

**CENTURION UNIVERSITY OF TECHNOLOGY AND
MANAGEMENT, ODISHA**

SCHOOL OF BASIC SCIENCES



5-YEAR INTEGRATED M.Sc. PROGRAMME

IN

APPLIED CHEMISTRY

2012-13

SYLLABUS

**CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT,
PARALAKHEMUNDI**

5 Year Integrated M.Sc. in Applied Chemistry

Detailed Course Structure

SEMESTER-I				
Sl no	Subject Code	Subject	Contact Hours per week (L+T+P)	Credits
1	MIL101	ORIYA/HINDI	2+0+0	2
2	PHY101	PROPERTIES OF MATTER, WAVES & OSCILLATIONS	3+1+0	4
3	CHE101	GENERAL CHEMISTRY-I	3+1+0	4
4	MAT101	ORDINARY DIFFERENTIAL EQUATION-I	3+1+0	4
5	BIO101	BIOLOGY	3+1+0	4
6	PL101	PHYSICS LABORATORY-1	0+0+3	2
7	CL101	CHEMISTRY LABORATORY-1	0+0+3	2
8	BL101	BIOLOGY LABORATORY	0+0+3	2
TOTAL CREDITS				24

SEMESTER-II				
Sl no	Subject Code	Subject	Contact Hours per week (L+T+P)	Credits
1	ENG201	COMMUNICATIVE ENGLISH-I	2+0+0	2
2	PHY201	HEAT & THERMODYNAMICS	3+1+0	4
3	CHE201	GENERAL CHEMISTRY-II	3+1+0	4
4	MAT201	CALCULUS & SOLID GEOMETRY	3+1+0	4
5	EVS201	ENVIRONMENTAL STUDIES	3+1+0	4
6	PL201	PHYSICS LABORATORY-2	0+0+3	2
7	CL201	CHEMISTRY LABORATORY-2	0+0+3	2
8	EL201	COMMUNICATIVE PRACTICE LABORATORY-I	0+0+3	2
TOTAL CREDITS				24

SEMESTER-III				
Sl no	Subject Code	Subject	Contact Hours per week (L+T+P)	Credits
1	ENG301	COMMUNICATIVE ENGLISH-II	2+0+0	2
2	PHY301	GEOMETRICAL AND PHYSICAL OPTICS	3+1+0	4
3	CHE301	INDUSTRIAL CHEMISTRY	3+1+0	4
4	MAT301	ANALYSIS-I	3+1+0	4
5	ISC301	INDIAN SOCIETY AND CULTURE	3+1+0	4
6	PL301	PHYSICS LABORATORY-3	0+0+3	2
7	CL301	INDUSTRIAL CHEMISTRY LABORATORY	0+0+3	2
8	EL301	COMMUNICATIVE PRACTICE LABORATORY-II	0+0+3	2
TOTAL CREDITS				24

SEMESTER-IV				
Sl no	Subject Code	Subject	Contact Hours per week (L+T+P)	Credits
1	PHY401	ELECTRICITY & MAGNETISM	3+1+0	4
2	MAT401	LINEAR ALGEBRA	3+1+0	4
3	CHE401	INORGANIC CHEMISTRY-I	3+1+0	4
4	CHE402	PHYSICAL CHEMISTRY-I	3+1+0	4
5	FEL401	FREE ELECTIVE-I	3+1+0	4
6	PL401	PHYSICS LABORATORY-4	0+0+3	2
7	CL401	INORGANIC CHEMISTRY LABORATORY	0+0+3	2
TOTAL CREDITS				24

SEMESTER-V				
Sl no	Subject Code	Subject	Contact Hours per week (L+T+P)	Credits
1	CHE501	PHYSICAL CHEMISTRY-II	3+1+0	4
2	CHE502	INORGANIC CHEMISTRY-II	3+1+0	4
3	CHE503	ORGANIC CHEMISTRY-I	3+1+0	4
4	CHE504	APPLIED CHEMISTRY	3+1+0	4
5	FEL501	FREE ELECTIVE-II	3+1+0	4
6	CL501	CHEMISTRY LABORATORY-3	0+0+3	2
7	CL502	CHEMISTRY LABORATORY-4	0+0+3	2
TOTAL CREDITS				24

SEMESTER-VI				
Sl no	Subject Code	Subject	Contact Hours per week (L+T+P)	Credits
1	CHE601	PHYSICAL CHEMISTRY-III	3+1+0	4
2	CHE602	INORGANIC CHEMISTRY-III	3+1+0	4
3	CHE603	ORGANIC CHEMISTRY-II(REACTION MECHANISM)	3+1+0	4
4	CHE604	ORGANIC CHEMISTRY-III(CHEMISTRY OF NATURAL PRODUCTS)	3+1+0	4
5	CHE605	INSTRUMENTAL METHODS OF ANALYSIS	3+1+0	4
6	CL601	CHEMISTRY LABORATORY-5	0+0+3	2
7	CL602	CHEMISTRY LABORATORY-6	0+0+3	2
TOTAL CREDITS				24

SEMESTER-VII				
Sl no	Subject Code	Subject	Contact Hours per week (L+T+P)	Credits
1	CHE701	PHYSICAL CHEMISTRY-IV	3+1+0	4
2	CHE702	INORGANIC CHEMISTRY-IV	3+1+0	4
3	CHE703	ORGANIC CHEMISTRY-IV	3+1+0	4
4	CHE704	POLYMER CHEMISTRY	3+1+0	4
5	CL701	CHEMISTRY LABORATORY-7	0+0+6	4
6	FEL701	FREE ELECTIVE-III	3+1+0	4
TOTAL CREDITS				24

SEMESTER-VIII				
Sl no	Subject Code	Subject	Contact Hours per week (L+T+P)	Credits
1	CHE801	PHYSICAL CHEMISTRY-V	3+1+0	4
2	CHE802	INORGANIC CHEMISTRY-V	3+1+0	4
3	CHE803	ORGANIC CHEMISTRY-V	3+1+0	4
4	CHE804	NUCLEAR CHEMISTRY	3+1+0	4
5	CL801	CHEMISTRY LABORATORY-8	0+0+6	4
6	FEL801	FREE ELECTIVE-IV	3+1+0	4
TOTAL CREDITS				24

SEMESTER-IX				
Sl no	Subject Code	Subject	Contact Hours per week (L+T+P)	Credits
1	CHE901	ADVANCED INORGANIC CHEMISTRY	3+1+0	4
2	CHE902	ADVANCED ORGANIC CHEMISTRY	3+1+0	4
3	CHE903	ADVANCED PHYSICAL CHEMISTRY	3+1+0	4
4	CHE904	SOLID STATE CHEMISTRY	3+1+0	4
5	CL901	CHEMISTRY LABORATORY-9	0+0+6	4
6	CS901	SEMINAR		4
TOTAL CREDITS				24

SEMESTER-X				
Sl no	Subject Code	Subject	Contact Hours per week (L+T+P)	Credits
1	CHE1001	ORGANIC SPECTROSCOPY	3+1+0	4
2	CHE1002	BIO-INORGANIC CHEMISTRY	3+1+0	4
3	CS1001	SEMINAR		4
4	CD1001	PROJECT/DISSERTATION		12
TOTAL CREDITS				24

FREE ELECTIVES:

1. PROBABILITY & STATISTICS
2. BASIC ELECTRONICS
3. BIOTECHNOLOGY
4. PRINCIPLES OF ECONOMIC ANALYSIS
5. ORGANISATIONAL BEHAVIOUR
6. NUMERICAL ANALYSIS

M.I.L 101 M.I.L (Odia) (2-0-0)

FIRST SEMESTER

(ଆଧୁନିକ ଭାରତୀୟ ଭାଷା, ଓଡ଼ିଆ)

