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P. G. SEMESTER EXAMINATION REGULATIONS

CHAPTER – I

REGULATION OF GENERAL ACADEMIC MATTERS

1.1 The Departments shall follow Semester System of teaching and Examination based on continuous evaluation internally as well as externally subject to moderation of question papers. The system of evaluations of the students shall be based on Course Credit System.

1.1.1 Academic Year

The Academic Year of the department shall ordinarily be from JUNE to MAY. It may however, be modified by the Staff Council from time to time.

1.1.2 Semester

The academic year shall have two semesters, each of which shall be of 6 months duration.

1.2 Minimum working days in a Semester

A Semester shall have a minimum of 90 working/instructional days excluding examination days/Sundays/Holidays etc. The minimum number of classes in a semester shall not fall short of the number of classes as mentioned below.

1. One Credit hour courses = 10 classes minimum
2. Two Credit hour courses = 20 classes minimum
3. Three Credit hour courses = 30 classes minimum
4. Four Credit hour courses = 40 classes minimum
5. Five Credit hour courses = 50 classes minimum

1.3 ***Credit hours***

One credit shall signify the quantum of teaching imparted corresponding to one hour of theory class and two hours of laboratory/project work and two hours of seminar per week during a semester in respect of a particular course. Each teaching hour of theory class will be of 60 minutes and practical classes/project work will be of 120 minutes duration and seminar will be of 120 minutes duration. For field study outside headquarters, one working day will be considered as two teaching hours. However, the field study should not exceed 30 days (including Sundays) in one semester.

The P. G. Syllabus may be so designed that the total of credit hours for all four semesters shall be 80 spread equally over all semesters as far as practicable, tutorials and proctorials shall be treated as non-credit components.

1.4 ***Course***

A course is a Unit of instruction under any discipline carrying a specific number of credit hours describing its weightage. Those courses, which a student must take as compulsory requirement, are, called Core Courses. Those courses, which a student opts out of a list of specialized courses offered by the department, are called Elective Courses.

Choice Based Credit System (CBCS) is introduced at the P. G. Semester-I level uniformly in all the subjects to be taught in paper-103. The students of P. G. Arts stream can not opt for the CBCS course of Science stream. The details of the CBCS courses offered by different P. G. Departments are given in Annexure-II.

ANNEXURE-II

CBCS: P. G. Paper-103

Department	Name of the CBCS Course
Botany	Plant in Human Welfare
Chemistry	Polymer Science
Commerce	Fundamental of Business Organization and Entrepreneurship Development
Economics	Indian Economy
Education	Pedagogical Trends and Issue
English	Global English
Geography	Introduction to Geography
History	Tourism & Heritage Management
Mathematics	Elements of Computer Programming
Odia	"Adhunika Odia Nataka o Odia Bhashara Dhwanitatwa" (Modern Odia Drama and Odia Phonetics)
Physics	Foundation in Physics
Philosophy	Practical Ethics
Political Science	Indian Government & Politics
Psychology	Fundamentals of Psychology
Sanskrit	Ancient Indian Culture
Zoology	Animal World, Human Health & Economic Zoology

1.4.1 ***Grade***

The grade awarded to a student in any particular course shall be based on his/her performance in all the tests conducted during a semester and shall be awarded at the end of the semester. The grade in each course is expressed in numerical value in 10.00 scale. The marks of a student shall be converted to10.00 scale and the points scored thereby shall be called the "Grade Point" in the course. Respective "Grade Point Average" (GPA) and "Overall Grade Point Average" (OGPA) shall be awarded at the end of each semester and all semester respectively. A 3.0 Grade Point is required for passing in individual paper and 4.0 GPA to pass any semester examination. The G. P. shall be rounded to one decimal point and GPA to two decimal points.

1.4.2 Grade Point Average (G.P.A.)

Grade Point Average (G.P.A.) of a semester shall be calculated as:

$$\text{GPA} = \frac{\text{Summation of } \{(\text{Credits in each course}) \times (\text{Grade point in that course})\}}{\text{Total No. of Credits in that Semester}}$$

Where the summation is taken over all courses in a given semester, G.P.A. shall be rounded up to 2 decimal points.

1.4.3 O.G.P.A. (Overall Grade Point Average)

It is the average of accumulated grade points of a student, worked out by dividing the cumulative total of grade points by the cumulative total of credit hours of all the courses covered and completed by a student during all the Semesters. For the first semester of the programme the GPA and OGPA shall be the same.

$$\text{OGPA} = \frac{\text{Summation of } \{(\text{Credits in each semester}) \times (\text{Total Credits in that semester})\}}{\text{Total No. of Credits in that Semester}}$$

Where the summation is taken over all semesters in a given programme. OGPA shall be rounded up to e decimal points. For merit lists, in case of equality, the OGPA shall be calculated beyond two decimal places if necessary.

1.4.4 Conversion of grades to marks and classification of results under course credit system

The OGPA can be converted to percentage of marks in the following manner:

Percentage of Marks = (OGPA) ×10

A student after successful completion of all the semesters, Degree shall be awarded in the following manner:

O.G.P.A. ≥ 6.0	: FIRST CLASS
O.G.P.A. ≥ 5.0 - < 6.0	: SECOND CLASS
O.G.P.A. 4.0 - < 5.0	: THIRD CLASS
O.G.P.A. < 4.0	: FAIL

1.5 ***Academic Calendar***

The Examination Section and the academic section shall finalise the schedule of semester registration and other academic activities at the start of academic session. The Academic Calendar shall be prepared by the Academic Committee of the University in consultation with examination section.

The broad format for academic calendar for P. G. with regard to admission, registration and commencement of classes shall be as follows:

Admission and Registration and Commencement of Classes for 1st Semester	JULY
1st Semester Examination	DECEMBER
Commencement of Classes 2nd Semester	JANUARY-MAY
2nd Semester Examination	JUNE
Commencement of 3rd Semester Classes	JULY-NOVEMBER
3rd Semester Examination	DECEMBER
Commencement of 4th Semester Classes	JANUARY-APRIL
4th Semester Examination	APRIL & MAY
Final Results to be published in the month of	JUNE

1.5.1 Requirement of award of degree

The minimum credit hour requirement for the Master Degree shall be 80 (eighty) credits and the residence required for Master Degree shall be continuous four semesters from the first date of registration and the maximum time allowed to complete the Master Degree shall be 8 (eight) semesters.

