

Unit 3: Quadratic residues – Gauss lemma – Quadratic reciprocity – Jacobi symbol.

Unit 4: Greatest integer function – Arithmetic function – Moebius inversion formula, recurrence relations.

Unit 5: Diophantine Equations – Solution of equations of the form \( ax + by = c \), \( x^2 + y^2 = z^2 \), \( x^4 + y^4 = z^4 \) and \( ax^2 + by^2 + cz^2 = 0 \).

REFERENCES

Unit 1: Linear Programming problem – Graphical solution – Formulation of LPP – Simplex method.


Unit 3: Degeneracy – cycling in LPP – Application of simplex method – Revised Simplex method.


Unit 5: Integer programming – Culty plane method – (Gomarian constraint).

REFERENCES


Unit 2: Connectedness: Connected and disconnected graphs – Center – Adjacency Matrix and Incidence Matrix – Operations on graphs.

Unit 3: Bipartite Graphs: Definitions and examples – Characterisation of Bipartite graphs – Trees.

Unit 4: Eulerian and Hamiltonian Graphs: Eulerian graphs – Hamiltonian graphs – Closure and Hamiltonian.

Unit 5: Directed Graphs – Definition and Basic Concepts – Connectedness in Directed Graphs – Tournaments.

REFERENCES
3. Narasingh Deo, (1974). Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall of India,


Unequal intervals: Divided differences – Newton’s divided difference formula – Lagrange’s interpolation formula – Inverse interpolation.


Unit 5: Difference Equations: Definition – Order and degree of difference equation – Linear difference equation – Finding complementary function – Particular integral – Simple applications.

REFERENCES

Unit 1: Forces acting at a point – Resultant and Components – Parallelogram law of forces – Triangle law of forces – Converse – Lami’s theorem – resolution of a force – theorems of resolved parts – Resultant of any number of coplanar forces – Condition of equilibrium.


Unit 3: Projectiles – Path of Projectile is a parabola – Range etc – Range of a particle projected on an inclined plane etc.


Unit 5: Central orbits – Components of velocity and acceleration along and perpendicular to the radius vector – Differential equation of a central orbit – Pedal equation.

REFERENCES
Unit 1: Geometry of Complex numbers – Elementary transformations – Bilinear transformations – Cross Ration – Fixed points of bilinear transformation.


Unit 3: Definite integral – Cauchy’s theorem – Cauchy’s integral formula – Cauchy’s inequality – Morera’s theorem – Lioville’s theorem and fundamental theorem of algebra – Maximum modulus theorem.

Unit 4: Taylor’s and Laurent’s theorem – Zeros of an analytic function.

Unit 5: Singularities – Cauchy’s residue theorem – Arguments theorem – Rouche’s theorem.

Unit 6: Contour integration.

REFERENCES


Unit 4: Inventory control – various costs – EOQ – with or without shortages – multi item Inventory model with constraints – price break in inventory.

Unit 5: Queuing theory – elements of queue – Poisson arrival and exponential service – Multiple servers – finite population and finite capacity.

REFERENCES
Unit 1: Two Basic principles – Simple arrangement and selections with or without repetition – Distribution – Binomial Coefficients.


Unit 3: Recurrence relations – Divide and conquer relations – Derangement – Solution of linear recurrence relation.

Unit 4: Fibonacci number – Stirling number of first and second kind – Catalan number – Menage number.


REFERENCES
Unit 1: Crisp Sets – Fuzzy Sets – Basic Types – Basic Concepts – Characteristics and Significance of the Paradigm shift.

Unit 2: Additional properties of \( \alpha \)-cuts – representations of fuzzy sets – Extension principle for fuzzy sets.


Unit 4: Fuzzy Numbers – Linguistic variables – Arithmetic operations on intervals – Arithmetic operations on fuzzy numbers – Lattice of fuzzy numbers – Fuzzy Equations.


REFERENCES

Unit 1: Introduction to object oriented approach – Characteristics of OOP – Classes, objects, inheritance and overloading.

Unit 2: C++ console I/O – Conditional statements – Looping statements – Function overloading – Constructors and destructors – Friend and online functions – Static variables and functions.

Unit 3: Using pointers to objects, this pointer – New and delete operators – Operator overloading – Overloading unary and binary operators using friend functions and member functions.

Unit 4: Inheritance – Levels of inheritance – Multiple inheritance – Multilevel inheritance – Virtual base classes – Pointers to derived classes – Virtual functions – Polymorphism.