ଆଧୁନିକ ଭାରତୀୟ ଭାଷା (ଓଡ଼ିଆ) ପାଠ୍ୟକ୍ରମ ପାଇଁ ୧୦୦ **Percentage Point** ରହିବ ।

ଉପାଂଶ-୧

ପ୍ରବନ୍ଧ ବାଚାୟନ - ସଂପାଦନା - ଶରତ ଚନ୍ଦ୍ର କର ।

- ପାଠ୍ୟ ୧) ଗୁରୁ ଓ ଶିଷ୍ୟ- ଅଧ୍ୟାପକ ବିପିନ ବିହାରୀ ରାୟ ।
୨) ଜନ୍ମଭୂମି-ଡ. କୃଷ୍ଣଚନ୍ଦ୍ର ପାଣିଗ୍ରାହୀ ।
୩) ଭୂଲ-ଡ: ଭୁବନେଶ୍ୱର ବେହେରା ।

ଉପାଂଶ-୨

କବିତାର ନୂଆ ମାନଚିତ୍ର- ସଂପାଦନା- ଦାଶରଥୀ ଦାସ ।

- ପାଠ୍ୟ - ୧) ମୁଁ ହାଟ ବାହୁଡା-ଫକୀର ମୋହନ ସେନାପତି ।
୨) ବନ୍ଦୀର ଆତ୍ମକଥା-ଗୋପବନ୍ଧୁ ଦାଶ ।
୩) ଆଗାମୀ - କାଳିନ୍ଦୀ ଚରଣ ପାଣିଗ୍ରାହୀ ।
୪) ଅପଥଗାମୀ - ରାଧାମୋହନ ଗଡନାୟକ ।
୫) ଝଡ- ସଚ୍ଚିଦାନନ୍ଦ ରାଉତ୍ରାୟ ।

(ଉପରୋକ୍ତ ଦୁଇଟି ଉପାଂଶରୁ ଦୀର୍ଘତର ମୂଳକ ପ୍ରଶ୍ନ ଦିଆଯିବ । ସେହିପରି ଉଭୟ ଉପାଂଶରୁ ଦୁଇଟି କରି ଚାରୋଟିର ସରଳାର୍ଥ ପ୍ରଶ୍ନ ଦିଆଯିବ ।

ଉପାଂଶ-୩

ପ୍ରବନ୍ଧ ଲିଖନ ।

(ସାହିତ୍ୟ- ବିଜ୍ଞାନ ଭିତ୍ତିକ ଚିନ୍ତାମୂଳକ ଓ ସମସ୍ୟା ଧର୍ମୀ) ।

ଉପାଂଶ-୪

ଭ୍ରମ ସଂଶୋଧନ

- କ) ଶବ୍ଦଗତ ଭ୍ରମ
ଖ) ବାକ୍ୟଗତ ଭ୍ରମ

M.I.L 101 M.I.L (Hindi) (2-0-0)
FIRST SEMESTER

There shall be one paper carrying 100 percentage point in the First Semester.

1. गद्यपाठ : श्रेष्ठ हिन्दी निबन्ध : सम्पादक - डॉ अजय कुमार पट्टनायक,
शबनम पुस्तक महल, कटक।
पाठ्य विषय: ईर्ष्या : रामचन्द्र शुक्ल
कुटज : हजारी प्रसाद द्विवेदी
पर्वतपुत्र : महादेवी वर्मा
2. पद्यपाठ : काव्य सौरभ : सम्पादक : पुरुषोत्तम दास मोदी, विस्वविद्यालय
प्रकाशन, वाराणासी।
पाठ्य विषय क) कबीर - साखियाँ-----1-10
ख) सुरदास- बाल लीला : पद-3, बिनयपद : 4, 5
ग) जय शंकर प्रसाद - बीती बिभाबरी
घ) सुमित्रा नन्दन पंत - मौन निमन्त्रण
ङ) महादेवी वर्मा : गीत संख्या -2
(यह मन्दिर का दीप...)
3. व्याकरण (लिंग, वचन, क्रिया, कारक, वाक्य, शब्द क्रम सम्बन्धी वाक्य शुद्धि)
4. संक्षेपण (**Précis Writing**)
(A Passage about 150 words to be given for précis writing)

The division of the units for the examination will be as follows:

Unit-I

One long question from Prose.

Unit-II

One long question from Poetry.

Unit-III

- a) Explanation from Prose
- b) Explanation from Poetry.

Unit-IV

Grammar

Unit - V

Précis Writing

1. सन्दर्भ ग्रन्थ :
 1. आधुनिक हिन्दी व्याकरण ओर रचना - वासुदेव नन्दन प्रसाद.
 2. शुद्ध हिन्दी : डॉ. हरदेव बाहरी

PHY101 PROPERTIES OF MATTER, WAVES AND OSCILLATIONS (3-1-0)

FIRST SEMESTER

Module-I

Moment of Inertia, Theorem of Parallel and Perpendicular axes. Moment of inertia of circular disc, cylinder, sphere and rectangular objects, Routh's rule, Bar pendulum, Kater's Pendulum, Correction for finite amplitude of Swing and Rigidity of support, Gravitational field and Potential due to a spherical shell and Solid sphere.

Module-II

Elasticity: Relation among elastic constants, torsion of right circular cylinder, bending of beams, Vibration of loaded cantilever, Vibration of springs (flat).

Surface Tension: Surface tension, Surface energy, Pressure difference across curved liquid surface, shape of a large drop (Quincke's method), Gravity waves, Capillary waves and Ripples.

Viscosity: Stoke's law, Poiseuille's equation, Searle's viscometer, Viscosity of gases (Rankine's method).

Module-III

Waves and oscillations: Superposition of SHM, Lissajous figures, free, damped and forced vibrations, Q-factor, Resonance, Velocity of longitudinal waves and transverse waves, Vibration of strings - theory of plucked, struck and bowed strings.

Ultrasonics- Production, detection and applications of ultrasonic waves.

Text Books:

1. Properties of Matter - D. S. Mathur, S Chand Publication, (reprint) 2011.
2. A Textbook of Sound (Paperback) by P. K. Mittal, Jai Dev Anand, Har-Anand Publication, 2011.

Reference Books:

1. A text book of Sound - by Khanna & Bedi.
2. A text book of sound - A.B. Wood
3. Advanced text book of Sound - D. P. Ray Choudhari.
4. Properties of Matter - Newmann and Searle.
5. Oscillations & Waves - D. P. Khandelwal, Himalaya Publication.

CHE 101 GENERAL CHEMISTRY-I (3-1-0)

FIRST SEMESTER

Module-1 (Inorganic Chemistry)

Atomic Structure: Bohr's model & its drawbacks, Sommerfeld's model, Wave nature, de-Broglie's equation, Heisenberg's uncertainty principle, Schrodinger's wave equation, Physical significance of

wave function, orbital shapes, quantum numbers, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau principle, Stability of completely filled and partially filled orbitals.

Periodic classification: Early attempts of classification of elements: Dobereiner's triads. Newlands Octaves. Lothar Meyer's atomic volume curve. Mendeleev's classification: Mendeleev's periodic law and periodic table. Main features of Mendeleev's periodic table. Merits of Mendeleev's periodic classification. Defects in Mendeleev's periodic classification. Modern classification & Modern periodic law. Long Form of the periodic table., Periodicity in properties.

Chemical Bonding: Ionic Bond, Lattice energy, Born-Haber cycle, dipole moment, Covalent bond, Coordinate covalent bond, valence bond approach, hybridization (sp, sp^2, sp^3), MO theory, LCAO, MO diagram of H_2, B_2, N_2, O_2 & NO, CO, Metallic bond.

Module -II (Physical Chemistry)

Kinetic Theory of Gases: Derivation of Kinetic equation & deduction of gas laws, Avogadro's Hypothesis, Law of diffusion, gas constant, behavior of real gases, Vander waal's equation of state.

Chemical Kinetics: Rate of reaction, factors influencing the rate of reaction, Molecularity & order of a reaction, Derivation of Zero order, 1st order & 2nd order rate equations, Half life period, Determination of order, Collision theory, effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

Electrochemistry: Specific, equivalent and molar conductance, Kohlrausch's law of independent mobility of ions Variation of specific & equivalent conductance with dilution for strong & weak electrolytes, Application of conductance measurement, Conductometric titrations, Acids and bases, Lowry-Bronsted and Lewis concepts of acids and bases, pH, theory of acid -base indicators, buffer solution, buffer capacity and buffer range.

