

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

SCHOOL OF BASIC SCIENCES



**5-YEAR INTEGRATED M.Sc. PROGRAMME
IN
APPLIED PHYSICS
2012-13
SYLLABUS**

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

5 Year Integrated M.Sc. in Applied Physics

Detailed Course Structure

SEMESTER-I				
Sl no	Subject Code	Subject	Contact Hours per (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 (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 (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 (L+T+P)	Credits
1	PHY401	ELECTRICITY AND MAGNETISM	3+1+0	4
2	PHY402	MATHEMATICAL PHYSICS-I	3+1+0	4
3	PHY403	BASIC ELECTRONICS	3+1+0	4
4	MAT401	LINEAR ALGEBRA	3+1+0	4
5	FEL401	FREE ELECTIVE-I	3+1+0	4
6	PL401	PHYSICS LABORATORY-4	0+0+3	2
7	ML401	MATHEMATICS LABORATORY (FORTRAN PROGRAMMING)	1+0+3	2
TOTAL CREDITS				24

SEMESTER-V				
Sl no	Subject Code	Subject	Contact Hours per (L+T+P)	Credits
1	PHY501	QUANTUM MECHANICS-I	3+1+0	4
2	PHY502	CLASSICAL MECHANICS	3+1+0	4
3	PHY503	ATOMIC PHYSICS&SPECIAL THEORY OF RELATIVITY	3+1+0	4
4	FEL501	FREE ELECTIVE-II	3+1+0	4
5	PHY505	PROGRAMMING IN "C"	2+0+0	2
6	PL501	PHYSICS LABORATORY-5	0+0+3	2
7	PL502	PHYSICS LABORATORY-6	0+0+3	2
8	PL503	PROGRAMMING IN "C" LAB	0+0+3	2
TOTAL CREDITS				24

SEMESTER-VI				
Sl no	Subject Code	Subject	Contact Hours per (L+T+P)	Credits
1	PHY601	SOLID STATE PHYSICS-I	3+1+0	4
2	PHY602	ELECTRONICS DEVICES	3+1+0	4
3	PHY603	NUCLEAR PHYSICS-I	3+1+0	4
4	PHY604	ELECTROMAGNETIC THEORY	3+1+0	4
5	PHY605	FIBRE OPTICS & LASER	3+1+0	4
6	PL601	PHYSICS LABORATORY-7	0+0+3	2
7	PL602	PHYSICS LABORATORY-8	0+0+3	2
TOTAL CREDITS				24

SEMESTER-VII				
Sl no	Subject Code	Subject	Contact Hours per (L+T+P)	Credits
1	PHY701	DIGITAL SIGNAL PROCESSING	3+1+0	4
2	PHY702	MATHEMATICAL PHYSICS-II	3+1+0	4
3	PHY703	ELECTRODYNAMICS	3+1+0	4
4	PHY704	NUCLEAR PHYSICS-II	3+1+0	4
5	PL701	PHYSICS LABORATORY-9	0+0+3	2
6	PL702	PHYSICS LABORATORY-10	0+0+3	2
7	FEL701	FREE ELECTIVE-III	3+1+0	4
TOTAL CREDITS				24

SEMESTER-VIII				
Sl no	Subject Code	Subject	Contact Hours per (L+T+P)	Credits
1	PHY801	QUANTUM MECHANICS-II	3+1+0	4
2	PHY802	SOLID STATE PHYSICS-II	3+1+0	4
3	PHY803	STATISTICAL PHYSICS	3+1+0	4
4	PHY804	GENERAL THEORY OF RELATIVITY & PARTICLE PHYSICS	3+1+0	4
5	PL801	PHYSICS LABORATORY-11	0+0+3	2
6	PL802	PHYSICS LABORATORY-12	0+0+3	2
7	FEL801	FREE ELECTIVE-IV	3+1+0	4
TOTAL CREDITS				24

SEMESTER-IX				
Sl no	Subject Code	Subject	Contact Hours per (L+T+P)	Credits
1	PHY901	PLASMA PHYSICS	3+1+0	4
2	PHY902	RELATIVISTIC QUANTUM MECHANICS & QUANTUM FIELD THEORY	3+1+0	4
3	PHY903	IMAGE PROCESSING	3+1+0	4
4	PHY904	NANO PHYSICS-I	3+1+0	4
5	PL901	PHYSICS LABORATORY-13	0+0+3	2
6	PL902	PHYSICS LABORATORY-14	0+0+3	2
7	PS901	SEMINAR		4
TOTAL CREDITS				24

SEMESTER-X				
Sl no	Subject Code	Subject	Contact Hours per (L+T+P)	Credits
1	PHY1001	ADVANCED ELECTRONICS	3+1+0	4
2	PHY1002	NANO PHYSICS-II	3+1+0	4
3	PS1001	SEMINAR		4
4	PD1001	PROJECT/DISSERTATION		12
TOTAL CREDITS				24

FREE ELECTIVES:

1. PROBABILITY & STATISTICS
2. APPLIED CHEMISTRY
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 ବାତାୟନ - 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 ରାଉତରାୟ ।

(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

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, Azardirachta), Germplasm conservation, Biofertilizer&biopesticide, preliminary idea about plant cell and tissue culture, General principles of genetic engineering and its applications.

Text Books :

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 λ , 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.

CL101 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

BL101 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 Gibbs 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.