Unit 5: Files – Templates – Exception handing.

REFERENCES

Objectives:
The key objectives of this paper are

- To learn the basic concepts, theories and laws of ray optics and physical optics.
- To understand the various experiments and instruments based on the theories of ray optics and physical optics, particularly to study the optical instruments, interferometers, diffractometer and polarizer.
- To know about the laser theory, Fiber optic principles and devices associated with laser and optical fibers.

UNIT – I: GEOMETRICAL OPTICS (24 hrs)
Convex lens - Optic Centre - Cardinal Points - Principal foci and principal points - Optic centre of a lens - Eye pieces: Huygens and Ramsden - Telescope: Refracting Astronomical - Reflecting Astronomical - Refracting telescopes - Spherical aberration and lenses - Methods of minimizing spherical aberration - Condition for minimum spherical aberration in the case of two lenses separated by a distance - Chromatic aberration in lenses - Condition for achromatism of two thin lenses (in contact and out of contact) - coma - astigmatism - Constant deviation spectrometer - calculation of characteristic wave number of spectral lines.

UNIT – II: INTERFERENCE (24 hrs)

UNIT – III: DIFFRACTION (24 hrs)
Fresnel assumptions - Rectilinear propagation of light - Zone plate - Fresnel and Fraunhofer Diffraction - Fresnel Diffraction at a Straight edge and Narrow wire - Fraunhofer Diffraction at a Single slit and Double slit - Missing orders in a Double slit, Diffraction pattern - Plane Transmission grating - Dispersive power of grating - Overlapping spectra Rayleigh’s criteria - Resolving power of telescope and grating

UNIT – IV: POLARISATION (24 hrs)
Polarisation - Double refraction - Nicol prism - Huygen’s theory for uniaxial crystals - Quarter wave plate and half wave plate - Production and detection of Plane, Circularly and Elliptically Polarized light - Babinet’s compensator - Optical activity - Fresnel’s Explanation of optical rotation - Experimental verification - Specific rotation: Laurent’s half shade polarimeter. - Kerr effect and Faraday effect.

UNIT – V: LASERS AND FIBRE OPTICS (24 hrs)
REFERENCES

7. http://www2.warwick.ac.uk/fac/physics/teach/module/home/px207
Objectives:
Students know the structure of the atom, atomic models, laws of optical spectra, characteristics of rays and spectroscopic techniques.

UNIT-I: STRUCTURE OF THE ATOM (24 hrs)

UNIT- II: ATOM MODEL (24 hrs)

UNIT- III: OPTICAL SPECTRA (24 hrs)
Spectral terms and notations - selection rules - fine structure of sodium D lines - alkali spectra - fine structure of alkali spectra - spectrum of Helium.
Zeeman effect – Larmor’s theorem – Paschen back effect – Stark effect – Production of X-rays – Bragg’s law – Bragg’s X-ray spectrometer – X-ray spectra – Characteristics of X-ray spectra – Mosley’s law – Compton effect – Photo electric effect – Experimental investigation – Einstein’s Photo electric equation – Photo voltaic cell

UNIT- IV: MOLECULAR SPECTRA AND RAMAN EFFECT (24 hrs)

UNIT-V: SPECTROSCOPIC TECHNIQUES (24 hrs)

REFERENCES
5. Guptakumar Sharma , (2011).Elements of Spectroscopy, Meerut, Pragatiprakashan,
6. Gurdeep Chatwaland, Spectroscopy, ShamAnand
11. http://www2.warwick.ac.uk/fac/physics/teach/module/home/px207
Objectives:
To understand the basics of vector calculus, matrices, Laplacetrans forms and statistics. With these background, students are made to gain the knowledge of concept of theoretical/analytical physics oriented courses like classical mechanics, quantum mechanics, electromagnetic theory and its applications.