Module-III (Organic Chemistry)

Distribution of electrons in organic molecules: Inductive effect, Electromeric effect, hyperconjugation steric effect & resonance.

Reaction intermediates: Generation, structure & stability of carbocation, carboanion & free radicals.

Reaction Mechanism: $SN_1, SN_2, SE_1, SE_2, AdN, AdE$

Basic Stereochemistry : Concept of isomerism, types of isomerism, conformational isomerism of ethane & n-butane, Newman projection, sawhorse and Fischer formulae, configurational isomerism-optical isomerism-conditions of optical activity, optical isomerism of lactic acid & tartaric acid, enantiomers, diastereoisomers, meso compounds, racemic modifications, D & L and R & S systems of nomenclature, Geometrical isomerism with examples, E & Z system of nomenclature.

Alkanes: Preparation and properties of alkanes.

Alkenes and Alkynes: Preparation, Properties: Hydrogenation, Electrophilic addition-HX, H_2O , acidity of alkynes

Alkyl halides: Preparation from alcohol, Chemical reactions, properties, reactivity of organic halides.

Organometallic Compounds: Grignard's reagent, Preparation from alkylbromide, synthetic uses.

Text Books:

1. Principles of Physical Chemistry: B.R.Puri, L.R.Sharma, and M.S.Pathania, Vishal Publishing co.
2. Advanced Inorganic Chemistry, Vol-I: Gurdeep Raj, Goel publishing House.
3. A text book of Inorganic Chemistry: Malik, Madan&Tuli
4. Advanced Organic Chemistry: A.Bahl & B.S.Bahl, S.Chand & Company Ltd., New Delhi

Reference Books:

1. Elements of Physical Chemistry: P.W.Atkins, Oxford University Press
2. A text book of Physical Chemistry: S.Glasstone, The Macmillan Press Ltd
3. Basic Inorganic Chemistry: F.A.Cotton, G.Wilkinson&P.Gaus, John wiley and sons.
4. Concise Inorganic Chemistry: J.D.Lee, ELBS with Champman& Hall.
5. Organic Chemistry, Vol.I: I.L.Finar, ELBS with Longman/Pearson Education

MAT 101 ORDINARY DIFFERENTIAL EQUATION-I (3-1-0)

FIRST SEMESTER

MODULE-I

Introduction and some basic concept of differential equations, Solution of Higher order Linear differential equations with constant coefficients and equations with variable coefficients.

MODULE-II

Power Series solutions about ordinary point, Legendre's Equation and its simple properties.

MODULE-III

Power Series solutions about singular points, Bessel's Equation and Bessel's Function.

Text Book:

- 1) Text Book of Differential Equations : N.M. Kapoor,
Chapters: 4,5,13,14,15

Reference Books:

- 1) Introductory course in Differential Equations : D.A. Murray
- 2) Elements of Ordinary Differential Equations and Special Functions : A. Chakrabarty
(New Age International)

BIO 101 BIOLOGY (3-1-0)

FIRST SEMESTER

Module-I

The living world & the cell as the unit of life:

The living world: Origin, evolution & maintenance of life, varieties of living organisms – two & five kingdom classifications, fundamental knowledge on the chemistry and biological importance of water, nucleic acid, amino acid, protein and carbohydrates.

The cell: Discovery, cell theory, Prokaryotic & eukaryotic cells, plant & animal cells, ultra structure of a typical cell, structure and function of cell wall, plasma membrane, chloroplast, mitochondria, lysosome, ribosome, nucleus, ER, golgi complex, chromosomes.

Module-II

Microbes, Plants & Animals:

Salient features of bacteria, viruses, algae & fungi (general characteristics and economic importance), structure & life cycle of a typical flowering plant, General characteristics of non-chordates and their difference.

Nature of living beings: Plant nutrition – Photosynthesis, nitrogen fixation & nitrogen cycle, Human physiology – food, diet & digestion, Blood & its composition, function and circulation. Principles of heredity – Mendelism, chromosomal basis of sex determination in man.

Module-III

Applied Biology:

Economic importance of medicinal plants (ocimum, Aegle, Azadirachta), Germplasm conservation, Biofertilizer&biopesticide, preliminary idea about plant cell and tissue culture, General principles of genetic engineering and its applications.

Text Books :

1. A Text Book on Cell Biology, Genetics, Molecular Biology, Evolution And Ecology by P.S. Verma, S Chand Publishing, 2004.

Reference Books:

- 1 Cell biology by C.B.Power
- 2 Cell & Molecular biology by P.K.Gupta
- 3 Microbiology by Prescott
- 4 Biotechnology by B.D.Singh
- 5 Human Physiology by Patabirman
- 6 Genetics by P.K.Gupta

PL101 PHYSICS LABORATORY-1 (0-0-3)

FIRST SEMESTER

1. Determination of 'g' by bar pendulum.
2. Determination of Moment of Inertia of rolling cylinder.
3. Determination of surface tension by capillary rise method.
4. Determination of Latent heat of steam with radiation correction.
5. Determination of A , D_m & μ . by spectrometer.
6. Determination of coefficient of cubical expansion by wt thermometer.
7. Determination of Resistance of B.G. by half deflection method.
8. Determination of field along the axis of circular coil
9. Study the characteristics of diode valve & finding plate resistance.
10. Study of characteristics of PN-Junction diode.

CL 101 CHEMISTRY LABORATORY-I (0-0-3)

FIRST SEMESTER

1. Qualitative analysis of mixture of Inorganic substances containing not more than four radicals except Fluoride, Oxalate, Chromate, Dichromate, Permanganate & arsenate
2. Preparation of buffer solutions of
 CH_3COONa & CH_3COOH .
 NH_4Cl & NH_4OH
 NaH_2PO_2 & Na_2HPO_4
 Measurement of their pH by pH papers & Universal indicator.
3. Conductometric titration of acids and bases.
4. Standardisation of KMnO_4 by using Standard $\text{Na}_2\text{C}_2\text{O}_4$
5. Estimation of Fe^{2+} in Mohr's salt Solution using standard KMnO_4

BL 101 BIOLOGY LABORATORY (0-0-3)

FIRST SEMESTER

1. Study of cell structure from onion leaf peels.
2. Study of cyclosis in *Tradescantia*.
3. Study of bacteria, algae & fungi
4. To study the effect of light intensity, quality and concentration of CO_2 in the rate of photosynthesis.
5. Determination of blood group.
6. Leucocytes count in Mammalian blood film.
7. Paper Chromatography.
8. Demonstration for media preparation for plant tissue culture.
9. To study the structure of a typical angiospermic plant.
10. Study on different types of bones and its functions.

ENG 201 COMMUNICATIVE ENGLISH-1 (2-0-0)

SECOND SEMESTER

The paper in English is of 100 (Hundred) percentage marks.

Module-I: Communication Skill

Communication: Definition, concept

Channels of Communication: Sender, receiver, channel, message, encoding, decoding, context, feedback

Verbal & Non-Verbal Communication: Spoken & written-advantages & disadvantages

Bias free English,

Formal & informal style.

Module-II: Communicative Grammar

Time, Tense & Aspect

Verbs of state & events

Modality

Active & Passive voice

Antonyms, Synonyms, Homonyms, one word substitutions & correction of errors

Module-III: Sounds of English

Length of vowels:

Long vowels as in the words feel, food, shoot, card etc.

Short vowels as in the words pen, sun, cut, shut, etc.

Consonants

Stress pattern

Intonation: Rising & Falling.

Text Books:

Effective technical communication by M.A.Rizvi

Reference Books:

Communicative English & Business Communication by R.K.Panda, J.Khuntia, M.Pati, Alok Publication.

Communicative Grammar of English Geoffery Leech

Brush up your English- S.T.Iman (Bharati Bhavan, Patna)

PHY 201 HEAT & THERMODYNAMICS (3-1-0)

SECOND SEMESTER

Module-I

Kinetic Theory: Vander Waals' equation, Reduced equation of state, critical phenomena, Mean free path, Transport phenomena, Calculation of specific heat, Conductivity and Viscosity of gases, Maxwell's law of distribution of velocities, Brownian motion, Einstein's theory.