1.6 Requirement for attendance

A candidate shall be required to attend 75% lectures, tutorials and practical classes separately during the semester (For late admitted students' attendance to be calculated from the date of admission). Condonation may be granted by the staff council only to the extent of 15% in exceptional cases. (Illness, accident, mishap in the family, deputation by University/Department). When a candidate has been deputed by the University to represent the University/state for any activity, the lectures delivered during his/her absence for the purpose shall not be counted towards the calculation of attendance provided the student submits a certificate to that effect from the appropriate authority.

1.7 ***Registration in a semester***

A student has to register his/her name at the beginning of every semester in the prescribed form, for the course he/she wants to take in that semester. Examination Section (General) shall notify the registration dates and the list of registered students for the semester shall be given to the Head of the Department within two weeks of the commencement of the Semester.

CHAPTER – II
REGULATIONS ON EXAMINATION MATTERS

2.1 Mid Term Examination

In each Semester there shall be one Mid Term Assessment examination of 60 minutes duration. The Mid Term examination shall be conducted by COE like that of End Term examination. The answer scripts shall be evaluated by the external and internal examiners and the marks along with answer scripts shall be retained in COE.

2.2 Semester Examination

After the end of each semester there shall be an examination of each theory paper of 2 hours duration and of each practical paper of 4 hours duration, which shall be called Term End / "Semester Examination". The maximum marks for each theory paper shall be 50 out of which 40 marks for term end and 10 marks for Mid Term. The maximum marks for each practical/ semester/ project/ dissertation/ review examination shall be 50 for Arts and Commerce and 100 marks for Science. The classes shall remain suspended ten days (including Sundays and holidays, if any) before the date of commencement of semester test for preparation by the students.

2.3 Results of Examinations

The results shall be declared ordinarily within four weeks of completion of the examinations. A students who seeks re-addition of his/her marks in a course shall be allowed to do so by submitting an application to Registrar along with a required fees in the fee counter of the University. All such cases/complaints if any shall be disposed of by the Examination Section in a prefixed day and necessary corrections if any shall be reflected in the mark/grade sheet. The candidates shall have to appear in all the Units of a semester examination to be eligible to be a declared 'pass' provided he/she secures minimum pass marks/grade.

2.4 Promotion to the next semester

A student shall be admitted to the next semester only when he/she appears in all the papers of the concerned semester examination. However, a student failing to appear semester examination in some or of all papers due to some reasons as mentioned in 2.5 may be admitted to the next semester. Such a student shall produce sufficient proof in favour of his/her reason for not being able to appear in some or all papers of the Semester Examination on the next academic session in the corresponding semesters.

2.5 ***Absence from Examination***

If a student is unable to appear a semester examination in some or all papers the Registrar shall consider his/her case for admission into the next higher semester only the following cases:

(a) When he/she is hospitalized.

(b) When he/she is not be able to appear in the examination due to serious illness or death of parents, brothers, sisters, spouse or children.

(c) When he/she met an accident of serious nature.

(d) When the department/University or any official directive deputes him/her

2.6 ***Procedure for Repeat/Improvement***

A student who wants to sit for the semester examination of first and/or second semester in the subsequent academic session (for repeat or improvement) he/she shall have to apply to the Registrar in plain paper before fifteen days of the commencement of the said examination. If allowed by the Registrar, he/she shall deposit the required fees for each paper with centre charge and produce the proof to the teacher in-charge examination with permission letter from the Registrar.

In a semester to appear improvement examination the candidates must have passed the semester examination. A candidate can appear repeat examination of papers in which he/she has failed or not appeared for reasons mentioned in 2.5.

The Master Degree student seeking to appear/improvement examination in any course(s) shall get 3 chances for 1st and 2nd semester within 8 semesters.
Candidates appearing in repeat/improvement examination shall not be considered in the merit list and it shall be reflected in the Provisional Certificate cum Mark sheet (PCM) but not in the final degree certificate.

2.7 Award of Degree Certificate, Grade/Mark sheet

A Degree certificate under the official seal of the university and signed by the Vice-Chancellor shall be presented at the Convocation or in absentia to each of the successful students of particular degree. The Controller of Examinations shall issue the mark/grade sheet of each semester to the candidates in the sheet of each semester to the candidates in the prescribed format by depositing the required fees for marks/Grade Sheet to be deposited in the University counter.

2.8 **Guideline for filling up of Forms for PG Classes (IMP/ Repeat)**

A student shall repeat all the theory and practical papers in which he/she failed in the semester examination within a period of eight semesters from the date of first registration. Such students shall have to apply to the Head of the Department/Registrar in plain paper during the filling up of form for the ensuing semester examination. If allowed, he/she shall deposit the fees as prescribed by the University

If a candidate secures less than 3.0 Grade point in a paper(s) and less than 4.0 Grade point average in a Semester examination he/she has to appear all the papers in that Semester.

If a candidate secures less than 3.0 Grade Point in a paper(s) and a minimum 4.0 Grade point average in a semester examination, he/she has to appear only the paper(s) in which he/she secured less than 3.0 Grade point.

A candidate is eligible to sit for improvement in a paper(s) only when he/she has passed the semester examination concerned. Further, he/she can improve in a maximum of EIGHT paper(s) in the entire course. The Master Degree students seeking to take improvement examination in any course(s) shall get chances within 8 semesters from the year of admission to the course. The candidates taking this advantage (improvement) will be examined on the basis of current syllabus and the higher marks shall be retained during computation of result.

2.9 If a candidate fails to appear in any paper of the said examination and marked ABSENT his/her results will be declared only when he/she clears that paper/those papers.

2.10 ***Disciplines in the Examination***

(A)Late Comers: A student arriving in the examination hall/room fifteen minutes after the commencement of the examination shall not be ordinarily allowed to sit for the examination. No examinee shall be allowed to go out of the examination hall within one hour of commencement of examination. The invigilators shall keep a record of temporary absence of students from the examination hall/room during the examination.

(B) Adoption of unfair means in the Examination:
Possession of unauthorized materials and using it, copying from scripts of other students or from any other source, showing his/her answer script to others during the examination, creating disturbance or acting in a manner so as to cause inconvenience to other students in the examination hall or near about shall be treated as adoption of unfair means or malpractice.