UNIT – I: VECTOR CALCULUS(24 hrs)

UNIT – II: MATRICES(24 hrs)

UNIT – II: MATRICES FOR PHYSICS(24 hrs)

UNIT – IV: LAPLACE TRANSFORMS(24 hrs)

UNIT – V: STATISTICS(24 hrs)

REFERENCES
2. Gupta B.D., (1997), Mathematical Physics, Vikas Publishing house
UNIT – I: LAGRANGE’S FORMULATION (24 hrs)

UNIT – II: HAMILTONIAN FORMULATION

UNIT-III: FORMULATION OF QUANTUM MECHANICS(24 hrs)
Inadequacy of classical mechanics - Black body radiation – Planck’s hypothesis- Photoelectric effect - Einstein's light quantum hypothesis and photoelectric equation - Matter waves - Phase and group velocity - wave packet - expressions for deBroglie wavelength - Davisson and Germer's experiment - G.P. Thomson experiment - electron microscope

UNIT-IV: WAVE MECHANICS(24 hrs)
Wave function $\psi$ - significance of wave function $\psi$ - properties of wave functions- - Heisenberg's uncertainty principle - its consequences - - operator formalism - linear operators – adjoint operators - expectation values - eigen value and eigen function-Postulates of quantum mechanics

UNIT-V: SCHröDINGER EQUATIONS AND ITS APPLICATIONS (24 hrs)
Schrödinger equation - time dependent and time independent - application of Schrödinger equations - linear harmonic oscillator - zero point energy - particle in a one dimensional box - barrier penetration and tunneling effect - rigid rotator - hydrogen atom.

REFERENCES
2. SathyaPrakash, (2010). Quantum mechanics by, Meerut, , PragatiPrakashan,
5. Ghatak A, (2002).Basic quantum mechanics ,New Delhi, McMillan India
Objectives:
To provide an in-depth foundation in solid state physics especially in crystallography, x-ray diffraction, phonons, magnetic, super conductors and dielectric property of the solids.

UNIT – I: CRYSTAL STRUCTURE(24 hrs)
Crystal imperfections – Point defects – line defects – Surface defects – Volume defects.

UNIT – II: ELECTRON THEORY OF SOLIDS(24 hrs)

UNIT – III: DIELECTRIC MATERIALS(24 hrs)

UNIT – IV: SUPERCONDUCTORS(24 hrs)

UNIT – V: NEW MATERIALS(24 hrs)
Metallic glasses - Fiber Reinforced Plastics (FRP) and Fiber Reinforced Metals (FRM) - Metal matrix composites – Biomaterials – Ceramics – Shape memory alloys – SMART materials – conducting polymers.

REFERENCES
2. Arumugam M., Material Science, Anuradha Agencies
CORE PAPER –X
NUCLEAR PHYSICS
(120 Hrs)

SUBJECT CODE:

Objectives:
- To enable the students to know the elements of nuclear structure and radioactivity
- To know the different nuclear models and to understand the elementary particles and their interactions.

UNIT – I: RADIO ACTIVITY (24 hrs)

UNIT – II: NUCLEAR ACCELERATORS AND DETECTORS(24 hrs)
Linear accelerator (LINAC) – Betatron – Synchrotron – Proton Synchroton – Ionization chamber – GM counter – Wilson’s cloud chamber – Bubble chamber – Spark chamber - Scintillation counter – Cerenkov counter

UNIT- III: NUCLEAR PROPERTIES AND MODELS(24 hrs)

UNIT – IV: NUCLEAR REACTIONS (24 hrs)

UNIT- V: COSMIC RAYS AND ELEMENTARY PARTICLES(24 hrs)
Discovery of cosmic rays – latitude effect – Azimuth effect – Altitude effect – Primary and Secondary cosmic rays – cosmic ray showers – Discovery of positron – the mesons – Van allen belts.
Elementary Particles: Classification – Particles and anti particles – the fundamental interactions.

REFERENCES
2. Pandiya and Yadav,(1997). Elements of Nuclear Physics, Kedar Nath Ram Nath, Meerut
CORE PAPER –XI
RELATIVITY AND SPACE PHYSICS
(120 Hrs)

OBJECTIVES
To know about celestial bodies, the theories of the evolution of the universe and to understand the concept of relativity and their applications.

UNIT – I: RELATIVITY(24 hrs)

UNIT –II: UNIVERSE(24 HRS)

UNIT –III: SUN(24 hrs)

UNIT –IV: STARS(24 HRS)

UNIT –V: ASTRONOMICAL INSTRUMENTS AND ORIGIN OF UNIVERSE(24 HRS)

REFERENCES
2. K.D. Abyankar, Astrophysics of solar system by University press, India.
3. The fascinating Astronomy, published by devadas telescopes, Chennai.
4. www.gascwbgr.org
CORE PAPER –XII
PROGRAMMING IN C WITH PHYSICS APPLICATIONS
(120 Hrs)

OBJECTIVES:
To Know about the techniques and applications of C Programming and to solve the Physics
problems using C-programming techniques and to improve the science concepts based
programming skills.