Thermal Conductivity: Differential equation of heat flow, Temperature distribution of heated rods, Ingen- Hausz, Searle's and Lee's methods for determination of thermal conductivity of solids, thermal conductivity of liquids and gases, their experimental determination.

Module-II

Radiation: Kirchhoff's law, Stefan's law; Radiation pressure, Energy distribution of Black body radiation, Wien's, Rayleigh - Jeans' and Planck's law.
Einstein and Debye's theory of specific heat of solids

Thermodynamics: Work and internal energy in different processes, indicator diagram, First law of thermodynamics and its applications, Carnot's cycle & Engine, Carnot's theorem. Absolute scale of temperature, second law of thermodynamics, entropy and unavailable energy, change of entropy in reversible and irreversible processes, entropy of an ideal gas, temperature and entropy diagram,

Module-III

Enthalpy, Helmholtz and Gibb's function. Maxwell's thermodynamic relations and applications.

Clausius-Clapeyron equation, vapour pressure, Joule Thomson effect, porous plug experiment, third law of thermodynamics, production and measurement of low temperature. liquefaction of gases, adiabatic demagnetization, thermoelectricity, thermodynamic treatment of thermocouple,.

Text Books:

1. Heat and Thermodynamics - M. W. Zemanasky, Tata McGraw Hill Education Pvt. Ltd., 2011.

Reference Books:

- 1 A Treatise on Heat – M.N. Saha and B.N. Srivastava, The Indian Press (Publications) Pvt. Ltd., (reprint) 2012.
- 2 Advanced Text Book on Heat - P. K. Chakraborty, Sridhar Prakashani, Kolkata, (reprint) 2011.

CHE 201 GENERAL CHEMISTRY-II (3-1-0)

SECOND SEMESTER

Module-1 (Inorganic Chemistry)

Chemistry of d block elements, general trends in the groups, Electronic configurations, atomic and covalent radii, electron affinity, electronegativity & ionization potential, colour and magnetic properties, variable valency.

Inert gases, Preparation & properties of the compounds and uses of the gases & their compounds.

Preparation, Properties and structure of boric acid, diborane, borazines, silicones, hydrazine.

Isotopes of hydrogen, ortho & para hydrogen, study of hydrides & their classifications.

Nuclear Chemistry: characteristics of radioactive rays, group displacement law, mass defect, binding energy, decay constant, half-life period, nuclear fission & fusion

Module-II (Physical Chemistry)

Colligative Properties: Osmotic Pressure & laws, relative lowering of vapour pressure of a Solution, lowering of freezing point and elevation of boiling point of a solution, Determination of Molecular weight by these methods.

Colloidal State:- Types of Colloids, their methods of preparation, dialysis, optical and electrical Properties of colloids, coagulation.

Phase rule- Definition of phase, component, degrees of freedom, Water and Sulphur systems.

Chemical equilibrium: Law of mass action, Le chatelier principle & their applications to manufacture of ammonia, dissociation of PCl_5 , dissociation of nitrogen tetroxide, hydrolysis of ethyl acetate.

Module-III (Organic Chemistry)

Alcohols: classifications, preparation from halides, organometallics, aldehydes, ketones, esters, properties: metals, PCl_5 , oxidation, esterification

Aldehydes & Ketones: Preparation from acid halides, organometallics, alcohols, dry distillation, properties: oxidation, reduction, carbonyl addition reaction with water, alcohol, phenyl hydrazine, hydroxyl amine, semicarbazide, HCN, aldol condensation, Cannizzaro's reaction.

Carboxylic acids: Preparation from aldehydes, ketones, nitriles, esters, properties: PCl_5 , SOCl_2 , esterification

Esters containing active methylene group: Acetoacetic ester: synthesis (Claisen reaction), synthetic uses (alkenes, ketones & acids), structure of acetoacetic ester, keto-enol tautomerism, Malonic ester: preparation, synthetic uses (alkanes, ketones, acids)

Amines: classification, preparation of primary amine from nitro compounds, nitriles, isocyanides, properties: HNO_2 , acylation, distinction between three amines.

Carbohydrates: classification & nomenclature, glucose & fructose, osazone formation, reaction with Fehling's solution, mutarotation, interconversion of glucose and fructose.

Aromaticity: Huckel rule, nomenclature of benzene derivatives, structure of benzene, Kekulé structure, resonance structure.

Aromatic compounds: Chloroderivatives of benzene and toluene, nitro compounds & their reduction products, aniline, diazonium salts and their synthetic applications, phenylhydrazine, benzene sulphonic acid, phenols: preparation (diazo reaction & fusion), properties (acidity, esterification, electrophilic substitution, Kolbe's synthesis, Reimer-Tiemann reaction, diazo coupling).

Heterocyclic compounds: five membered heterocycles (Pyrrole, thiophene & furan) - nomenclature

Text Books:

1. Principles of Physical Chemistry: B.R.Puri, L.R.Sharma, and M.S.Pathania, Vishal Publishing co.
2. Advanced Inorganic Chemistry, Vol-I: Gurdeep Raj, Goel publishing House.
3. A text book of Inorganic Chemistry: Malik, Madan & Tuli
4. Advanced Organic Chemistry: A.Bahl & B.S.Bahl, S.Chand & Company Ltd., New Delhi

Reference Books:

- 1 Elements of Physical Chemistry: P.W.Atkins, Oxford University Press
- 2 A text book of Physical Chemistry: S.Glasstone, The Macmillan Press Ltd
- 3 Basic Inorganic Chemistry: F.A.Cotton, G.Wilkinson & P.Gaus, John Wiley and sons.
- 4 Concise Inorganic Chemistry: J.D.Lee, ELBS with Chapman & Hall.
- 5 Organic Chemistry, Vol.I: I.L.Finlar, ELBS with Longman/Pearson Education

MAT 201 CALCULUS & SOLID GEOMETRY (3-1-0)

SECOND SEMESTER

MODULE-I

Curvature, Asymptotes, Tracing of Curves:

Cartesian, Cycloid, Folium of Descartes, Astroid, Limacon, Cissoids, Cardioid, Lemniscate and Loops.

MODULE-II

Rectification, Quadrature, Volume and surface area of solids of revolutions.

MODULE-III

Spheres, Cones, Cylinders and Central Conicoids.

Text Books:

- 1) A Text book of Calculus Part – II : Shantinakaran
Chapter : 8 (Art. 24, 25, 26)
- 2) A Text book of Calculus Part-III : Shantinakaran
Chapters : 1 (Art 1, 2), 3,4(Art 10-12 omitting Simpson's rule), 5,6.
- 3) Analytical Geometry of Quadratic Surfaces : B.P. Acharya& D.C. Sahoo
Chapters : 2,3,4

EVS 201 ENVIRONMENTAL STUDIES (3-1-0)

SECOND SEMESTER

Module-I

Concepts of Ecology & Environment: Definition-Environment, Ecology & Ecosystem; Environmental concepts – Atmosphere, Hydrosphere, Lithosphere & Biosphere, Environmental factors – Abiotic factors (Climate & Edaphic) & Biotic factors, Environmental gradients & limiting factor.

Concept of Ecosystem & Processes: Type & Structure, Ecosystem Processes – Energy flow, food chain, food web & ecological pyramids; Biogeochemical cycles – Hydrological cycle(water), gaseous cycle(carbon & oxygen), sedimentary cycle(nitrogen & sulphur).

Module-II

Population ecology & Ecological succession:

Population ecology: Population density, natality, mortality, population age structure, population growth curves & carrying capacity.

Ecological succession: Characteristics, types (Hydrosere & Xerosere) & Process.

Environmental Pollution: Water pollution, Noise pollution, Air pollution(source, effect, control measure), Depletion of ozone layer – cause, effect & control measure, Green House Effects & Global warming, Acid rain, Biological concentration and biomagnifications, Sewage & sewage treatment.