Sd/-
REGISTRAR

PG COURSE STRUCTURE AT A GLANCE
DEPARTMENT OF CHEMISTRY

Paper	Name of the Course	Marks
	First Semester	
CHE-101 (Theory)	Inorganic	50
CHE-102 (Theory)	Organic	50
CHE-103 (Theory)	Polymer Science (CBCS)	50
CHE-104 (Practical)	Organic	100
		Total = 250
	Second Semester	
CHE-201 (Theory)	Inorganic	50
CHE-202 (Theory)	Organic	50
CHE-203 (Theory)	Physical	50
CHE-204 (Practical)	Inorganic	100
		Total = 250
	Third Semester	
CHE-301 (Theory)	Inorganic	50
CHE-302 (Theory)	Organic	50
CHE-303 (Theory)	Physical	50
CHE-304 (Practical)	Physical	100
		Total = 250
	Fourth Semester	
CHE-401 (Theory)	General Chemistry	50
CHE-402 (Theory)	Organic Special	50
CHE-403 (Theory)	Physical	50
CHE-404 (Practical)	Organic Special Practical	100
		Total = 250
CHE-402 (Theory)	Inorganic Special-I	50
CHE-403 (Theory)	Inorganic Special-II	50
CHE-404 (Practical)	Inorganic Special Practical	100
		Total = 250
CHE-402 (Theory)	Physical Special-I	50
CHE-403 (Theory)	Physical Special-II	50
CHE-404 (Practical)	Physical Special Practical	100
		Total = 250
CHE-402 (Theory)	Industrial Chemistry Special-I	50
CHE-403 (Theory)	Industrial Chemistry Special-II	50
CHE-404 (Practical)	Industrial Chemistry Practical	100
		Total = 250

FIRST SEMESTER

Paper - CHE-101: INORGANIC

Full Mark 50- (40+10 Marks)

UNIT -1: Nuclear Chemistry:

(a) Nuclides, their classification, nuclear stability, nucleus, its size and shape, mechanical effect due to orbiting and spinning of nucleons, magnetic quantum number, principal and radial quantum numbers, Maria-Goeppert notation for nucleons, total angular momentum of nucleus, net magnetic moment of nuclei, Nordheim rule.

(b) Nuclear models and nuclear reaction: shell model, liquid drop model, proton and neutron configuration, spin and pairity of nucleon, types of nuclear reactions, conservation in nuclear reaction, reaction cross section, compound nucleus theory.

(c) Nuclear reactor: Fission energy, classification of reactors, uranium reactor, breeder reactor, reactor power.

UNIT-2 : Ionic bond and solid states:

(a) Ionic bond: lattice energy, Born-Lande equation, size effect, effects of radius ratio on coordination number of ionic compounds, crystal structures of NaCl, CsCl, CaF_2, TiO_2 , lattice energy and hydration energy, their effects on solubility of ionic compounds.

(b) Solid State: crystal angles, crystal symmetry, law of rational indices, crystallographic systems, Miller indices, basic principle of structure determination of ionic solids by x-ray diffraction methods (rotating crystal method, oscillating crystal method, powder method), crystal defects (Shottky and Frenkel).

UNIT-3

(a) Electron deficient compounds: definition and examples, hydrides of boron (boranes), general methods of preparation, properties, structure and bonding in higher boranes (B_4H_{10}, B_5H_9, B_5H_{11}, B_6H_{10}), three centred bond, Linnett double quartet approach, applications.

(b) Isopoly and heteropoly acids: isopoly molybdates, tungstates, and vanadates.

Books for reference:

1. Essentials of Nuclear Chemistry - H. J. Arniker.
2. Concise Inorganic Chemistry - J. D. Lee.
3. Text Book of Physical Chemistry - S. Glasstone.
4. Principles of Physical Chemistry - Puri, Sharma and Pathania.
5. Physical Chemistry - P. C. Rakshit.
6. Selected topics in Inorganic Chemistry - Mallik W. U., Tuli G. D., Madan R. D.; S. Chand & Co.

Paper - CHE- 102: ORGANIC

Full Mark 50- (40+10 Marks)

UNIT -1: Reaction intermediates:

(a) Non-classical carbonium ion (generation, structure, stability and fate).

(b) Free radicals, arynes and nitrenes (generation structure, stability and fate).

UNIT-2: Substitution reactions

(A) **Nucleophilic substitution reaction**

(i) Aliphatic nucleophilic substitution S_N1, S_N2 & S_Ni reactions, neighbouring group participation reactions (partici-pation by double bonds), aromatic ring substitution, amb-ident nucleophile and substrate effect of nucleophile.

(ii) Aromatic nucleophilc substitution, intermediate Meisenheimer- complex mechanism, S_N Ar mechanism and benzyne mechanism, Sommelet-Hauser reaction, Von Richter rearrangement.

(B) **Electophillic subsititution reactions**

(i) Aliphatic electrophilic substitution S_E1, S_E2, S_Ei reaction, mechanism and stereo chemistry.

(ii) Aromatic electrophilic substitution sigma and pi complex mechanism orientation and reactivity in substituted benzene ring, ortho-para ratio. Vilsmeier Haack reaction, Bischler-Napieralski reaction, Pechmann reaction, Fries rearrangement.

(iii) Free radical substitution reactions: free redical substitution ianism (reactions at sp^3 and sp^2 carbon).

UNIT-3: Addition and elimination reactions

(a) Nucleophilic and free radical addition.

(b) Elimination reactions: El, E2 and El CB mechanisms and orientation, effect of substrate, leaving group and medium, orientation of the double bond, Saytzeff rule and Hoffmann rule, pyrolytic eliminations.

Books For Reference:

1. Electronic Structure of Organic molecules - L. N. Ferguson.
2. Organic Reaction mechanism - E. S. Gold.
3. Advanced Organic Chemistry: Reaction mechanism and structure - Jerry March.
4. Organic Reaction Mechanism - N. Tiwari, Books & Allied Pvt. Ltd.

Paper- CHE-103: POLYMER SCIENCE (CBCS)

Full Mark 50- (40+10 Marks)

UNIT-1 **10 periods**

(a) Introduction to Polymer Science: Definition of Polymers, Degree of Polymerization, Nomenclature and classification of polymers, Natural & Synthetic polymers, Homopolymer and Copolymers, Polymerization process, Addition and Condensation polymerization.

(b) Addition Polymerization: Introduction, Monomers of Addition polymers, Free radical initiators, Polymerization mechanism, Steady-state kinetics of Radical Polymerization, Determination of molecular weight by viscosity method.

UNIT-2 **10 periods**

(a) Condensation Polymerization: Nylon 6, Nylon 6.6, Polyester, Phenol- formaldehyde resins, Epoxy resins, Polysiloxane, Amino resins, Melamine- formaldehyde Polymers.

(b) Co-polymerization: Classification of copolymer, The copolymer equation, Kinetics of Copolymerization, Mayo and Lewis equation, Determination of Monomer reactivity ratios, Fineman and Ross method, Graft Copolymer.

UNIT-3 **10 periods**

(a) Industrial Polymers: Classification of Industrial Polymers, Polyethylene, Low Density Polyethylene, HDPE, Natural Rubber, Vulcanization of Rubber.