PL 201 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 Quincke's drop method.
4. Calibration of set of weights.
5. Determination of Latent heat of ice with radiation correction.
6. Determination of μ -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.

CL 201 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, Maluslaw, 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 Dedekind 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 reminder, 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

PL 301 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.

CL 301 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

EL 301 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.

PHY 402 MATHEMATICAL PHYSICS-1 (3-1-0)

FOURTH SEMESTER

Module-I

Vector analysis - Scalar and Vector product, Polar and axial vector, Differentiation of vector, Gradient, divergence, Curl and Laplacian. Line, Surface and volume integral, Gauss, Stokes and Greens theorem. Orthogonal curvilinear coordinates, Expression for grad, div, Curl and Laplacian in different coordinate systems (Cartesian, Spherical and Cylindrical coordinates).

Module-II

Complex Variable, Complex algebra, Analytic function, Cauchy Riemann condition, Cauchy's theorem, Cauchy's integral formula. Taylor and Laurent expansion, Singularities, Cauchy's Residue theorem and applications.

Differential Equation: Linear second order homogeneous differential equation, singular points, power series solutions of Legendre, Hermite and Laguerre's differential equation, polynomials and generating functions, recurrence relation, Rodrigue's formula and orthogonally.

Module-III

Special functions and matrices: Gamma and Beta functions, Fourier series and transforms Matrices; Different types of matrices, algebra of matrices, Determinant of a Matrix, inverse of matrix, Rank of a matrix, orthogonal, unitary and similarity transformations. Solutions of linear equations, eigen value, eigen vectors, Diagonalisation of a matrix.

Text Books:

1. Mathematical Methods for Physicists - G. Arfken, Elsevier Publisher, 2012.

Reference Books:

- 1 Mathematical Physics - C. Harper,
- 2 Mathematical Methods of Physics-J. Mathew & R. L. Walker.
- 3 Mathematical Physics- Satyaprakash.
- 4 Mathematics for Physics and Chemistry - Murphy and Morgan
- 5 Mathematical Physics-H. K. Dosh
- 6 Mathematical Physics-P. K. Chakravarty
- 7 Mathematical Physics-B.S. Rajput

PHY 403 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.

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. Krishnamurthy 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)

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(12.1 to 12.8, 12.13, 12.14),

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 archebacteria, 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 Prescott
4. Microbiology by Pehlzar
5. Biochemistry by Voet & Voet
6. Biochemistry by Lehninger
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.

**ML401 MATHEMATICS LABORATORY (1-0-3)
(FORTRAN PROGRAMMING)**

FOURTH SEMESTER

MODULE-I

Understanding the computer, flow charts.

Importance of computers, History of Computers. Types of computers, classification of Computers, Computing concepts input device, driving the computer the software Programming Language high level language. Programme models, interactive Computer using the computer problem solving Flow charting.

FORTRAN-IV

Introduction, storing Numbers, Reading in Data, making Decisions overview computes and Language.

Numerical constants, variable names, type statements- Integral Real, Arithmetic Expressions, Mind Mode of Operations. Built in Mathematical functions, Arithmetic Assignment Statement, computer Arithmetics.

MODULE-II

Numerical INPUT/OUTPUT

Unformatted Input/Output, Introduction to Formatted Input/Output Formatted Input and Input field specifications, Formatted WRITE Statements and Carriage control, Output field specifications, literal field, Records, Multiple Records, Slash Repetition factor, sample complete programme.

MODULE-III

Transfer of Control:

Unconditional Transfer, conditional transfer, Relational Expression, Logical IF Statement, Controlling a loop. Arithmetic IF Statement, computed GO TO Statement, Algorithms.

Continue statement, Simple-uses of the DO Statement, DO statement, rules on the use of the DO Loop, Exit from a DO loop, Transfer within and to a DO Loop, Necessity of the continue statement, Nested DO Loops.

Subscriptial variable and Maton Algebra:

One dimensional Aray, DIMENSION Statement Arithmetic Expression for subscripts, Examples using Arrays, Multidimensional Arrays. Array In put/Out put Implied DO Loops. Programming Techniques example. Addition, Substraction and multiplication, inverse of a main.

PRACTICAL (Programming in Fortran):

- (i) Write a programme and draw the flow chart for searching of primes less than or equal to 1000(N).
- (ii) Write a programme and draw the flow chart for

arranging a given set of numbers in ascending or descending order.

- (iii) Write a programme and draw the flow chart to find the sum of digits of a number.
- (iv) Write a programme and draw the flow chart to evaluate the area under the curve $Y = ax + b$ and X-axis between the limits $X=0$ and $X=10$ using Trapezoidal rule.
- (v) Write a programme and draw the flow chart to evaluate the integral $\int f(x) dx$ using Simpson's rules.
- (vi) Write a programme and draw the flow chart to solve a quadratic equation.
- (vii) Write a programme and draw the flow chart to evaluate the product of two matrices.
- (viii) Write a programme and draw the flow chart to find the sum of odd/even natural numbers.