UNIT – I: C LANGUAGE FUNDAMENTALS (24 hrs)
History of C language - Basic Structure of C Programming - Character set - Constants -
Variables - Data Types - Operators and Expression - Escape Sequence Characters - Library
Functions - Input and Output statements: scanf - printf - getchar - putchar - gets – puts.

UNIT – II: CONTROL STRUCTURES (24 hrs)
Arrays Variables – Assigning Data for Array - One, Two and Multi dimensional Array -
Conditional control statement: if, else, nested if, switch case - Looping statement: while, do
while, for, nested for- break - continue and Unconditional control statement: go..to statement.

UNIT – III: FUNCTIONS, STRUCTURE AND UNIONS (24 hrs)
Function declaration – argument – Call the function – Return statement - Type of functions -
Recursive functions - Passing Array to functions - Automatic, Static, Register and External
storage - Defining a structure – Declaring structure variables – Accessing structure members –
Structure initialization – Structure within structures – Structures and functions – Unions –
Size of structures.

UNIT – IV: POINTERS AND FILES (24 hrs)
Understanding pointers – Accessing the address of a variable – Declaring pointer variables –
Initialization of pointer variables – Accessing a variable through its pointer – Pointer
expressions
Defining and opening a file – Closing a file - Input/output operation in files – Error handling
during I/O operations – Command line arguments.

UNIT – V: PHYSICS APPLICATION PROGRAMS (24 hrs)
Quadratic equations - Matrix multiplication - Conversion of temperature from C to F and F to
C - Determination of G by Boy’s Method - Young’s Modulus - Uniform bending -
Spectrometer - Refractive index & Dispersive power of prism - Newton’s Rings - Radius of
curvature - Determination of Velocity of light - Foucault’s Rotating Mirror Method .

REFERENCES
3. YeshavantKanitkar,(2002). Let us C, New Delhi, BPB publications,
4. https://bponline.com
Any 12 experiments:

1. Spectrometer – i -i’ curve
2. Spectrometer – Cauchy’s constant
3. Spectrometer - \( \mu \) of a glass prism - i-d Curve
4. Spectrometer - Grating N and \( \lambda \) - minimum deviation method
5. Newton’s Rings - Refractive Index of Liquid
7. Air wedge - Thickness of a wire
8. Kundt's Tube – Determination of velocity of sound
9. Comparison of emfs of the given cells using B.G.
10. Ballistic Galvanometer – Figure of merit
11. Potentiometer – High range voltmeter
12. Hartley oscillator
13. Colpitt’s oscillator
14. FET characteristics
15. Band gap energy of the semiconductor
16. Laser Diffraction – Determination of wave length of the diode laser
17. Resolving power of a lens using He-Ne laser
18. Verification of Malus law using diode laser
19. Astablemultivibrator using 555 timer.

REFERENCES

2. Sasikumar R.,(2011). Practical Physics, New Delhi,PHI Learning Pvt. Ltd.,
CORE PRACTICAL -IV
(120 Hours)

Any 12 experiments:

8085 MICROPROCESSOR PROGRAMMING:

1. Program to transfer data between memories
2. Program to find the 1’s and 2’s complement of 8 - bit data
3. Program to perform 8 – Bit Addition and Subtraction
4. Program to perform 8 –Bit Ascending order
5. Program to perform 8 –Bit Descending order
6. Program to perform 8 –Bit Multiplication
7. Program to perform 16 Bit Addition
8. Program to perform BCD Addition
9. Program to find the smallest and largest in a data Array

C – PROGRAMMING in Physics

1. Conversion of temperature from $^\circ$C to $^\circ$F and $^\circ$F to $^\circ$C
2. Determination of ‘G’ by Boy’s Method
3. Young’s Modulus - Uniform bending
4. Spectrometer - Refractive index & Dispersive power of prism
5. Newton’s Rings - Radius of curvature
6. Determination of Velocity of light - Foucault’s Rotating Mirror Method
7. Determine the Square root of the Quadratic equations
8. Matrix multiplication of a given 2 x 2 matrices
9. Determination of escape Velocity of a satellite