(b) Biodegradable Polymers: Introduction, Definition, Types of Biodegradable polymers. Natural Biodegradable Plastics: Starch based plastics, Cellulose based plastics, Protein based plastics and protein plastics.

BOOKS FOR REFERENCE:

1. Principle of Polymer Science - Paul J. Flory.
2. Text Book of Polymer Science - F. W. Billmayer.
3. Organic Polymer Chemistry - K. J. Saunders.
4. A Text Book of Polymer Science - P. L. Nayak, Kalyani Publishers.

Paper-CHE-104: ORGANIC PRACTICAL
(100 Marks)

1. Identification of organic compounds having at least two functional groups.

2. Estimation:
   (a) Methoxy group
   (b) Acetyl group
   (c) Nitrogen
   (d) Carbon, hydrogen
   (e) Spectrophotometric and volumetric analysis of keto group.

NOTE: At least three estimations should be performed.

3. Preparation:
   (a) p-toluidine to p-iodotoluine
   (b) benzaldehyde to benzoin to benzil to benzilic acid
   (c) benzilic acid to o-benzoyl benzoic acid to anthraquinone to anthrone
   (d) ethyl acetate to ethyl acetoacetate
   (e) anisole to phenacetin

4. Synthesis of a simple dye and check its purity by paper chromatography or extinction coefficient measurements.

SECOND SEMESTER

Paper - CHE- 201: INORAGANIC

Full Mark 50- (40+10 Marks)

UNIT-1: Organometallics

(a) Definition, classification transition metal alkyls and aryls, general methods of preparation, properties, structures, and bonding.

(b) Transition metal π-complexes, cyclopentadienyl complexes, general methods of preparation, properties, structures, and bonding in ferrocene, η^6-arene complexes.

(c) Reactions of organometailic compounds, oxidative addition, reductive elimination, insertion, nucleophilic and electrophilic attack on coordinated ligands.

UNIT -2: Bioinorganic Chemistry

(a) Metallo-proteins, role of metal ions in biosystems, transportation, hydrolysis, decarboxylation, electron transport, redox reactions, phosphate group transfer (basic concept with examples).

(b) Active transport of cations across biomembrane through the ionophores, possible reaction pathways of reduction of N_2 in nitrogenase enzyme, catalytic mechanism in carboxypeptidaseA, reactivity of oxaloacetate decarboxylase enzyme, general mechanism of hydrolysis of ATP and phosphate group transfer from ATP involving. ATPase and Kinase.

UNIT-3: Homogeneous Catalysis

General features of catalyst, catalytic steps, hydrogenation of alkenes, Ziegler-Natta polymerization of alkenes, hydrocarbonylation of olefenes, Monsanto acetic acid synthesis, water gas-shift reaction, activation of C-H bond.

Books for reference:

1. Organometallic compounds by Inderjit Kumar.
2. Bioorganic Chemistry by Asim K. Das, Books and Allied Pvt Ltd.
3. Bioinorganic Chemistry by K Hussain Reddy, New Age International Pvt Ltd.
4. Principles of Bioinorganic Chemistry by Lippard SJ and Berg JM, Panima Publ Corp. New Delhi.
5. Coordination Chemistry by D. Banerjee.
6. Advanced Inorganic Chemistry (6th Edu) by Cotton & Wilkinson.
7. Organometallics by R. C. Mehrotra.

Paper - CHE-202: ORGANIC

Full Mark 50- (40+10 Marks)

UNIT-1: Molecular rearrangements

(a) Rearrangements involving electron deficient carbon: Demjanov, Wolff, Wagner-Meerwein, and Dienone Phenol rearrangement.

(b) Rearrangement involving electron deficient nitrogen: Curtius, Schmidt and Lossen rearrangement.

(c) Rearrangement involving electron deficient oxygen: Baeyer-Villiger and hydroperoxide rearrangement.

UNIT-2: Conformation and Reactivity

(a) Conformational effect in six membered ring containing instauration.
(b) Relative reactivity of diastereoisomers in ionic elimination.
(c) Intramolecular rearrangements and neighbouring group participation reactions. Curtin-Hammett Principle.

UNIT-3: Spectroscopy

(a) Application of Ultraviolet, IR, NMR and Mass spectros – copy in determination of molecular structure of organic compounds.
(b) NMR: Principles and applications of ^{13}C-NMR, nuclear overhauser effect (NOE), elementary knowledge of 2D NMR and its application.
(c) EPR: Basic principle and application of electron paramagnetic resonance spectroscopy.

BOOKS FOR REFERENCE:

1. Stereochemistry of carbon compounds by E. Eliel.
2. Organic Reaction mechanism by E. S. Gold.
3. Advanced Organic Chemistry Reactions, Mechanisms, and structure by Jerry March. JohnWiley & Sons.
4. Spectroscopic Methods in Organic Chemistry by William & Fleming.
5. Organic Spectroscopy by Willian Kemp.
6. Spectro Scopic identification of organic Compound by Silverstein, Bassler and Morrill.

Paper- CHE-203: PHYSICAL

Full Mark 50- (40+10 Marks)

Unit-1 : Thermodynamics -1

(a) Second law of thermodynamics, heat engines and refrigeration engines, entropy and its variation with temperature, pressure and volume, entropy of mixing, entropy correction from ideal behaviour, thermodynamic equation of state, entropy and heat capacities relationships, difference of heat capacities, work function, free energy, Gibb's Helmholtz equation and its application.

(b) Third law of thermodynamics, its application to solids, liquids and gases, Nernst heat theorem and its applications.

(c) Entropy and thermodynamic probability, Boltzman-Planck equation for entropy, Maxwell-Boltzmann distribution law (evaluation of MB constants excluded),effect of degeneracy.

(d) Partition function, molecular and molar partition function, evaluation of translational partition function, entropy in terms of partition function, entropy of monoatomic gases, Sackur Tesrode equation.

UNIT-2: Thermodynamics -II

(a) Partial molar properties, chemical potential and its variation with temperature and pressure, determination of partial molar properties (1) by direct method (2) from apparent molar properties (3) from equation of state.

(b) **Free energy**

Equilibrium constant and its expression for gaseous systems and dilute solutions. Van't

Hoff's isotherm and its integration, standard free energy, entropy determination.

(c) **Dipole moment**

Mosotti-Clausius equation, Electron and atom polarization, orientation polarization, determination of dipole moment by vapour temperature method, refraction method and dilute solution method, applications of dipole moment.

UNIT-3 : **Gaseous State and Chemical Kinetics**

(a) Gaseous state of matter: Virial theorem, molecular collision, mean free path, viscosity, conductivity and diffusion of gasses, molecular diameter, law of distribution velocity, Brownian motion and determination of Avogadro's number by vertical method.