Module-III

Conservation of natural resources: Natural resources – renewable, non-renewable, abstract resources, Biodiversity & its conservation, wild life conservation, pollution control board, Environmental awareness & mass education.

Text Books:

1. Text book of Environmental studies by A.K.Panigrahy & A.Sahu, Sadagrantha Mandir Publishing, Berhampur.

Reference Books:

1. Fundamentals of Ecology by E.P.Odum

2. Environmental Engineering by G.Kiely
3. Fundamentals of Environmental studies by N.K.Tripathy
4. Environmental Biology by P.D.Sharma
5. Ecology & Environment by P.D.Sharma
6. Principles of Environmental Engineering & Science by Davis & Masten
7. Principles of Environmental Science by Cunningham.

PL201 PHYSICS LABORATORY-2 (0-0-3)

SECOND SEMESTER

1. Determination of by 'Y' single cantilever method'
2. Verification of laws of transverse vibration by sonometer.
3. Determination of surface tension by Quinke's drop method.
4. Calibration of set of weights.
5. Determination of Latent heat of ice with radiation correction.
6. Determination of $\mu_{\text{byi-D}}$ curve using spectrometer.
7. Determination of diameter of Lycopodium powder.
8. Determination of figure of merit of ballistic Galvanometer.
9. Study the characteristics of Triode and find triode constants.
10. Study of half/full wave rectifier with filter circuit.

CL201 CHEMISTRY LABORATORY-II (0-0-3)

SECOND SEMESTER

1. Systematic identification of functional groups of simple organic compounds of CHO & CHN systems.
2. Determination of MP/BP of organic compound.
3. Estimation of Copper iodometrically.
4. Estimation of Chlorine iodometrically.
5. Estimation of Fe^{2+} & Fe^{3+} by dichrometry method

EL 201 COMMUNICATIVE PRACTICE LAB-II (0-0-3)

SECOND SEMESTER

LISTENING SKILLS

Listening for information

- a) The students can listen to a given speech in normal speed (150/200 words per min) and locate important points and arrange them in logical order.
- b) While listening to a speech given in normal speed the student can fill up blanks, spaces, flow charts and can take notes.

SPEAKING SKILLS

Conversation Situations and Role Plays:

Introductions, greetings, giving directions, appointments, seeking permissions, requesting for information, asking for help and similar kind of activities.

READING SKILLS

The student can read a scientific passage for moderate length (300-400 words) for the purpose of skimming, scanning, note making and vocabulary building.

WRITING SKILLS

- a) Paragraph construction
From general - specific, data - comment, problem- solution, process-description
- b) Précis writing and summarization
- c) Official notices and business letters

ENG 301 COMMUNICATIVE ENGLISH-II (2-0-0)

THIRD SEMESTER

The paper in English is of 100 (Hundred) percentage marks.

Module-I: Communication in Organizational Setting

General Communication & Business Communication

Internal & External Communication

Dimensions of Communication in an Organization: Upward, Downward, Horizontal & Grapevine

7 Cs of Communication

Barriers of Communication

Module-II: Writing Skill

Paragraph writing: Topic sentence & Main idea

Cohesion & Coherence: Sentence linkers

E-mails & Business letters

Preparing business reports & proposals

Note making & summarizing

Preparing resume, CV & Cover letters

Module-III: Presentation

Meeting documentation: Preparing an agenda, drafting resolutions & writing minutes

Presentations: Oral & Written

Interviews: Types, decorum & other formalities

Group discussions.

Text Books:

Effective technical communication by M.A.Rizvi

Reference Books:

Business communication by Urmila Rai & S.M.Rai

Communicative English & Business Communication by R.K.Panda, J.Khuntia, M.Pati, Alok Publication

PHY 301 GEOMETRICAL AND PHYSICAL OPTICS (3-1-0)

THIRD SEMESTER

Module-I

Geometrical Optics: Fermat's Principle, cardinal points, combination of two thin lenses, thick lens, spherical aberration and its remedy, chromatic aberration, condition of achromatism, Huygen and Ramsden's eye piece.

Dispersion and Dispersive power, Deviation without dispersion, dispersion without deviation, measurement of velocity of light, Michelson's method, primary and secondary rainbow, Huygens's principle, its application to total internal reflection and refraction through a thin lens (General lens formula).

Module-II

Interference: Young's experiment, condition of interference, Intensity distribution for fringes, Biprism, Bi-mirror, Lloyd's single mirror, fringes of equal inclination and equal thickness, phase change on reflection, Newton's rings due to reflected and transmitted light, Michelson and Fabry Perot interferometer.

Diffraction: Fresnel and Fraunhofer diffraction, Zone plate, Single slit, Double slit and Plane diffraction grating.

Module-III

Polarisation: Polarisation by reflection and double refraction, Brewster's law, Malus law, Huygen's construction of wavefront in uniaxial crystal, ordinary and extraordinary rays, Nicol prism, half and quarter wave plate. Production, detection and analysis of plane, circularly and elliptical polarised light, Babinet's compensator, polaroid, principle of saccharimeter, polarimeter.

Text Books:

1. Optics by A.K. Ghatak, TMH.

Reference Books:

1. Optics and Atomic Physics - D. P. Khandelwal, Himalaya Publication.
2. Optics - M. Born and Wolf, Cambridge University Press.
3. Fundamentals of Optics by Jenkins and White, TMH,
4. Geometrical & Physical Optics by P.K. Chakrabarti, NCBA(P) Ltd., Kolkata, 2005.
5. A text book of Optics by N Subramanyam, Brij Lal, M.N. Avadhanulu, S Chand & Co, 2006.

CHE 301 INDUSTRIAL CHEMISTRY (3-1-0)

THIRD SEMESTER

Module –I_ (Cement, Paints & Dyes)

Cement:- Portland Cement, Raw materials, Manufacture, Reaction in the Kiln, Additives, Gypsum, Plaster of paris, Setting of cement, Properties of cement, Specifications of cement, Uses.

Paints:- Pigments (ZnO, white lead, TiO₂, blue, red, green, yellow, black) Oil emulsion paints Uses, Characteristics of a good paint.

Dyes:- Colour and constitution, Applications to fibre.

Module –II_ (Paper, Fertilizers, Insecticides)

Paper:- Manufacture of pulp, Manufacture of paper.

Fertilizers:- Artificial fertilizers, NH₄NO₃, (NH₄)₂SO₄, Urea and its manufacture. CAN , NPK

Insecticides:- DDT, BHC, Rodenticides, Fungicides, Herbicides

Module-III (Sugar, Soaps & Detergents)

Sugar:- Manufacture of cane sugar, Additives purification, Use of waste materials of sugar industry.

Soap:- Oils, Fats & Waxes, Hydrogenation of oils, Manufacture of soap, cleansing action of soap.

Detergents: - Principal groups of synthetic detergents, Anionic, Cationic & non-ionic detergents Additives, Shampoos.

Fine Chemicals: Manufacturing & Purification of Sulphuric acid (Chamber & Contact process), Nitric acid (Birkland & Eyde Process) & Sodium hydroxide (Electrolysis).

Text Books:

1. Industrial Chemistry by B.K.Sharma, GOEL Publishing House
2. Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing company(P) Ltd.

Reference Books:

1. A text book of Engineering Chemistry by Shashi Chawla, Dhanpat Rai & Co.
2. Riegel's Handbook of Industrial Chemistry, CBS Publishers & Distributors

MAT 301 ANALYSIS-I (3-1-0)

THIRD SEMESTER

MODULE-I

Ordered field of Real numbers, l.u.b. and g.l.b. completeness of \mathbb{R} (Not through Dedkind cuts), complex numbers, Inequalities, Metric properties of \mathbb{R} , limit points, closed sets, open sets, Bolzano-Weirstrass theorem.

MODULE-II

Convergence of real sequence and series, monotonic sequences, Cauchy Criteria of convergence, limit superior, limit inferior, Tests of convergence of spaces of positive terms, comparison tests, Ratio test, Root test, Absolute convergence, Alternating series test.

MODULE-III

Limit and continuity of functions, properties of continuous functions, discontinuities, uniform continuity, Differentiability of real functions, Higher derivations, Leibnitz theorem, Mean value theorems, Taylor's theorem with remainder, Taylor's series.

