Titration.
3. Estimation of at least two halides by adsorption indicator.
4. Gravimetric estimation of Ba^{2+} and $C_2O_4^{2-}$ ions.

RECOMMENDED BOOKS

1. Huheey, J. E, Keiter, E. A. and Keiter, R. L., "Inorganic Chemistry: Principles of Structure and Reactivity", 4th Ed., Harper & Row, New York, 2001.
2. Cotton, F. A., Wilkinson, G., Murillo, C. A. and Bochmann. M., "Advanced Inorganic Chemistry", 6th Ed., Wiley-Intersceince, New York, 1999.

3. Greenwood, N. N., and Earnshaw, A., "Chemistry of the Elements", 2nd Ed., Pergamon Press, New York, 1992.
4. Willium W. Porterfield. Inorganic chemistry, Unified approach, Elsevier company, Delhi, (2005)
5. Mackay, K. M., Mackay, R. A. and Henderson, W., "Introduction to Modern Inorganic Chemistry", 5th Edition, Stanley Thomas Publisher Ltd. 1996
6. Bassette, J., Denney, G. H. and Mendham, J., "Vogel's Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis" English Language Book Society, 4th Edition, 1981.
7. Vogel, A. I., "A Textbook of Micro and Semi-micro Qualitative Inorganic Analysis" Longman Green & Co. 1995.

3rd Year; 6th Semester

Title of the Course: **ORGANIC CHEMISTRY** Code: **CHEM-362**

Credit Hours: **03** Marks: **100**

Addition Reactions

***Electrophilic and Nucleophilic Addition to C=C*:** Their mechanisms, orientation and stereochemistry; electrophilic addition of halogens and hydrogen halides to C=C; electrophilic addition to conjugated dienes; nucleophilic addition to C=C and C=C-C=O linkage.

Nucleophilic Addition *to C=O*: Structure and reactivity of carbony1 group; simple addition reactions i.e. addition of water, alcohol, hydrogen cyanide and bisulphite; addition/elimination reactions: addition of derivates of ammonia; stereoselectivity in carbony1 addition reactions.

Organometallic Compounds

Principles; organomagnesium, organosodium, organolithium, organocopper, organocadmium, organomercury and organozinc compounds: their structure and reactivity, methods of preparation and synthetic applications.

Chemistry of Enolate Ions and Enols

Acidity of carbonyl compounds; enolization of carbonyl compounds; α- halogenation of carbonyl compounds; aldol-addition and aldolcondensation; condensation reactions involving ester enolate ions; alkylation of ester enolate ions.

Aromatic Substitution Reactions

Electrophilic Substitution Reactions: Mechanisms of substitution; orientation and reactivity; electrophilic substitution reactions i.e. nitration, halogenation, sulphonation, Friedel-Craft's reaction, diazocoupling, formylation and carboxylation.

Nucleophilic Substitution Reactions: Mechanisms - study of SNAr, SN1 and benzyne mechanisms; structure and reactivity - the effects of substrate structure, leaving group and the attacking nucleophile on the rates of substitution reactions.

3rd Year; 6th Semester

Title of the Practical: **ORGANIC CHEMISTRY** Code: **CHEM-362**

Credit Hours: **01** Marks: **25**

Laboratory work illustrating topics covered in the lecture of CHEM-361

RECOMMENDED BOOKS:

1. Norman, R. O.C. and Coxon, J. M., "Principles of Organic Synthesis", Nelson Thornes, Cheltenham.
2. Clayden, J., Greeves, N., Warren, S. and Wothers, P., "Organic Chemistry", Oxford University Press, New York.
3. Sykes, P., "A Guide Book to Mechanism in Organic Chemistry", Longman, London.
4. March, J., "Advanced Organic Chemistry", John Wiley & Sons, New York.
5. Loudon, G. M., "Organic Chemistry", Oxford University Press, New York.
6. Carey, F. A., "Organic Chemistry", McGraw-Hill, New York.
7. Morrison, R. T. and Boyd, R. N., "Organic Chemistry", Prentice-Hall of India, New Delhi.
8. Solomons, T. W. G. and Fryhle, C. B., "Organic Chemistry", John Wiley & Sons, New York.
9. Pine, S. H., "Organic Chemistry", National Book Foundation, Islamabad.
10. Bruckner, R., "Advanced Organic Chemistry-Reaction Mechanisms", Harcourt Science & Technology Company, New York.