(b) Chemical Kinetics: Arrhenius equation, absolute theory of reaction rates, collision theory, application of collision theory to unimolecular and bimolecular reactions.

(c) Chain reactions with reference to the formation of HBr and pyrolysis of CH_3CHO, chemical reactions in solutions catalysed by acid and base.

Books for Reference:

1. Text Book of Physical Chemistry - S. Glasstone.
2. Thermodynamics for chemists - S. Glasstone.
3. Physical Chemistry – S. Glasstone.
4. Theoretical Chemistry - S. Glasstone.
5. Statistical Thermodynamics - M. C. Gupta.

Paper-CHE-204: INORGANIC PRACTICAL

(100 Marks)

1. **QUALITATIVE ANALYSIS (Marks-35)**

Qualitative analysis of inorganic mixture containing not more than six radical / six radicals with any one of the following rare metals like tungsten, molybdenum, titanium and vanadium. (Organic radicals are excluded)

2. **QUANTITATIVE ANALYSIS (Marks-35)**

Estimation major constituents of:-

(i) chrome iron ore, (ii) white metal, (iii) pyrolusite, (iv) bronze

(v) Complete 100 percent analysis of (a) dolomite or portland cement and (b) brass

3. **Viva voce - 20 marks**

4. Record - 10 marks

THIRD SEMESTER

Paper-CHE-301: INORGANIC

Full Mark 50- (40+10 Marks)

UNIT-1: Theories of metal ligand bonding

(a) Crystal field theory: Octahedral ligand field, square planner and tetrahedral ligand fields, factors affecting magnitude of crystal fields splitting, tetrahedral distortion in octahedral symmetry, Jahn-Teller effect, crystal field stabilisation energy (CFSE), its uses.

(b) M. O. theory of metal complexes: Octahedal complexes, MOT for sigma bonding complexes, Effect of π- bonding on Δ_0, relations between bonding ability of ligands and spectrochemical series.

UNIT-2: Electron Transfer Reactions and Electronic Spectra

a) Crystal field effects on electron transfer reaction, the hydrated electron.

b) One and two electron transfer reaction, inner sphere and outer sphere mechanism, complementary and non complementary electron transfer reactions, Kinetic application of crystal field theory.

c) Spectral properties: types of electronic spectra, Laporte selection rule, spin selection rule, charge transfer spectra, d-d-transition spectra, term symbol, Orgel diagram for d^1, d^2, and d^5 systems.

UNIT-3: Mechanism of inorganic reactions

(a) Substitution in Octahedral complexes - Nature of substitution reactions, Mechanism of substitution reactions of Co (III) and Pt (II) complexes, acid hydrolysis, π-bonding in dissociation reactions of octahedral complexes.

(b) Base hydrolysis of octahedral Co (III) and Pt (II) complexes, conjugate base and ion pair mechanism.

(c) Reactions involving replacement of co-ordinated water.

(d) Substitution reactions without cleavage of metal ligand bond (sigma and pi bonds).

Books For Reference:

1. Inorganic Chemistry - J. Huheey
2. Inorganic Reactions and Mechanism - Basolo and Pearson
3. Inorganic Reactions and Mechanism – M. L. Tobe
4. Inorganic Complexes – Jorgensen
5. Chemistry to Ligand Fields Theory – Ballhousen
6. Introduction to Ligand Fields Theory – Ballhousen.
7. Inorganic Co-ordination Compounds – D. Banerjee

Paper-CHE 302: ORGANIC

Full Mark 50- (40+10 Marks)

UNIT-1: Natural products

(a) Alkaloid: quinine (structure, synthesis and biogenesis)
(b) Vitamin A: structure and synthesis.
(c) Terpene - comphor: structure and synthesis
(d) Steroid - cholesterol structure and synthesis

UNIT-2: Theory of concerted reactions-I

(a) Molecular orbitals of ethylene, butadine and allyl systems (cation, anion and radical), Assignment of symmetry of the molecular orbitals with respect of mirror plane and C_2 axis.
(b) Pericylclic reactions: frontier orbital approach, Aromatic transtion state approach (Huckel and Mobiious systems), Woodward - Hofmann rule for pericyclic reactions.

UNIT-3 : **Theory of concerted reactions- II**

(a) Electrocyclic reactions: conversion of butadiene to cyclobutene (to be discussed on the basis of correlation diagram)
(b) Cycloadditions: suprafacial and antarafacial cyclo additions, cyclo-additions of butadiene with ethylene, cyclo-addition of ethylene (correlation diagram for superacial additions shall be discussed only antarafacial addition is discussed with frontier orbital approach and aromatic transition state approach).

BOOKS FOR REFERENCE:

1. Organic Chemistry Vol. II - I. L. Finar
2. Chemistry of Natural Products Vol. II - Sharma and Agrawal
3. Conservation of orbital Symmetry - R. B. Wodward and R. Hofmann
4. Organic Reactions and Orbital Symmetry - T. L. Gilchrist and R. C. Storr.
5. Pericyclic Reaction and Organic Photochemistry - V. P. Sharma and Rakesh Kumar Pragati Prakashan,
6. Frontier Orbital and Symmetry Controlled Pericyclic Reactions by R. K. Kar, Books and Allied Pvt. Ltd.
7. Advanced Organic Chemistry by Jagadamba Singh and L. D. S. Yadav, Pragati Prakashan.

Paper-CHE-303: PHYSICAL

Full Mark 50- (40+10 Marks)

UNIT-1

(a) Interioninc attraction Theory.
(b) Derivation of Debye-Huckel-Onsagar conductance equation, Its verification and modification, determination of degree of dissociation of electrolytes.
(c) Theoretical calculation of activity coefficient from ionic strength by Debye-Huckel theory, determination of activity coefficient by Freezing point method, EMF method and solubility method.

UNIT-2

(a) Ion association, determination of thermodynamic dissociation constant of weak electrolyte by Shedlovsky method, reversible cells, chemical and concentration cells, liquid- junction potential, single electrode potential, oxidation and reduction electrodes.
(b) Determination of dissociation constant of weak monobasic acid, hydrolysis constant of salts, ionic product of water, solubility product of sparingly soluble salts from EMF measurement.
(c) Hydrogen ion concentration in ampholytes and isoelectric points.

UNIT -3

(a) Electrolytic polarization, decomposition potential and over voltage.

(b) Photochemistry: Laws of light absorption, photoelectric effect, Photochemical equivalence, Fluorescence and Phosphorescence, chemiluminescence, photosensitization, predissociation and quantum efficiency of photo chemical reactions.