Text Book:

- 1) Mathematical Analysis (Wiley Eastern) : S.C. Malik and S.Arora
Chapters: 1 (excluding 4.3 and 4.4), 2,3,4 (upto Art.5 and 10.1, 10.2), 5,6

Reference Books:

- 1) Fundamentals of Real Analysis :S.L.Gupta&Nisha Rani
- 2) Mathematical Analysis-II : Sharma & Vasistha
- 3) Fundamental of Mathematical Analysis :G.das&S.Pattanayak

ISC 301 INDIAN SOCIETY AND CULTURE (3-1-0)

THIRD SEMESTER

Module-I

- i) Indus Civilization – Society, Religion and economic life.
- ii) Vedic Civilization – Society and Religion, The position of women.

Module –II

Religious upheaval in the 6th century B.C.

- i) Emergence of Jainism & its impact on Indian Society
- ii) Emergence of Buddhism and its contributions to the field of Indian art & architecture.

Module – III

Cultural efflorescence during Kushanas & Guptas.

- i) Cultural synthesis, Gandhara school art, Mathura art.
- ii) Literature – Sanskrit literature.
- iii) Hindu cultural expansion – South – East Asia.

Module – IV

Emergence of religious movements in Medieval period.

- i) Emergence of Bhakti Movement – Kabir, Nanak, Chaitanya.
- ii) Rise of Sufi Movement
- iii) Medieval Education

Module – V

- i) Socio – Religious Movements during 19th century – Raja Ra, Mohan Roy, Dayananda Saraswati, Vivekananda.
- ii) The growth and development of Modern education (1835-1905)

Text Books:

- 1) The wonder that was India by A.L.Basham, Picador India.

Reference Books:

- 1) Life & Culture in Ancient India – B.N.Lunia.
- 2) Ancient Indian History – K.L.Khurana
- 3) Cultural history of India - K.L.Khurana
- 4) Social & Cultural history of India – O.M.Prakash
- 5) Glimpses of Medieval Indian Culture – Yusuf Hussain

PL301 PHYSICS LABORATORY-3 (0-0-3)

THIRD SEMESTER

1. Determination of 'Y' by double cantilever method.
2. Determination of absolute frequency of a tuning fork using Sonometer.
3. Determination of Rigidity Modulus of a wire by static method.
4. Determination of Poisson's ratio of Rubber.
5. Determination of 'J' by Joule's calorimeter with Radiation correction.
6. Determination of thermal conductivity of bad conductor by Lee's disc method.
7. Determination of λ by Newton's ring method.
8. Determination of resolving power of a telescope.
9. Determination of Galvanometer resistance by Kelvin's method.
10. Comparison of two nearly equal resistances by Carey- Foster's Bridge.

CL301 INDUSTRIAL CHEMISTRY LAB (0-0-3)

THIRD SEMESTER

1. Preparation of soap by cold process.
2. Food Adulteration detection.
3. Determination of sugar concentration by using specific gravity bottle/refractometer.
4. Determination of acid value of an oil.
5. Determination of saponification value of an oil.
6. Determination of iodine value of an oil.
7. Estimation of nitrogen in nitrogen fertilizers.
8. Preparation of natural dyes.
9. Determination of flash point & fire point of an oil.
10. Determination of viscosity of a lubricating oil by using Red wood viscometer

EL301 COMMUNICATIVE PRACTICE LAB-II (0-0-3)

THIRD SEMESTER

LISTENING SKILLS

- a) Listening to news bulletins
- b) Viewing and reviewing documentaries and short films

SPEAKING SKILLS

- a) Situational Dialogues / Role Plays
- b) Oral Presentations- Prepared and Extempore
- c) 'Just a minute' Sessions (JAM)
- d) Group Discussions on current topics

READING SKILLS

- a) Reading comprehension exercises
- b) Newspaper / article reading

WRITING SKILLS

- a) Creative Writing
- b) Email Messages
- c) Report Writing
- d) Writing Resumes and Cover Letters

GRAMMAR

- a) Minimizing errors/ mistakes in sentences
- b) Exercises on articles, prepositions, subject-verb agreement, tense, conditionals, voice change

PHY 401 ELECTRICITY AND MAGNETISM (3-1-0)

FOURTH SEMESTER

Module-I

Electrostatics: Electric field and potential, Electric dipole, Potential due to arbitrary charge distribution, Force and Torque on a dipole placed in an electric field. Gauss's law, Field due to a spherical, Linear and plane charge distribution. Poisson and Laplace's equation of potential, conducting sphere in a uniform field. Dielectric Polarisation, Gauss Displacement law, Dielectric sphere in a uniform field, Clausius - Mossotti relation, Electrostatic energy of a system of charges, energy density in electric field.

Module-II

Electric and Magnetic Fields: Magnetic field(B), Lorentz force on a moving charge, unit for B defined through force on a straight current, Torque on a current loop in a magnetic field, Magnetic dipoles in atoms and molecules, gyromagnetic ratio. Magnetic field due to current: Biot and Savarts' law, Field equations in magneto statics, Ampere's law, Fields due to a straight wire. Magnetic dipole, Circular current and Solenoid, Magnetic fields in matter: Magnetising current, Magnetisation vector Hand B fields. Magnetic permeability, Magnetic susceptibility, Magnetic properties of materials, elementary theory of dia, Para and Ferromagnetism, Hysteresis.

Module-III

Electromagnetic Induction and Current Electricity: Electromagnetic Inductions, Faraday's and Lenz's law self and Mutual induction. Growth and decay of D.C in LCR circuit, A.C in LCR circuits, impedance, Power factor, Watt less current, Series and Parallel resonant circuit, sharpness of resonance, Q-factor, Kirchoff's law and its application to Wheatstone's Bridge, Sensitivity, Anderson and Owen's Bridge, Maxwell Bridge, Ballistic Galvanometer, Search Coil.

Text Books:

1. Introduction to Electrodynamics by D J Griffiths, PHI Learning, 2009.

Reference Books:

2. Electricity and Magnetism by - D. C. Tayal, Himalaya Publishing, 2009.
3. Electricity and Magnetism - K. K. Tiwari
4. Electricity and Magnetism - Segal, Chopra, Segal.

MAT 401 LINEAR ALGEBRA (3-1-0)

FOURTH SEMESTER

MODULE-I

Vector spaces, definition and examples, subspaces, span of a set, linear dependence and independence, dimension and basis.

MODULE-II

Linear transformation, definition and examples, range and kernel, rank and nullity, the space $L(U,V)$, composition of Linear maps, matrix and linear map, linear operations, matrix multiplication, rank and nullity of matrix, transpose of a matrix.

MODULE-III

Elementary row operations, systems of linear equations, matrix inversion, determinants, minors and rank of a matrix, product of determinants, application to linear equations, eigen value and eigen vector.

Text Book:

- 1) An Introduction to Linear Algebra : V. Krishnamurty and others (affiliated East-West press).
Chapters: 3,4 (4.1 to 4.7), 5,6 (6.5 to 6.8)

Reference Books:

- 1) Basic Structures in Algebra, Part-I : J.N. Patnaik
- 2) Matrix Theory and Linear Algebra : I.N. Herstein and D.J. Winter (Ma Chilan Publishing company)
- 3) First course in Linear algebra : Bhattacharya, Jain and Nagpaul (New Age International)

CHE 401 INORGANIC CHEMISTRY-I (3-1-0)

FOURTH SEMESTER

Module-1

Atomic Structure: Wave nature, de-Broglies equation, Heisenberg's uncertainty principle, Black body radiation, Compton effect, Photoelectric effect, Planks quantum theory (concept of quantization of energy) Schrodinger's wave equation, Physical significance of wave function, normal & orthogonal wave function, Schrodinger's equation for hydrogen atom (solution of the equation for hydrogen atom is not required) radial & angular wave function, probability density pattern for hydrogen atom (qualitative idea), orbital shapes, quantum numbers, Paulis exclusion principles, Hund's rule of maximum multiplicity, Aufbau principle, Stability of completely filled and partially filled orbitals.