Text Books:

1. Programming in Asic by E. Balagurusamy.
2. Programming with FORTRAN by SeymolerLipschutz

Mc. Graw Hill – Chapters : 1 (1.1, 14-17), 2 (2.1-2.10) 3(3.1-3.10), 4(4.1-4.9), 5(5.1-5.9), 6(6.1-6.8)



5TH SEMESTER

MSPH3501 QUANTUM MECHANICS-I (3-1-0)

Module-1 (# of Lectures: 17)

Inadequacy of classical physics & Birth of Quantum Physics: Energy distribution in the spectrum of black body radiation, Limitations of Rayleigh-Jeans law & Wiens law, Planck's hypothesis, problem resolution by Planck's law; Particle nature Dual nature of radiation, Wave nature of particles, Bohr's model of H-atom, Line spectrum of H-atom. of electromagnetic (em) radiation, Photons: Quanta of em radiation, Explanation of photoelectric effect & Compton Effect,

de-Broglie hypothesis, Davisson Germer experiment, matter wave, velocity of matter wave, Wave particle duality, Complementarity, superposition of two waves, phase velocity and group velocity, Gaussian wave-packet, Localization and time evolution of wave packet. Heisenberg's Uncertainty

Principle, Illustration through thought experiments with Gamma ray microscope, and electron diffraction through single slit. Application of Uncertainty Principle: Estimation of ground state energies of harmonic oscillator and hydrogen atom, Non existence of electron in the nucleus, Uncertainty and Complementarity.

Time dependent Schrödinger equation in one and three dimension, The wave function, Normalization of the wave function, Equation of continuity, probability density and probability current density, Observables, expectation value of an observable, Ehrenfest's Theorem. Time independent Schrödinger equation, stationary states, constants of motion in Quantum Mechanics. The quantum virial theorem.

Module-2 (# of Lectures:20)

Mathematical Framework of Quantum Mechanics: Linear vector space, Bra and ket vectors, Scalar product of vectors and their properties, Linear operators, Adjoint and Unitary operators, Expectation values of dynamical variables and Born's interpretation, Hermitian Operators, Eigenvalues and eigenvectors, probability interpretation, degeneracy, Schmidt's Orthogonalization.

The basis space Expansion theorem, Completeness and closure property, Operators associated with dynamical variables in Quantum Mechanics, Representation of position linear momentum and energy operators in coordinate space and momentum space. Schrodinger Equation in coordinate & momentum space, Algebra of linear operators, Commutation relations among position and momentum operators, commutator Algebra, Uncertainty relation as a consequence of non-commutability, Minimum uncertainty wave packet.

Module-3 (# of lectures: 11)

Solution of Schrodinger Equation for various cases: Solution of time Independent Schrödinger Equation in one dimension, Boundary and continuity condition, symmetry and anti symmetry of wave function, parity operator its properties. Solution to the problem of Particle in a one dimensional box, finite square well, potential barrier. (Discussion of General features of solution of one dimension problem, free states and bound states, non-degenerate energy levels in one dimensional problem). One dimensional Harmonic oscillator, energy eigenvalues and eigenfunctions. Schrodinger Equation for Hydrogen atom and its solution.

Books:

7. Quantum Mechanics, A Ghatak & S Lokanathan (McMillan India)
8. Basic Quantum Mechanics, A Ghatak, (McMillan)
9. Quantum Physics, S. Gasiorowicz (John Wiley)
10. Modern Quantum Mechanic, J J Sakurai (Addison Wesley)
11. Quantum Mechanics, Gupta & Kumar (Jai Prakash Nath Publications)
12. Intro to Quantum Mechanics, M. Das & P.K. Jena, (SriKrishna Prakashan)

MSPH3502 CLASSICAL MECHANICS-I (3-1-0)

Module-1 (17 lectures)**Constrained Motion**

Constraints, Classification of Constraints, Principle of Virtual Work, D'Alembert's principle and its applications.

The Lagrangian formulation

Degrees of freedom, Generalized coordinates, Lagrange equation of motion, Procedure for formation of Lagrange equations, Lagrange equation for non-conservative forces, linear generalized (velocity dependent) potentials, Symmetry properties and conservation laws, Invariance of Lagrange equation, invariance under Galilean transformation, cyclic-coordinates, integrals of motion.

The Central Force

Reduction of two-body problem to one-body problem, central force and motion in a plane, equations of motion, equation of orbit, Inverse square law force, Kepler's laws of planetary motion, stability of orbits, artificial satellites, virial theorem.

Module-II (18 lectures)**Rotating Frames of Reference & Rigid Body Dynamics**

Degrees of freedom and generalized coordinates of a free rigid body, frames of reference, Eulerian angles, angular velocity of a particle; torque, angular momentum and moment of inertia tensor; Properties and theorems relating the M.I. tensor, kinetic energy of a rotating rigid body, symmetric bodies, Euler's equation of motion of a rigid body, Rotation of a heavy symmetric top under action of gravity.

Hamilton's formulation

Generalized momentum & cyclic (or ignorable) coordinates, Conservation theorems, Hamiltonian function and conservation of energy, Hamilton's equation of motion, Examples in Hamiltonian dynamics.

Principle of Least Action and Variational Principle

Calculus of variations and Euler-Lagrange equations, (Hamilton's) Variational principle, deduction Euler-Lagrange equation and Hamilton's Equation using the variational principle, applications of variational principle, the Shortest Distance problem, Geodesics of a Sphere, Noether's theorem (Statement only).

Module-III (16 lectures)**Canonical Transformations**

Canonical transformations, generating functions, properties of canonical transformation, examples of canonical transformations, Infinitesimal contact transformations.

Poisson Brackets

Definition, some useful identities, angular momentum and Poisson brackets, Invariance of PB under canonical transformation, configuration space, phase space and state space. Liouville theorem (statement only).