REFERENCES

UNIT I
Coordination chemistry - terminology, classification of ligands, chelation, nomenclature of complexes, Werner’s theory and Effective Atomic Number (EAN) concept. Isomerism in complexes - structural isomerism - coordination, ionisation, hydrate, ligand and linkage isomerism. Stereoisomerism - geometrical isomerism in 4 coordinated complexes - $\text{Ma}_2\text{b}_2$, $\text{Ma}_2\text{bc}, \text{M(ab)}_2$ and 6 coordinated complexes - $\text{Ma}_4\text{b}_2$, $\text{Ma}_3\text{b}_3$, $\text{M(aa)}_2\text{b}_2$. Optical isomerism and conditions for optical isomerism - optical isomerism in 6 coordinated complexes - $\text{M(aa)}_3$ and $\text{M(aa)}_2\text{b}_2$.

UNIT II
Theories of metal - ligand bonding in complexes - valence bond theory (VBT), formation of outer orbital and inner orbital complexes, magnetic behaviour of the complexes and limitations of VBT. Crystal field theory (CFT) - crystal field splitting in octahedral and tetrahedral complexes. Strong and weak ligands, factors affecting $\Delta_o$ values, spectrochemical series, high spin and low spin complexes. Application of CFT to magnetic properties and colour of complexes, crystal field stabilisation energy (CFSE) and its uses. Limitations of CFT. Comparison between VBT and CFT.

UNIT III
Applications of coordination compounds in quantitative analysis - gravimetric estimation of nickel using DMG and aluminum using oxine, estimation of hardness of water using EDTA. Structures and functions of chlorophyll and hemoglobin. Metal carbonyls - general methods of preparation, nature of M-CO bond, structure of $\text{Ni(CO)}_4$, $\text{Fe(CO)}_5$, $\text{Fe}_2\text{(CO)}_9$, $\text{Mn}_2\text{(CO)}_{10}$ and $\text{Co}_2\text{(CO)}_8$.

UNIT IV
Calculation of number of atoms in simple cubic (SC), face centered cubic (FCC) and body centered cubic (BCC) unit cells. Symmetry in crystals - symmetry operations and symmetry elements - plane of symmetry, axis of symmetry and centre of symmetry. Symmetry elements of a cubic crystal. Semiconductors - intrinsic and extrinsic - n-type and p-type. Electron gas theory and band theory of metals.

UNIT V
REFERENCES
7. https://www.youtube.com/watch?v=MV-o_8ohB2o
CORE PAPER VI
ORGANIC CHEMISTRY - I
(120 HRS)

SUBJECT CODE:

UNIT I

UNIT II
Preparation and properties of formic and acetic, benzoic, oxalic and malonic acids. Action of heat on formic, acetic, oxalic, malonic and succinic acids. Mechanism of hydrolysis of esters by $\text{BAC}_2$ and $\text{AAC}_2$. Diethyl malonate - preparation and synthesis of acetic acid, adipic acid, cinnamic acid, glycine and malonyl urea from diethyl malonate. Ethylacetoacetate - preparation and synthesis of succinic acid, crotonic acid, butanone, 4-methyl uracil and antipyrine from ethylacetoacetate.

UNIT III

UNIT IV

UNIT V
Molecular rearrangements - mechanisms of Pinacol-pinacolone, Beckmann, benzidine, Hoffmann, Curtius, Schmidt, benzil - benzilic acid, Claisen, Cope, Fries and Wolf rearrangements. (Applications not required)

REFERENCES
UNIT – I

UNIT – II

UNIT – III

UNIT – IV

UNIT – V

REFERENCES
5. https://www.youtube.com/watch?v=6qqrdwldJCI
6. https://www.slideshare.net/MadihahRamly/chapter-6-electrochemistry-49983898

III YEAR
UNIT – I

UNIT – II
Occurrence, extraction, chemical properties and uses of boron. Preparation, properties, structure and uses of diborane, sodium borohydride, boric acid, borax and boron nitride-borax bead test. Borazine-preparation, chemical properties and structure – comparison of borazine with benzene.

UNIT – III
Compounds of silicon-quartz, tridymite, cristobalite and carborundum. Silicates-types, structures and uses. Isolation of noble gases from liquid air-clathrate compounds-types and properties. Preparation, properties and structures of – XeF₂, XeF₄, XeF₆, XeO₃ and XeOF₄. Inter halogen compounds: preparation, properties, uses and structures of ICl, IBr, ICl₃, IF₅ and IF₇.