11. Carroll, F. A., "Perspectives on Structure and Mechanism in Organic Chemistry", Brooks/Cole Publishing Company, New York.
12. Ege, S., "Organic Chemistry", A.I.T.B.S. Publishers & Distributors, Delhi.
13. Parkins, A. W. and Poller, R. C., "An Introduction to Organometallic Chemistry", Macmillan, London.

3rd Year; 6th Semester

Title of the Course: **PHYSICAL CHEMISTRY** Code: **CHEM-372**

Credit Hours: **03** Marks: **100**

Course Contents:

Electrochemistry

An introduction to electrochemistry, chemical reactions and redox potentials, electrochemical cells and types of electrodes. Nernst's equation and its application. Predicting reactions, stability of oxidation states, cell potential and thermodynamics. Theory of metallic conduction. Electrode potential, liquid junction potential, transference number. Ions in aqueous solution. Ionic activity and Debye Hūckel theory.

Nuclear Chemistry

Atomic nucleus, nuclides, nuclear stability, modes of decay, nuclear energetics, nuclear models (shell + liquid drop model), fusion and fission, non-spontaneous nuclear processes, nuclear reactors, beta decay systematic, nuclear spins.

Group Theory

Symmetry and symmetry operations. Point groups. Properties of groups, matrices, transformation of matrices, character tables and their applications in molecular spectroscopy.

Photochemistry

Principles of photochemistry. Laws of photochemistry. Einstein's law of photochemical equivalence. Rates of intramolecular processes. Chemical reactions and their quantum yields. Hydrogen – bromine and hydrogen – chlorine reactions.

3rd Year; 6th Semester

Title of the Practical: **PHYSICAL CHEMISTRY** Code: **CHEM-372**

Credit Hours: **01** Marks: **25**

1. Spectroscopic determination of Cu % in the given sample.
2. Conductometric determination of Cu (II)- EDTA mole ratio in the complex.
3. To determine the effectiveness of an extraction of I2 solution by using Solvent Extraction method.
4. Determination of molecular weight of a polymer by viscosity method.
5. Determination of percentage composition of KMnO4/ K2Cr2O7 in a given solution by spectrophotometry.
6. Evaluation of pKa value of an indicator by spectrometric method.
7. Conductometric determination of hydrolysis constant (Kh) of conjugate base of a weak acid.

RECOMMENDED BOOKS:

1. Cotton F.A. "Chemical Applications of Groups Theory" Interscience Publishers (1963).
2. Lowell Hall H. "Group Theory and Symmetry in Chemistry" McGraw Hill Book Company (1969).
3. Albert R.A., Robert J.S. and Moungi G.B. "Physical Chemistry". 4th ed., John Wiley and Sons (2004).
4. Ball D.W. "Physical Chemistry" 1st ed., Brooks/Cole Co. Inc. (2003).
5. Calvert J.G. and Pitts J.N. "Photochemistry" John Wiley, New York (1966).
6. Suppan P. "Principles of Photochemistry", The Chemical Soc., UK (1973).
7. Vertes A. "Basics of Nuclear Science" Kluwer Academic Publisher London (2003).
8. Friedlander G. and Kennedy J.W. "Nuclear and Radiochemistry" 3rd ed., Wiley, New York (1981).
9. Bassetts J., Denney C., Jeffery G.H. and Mendham J. "Vogel's Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis" English Language Book Society. 4th ed. (1978).
10. Hatch R.C. "Experimental Chemistry" van Nostrand Reinhold Company (1972).

11. Halpern, Arthur M. "Experimental Physical Chemistry: A Laboratory Textbook" 2nd ed., Prentice Hall (1962).
12. Shoemaker D. "Experimental Physical Chemistry" McGraw Hill (1989).

3rd Year; 6th Semester

Title of the Course: **ANALYTICAL CHEMISTRY** Code: **CHEM-312**

Credit Hours: **03** Marks: **100**

Course Contents:

A. Separation Techniques

Introduction and Classification of Separation Techniques

1. Masking
2. Precipitation
3. Filtration
4. Dislillation
5. Volitilization
6. Solvent Extraction
7. Chromatography
8. Electrophoresis

B. Thermal Analysis

Basic principles, instrumentation and applications of Thermogravimetry (TGA) and Differential Thermal Analysis (DTA).