Hamilton-Jacobi Theory

The Hamilton-Jacobi equation, solution of the Harmonic Oscillator problem by HJ method, Connection with canonical transformation, examples, Action-angle variables.

Small Oscillations

Two coupled oscillators, General theory of Small oscillations with generalized coordinates; the normal modes of a non-degenerate and degenerate cases, introductory concepts of parametric resonance, anharmonic oscillations, resonance in nonlinear oscillations.

Reference Books :

3. Classical Mechanics, J C Upadhyaya, Himalaya Publishing House, Mumbai.
4. Classical Mechanics, NC Rana & PS Joag, Tata McGraw-Hill.
5. Classical Mechanics , H.Goldstein, Narosa Publishing Home, New Delhi.
6. Classical Mechanics, CR Mondal, Prentice Hall of India.
7. Classical Mechanics, GUPTA, KUMAR & SHARMA.
8. Mechanics By LD Landau and EM Lifshitz, Elsevier, 2007.

MSPH3503 ADVANCED ELECTRONICS (3-1-0)

Module – I (12hours)

Small Signal Modeling of BJT and Analysis : The re transistor model, hybrid model, graphical determination of h-parameters.

Small Signal Modeling and Analysis of FETs : Small Signal Model, Analysis of JFET C-S and C-D configuration. Analysis of E-MOSFET and D-MOSFET configurations.

Active Filters:

First & Second order low pass / high pass, band pass, band reject, and all pass filters. Universal active filter design. Wien Bridge oscillator, Sawtooth wave generator OP Amps. Voltage Controlled Oscillator.

Module – II (12hours)

Bistable Multivibrator : Stable States, Fixed Biased and Self-biased Transistor binary, Commutating capacitors, Symmetrical / Unsymmetrical triggering, Schmitt trigger Circuit. Cathode coupled Binary, Emitter coupled Binary.

The Monostable Multivibrator : Gate width Collector coupled, wave forms triggering. Emitter- coupled Monostable Multi.

Astable – Multivibrator: Emitter coupled, Collector coupled , Wave forms.

Module – III (16 hours)

Negative Resistance Switching Circuits:

Tunnel Diode operation and characteristics, Monostable Astable, Bistable circuits using tunnel diode , Voltage controlled Negative Resistance Switching Circuits.

UJT : operation and characteristics. Application of UJT to generate Saw tooth waveform,

SCR : Turn-On & Turn-OFF Mechanism of SCR, its gate characteristics , Device Specification and rating , series and parallel operation, thyristor protection circuits, design of snubber circuit.

Microprocessor Architecture :- Introduction to Microprocessor and Microcomputer Architecture, Pins & Signals, Register Organization, Timing & Control Module, 8085 Instruction Timing & Execution. Instruction Set and Assembly Language Programming of 8085:- Instruction set of 8085, Memory & I/O Addressing, Assembly language programming using 8085 Instruction Set, use of Stack & Subroutines

Text Book:

6. Pulse , Digital and switching Waveforms - Jacob Mill man and Herbert, Taub (TMH Publication). (selected portions from Chapter 4,5,10,11, 12, 13,14, and15)
7. OP-Amps and Linear Integrated Circuits – Ramakant A. Gayakwad (PHI Publication).
8. Pulse and Digital Circuits by A. Anand Kumar, PHI
9. Microprocessor architecture, programming & application with 8085 by R.S. Gaonkar.

Supplementary Books:

1. OP-Amps and Linear Integrated Circuits – Robert F. Coughlin, Frederick F. Driscoll (Pearson Education Publication).

MSFE3501 FREE ELECTIVE- II (PROBABILITY & STATISTICS) (3-1-0)

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:

5. 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)
6. 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).

MSIT3501 PROGRAMMING IN C (2-0-0)

MODULE-I

Problem solving techniques: Algorithms, Flow charts, Pseudocodes, Structured programming-sequence, selection and iterations.

Introduction to C: Overview of C, Structure of C program, Character set, Identifiers, Keywords. Constants, Variables Data Types: Size and range of data types, type conversions.

Operators: Arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, precedence and order of evaluation. **Managing Input and Output:** I/O functions: printf, scanf, getchar, putchar, gets, puts etc.

MODULE-II

Decision Making and Branching: if, if-else, if-else-if, nested if and switch statements.

Loop Control Structures: while, do-while and for loops. Jumping statements: goto, break, continue, return, and exit.

Arrays: declaration, definition, accessing elements of one dimensional and two-dimensional arrays and applications.

Strings: String Manipulation and String handling functions.

Functions: Types of functions, prototype declaration, definition, parameter passing, recursive functions, storage classes - extern, auto, register, static, scope rules.

MODULE-III

Derived data types: Structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, Union and typedef, bit fields.

Introductions to pointers: Pointer arithmetic, Pointers to arrays, Pointers to functions, Pointers to structures, Self referential Structures. Pointers to pointers, pointers and multidimensional arrays, command line arguments.

File management in C: Input and output, concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling.

Text Books

6. Byron Gottfried, "Programming with C" TMH Publications
7. Ashok. N. Kamthane, "Computer Programming", Pearson Education

MSPL3501 PHYSICS LABORATORY- 5 (0-0-3)

List of Experiments

- 2) Determination of Rigidity modules of a wire by Maxwell's Needle method.
- 3) Determination of surface tension of soap solution.
- 4) Determination of resolving power of grating.
- 5) Determination of specific rotativity of sugar solution using polarimeter.