UNIT – IV
Non-aqueous solvents-classification of solvents, characteristic properties of a solvent. Physical properties, chemical reactions, advantages and limitations of liquid ammonia, liquid hydrogen fluoride and liquid sulphur dioxide.

UNIT – V

REFERENCES
4. www.adichemistry.com
5. signoftruth.vom>non-aqueous-solvents
7. Chem..libretents.org.
CORE PAPER IX
ORGANIC CHEMISTRY –II
(120 Hrs)

SUBJECT CODE:

UNIT-I
Isomerism: structural and stereoisomerism - geometrical isomerism-Cahn – Ingold - Prelog rules for priority of groups, E-Z notation, determination of configuration of geometrical isomers by physical and chemical methods. Optical isomerism, plane polarized light, chirality, enantiomers, diastereomers, anomers, epimers, optical isomerism in lactic acid and tartaric acid. R-S configuration.

UNIT-II
Conformational analysis - distinction between conformation and configuration. Conformations and potential energy diagrams of ethane and n-butane. Conformations of cyclohexane- chair, half chair, boat and twist forms. Methyl cyclohexane, conformations and stabilities of 1,2 –dimethylcyclohexane, 1,3 –dimethylcyclohexane and 1,4 –dimethylcyclohexane, conformations in cyclohexanol, cyclohexane-1,3- diol and cyclohexane-1,4,-diol.

UNIT-III
Free radicals-classification, generation of free radicals, detection of free radicals, configuration of free radicals and relative stabilities of alkyl free radicals. Stability of triphenylmethyl free radical, reactions involving free radicals-polymerization, allylic bromination by NBS, autoxidation, Sandmeyer reaction, Gomberg and Ullmann reactions.

UNIT-IV

UNIT-V

REFERENCES
4. https://www.youtube.com/watch?v=dORAZvh6bI
UNIT – I

UNIT – II
Simple collision theory – its limitations and modifications. Lindemann theory of unimolecular reactions. A qualitative discussion of absolute reaction rate theory (ARRT) using HI reaction – significance of entropy of activation, comparison of collision theory with ARRT. Catalysis – definition, types, characteristics of catalytic reactions, catalytic promoter, catalytic poison, auto catalyst, negative catalyst and induced catalyst. Energy of activation and catalysis. Theories of catalysis. Enzyme catalysis, lock and key and Michaleis - Menton (Derivation not required) mechanisms.

UNIT – III
Phase rule – Definition of phase, component and degrees of freedom. Derivation of phase rule. Application of phase rule to one component systems – phase diagrams of H₂O, CO₂ and sulphur systems. Application of phase rule to two component systems – lead-silver and zinc-magnesium systems. Phase diagrams for two component liquid systems – completely miscible and partially miscible (Phenol-water, triethylamine-water and nicotine-water) systems.

UNIT – IV

UNIT – V

REFERENCES
UNIT -I
Storage and handling of chemicals - corrosive, inflammable, explosive, toxic, poisonous and carcinogenic chemicals. First aid procedures for laboratory accidents involving toxic and poisonous chemicals, electrical shock, cuts and burns from hot objects. Laboratory cleansing methods and cleaning agents. Interchangeable glass ground joint apparatus and their advantages. Calibration and grading of pipette, burette and volumetric flask.

UNIT -II
Evaluation of analytical Data- Errors - types-determinate indeterminate and gross errors. Errors in measurements - weighing, measuring solutions, titrations and gravimetric analysis. Absolute error and relative error. Precision and accuracy, difference between precision and accuracy. Significant figures, mean, median and mode, average, deviation-standard deviation. confidence limits, Q-test, F-test and t-test. SI and derived units.

UNIT -III
Semimicro qualitative analysis - anions (interfering and non-interfering), reactions of some common anions (carbonate, sulphide, sulphate, nitrate, halides, oxalate, borate and phosphate), principle involved in the preparation of sodium carbonate extract and elimination of interfering anions. Classification of cations into groups, reactions of various cations, group reagents, solubility product and common ion effect.

UNIT -IV

UNIT -V
Gravimetric analysis-methods of precipitation, conditions of precipitation, choice of precipitants. Types of organic precipitants, sequestering agents, solubility product and precipitation, factors affecting the solubility of precipitates, co-precipitation and post precipitation, procedure to minimise coprecipitation and post precipitation. Precipitation from homogeneous solution, Washing and drying of precipitates.