Book for Reference:

1. Text Book of Physical Chemistry - S. Glasstone.
2. Thermodynamics for chemists - S. Glasstone.
3. Electrochemistry - S. Glasstone.
4. Advance Physical Chemistry - V. K. Gupta & R. G. Sharma.

Paper- CHE-304: PHYSICAL PRACTICAL
(100 Marks)

1. CHEMICAL KINETICS

(a) Kinetics of Ester hydrolysis by acids and alkalis.

2. DISTRIBUTION

(a) Distribution of iodine in water and any organic solvent.
(b) Distribution of ammonia in water and any organic solvent.

3. CONDUCTOMETRY

(a) Determination of cell constant and equivalent conductance at infinite dilution.
(b) Titration (i) NaOH against HCl, (ii) NaOH against mixture of CH_3COOH and HCl.
(c) Mole ratio of CrO_4^{2--} and $Cr_2O_7^{2--}$.
(d) Dissociation constant of weak monobasic acid.
(e) Solubility and solubility product of sparingly soluble salt AgCl.

4. ADSORPTION

(a) Determination of adsorption of acetic acid on activated charcoal in aqueous solution.

5. VICTOR MEYER'S METHOD

Determination of molecular mass of volatile substance.

6. POLARIMETRY

Study of the kinetics of Hydrolysis of cane sugar.

7. POTENTIOMENRY

(a) Determination of P^H of a given solution using Quinhydrone electrode.
(b) Determination of dissociation constant of weak monobasic acid.

(Two Experiments 2×35, Viva voce 20, Record 10)

BOOKS FOR REFERENCE:

1. Physical Chemistry Practical - Behera & Das.
2. Physical Chemistry Experiment - Palit & Dey.
3. Advanced Physical Chemistry Experiment - Gurtu & Kapoor.

FOURTH SEMESTER

Paper- CHE-401: GENERAL CHEMISTRY

Full Mark 50- (40+10 Marks)

UNIT-1

(a) Group theory: groups, subgroups, cosets, classes, symmetry elements and symmetry operations.

(b) Matrix formulation (idea of matrix multiplication inverse, trace, diagonalisation, eigen values and eigen vectors should be given).

(c) Classification of point groups, (H_2O, NH_3, C_6H_6, CH_4 ferrocene) and Octaheral groups to be discussed.

(d) Aromaticity, (4n+2) rule, application of group theory to simple MO determinants.

UNIT-2

(a) Quantum mechanical operators, particle in one and three dimensional box, harmonic oscillator, rigid rotator, rotational energies of diatomic molecules. Interaction of radiation with rotating molecules, determination of moment of inertia and bond length from rotational spectra, relative intensities of spectral lines.

(b) Rotational spectra: linear, molecular symmetric tops, spherical tops, asymmetric tops.

UNIT-3

(a) MO orbital solutions of problems dealing with H_2^-, H_2^-, and H_2^+, ethylene, butadiene, benzene.

(b) Molecular orbital: Hydrogen like orbitals, M. O. calculations, electronic energy levels, LCAO method, overlap and coulomb Integrals, bond order, free value Index, charge distribution, mobile bond order, self consistent field.

BOOKS FOR REFERENCE:

1. Introduction to Molecular spectroscopy – Barrow.
2. Structure and Molecules – Barrow.
3. Chemical applications to Group Theory - F. A. Cotton.
4. M. O. Calculations - J. D. Roberts.
5. M. O. for Organic Chemistry – Stretwieser.
6. Introduction to Ligand Field Theory – Ballhousen.
7. Inorganic Coordination Compounds – D. Banerjee.

Paper-CHE-402: ORGANIC SPECIAL

Full Mark 50- (40+10 Marks)

UNIT-1 : Organic synthesis

(a) Synthesis of compounds using organometallics, Grignard's organo sodium, lithium, cadmium, zinc and tin.

(b) Synthesis of naturally occurring compounds: Penicillin, ATP, prostaglandin PGE_2.

UNIT-2: Name reactions

Perkin, Stobbe, Darzen, Thorpe, Prins, Mannich reaction with application.

UNIT-3: Four centre reaction

(a) Diel's Alder reaction, mechanism, stereochemistry and application, 1, 3 – dipolar ractions involving diazoketones nitriloxide and related compounds like ketocarbons, thermal reactions (Wagner Meerwin, Demjanov, dienone- phenol rearrangement).

(b) Sigmatropic rearrangements.

Books for reference:

1. Organic Chemistry Vol. II - I. L. Finar
2. Chemistry of Natural Products Vol. II - Sharma and Agrawal
3. Conservation of orbital Symmetry - R. B. Wodward and R. Hofmann
4. Organic Reactions and Orbital Symmetry - T. L. Gilchrist and R. C. Storr.
5. Pericyclic Reaction and Organic Photochemistry - V. P. Sharma and Rakesh Kumar, Pragati Prakashan.
6. Frontier Orbital and Symmetry Controlled Pericyclic Reactions by R. K. Kar, Books and Allied Pvt. Ltd.
7. Advanced Organic Chemistry by Jagadamba Singh and L. D. S. Yadav, Pragati Prakashan.

Paper-CHE-403 PHYSICAL

Full Mark 50- (40+10 Marks)

UNIT-1: Photochemistry

a) Light absorption, fluorescence and phosphorescence, light absorption and structure, photo dissociation.
b) photochemical reduction.
c) isomerisation.
d) flash photolysis, chemistry of vision.

UNIT-2: Spectroscopy-II

(a) ORD: Terminology, Cotton effect, ORD of ketones, axial halo ketone rule.
(c) flame emission spectroscopy.
(d) cyclic voltametry, basic principles and general analytical applications.

UNIT-3: Spectroscopy- III

(a) Raman spectra, Raleigh and Raman scattering, vibrational and rotational Raman spectra.
(b) TGA and DTA, instrumentation, application to $CuSO_4$ $5H_2O$, oxalate systems and other phase transfer reactions, thermometric titrations, theory, instrumentation, complexation titration dealing with EDTA.

Books For Reference:

1. Basic Principles of Organic Chemistry – Robert and Casserio
2. Spectroscopy - Barrow
3. Spectroscopy Vol. I & II - Walker & Straw
4. Instrumental Methods of Chemical Analysis by B. K. Sharma, Goel Publications

Paper-CHE-404
ORGANIC SPECIAL PRACTICAL
(100 Marks)

1. Separation and Identification of organic mixture containing two components.
2. Separation of dye mixtures by chromatography.
3. Estimation of C. H. N. and acetyl group (semi micro).
4. Preparation of at least five compounds involving vacuum distillation and fractional distillation (Ex.p-nitroaniline, thiocarbanilide, m-dinitro benzene, p-tolyl sulphonic acid)

5. Paper chromatography of amino acids.
6. Estimation of formaldehyde.
7. Preparation of caffeine from waste tea leaves, cysteine from human hair, hippuric acid from human urine and lactose from milk.
8. Titration curve of amino acids.
9. Estimation of protein content in liver.
10. Quantitative determination and identification of amino acids, nucleic acids and sugars by paper chromatography.