- 3) Determination of wavelength of unknown light with a plane transmission grating.
- 4) Determination of the specific resistance of the material of the wire using Meter Bridge.
- 5) Measurement of the average resistance for unit length of a meter bridge wire by Carey Foster's method and hence to determine the value of an unknown resistance.
2. Comparison of emfs of two cells by stretched wire potentiometer.
3. Study of Hall Effect.
4. To determine the Planck's constant using a photo voltaic cell.

Text/Reference books:

- 7 A text book of practical physics by Dr. Samir K Ghosh, Central Publishers, 2008.
- 8 An advanced course in practical physics by D. Chattopadhyay and P.C. Rakshit, Central 2012.
- 9 B.Sc. Practical Physics, by C.L. Arora, S. Chand 2006.

MSPL3502 ELECTRONICS LAB (0-0-3)

11. Identification, specification and testing of Electronic Components-Resistors, capacitors, Inductors, Junction Diodes, Zener Diode, laser diode, BJT, Power BJTs, FET, OPAMP.
12. Study of different types of measuring instruments (I-meter-V-meter, DMM, AMM, Oscilloscope (CRO, DSO), Function Generator and regulated power supply.
13. V - I Characteristic of a semiconductor diode. Determining DC and AC resistance and Half wave and Full wave rectifiers with capacitor filter. Record of waveforms, Measurement of Average and RMS values.
14. BJT bias circuit – Design, assemble and test.
15. Design, assemble and test. of JFET/MOSFET bias circuits –
16. Application of Op-Amp as differentiator, integrator, square wave generator.
17. Design, assemble and Test of JFET/MOSFET common-source and common drain – D.C and A.C performance: Voltage gain, input impedance and output impedance.
18. R.C phase shift oscillator/Wien-Bridge Oscillator using OPAMP.
19. Frequency response of a common-emitter amplifier: low frequency, high frequency and mid frequency response.

6. Implementation of Truth Tables of AND,OR,NOR,NAND,EX-OR,EX-NOR logic gates.
7. Soldering Practice using passive and active devices, Wire cutting with stripper & Wire wrapping using PCB(Single Layer and Multilayer) and Strip Board, Breadboard, splicing of co-axial cable and data cable.
8. Project on Design of Digital Clock / Design of Remote controller / Design of burglar alarm .

MSTL3502 PROGRAMMING IN 'C' Lab (0-0-3)

Experiment No.1

11. Write a C program to demonstrate different data types in C.
12. Write a C program to find the greatest of five numbers using conditional operator.
- (iii)Write a C program to perform the arithmetic operations -addition, subtraction, multiplication, and division of integers. Error should be reported, if any attempt is made to divide by zero.

Experiment No.2

- (i)Write a C program to generate all odd and even numbers within a specific range.
2. Write a C program to find the roots of a given quadratic equation with non-zero coefficients.
3. Write a C program to find whether a given integer is prime number or not.

Experiment No.3

- 3 Write a program to evaluate the following series. $1 + x/2! + x^2/4! + x^3/6! + x^4/8! + x^5/10!$
- 4 Write a C program to find the roots of a given quadratic equation with non-zero coefficients.
- 5 Write a C program to find whether a given integer is prime number or not.

Experiment No.4

5. Write a C program to generate and print the first N Fibonacci numbers.
6. Write a C program to find factorial of a given number.
7. Write C program to check a number is an Armstrong's number or not.

Experiment No.5.

- 6 Write a C program to find the GCD and LCM of two given integers.
- 7 Write a C program to reverse a given four-digit number and check whether the number is a palindrome or not.
- 8 Write program to print the following pattern up to desired no. of lines.

2 3
4 5 6

Experiment No.6

- 4) Write a C program to find both the largest and smallest number in a list of integers in an array.
- 5) Write a C program to insert a number in a given array.
- 6) Write a C program to delete a number in a given array.

Experiment No.7

2. Write a C program to find sum and difference of two matrices A and B.
3. Write a C program to read two matrices A (M x N) and B (P x Q), and compute the product of A.B after checking compatibility for multiplication.

Experiment No.8

8. Check Whether Entered string is Palindrome or Not.
9. Write a program to sort an array of strings read through the keyboard.
10. Write a program to find the no of blank spaces, vowels, words and lines in a paragraph.

Experiment No.9

11. Write C user defined functions
 To input N real numbers into single dimension array
 to compute their mean
 to compute their variance
 to compute their standard deviation

Using these functions write a C program to input N real numbers into a single dimension array, compute their mean, variance, and standard deviation.

- (ii) Write a C program to read a matrix A (M x N) and compute the following using user defined functions:
 - a. Sum of the elements of the specified row
 - b. Sum of the elements of the specified column
 - c. Sum of all the elements of the matrix

Experiment No.10

- (i) Write a program to create a structure for student (with fields Name, IdNo, gender and age).read the details of student and display it.
- (ii) Program to create a structure for bank customer (with fields Name, AccountNo and balance).read the details of N customer details and display it.
- (iii) Program to create a structure called Employee having member fields like name, gender and salary. Write a program that accepts the details of employees. Display the employee details who has highest salary. Display all employees in sorted order according to their salary.

Experiment No.11

- (i) Write a Program to add two numbers using pointer.
- (ii) Program to swap two values by using call by reference
- (iii) Write a C program using pointers to read in an array of integers and print its elements in reverse order.