Periodic classification of elements

Modern classification: Moseley's contribution to classification and Modern periodic law. Long Form of the periodic table. IUPAC numbering of groups. Features of the long form of the periodic table: Groups and periods; s, p, d & f blocks, Advantages of the long form of the periodic table. Defects in the long form of the periodic table. Periodicity in properties: Valency Atomic radii, Ionic radii, Ionization energy, Electron affinity, Electronegativity, screening effect, Metallic character.

Chemical Bonding: General characteristics of Ionic Bond, size effects, radius ratio of ions in crystals, Lattice energy, Born-Haber cycle, salvation energy, covalent character of ionic compounds, dipole moment, polarizing power and polarizability (Fajan's rule), percentage of ionic character from dipole moment & electronegativity difference.

Module-II

Covalent bond: Valence bond approach: Heitler-London treatment of the H₂ molecule (mathematical treatment totally excluded), resonance & resonance energy, directional characteristic of covalent bond, coordinate covalent bond, hybridization (sp, sp², sp³, dsp², dsp³, d²sp³), bond length, formal charges.

VSEPR theory of directed valence, shapes of simple inorganic molecules and ions containing lone pairs of electrons of non transition elements, structures of compounds of the type AB, AB₂, AB₃, AB₂E, AB₄, AB₃E, AB₂E₂, AB₅, AB₄E, AB₂E₃, AB₃E₂, AB₆, AB₄E₂.

Other types of chemical bonds: Vanderwaal's forces, Hydrogen bond and its occurrence, nature and consequences, elementary idea about metallic bond, conductors, semiconductors and insulators.

Qualitative treatment of molecular orbital theory, bonding, non-bonding and anti bonding molecular orbitals, LCAO, MO treatment of configuration of H₂, He₂, B₂, N₂, O₂, F₂, NO & CO, Metallic bond.

Module - III

Noble gases: Chemistry of noble gases & their compounds.

Nuclear Chemistry: Nature & properties of radioactive radiations, theory of radioactive disintegration, half-life period, radioactive series, artificial radioactivity, disintegration by alpha particles & neutrons, Fission & fusion reactions (qualitative treatment), radioactive isotopes, positive ray analysis, principles of mass spectrography, applications of radioactive isotopes.

Text Books:

1. Advanced Inorganic Chemistry, Vol-I: Gurdeep Raj, Goel publishing House.
2. A text book of Inorganic Chemistry: Malik, Madan & Tuli
3. Principles of Inorganic Chemistry: B.R.Puri, L.R.Sharma, and Kalia, Vishal Publishing co

Reference Books:

4. Basic Inorganic Chemistry: F.A.Cotton, G.Wilkinson & P.Gaus, John wiley and sons.
5. Concise Inorganic Chemistry: J.D.Lee, ELBS with Champman & Hall.

CHE 402 PHYSICAL CHEMISTRY-I (3-1-0)

FOURTH SEMESTER

Module -I

Gaseous state: Kinetic theory of gases, Derivation of expression for the pressure of gas, explanation of gas laws, Avo(Boyle' law, Charle's law, Dalton's law of partial pressure & Avogadro's law) on the basis of kinetic theory.

Maxwell Boltzman distribution of molecular velocities (only qualitative treatment-mathematical derivation excluded), Nature of the distribution curve and effect of temperature on distribution, calculation of the root mean square and the most probable velocities, Deviation of gas laws from ideal behaviour, Vander Waals equation of state, critical phenomena and critical constants, law of corresponding state, liquification of gases.

Module –II

Liquid state: The structure of liquids, vapour pressure, surface tension, parachor and its application, viscosity

Surface chemistry: Adsorption, Langmuir adsorption isotherms, Gibbs adsorption isotherm, Chemisorption, beta potential of colloids, stability, electrical and optical properties.

Solid state: Crystal systems, lattice planes and dimensions, structure of solids-nonmetallic elements, metallic elements, Qualitative treatment of the band theory of solids, simple inorganic compound and isomorphism of organic compounds.

Colligative properties: Lowering of vapour pressure, Raoult's law, thermodynamic derivations of laws relating to the elevation of boiling point, depression of freezing point and osmotic pressure, ideal and non ideal solutions, activity concept, abnormal molecular weight.

Module – III

Thermodynamics-I: First law of thermodynamics, Heat content & heat capacity, isothermal and adiabatic changes, work done in the expansion of an ideal gas, Joule Thomson effect, Joule Thomson coefficient for an ideal & Vanderwaal's gases.

Thermochemistry: Heat changes in chemical reactions, Hess's law of constant heat summation, Kirchoff's equation.

Thermodynamics-II: Second law, Carnot's theorem and Carnot's cycle, efficiency of heat engines, entropy changes in reversible and irreversible processes, entropy change in an ideal gas, variation of entropy with temperature, pressure and volume, free energy and work function, conditions of

equilibrium, Clapeyron-Clausius equation, Gibb's Helmholtz equation, partial molar quantities and their physical significance, chemical potential, Gibb's-Duhem equation.

Text Books:

1. Principles of Physical Chemistry: B.R.Puri, L.R.Sharma, and M.S.Pathania, Vishal Publishing co.
2. Essentials of Physical Chemistry: B.S.Bahl, G.D.Tuli & A.Bahl, S. Chand & co.

Reference Books:

1. Elements of Physical Chemistry: P.W.Atkins, Oxford University Press
2. A text book of Physical Chemistry: S.Glasstone, The Macmillan Press Ltd

FEL 401 PROBABILITY & STATISTICS (3-1-0)

FOURTH SEMESTER

MODULE-I

Probability:

Sample space and Events, Principles of Counting, Classical definition of probability, Axioms of probability, Elementary theorems, Addition and Multiplication rules, Conditional probability, Baye's theorem.

MODULE-II

Probability Distributions:

Discrete and Continuous Random Variables, Probability Density and Distribution functions, Mean and Variance of Distributions, Binomial, Poisson, Hypergeometric and Normal Distributions, Poisson Process, Poisson and Normal Distributions as Limiting forms of Binomial Distribution.

MODULE-III

Statistics:

Random Sampling, Population and Sample, Sampling Distribution of mean and variances, Point and Interval Estimations, Confidence Intervals, Null Hypothesis, Significance Tests, One Tailed & Two Tailed Tests, Test of Hypothesis concerning single mean & difference of means, Fitting Straight Lines, Correlation and Regression.

Text Books:

- 1) Statistical Methods By S.P. Gupta(31st Edition) ; Publisher: Sultan Chand & Sons
Chapters of Volume-II:1,2(Except Multinomial & Negative Binomial Distributions),3(Except Tests of Significance for Attributes)
10(Only Karl Pearson's Coefficient of Correlation)
11(Upto Regression equations of Y on X and X on Y)
- 2) Mathematical Statistics By S.C. Gupta & V.K. Kapur(10th Edition); Publisher: Sultan Chand & Sons
Chapters:5(5.3,5.3.1,5.3.2,5.4,5.4.1,5.4.3),7(7.3.1),8(8.2.1),9(9.1.1),
12(12.1to12.8,12.13,12.14),

FEL 401 BASIC ELECTRONICS (3-1-0)

FOURTH SEMESTER

Module-I

Introduction to Electronics: Signals, Frequency spectrum of signals, Analog and digital signals, Amplifiers. Semiconductor Diodes: Introduction, Physical operation of p-n junction diodes, Characteristics of p-n junction diodes, Rectifier circuits (half-wave, full-wave, bridge and peak rectifiers), Diode clipper and clamper circuits, Zener diode and voltage regulations.

Bipolar Junction Transistors (BJTs): Simplified structure and physical operation of n-p-n and p-n-p transistors, Current-voltage characteristics of BJT (Common-Emitter, Common-Base and Common Collector configurations), BJT as an amplifier and as a switch. DC biasing in BJT amplifier circuits, Small Signal Operation of BJT: Simplified hybrid- π model and its application to single stage BJT amplifiers.