Paper-CHE-402: INORGANIC SPECIAL - I

Full Mark 50- (40+10 Marks)

UNIT-1

(a) **Preparation of metal – complexes**

(i) Direct synthesis
(ii) Metal exchange
(iii) Ligand exchange
(iv) Addition reactions
(v) Cyclization
(vi) Substitution methods
(vii) …..rearrangement

(b) **Nature of …complex Bond**

(i) Crystal Field Theory
(ii) Valence Bond Theory
(iii) Molecular Orbital Theory
(iv) Noble Gas Formalism

(c) Structure Determination: Ismerism in Metal complexes (Geometrical, Structural, conformational and optical), Determination of structure of Zeise's Salt, Ferrocene, Cyclopentadienyl ... Pyrrolyl Iron.

(d) Reactions of metal complex: Reactions of cyclo-pentadienyl complexes, reactions of ferrocene, Friedel Crafdts Acylation and alkylation, Reduction, Aminomethylation, Sulphonoation, condensation, exchange reaction, Arylatins, Reduction, Addition reactions.

UNIT-2: Inorganic and co-ordination polymers:

(a) Phospho Nitrile and chloride polymers.
(b) Polymers containing Boron.
(c) Polymers containing Silicon.
(d) Co-ordination Polymers.

UNIT-3

(a) Stabilization of unusual valency states and less common co-ordination number in complex compounds. General concept about polarisability of ligands, L-M sigma bonds, Polarisability of M-L bonding by ligands, stabilization of univalent and quadrivalent Iron, zerovalent and Tetravalent Nickel, Univalent Manganese.

(b) Stereo Chemistry of complexes having co-ordination number 3, 5, 7 and 8. Effect of Non-bonding shells on the preferred stereochemistry of transitional metal complexes exhibiting co-ordination number 3, 4, 5, 6 and 7.

Paper-CHE-403: INORGANIC SPECIAL-II

Full Mark 50- (40+10 Marks)

UNIT-1

(a) Sigma bonding compounds: Nature of M-C and C-O bonds in carbonyls, spectra and crystallographic evidence and structure of metal cafbonyls: Fe $(CO)_3$, Fe_2 $(CO)_9$, $Mn_2(CO)_{10}$, $Re_2(CO)_{10}$.

(b) Substitution reaction of metal carbonyls with ligands containing N. P. and As and As donors, Oxidation reactions of substitutred carbonyls.

UNIT-2

(a) Inorganic Chemistry in Biological systems. Energy source of life, Metallopporphyrin, Photosynthesis and respiration, Enzymes, Biochemistry of iron, Essential and trace elements in biological system, Biochemistry of non-metals, problems in biological systems.

(b) Non-aromatic olefin and acetylene complexes, Ethylene complexes, Denises and other alkyne complexes.

(c) Catalysis in Organometallic compounds: Coordinative instauration, The 16, 18-electron rule and exidative addition reaction, Tolman catalytic loops, catalysis of reactions of synthesisgs. Heterogeneous catalysis.

(d) Metal cluster: Occurrence of metal - metal bonds, binuclear compounds, Trinuclear clusters.

UNIT-3

(a) Thermodynamics of metal complexes formation in solution: stability constants and significance of thermodynamic functions, correlation with property of metal, ionic charge, ionic radii ionization potential, electro negativity, atomic number and stereochemistry.

(b) Correlation with the properties of ligands, nature of donor atoms effect on substitution and ring formation.

(c) Mechanism of Inorganic substitution reaction: Substitution reactions of square planar complexes, reactions of Pt. (II) complexes. The trans effect, bonding theory, Mechanism of substitution, kinetics of substitution of Pt (II) complexes - Trans and cis effect of leaving group, effect of nuclophile, effect of temperature.

(d) Photochemistry of complex ions.

Books For Reference:

1. Mechanism of Inorganic Reactions - Basolo & Pearson.
2. Inorganic Chemistry - James E. Huheey.
3. Introduction to metal complex - T. SUTSUI etc.
4. Inorganic Polymers - Stone & Grahm.
5. Advanced Inorganic Chemistry - Cotton & Wilkinson.
6. Chemistry of Metal Chelates - Calvin & Martel.
7. Principles of Inorganic Chemistry - G. S. Manku
8. Introduction to Advanced Inorganic Chemistry - Durant & Durant.
9. Treatise in Inorganic Chemistry – Remy
10. Advances in Chemistry no. 100, Bioinorganic Chemistry – J. C. Bailer
11. Metal Complexes - Herberhold.

Paper-CHE-404
INORGANIC SPECIAL PRACTICAL
(Advanced Inorganic Chemistry Practical)
(100 Marks)

1. Qualitative Analysis

Qualitative Analysis of inorganic mixture containing not more than eight radicals (organic radicals are excluded). Any one of the following metal ions may be included (tungsten, molybdenum, titanium, vanadium, cerium, thorium, zirconium and uranium).

2. Quantitative Analysis

(a) Estimation of manganese and nickel in steel
(b) Estimation of nickel in steel
(c) Analysis of solder
(d) Analysis of phosper bronze
(e) Analysis of aluminium bronze
(f) Electrolytic analysis of brass

3. Preparation and analysis of one complex of any two of the following:

(a) Chromium
(b) Iron
(c) Cobalt
(d) Nickel
(e) Copper

Paper-CHE-402: PHYSICAL SPECIAL-I
Full Mark 50- (40+10 Marks)

UNIT-1

(a) Maxewell Boltzman Distribution Law, Evalution of Maxewell - Boltzmann constant, Mixture of gases, Mean values in statistical mechanics.
(b) Principle of equipartitin energy, Eigen values and Eigen values and Eigen States, Bose-Eienstein statistics, Fermi-Dirac Statistics, maxwell-Boltzmann Statistics, comparison of the three stastics Evaluation of the constant 'B', Eigen states and Maxwell Boltzmann equation.
(c) Application of Bose - Einstein statistics of gas degeneration and radiation, application of Fermi-Dirac statistics to Electron gas in metals.