Experiment No.12

- d) Write a C program which copies one file to another.
 - e) Write a C program to reverse the first n character in a file.
- (NOTE: The file name and n are specified on the command line).

Reference Books:

1. E. Balaguruswamy "Programming in C", Tata McGraw Hill-3rd edition
2. B.W. Kernighan & D.M. Ritchie, "C Programming Language", PHI.

6TH SEMESTER

MSPH3601 SOLID STATE PHYSICS-I (3-1-0)

Module-I

Crystal geometry and crystallography

Crystalline and Amorphous solids, crystal structure , Lattice and Basis, Types of Lattice, Unit cell, Primitive cell, Wigner-Seitz cell , Bravais lattices, hexagonal close packed structures , Directions and planes in crystal, miller indices of planes . Crystal structure determination by X rays diffraction , Use of electrons and neutrons in crystal structure determination, Laue's condition of X ray diffraction , Bragg's Law from Laue condition , Concept of Reciprocal lattice vectors , Atomic form factor , Geometrical structure factor. Elementary concepts of crystal defects.

Crystal Binding and Conduction in metals

Crystal Binding , Ionic crystal, Electrostatic energy, Madelung constant, Inert gas crystals, Vander walls-London interaction , Cohesive energy; Covalent binding , Metallic bonding , Hydrogen bonded crystals. Conduction in metals , Drude's Theory of electrical conduction , Density of states , Fermi level , Hall Effect, Thermal conductivity of metals, Superconductivity , History of superconductivity, Zero Resistivity, Meissner's Effect Type I and Type II superconductors.

Module-II

Lattice Vibrations:

Phonons and lattice vibration: Vibration of monoatomic and diatomic lattices, Dispersion Relation , optic and acoustic modes .

Thermal properties of insulators: Lattice heat capacity anharmonic crystal interactions and Thermal expansions, Thermal conductivity.

Free electrons Fermi gas: Heat capacity of the electron gas , Electrical and thermal conductivity of metals. Dielectric response of an electron gas, plasmons, electrostatic screening. Motion in magnetic field cyclotron frequency, Hall Effect.

Quantum theory of Diamagnetism and paramagnetism: derivation for susceptibility, paramagnetism of conduction electrons, Curie Law, Ferromagnetism and anti-ferromagnetism , Ferrimagnetism, Neel temperature, Spin waves, Magnons, Bloch T law.

Module-III

Band theory: Electrons in periodic potential, Bloch's theorem, Kronig-penny model, Origin of band gap.

Semiconductors: Intrinsic and impurity semiconductors, Band gap , Law of mass action, intrinsic carrier concentration, Impurity states, Energy bands in Si and Ge , P-N junctions.

Superconductivity: Experimental survey, Meissner effect, Type-I and Type-II superconductors, Thermodynamics of super conductors , London's theory, Josephson effect, flux quantization, Microwave quantum interference. BCS theory, High temperature superconductors (elementary ideas).

BOOKS :

1. Solid State Physics , C. Kittel (Wiley Eastern)
2. Elementary Solid State Physics , M. Ali Omar (Pearson)
3. Solid State Physics , M. A. Wahab (Narosa)
4. Solid State Physics, S O Pillai (Ne Age Publishers)
5. Solid State Physics by Neil W. Ashcroft (Thomson Press, India)

MSPH3602 STATISTICAL PHYSICS (3-1-0)

Module-I

The Statistical Basis of Thermodynamics:

The macroscopic and the microscopic states, Contacts between statistics and thermodynamics: physical significance of the number $\Omega(N, V, E)$, The classical ideal gas

Elements of Ensemble Theory:Phase space of a classical system, Liouville's theorem and its consequences, The micro-canonical ensemble, Examples: Ideal Monatomic gas.

The Canonical Ensemble:

Equilibrium between a system and a heat reservoir, A system in the canonical ensemble, Physical significance of the various statistical quantities in the canonical ensemble, Alternative expressions for the partition function, The classical systems: Ideal monatomic gas, The equipartition Theorem and the Virial Theorem.

Module-II

The Grand Canonical Ensemble:

Equilibrium between a system and a particle-energy reservoir, A system in the grand canonical ensemble, Physical significance of the various statistical quantities, Examples: Ideal monatomic gas, Density and energy fluctuations in the grand canonical ensemble: correspondence with other ensembles, Thermodynamic phase diagrams, Phase equilibrium and the Clausius-Clapeyron equation problems

Formulation of Quantum Statistics:

Quantum-mechanical ensemble theory: the density matrix, Statistics of the various ensembles, Examples, systems composed of indistinguishable particles, The density matrix and the partition function of a system of free particles, Problems

The Theory of Simple Gases:

An ideal gas in a quantum-mechanical ensemble, An ideal gas in other quantum-mechanical ensembles, Statistics of the occupation numbers, Kinetic considerations, Gaseous systems composed of molecules with internal motion, Chemical equilibrium, Problems

Module-III

Ideal Bose Systems:

Thermodynamic behavior of an ideal Bose gas, Bose-Einstein condensation in ultracold atomic gases, Thermodynamics of the blackbody radiation, The field of sound waves, problems

Ideal Fermi Systems:

Thermodynamic behavior of an ideal Fermi gas, The electron gas in metals, Ultracold atomic Fermi gases, statistical equilibrium of white dwarf stars, statistical model of the atom, problems

Statistical Mechanics of Interacting Systems: The method of Cluster Expansions:

Cluster expansion for a classical gas, Virial expansion for the equation of a state, Evaluation of the Virial coefficients, problems

Phase Transitions: Exact Results for Various Models:

One dimensional fluid models, The Ising model in one dimension, The n vector models in one dimension, The Ising model in two dimensions, Problems.