REFERENCES
5. https://www.slideshare.net/MarkSelby2/gravimetric-analysis-44916288
6. https://www.slideshare.net/bharat46083610/volumetric-analysis-79371821?qid=7d2d3cf8-43e3-465c-ae12-ab8db3fdd38e&v=&b=&from_search=4
7. http://www.academia.edu/5266578/Analytical_Chemistry_Lecture_Notes_
ELECTIVE PAPER - II
SPECTROSCOPY
(120 Hrs)

SUBJECT CODE:

UNIT-1

UNIT-II

UNIT III

UNIT IV
NMR Spectroscopy—theory—number of signals—equivalent and non-equivalent protons. Instrumentation (block diagram only). Chemical shift and reference standard. Factors affecting chemical shift—shielding and deshielding—anisotropy with reference to ethylene, acetylene and benzene. Spin – Spin Coupling. Rules of splitting signals—splitting of signals in 1,1,2-tribromoethane, ethanol and acetaldehyde. Coupling constant (elementary idea only) NMR spectra of ethyl bromide, 2-chloropropane, acetamide, toluene and 1,4-dioxane.

UNIT V
REFERENCES
3. http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction#NMRSpectroscopy
4. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/spectropy/spectro.htm
A. Gravimetric Analysis
1. Lead as lead chromate
2. Barium as barium chromate
3. Calcium as calcium oxalate monohydrate
4. Nickel as nickel dimethyl glyoxime complex
5. Magnesium as magnesium oxinate
6. Barium as barium sulphate (by insineration)
7. Lead as lead sulphate

B. Physical Chemistry Experiments
1. Determination of transition temperature of a hydrated salt
2. Determination of partition coefficient of iodine between CCl₄ and H₂O
3. Determination of equilibrium constant for the reaction KI + I₂ → KI₃
4. Determination of critical solution temperature (CST) of phenol-water system
5. Determination of effect of impurity (NaCl) on CST of phenol-water system
6. Determination of effect of impurity (Succinic acid) on CST of phenol-water system
7. Determination of molecular weight by Rast’s macro method
8. Phase diagram- simple eutectic system
9. Determination of rate constant of acid catalyzed hydrolysis of an ester
10. Kinetics of persulphate- Iodide reaction

Electrochemistry Experiments
11. Determination of cell constant
12. Determination of equivalent conductance of a strong and weak electrolyte.
13. Conductometric titration- strong acid vs strong base
14. Conductometric titration- weak acid vs strong base
15. Potentiometric titration- Redox reaction [KMnO₄ vs Fe(II)]
16. Potentiometric titration- acid-base titration [HCl vs NaOH]

C. Demonstration Experiments
1. Polarimetry- Inversion of cane sugar

REFERENCES
3. www.aiktcdspace.org>jspui>bitstream
4. https://www.tau.ac.il/~advanal/PotentiometricTitrations.htm
BOTANY

CORE PAPER VI

CELL BIOLOGY AND MOLECULAR BIOLOGY

(120 Hrs)

SUBJECT CODE:

Unit I
Introduction- scope- cell organisation- prokaryotic and eukaryotic. Cell boundaries- cell wall- gross layer i.e. middle lamella, primary wall, secondary wall- Structure, chemistry and functions of cell wall, pits- (simple and bordered), Plasmodesmata. Plasma membrane- occurrence, structure (fluid mosaic model) chemistry, function and origin. Occurrence, structure function and origin of Endoplasmic reticulum Golgi bodies, lysosomes, ribosomes, mitochondria and plastids.

Unit II
Ultrastructure and functions of Nucleus,nucleolus, chromosomes structure, euchromatin, heterochromatin, Polytenes and lampbrush chromosomes-, cell inclusion.Cell cycle, Cell division, Mitosis and Meiosis- their significance.

Molecular Biology

Unit III
Nucleic acid as genetic material, nucleotide, structure of nucleic acid, Genetic code and its properties, mechanisms of protein synthesis.

Unit IV
Gene expression, initiation, enzymes involved and termination of transcription. Translation – codon-anticodon. DNA damage and repairs

Unit V
Regulation of gene expression in prokaryote operon concept-positive and negative regulation of lac operon

REFERENCES

CORE PAPER VII
PHYSIOLOGY AND BIOCHEMISTRY
(120 Hrs)

UNIT I

UNIT II

UNIT III

UNIT IV
Plant growth regulators – auxins, gibberllins, ethylene and abscisic acid, brief account of plant responses to growth regulators, photoperiodism and photomorphogenesis, phytochromes, vernalization, Seed physiology- dormancy, storage and germination of seed.