UNIT-2

(a) Statistical thermodynamics, Entrophy and probability, Entroppy and number of Eigen states, Eigen states and energy range, thermodynamic function of a monoatomic gas.
(b) Partition function: Partition function and heat capacity, effect of zero energy level, translational partition function, electronic partition function of mono and diatomec molecules. Nuclear spin effect, Rotation and entropy.
(c) Vibrational partition function of molecules, entrophy, o. p-hydrogen and their ratio.
(d) Entropy of molecular hydrogen, Free energy and equilibria in gaseous system, partition function and quilibrium constant, free energy function and its evaluation.

UNIT-3

Heat capacity of solids: Elenstein heat capacity equation, Debye Specific heat equation.

Paper-CHE-403
PHYSICAL SPECIAL II
(40+10 Marks)

UNIT-1

(a) Atomic spectra, Spectra of hydrogen and hydrogen like atoms, Ritz combination principle and the different series in hydrogen spectra.
(b) Multiple structures of line spectra, Zeeman Effect, Magnetic quantum number.
(c) Spectra of alkali metals and the concept of electron spin quantum number.
(d) Coupling of spectral lines, L-S and J-J coupling.

UNIT-2

(a) Molecule treated as rigid and non rigid rotator.
(b) Molecule treated as harmonic and non-harmonic oscillator,
(c) Fine structure in vibration and rotation bands, P. Q. R. brances.
(d) Spectra of simple diatomic molecules.

UNIT-3

(a) Electronic spectra, Progression and sequence of bands, rotational fine structure, application of P. E. Curve, Morse equation, Frank-condon principle, Forbidden transition.
(b) Raman Spectra, Religh and Raman Scattering, vibration and rotation Raman Spectra.
(c) Qualitative studies of NMR, EPR, Mossbauer spectroscopy.

BOOKS FOR REFERENECE

1. Theoretical Chemistry - Glasstone.
2. Statistical Thermodynamics - M. C. Gupta.
3. Spectroscopy – Dyer.
4. Spectroscopy – Barrow.
5. Spectroscopy Vol. I and II - Walker & Straw.
6. Molecular Spectra - Herzberg.

Paper-CHE-404
PHYSICAL SPECIAL PRACTICAL
(Advanced Physical Chemistry Practical)
100 Marks

1. Determination of 2nd order velocity constant of the hydrolysis of ethyl acetate and methyl acetate by sodium hydroxide.
2. Determination of hydrolysis constant of aniline hydrochloride by conductometric and partition method.
3. Determination of the distribution Co-efficient of acetic acid between water and toluene and the calculation of the association constant of acid in toluene assuming the equilibrium.
4. Determination of the adsorption of acetic acid of activated charcoal in aqueous solution.
5. Viscocity of aqueous organic liquid mixtures (Dioxane, acetone and ethyl alcohol) at different temperature.
6. Determination of half wave potential of Cu & Co-ions by polarography.

Paper-CHE-402
INDUSTRIAL CHEMISTRY SPECIAL-I
(40+10 Marks)

UNIT-1

(a) Material accounting: Material balance equation: Material flow in a chemical process: Units of material flow and balancing, technique of balancing: balancing by using direct approach algeberic technique and tieelements (problems to be discussed).

(b) Energy accounting: Energy balance equations and its application. Energy balance in a stream heat exchange, energy balance around a sulphur dioxide plant. Simultaneous solution of material and energy balance.

UNIT-2

(a) Heat transfer steady flow of heat in a homogeneous body, series resistance to flow of heat, conduction of heat through cylindrical vessel, heat transfer by convection, concept of the film, overall co-efficients, magnitude of heat transfer co-efficient, fouling factors, practive of heat exchange, heat exchange concept in scale up.

(b) Kinetics:

(i) Homogeneous reactions: Method of mass transfer in chemical reaction vessels, Batch and flow reactors.

(ii) Heterogeneous reactions: Heterogeneous catalysis, catalyst evaluation programme.

UNIT-3

(a) Separation Process: Characteristics of separation processes, phaseequilibria, separations involving one, two and three component systems, distribution equilibrium separation, equilibrium distribution curve, capacity factors, separations factors, selection of separation processes.

(b) Unit process and unit operations in chemical industries.

Paper-CHE-403
INDUSTRIAL CHEMISTRY SPECIAL-II
(40+10 Marks)

UNIT-1

(a) Oils and fats: Solvent extraction of oils, Hydrogenation of oils, use of oils in the manufacture of soaps, paints, varnishes.

(b) Surface active agents: Classification, manufacture of detergents, used for cleansing purposes.

(c) Fermentation Industries: A general discussion on fermentation conditions, Manufacturing of penicillin.

UNIT-2

(a) Petroleum and petro-chemicals: Composition of petroleum, cracking process. commercial production of ethylene, acetylene, cyclohexane, caprolactum, polymerization mechanisms (Addition, condensation, step growth, chain growth method of polymerization).

(b) Fertilisers: Nirtrogeneous, Phosphatic and potash fertilizers.

(c) Paper Industry: Manufacture of pulp by different processes and paper manufacturing.

UNIT-3

(a) Plastic from natural sources, cellulose acetate, ethyl cellulose, caosin. phenolic plastics, polymethylmethacry lates.

(b) Emplosives: T. N. T. nitro cellulose, Dynamite, Gunpowder.

(c) Dyes and Dying: Fibres to be dyed, different types of dyes, vat dyes, mordant dyes, lakes, application of dyes.

(d) Alkydresins: General properties and chemistry, Raw materials, polymer properties: Modified alkyds with monomers and other materials, Non-coating applications.

BOOKS FOR REFERENCE:

1. Industrial Chemistry - B. K. Sharma.
2. A text book of chemical technology - (Vol. I & II) - S. D. Sukhla & G. D. Pandey.
3. Wood extraction - W. E. Hills.
4. Your guide to Plastics - J. Gordon Cook.
5. Applied Chemistry, Theory and Practice - O. P. Vermani & A. K. Narula
6. Hand Book of Industrial Chemistry - James A. Kent

Paper-CHE-404
INDUSTRIAL CHEMISTRY PRACTICAL
(100 Marks)

1. Determination of percentage purity of commercially available N. P .K. fertilizers.
2. Estimation of Mg. in bazaar salt.
3. Water analysis:
   (a) Residual chlorine in town supply water
   (b) NH... content of sewage water
   (c) Dissolved oxygen in water.
4. Estimation of oil content in different raw materials and estimation of acid value, saponification value and iodine value.
5. Determination of flash point and viscosity of an oil.
6. Kinetic study of a polymerisation process starting with a vinyl monomer.
7. Synthesis of industrially important chemicals and their analysis by instrument techniques.
8. A project report to be submitted on the working in at least two chemical industries of the state.

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