Books:

1. Statistical Mechanics, R.K. Pathria & P D Beale, (Elsevier).
2. Statistical Mechanics, K. Huang, (Wiley, India)
3. Statistical Mechanics by B. K. Agarwal (Universal Book Show Room).
4. FUNDAMENTALS OF STATISTICAL MECHANICS by B.B. Laud, (New Age International Publishers Ltd.)

MSPH3603 ATOMIC, MOLECULAR AND NUCLEAR PHYSICS (3-1-0)

Module-I

Atomic Physics

Rutherford Scattering, Bohr Sommerfeld theory of H-atom, Bohr's Correspondence principle, Vector model of atom, Orbital angular momentum of the electron, Angular momentum Algebra, Space quantization, Stern-Gerlach Experiment, Electron Spin, L-S coupling, J-J coupling, S-S coupling, Klebsch-Gordon Coefficients, Spectroscopic notations, Electron spin orbit interaction and fine structure, separation due to spin orbit interaction (p,d,f levels), Bohr magneton, Zeeman effect(Normal and anomalous), Stark effect.

X-rays, Continuous and Characteristics spectra, Moseley law, Absorption of X-rays. Duane and Hunt limit.

Module-II

Molecular Physics

Molecules as vibrators, Rigid Rotor Model of molecules, Vibrational and Rotational spectra, UV, IR, Radio spectroscopy, Raman effect, Raman spectroscopy

Module-III

Nuclear Physics

Size, mass, Charge of nuclei, Nuclear forces, Binding energy, Bethe-Weiszacher mass formula, Liquid Drop Model, Shell Model of the nucleus, Nuclear fission, fusion, Radioactivity,(β -, α -, γ - decay). Gamow's Theory of Alpha Decay , β -decay ,Radioactive series, Displacement Law, Successive disintegration , Radioactive equilibrium, Geiger Nuttal Law. Nuclear Reaction Conservation Laws, Q value , Nucleus cross section ,nuclear transmutation induced by proton , neutron , deuteron, and alpha particle . Radio Isotopes, Fission and Fusion reactions. Fusion in stars , Nuclear Reactors.

Books:

1. Atomic and Molecular Physics, Raj Kumar (Campus Books International (2003)
2. Atomic Physics & Atomic Spectra, Herzberg
3. Nuclear Physics, S N Ghoshal, (S Chand & Co Ltd)
4. Nuclear Physics, Kaplan
5. Modern physics , H.S. Mani and G.K. Mehta (Affiliated East West)

6. Subatomic physics, E. Henley and A. Garcia (World Scientific)
7. Concept of Nuclear physics, B.L. Cohen (McGraw –Hill)

MSPH3604 ELECTRODYNAMICS-I (3-1-0)

Module-I

Review of EM Theory

Potential Formulation of Electromagnetic Theory: Electric potential, Poisson's equation and Laplace's Equation; Solution of Laplace's Equation and Poisson's equation, Boundary conditions, Uniqueness theorems, Method of images, Multipole expansion, The field of a polarized object, The magnetic vector potential, Magnetostatic boundary conditions, Multipole expansion of vector potential

Maxwell's Equations

Displacement current and its physical significance, Maxwell's electromagnetic equations in free space, and in medium, Boundary conditions, Gauge transformations, Coulomb gauge and Lorentz gauge, Electromagnetic waves, Poynting Theorem, Energy and momentum of Electromagnetic wave, Maxwell's Stress Tensor, Conservation of momentum

Module-2:

Electromagnetic waves

The wave equation: The wave equation in one dimension, sinusoidal waves, Polarization, Boundary Conditions: Reflection and Transmission.

Electromagnetic Waves in Non-conducting Media: Monochromatic plane waves in Vacuum, Energy and momentum of Electromagnetic Waves, propagation Through Linear Media, Reflection and transmission at Normal Incidence, Reflection and Transmission at Oblique Incidence

Electromagnetic Waves in Conductors: The modified Wave Equation, Monochromatic Plane Waves in Conducting Media, Reflection and Transmission at a Conducting Surface

Module-3:

Special Theory of Relativity

Galilean Transformations, Newtonian Relativity and its limitations, Michelson Morley Experiment and its consequences, Postulates of special Theory of Relativity, Lorentz Transformation, Length contraction, Simultaneity, Time dilation, Relativistic addition of velocities, Four vectors, Position and velocity four vectors, Energy momentum four vector, Relativistic mass and momentum, Mass energy-momentum relation, Relativistic Doppler Effect, Expression for force, Relativistic Kinetic Energy.

Electromagnetic Radiation

Dipole Radiation: Retarded Potentials, Electric Dipole Radiation, Magnetic Dipole Radiation, Radiation from an Arbitrary Distribution of Charges and Currents

Radiation from a Point Charge: Lienard- Wiechert Potentials, The Fields of a point charge in motion, power radiated by a point charge.