Module-II

The Operational Amplifier (Op-Amp): The ideal Op-Amp, Inverting and non-inverting configurations, Difference amplifier, CMRR, Application of Op-Amp (Instrumentation amplifier, Summing amplifier, Integrator and Differentiator).

Electronic Instruments: Basic principle of Oscilloscope, Function of the sweep generator, Block diagrams of oscilloscope, Simple CRO, Measurement of frequency and phase by Lissajous method, Application of oscilloscope for measurement of voltage, period and frequency, Block diagram of standard signal generator, AF sine and square wave generator, and Function generator.

Module-III

Digital Electronic Principles: Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic, 1's & 2's complement

Logic Gates and Boolean algebra: The inverter, The AND, OR, NAND NOR, Exclusive-OR and Exclusive-NOR gate, Boolean operations and expressions, Laws and Rules of Boolean algebra, DeMorgan's theorem, Boolean analysis of logic circuits, Standard forms of Boolean expressions (SOP, POS), Boolean expression and truth table.

Combinational Logic and Their Functions: Basic combinational logic circuits, Implementation of Combinational logic, The universal properties of NAND and NOR gates.

Text Books:

1. Microelectronic Circuits (Fifth Edition), Adel S. Sedra and Kenneth C. Smith, Oxford university Press.
2. Electronic Instrumentation, H.S. Kalsi, Tata McGraw-Hill Publishing Company Limited
3. Digital Fundamentals (Eighth Edition), Thomas L. Floyd and R.P. Jain, Pearson Education

4. Electronic Devices and Circuit Theory (Ninth Edition), Robert L. Boylestad and Louis Nashelsky, Pearson Education.

FEL 401/FEL 501 BIOTECHNOLOGY (3-1-0)

FOURTH/FIFTH SEMESTER

Module:I

Cell & Molecular biology:

Cell biology: Discovery of cell, cell theory, cell theory, prokaryotic and eukaryotic cells, cell structure, structure and function of cell wall, plasma membrane, chloroplast, mitochondria, ribosome, nucleus, lysosome, peroxisome, chromosome.

Molecular biology: DNA as the genetic material, structure and biological importance of DNA, RNA and its type, structure of RNA, DNA replication in prokaryotes, protein synthesis.

Module:II

Biochemistry & Microbiology:

Biochemistry: Water, pH, Buffer, structure and biological importance of carbohydrates (Mono, Di and polysaccharides), amino acids (general structure and types), peptide bond, structure and biological importance of proteins (primary, secondary, tertiary and quaternary structure), Lipids (general idea).

Microbiology: Bacteriology: Bacteria, structure of a typical bacterial cell, Bacterial recombination (Transduction, transformation and conjugation), General idea about archaebacteria, Eubacteria and cyanobacteria)

Virology: Viruses, types and structure, Replication of bacteriophage.

Module:III

Genetic Engineering (Concept of G.E):

rDNA technology: Restriction enzymes and type, vectors and types, Introduction of DNA fragment into the vectors, introduction of rDNA into the host cell, Gel Electrophoresis, Blotting techniques and applications.

Text Books:

1. Cell Biology by C.B.Power
2. Cell & Molecular biology by P.K.Gupta

3. Microbiology By Presscott
4. Microbiology by Pehlzar
5. Biochemistry by Voet & Voet
6. Biochemistry by Lehnigen
7. Biochemisry by Jain & Jain
8. Biotechnology by B.D.Singh

FEL 401/FEL 501 PRINCIPLES OF ECONOMIC ANALYSIS (3-1-0)
FOURTH/FIFTH SEMESTER

MODULE: 1

Introduction: Nature and Scope of Economics. Basic Features and Problems of an Economy: Working of Price Mechanism. **Consumption Function:** Utility and Indifference Curve Analysis., **The Laws of Demand and Supply:** Demand ,Elasticity of Demand: Concept and Measurement, Price, Income and Cross Elasticities. Consumer's Surplus. Determinants of Elasticity of Demand. Importance of Elasticity of Demand. Law of Supply, **Production Function:** Laws of Variable Proportions. Iso-quants. Expansion Path; Returns to Scale. Internal and External Economies and Diseconomies.

MODULE: 2

Concepts of costs: Fixed and variable costs, Opportunity cost, Average and Marginal cost. **Concepts of Revenue :** Total, Average and Marginal Revenue. **Market Structures:** Market Structures and Business Decisions; **Perfect Competition:** Characteristics and Equilibrium of Firm and Industry; **Monopoly:** Characteristics and Determination Price under Monopoly; Comparison with Perfect Competition. **Monopolistic Competition:** Characteristics; Price and Output Determination under Monopolistic Competition; **Oligopoly:** Characteristics, Pricing and Output under Oligopoly; Classical Models of Oligopoly; Price Leadership; Collusive Oligopoly. Kinked Demand Model.

MODULE: 3

Factor Pricing: Marginal productivity theory of distribution, Rent - Ricardian and modern theories of rent. Wages - Modern theory of wages, wage differentials, Determination of Wage Rates under Perfect Competition and Monopoly;. Interest - Loanable fund and Liquidity preference theories of interest. Profit - Nature, Concepts, Uncertainty and Innovation theories of profit.

Text Books:

1. D.M. Mithani, Principles of Economics. Himalaya Publishing House.
2. R.K.Lekhi, Business Economics, Kalyani Publishers.

3. H.L.Ahuja,Principles of Microeconomics,S.Chand & company Ltd.
4. Ravindra H.Dholakia & Ajay N.Oza , Micro economics for Management Students, Oxford University Press.
5. Geetika,Piyali Ghosh,Purba Roy Choudhury,Managerial Economics, Tata McGraw Hill

FEL 401/FEL 501 ORGANIZATIONAL BEHAVIOUR (3-1-0)

FOURTH/FIFTH SEMESTER

Module – 1

Concept and models of OB, OB Systems- The Synergy

Module - 2(Individual System)

Perception, Learning and Behaviour Modification, Motivation, Attitude and Values, Personality, Emotion and stress.

Module – 3 (Social System)

Communication, Group Dynamics, Conflict , Leadership

Module - 4 (Organizational systems)

Organizational power and politics, Organizational culture and climate, Organizational Change and development, International Dimensions of OB, Managing Diversity.

Text Books :

1. Robins & Sanghii, Organisational Behaviour, Pearson
2. Aswathappa, Organization Behavior, Himalaya
3. Luthans ,F. Organisational Behaviour - TMH
4. Udai Pareek , Understanding Organisational Behaviour, Oxford
5. Prasad,L.M. Organization Behavior,S.Chand.
6. Greenberg and Baron, Behavior in organization, Prentice hall.

PL401 PHYSICS LABORATORY-4 (0-0-3)

FOURTH SEMESTER

1. Determination of frequency of vibration by Melde's experiment.
2. Determination of 'g' by Kater's pendulum.
3. Determination viscosity of liquid by oscillating disc method.
4. Calibration of a thermocouple.
5. Determination of ' λ ' using Biprism.

6. Study of diffraction fringes by single slit.
7. Determination of end corrections of a meter bridge.
8. Calibration of Bridge wire.
9. Study of characteristics of a transistor in common base configuration.
10. Study of Logic gates.

CL401 INORGANIC CHEMISTRY LABORATORY (0-0-3)

FOURTH SEMESTER

1. Inorganic Qualitative analysis: Identification of basic & acid radicals of a mixture of Inorganic substances containing not more than six radicals. (Interfering acid radicals like phosphate, fluoride, borate, & mixture of acid radicals – carbonates and sulphite, nitrite and nitrate, chloride, bromide and iodide, phosphate and arsenate, bromide and nitrate and one insoluble substance such as barium sulphate, aluminium oxide, tin dioxide and strontium sulphate etc.
2. Inorganic Quantitative analysis
 - a) Estimation of calcium by precipitation of oxalate (direct method) by permanganometry.
 - b) Estimation of MnO_2 in pyrolusite using sodium oxalate.
 - c) Estimation of Barium by acidimetry, alkalimetry method
 - d) Gravimetric estimation of Barium as BaSO_4
 - e) Gravimetric estimation of Ni as Nickel dimethylglyoxime