3rd Year; 6th Semester

Title of the Practical: **ANALYTICAL CHEMISTRY** Code: **CHEM-312**

Credit Hours: **01** Marks: **25**

Experiments based on theory topics as per facilities available.

RECOMMENDED BOOKS:

1. Analytical Chemistry by Gary D. Christian; 6th ed. 2004; John Wiley & Sons, Inc.
2. G. D. Christian and J.E. Reilly; "Instrumental analysis" Allyn and Bacon, Inc.

3. Douglas A. Skoog, and D.M.West, "Principle of Instrumental analysis" einholt, New York.
4. Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, "Fundamentals of Analytical Chemistry" 8th ed. 2003; Saunders College Publishing, Philadelphia.
5. Instrumental Methods of Analysis by Hobert H.Willard D.L. Merrit & J.R.J.A. Dean, Frank A. Settle; 7th Sub edition 1988; Wadsworth Publishing Company.
6. Laboratory Manual of Analytical Chemistry by C. Reilly; Allyn and Bacon, London.
7. Quantitative Analysis by W. J. Blaedal and V. W. Medloche; Harper & Row, N.Y.
8. J.G. Dick, Analytical Chemistry, McGraw-Hill, Tokyo.

3rd Year; 6th Semester

Title of the Course: **BIOCHEMISTRY** Code: **CHEM-332**

Credit Hours: **03** Marks: **100**

Objective of the Course:

Course will emphasize the all aspects of the biochemistry of enzymes. Importance of coenzyme and cofactors of the enzymes will also be covered. This course will also emphasize on the acid-base regulation in human body.

Course Contents:

Enzymes

Chemical nature, nomenclature and classification of enzymes, Cofactors, Substrate specificity, enzyme-substrate interactions and nature of active site, Mechanism of enzyme action with specific reference to chymotrypsin and ribonuclease, Kinetics of single substrate reactions, Effect of different factor on enzyme activity, Bisubstrate reactions,

Quantative assays of enzyme activity, Enzyme Inhibition, Regulatory enzymes; Allostric enzymes, Multienzyme system, Zymogens, and Isozymes, Enzymatic control of metabolic pathways, Immobilized enzymes; synthesis, properties and uses.

Acid-Base and Electrolyte Chemistry

Intracellular and Extracellular Electrolytes, Body fluids as electrolyte solutions, pH, Henderson-Hasselbalch Equation and Buffers, Acids and bases, Actual and titratable acidities, Equilibrium

reactions of acids, bases and protons, Buffer action, Effect of other ions on acid-base equilibria, Amino acids, peptides and proteins as acids and bases, Acid

and base production in human metabolism, Regulation of Acid-Base Balance; Control of acidity and physiolologic buffer action, Buffer capacity, Buffers of body fluids, Respiratory regulation of acid-base balance,Haemoglobin as an acid-base system, Renal control of Acid4 base balance, Acid- Base disorders; Acidosis, Alkalosis, Effect of acidbase disturbances on electrolytes, Homeostasis, Variation of Na+, K+, and Cl- in acid-base disturbances.

3rd Year; 6th Semester

Title of the Practical: **BIOCHEMISTRY** Code: **CHEM-332**

Credit Hours: **01** Marks: **25**

PRACTICALS

Laboratory work illustrating topics covered in the lecture of CHEM. 331.

1. Determination of pH, Preparation of buffers,
2. Enzyme catalysis, Progress curve for enzyme catalyzed reactions,
3. Determination of Km values, To study the effect of different factors on the rate of enzyme catalyzed reactions.

RECOMMENDED BOOKS:

1. Lehninger, A. L, "Principles of Biochemistry", Worth Publisher, New York, (2001).
2. Voet, D. and Voit J. G., "Biochemistry", John Wiley & Sons, New York, (2000).
3. West, Text Book of Biochemistry", 4th Ed., (2000) .
4. Zubay, G., Biochemistry, 4th Ed., Macmillan Publishing Co. (1999).
5. Wilhelm R. Frisell, "Human Biochemistry", Macmillan Publishing Co., Inc. New York (1982)
6. Guyton AC and Hall JE, "Text Book of Medical Physiology", 9thEd, W. B. Saunders Company, Tokyo, (1996).
7. Plummer, D.T., An introduction to practical biochemistry, TATA McGraw-Hill Publishing Company LTD. Sawhney, S. K. and R. Sing (Editors), Introductory Practical Biochemistry, Narosa Publishing House, New Delhi, (2005)