BOOKS:

1. Introduction to Electrodynamics, D.J.Griffiths(Prentice Hall of India)
2. Foundation of Electromagnetic Theory, J.R. Reitz and F.J. Milford(Pearson)
3. Electromagnetic Theory, Satya Prakash.
4. Relativity, R.Resnick (Wiley Eastern)

5. Mathematical Physics and sp. Relativity, M. Das, P.K. Jena, B.K.Dash(Srikrishna Prakashan)
6. Introduction to Relativity, J.B. Kogut (Elsevier India)
7. Modern Physics, J. Bernstein, S.Gasiorwicz(Pearson)

MSPH3605 COMPUTATIONAL PHYSICS (2-0-0)

Module-I (12 lectures)

Computational Physics: concept and practice: A first numerical problem: radioactive decay of a sample, numerical approach, design, construction and working of a program, testing the program, numerical considerations, programming guidelines and philosophy.

Realistic projectile motion: effect of air resistance in bicycle racing, trajectory of a cannon shell.

Oscillatory motion: simple, damped and forced harmonic motion, Driven non-linear pendulum, Introduction to chaos.

Module-II (12 lectures)

Potentials and Fields: Electric potentials and fields: Laplace and Poisson Equation, Magnetic field produced by a current, Magnetic field of solenoid.

Waves: One dimensional traveling waves in a stretched string, Frequency spectrum of waves on a string (Fast Fourier Transform, Power spectrum etc.)

Module-III (10 lectures)

Quantum Mechanics: Time-independent Schrodinger equation in one dimension, Matrix approach to solving two- and three-dimensional problems, Time-dependent Schrodinger equation.

Books:

1. Computational Physics by Nicholas J Giordano and Hisao Nakanishi, (Pearson, 2012).
2. Computational Physics: An Introduction, by RC Verma (New Age, 2007).

MSPL3601 ELECTRONICS SIMULATION LABORATORY (0-0-3)

USE Orcad spice software(1-8)

1. Half wave and full wave rectifier designing and finding out the i/p and o/p waveforms, RC coupled amplifier designing and finding out the i/p and o/p waveforms.
2. Designing and simulation of differentiator and integrator, comparator circuit.

3. Analysis of Clipper and clamper designing with different variable and finding out the i/p and o/p waveforms.
4. Design and simulation of Different biasing circuit of FET.
5. Design and simulation of Schmitt Trigger Circuit.
6. Design and simulation of Monostable , Bistable Multivibrator Circuit.
7. Design and simulation of Astable Multivibrator Circuit.
8. Design and simulation of Different Voltage limiter circuit.

Microprocessor Experiments (Using microprocessor kits)

A) 8085

- 6) Addition, Subtraction, Multiplication, Division two 8 bit numbers resulting 8/16 bit numbers.
- 7) Smallest /Largest number among n number in a given data array + Binary to Gray Code / Hexadecimal to decimal conversion.

Interfacing

- 8) Generate square waves on all lines of 8255 with different frequencies (concept of delay program)
- 9) Study of stepper Motor and its operations (Clockwise, anticlockwise, angular movement, rotate in various speeds) , Study of Traffic Light controller , Study of Elevator Simulator .

MSPL3602 COMPUTATIONAL PHYSICS LABORATORY WITH MATLAB-I (0-0-6)

1. **The Basics:** Creating and Working with Arrays of Numbers, Creating and Printing Simple Plots, Creating, Saving and Executing a Script File, Creating and Executing a Function File
2. **Directional Explorations:** Working with Arrays and Matrices, Working with Anonymous Functions, Importing and Exporting Data, Working with Files and Directories
3. **Matrices and Vectors:** Input, Indexing (or subscripting), Matrix manipulation, Creating Vectors
4. **Matrix and Array Operations:** Arithmetic operations, Relational operations, Logical operations, Elementary math functions, Matrix functions, Array vectorization
5. **Using Built- in Functions and On-line Help:** Finding and testing the determinant of a matrix,
6. Finding & testing eigenvalues and eigenvectors of matrix.
7. **Saving and Loading Data :** Saving into and loading from the binary mat-files, Improving data files, Recording a session with diary.
8. **Function Files:** Executing a function, More on Functions, M-Lint code analyzer, Sub functions, Nested Functions: Compiled (parsed) functions: The p-code, The profiler.
9. **Language-specific Features:** Use of comments to create on-line help, Continuation, Global variables, Loops, branches and control-flow, Interactive input, Recursion, Input/output.

10. Linear Algebra: Solving a linear system, Gaussian elimination, Gauss-Jordan Method
11. Linear Algebra: Lower-Upper decomposition, Matrix factorizations.
12. Curve fitting and Interpolation: Polynomial curve fitting, Curve fitting with polynomial functions,
13. Curve fitting and Interpolation: Least squares curve fitting, general nonlinear fits, Interpolation
14. Numerical Integration (Quadrature)
15. Ordinary Differential Equations: A first-order linear ODE,
16. Ordinary Differential Equations: A second-order nonlinear ODE, Specifying tolerance, The ODE suite, Event location.
17. Solving the Projectile Motion with air resistance with plots.
18. Solving the Harmonic Oscillator (Simple, Damped and Forced) with plots.
19. Solving Laplace Equation for a given boundary condition with plots.
20. Solving Poisson Equation for a given boundary condition with plots.
21. Solving Time-Independent One-dimensional Schrodinger Equation with plots.

Reference Books:

1. Getting Started with MATLAB, Rudra Pratap, Oxford University Press, (2010)
2. Computational Physics by Nicholas J Giordano and Hisao Nakanishi, Pearson, 2012.