UNIT V

REFERENCES

III YEAR
CORE PAPER VIII
GENETICS, PLANT BREEDING AND EVOLUTION
(120 Hrs)

SUBJECT CODE:

UNIT I

Unit II
Extra nuclear inheritance - male sterility in corn, Population genetics, Hardy-Weinberg’s principles, factors affecting.

UNIT III: PLANT BREEDING

UNIT IV
Utilization of wild species in crop improvement, inter specific crosses, genomic analysis and evolution of polyploidy crops, cytoplasmic male sterility systems in hybrid seed production, somoclonal variations in crop improvement, nucleic acid hybridization and RFLP in crop improvement

Evolution

Unit-V

REFERENCES
CORE PAPER IX
PLANT PATHOLOGY
(120 Hrs)

SUBJECT CODE:

Unit I
Detailed studies of the nature of plant disease and its causal agents (fungi, bacteria, viruses, nematodes, environmental/chemical agents), and of symbionts and their effect on plant health and disease resistance.

Unit II
Common disease its symptoms, disease cycle and control measure. Rots- Late blight disease of potato, Damping off disease of seedlings, Downy mildew –peas, Wilt of cotton, Leaf spot disease of ground nut, Wheat Rust , Citrus canker.

Unit III
Host pathogen interactions, Parasitism/disease development and attack methods, Molecular mechanisms of pathogenesis, recognition phenomenon, penetration, invasion, primary disease determinant, Defense mechanism in plants- phytoalexins, Systemic Acquired Resistance (SAR)

Unit IV
Transgenic approach for crop protection, Elementary genetic engineering .Management of pathogen through satellite, antisense – RNA, Ribosomes, coat protein, hypo virulence cross protection, useful genes and promoter technology. Engineering chemicals that elicit defense response to plants

Unit V
Epidemiological considerations on disease spread and major outbreaks, and disease control and management techniques (including resistance phenomena and impact). Biosafety and bioethics in plant pathology,

Control of plant disease-Cultural, chemical, biological means

REFERENCES
CORE PAPER - X
PLANT ECOLOGY AND ENVIRONMENTAL BOTANY
(120 Hours)

SUBJECT CODE:

Unit-I
Approaches to the study of ecology (Autecology and Synecology). Plant environment: Climatic and edaphic factors.

Unit-II
Vegetation—Development of vegetation—migration,  ecesis, colonization
Plant succession: Hydrosere and Xerosere.
Ecological classification of plants and their correlation to the habitat factors. Global biogeochemical cycles of carbon, nitrogen, phosphorous, and sulphur.

Unit-III
Approaches to phytogeography—Vegetational types of Tamilnadu: Evergreen, deciduous, scrub and mangrove.
Approaches to biodiversity, conservation insitu and exsitu methods. Megacenters of biodiversity.

Unit-IV
Biological diversity: Concept and levels. Role of biodiversity in ecosystem function and stability; speciation and extinction. IUCN categories of threat: causes of biodiversity loss; conservation—Keystone Species. Conventional and nonconventional energy sources.

Unit V
Social Issues and the Environment • From Unsustainable to Sustainable development • Urban problems related to energy • Water conservation, rain water harvesting, watershed management • Resettlement and rehabilitation of people; its problems and concerns. Case Studies • Environmental ethics: Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. • Wasteland reclamation. • Consumerism and waste products. • Environment Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and control of Pollution) Act • Wildlife Protection Act • Forest Conservation Act • Issues involved in enforcement of environmental legislation. • Public awareness.

REFERENCES
Unit - I
The scope of microbiology - History of microbiology – Classification of microorganisms - Whittaker.

Unit - II

Unit – III

Unit – IV
Microbiology of food – milk - composition of milk, dairy products – cheese and yogurt.
Source and processing of the following fermented foods: saurkraut and kimchi, tempeh kedelai, soysauce, toddy and sago – manihot.

Unit – V
Microorganisms and industry.
Industrial uses of bacteria – Lactic acid production, vinegar production.
Industrial uses of yeasts - Alcohol fermentation
Industrial uses of molds – Penicillin production

REFERENCES
UNIT I
Plant Tissue Culture: Media preparation, Types of tissue culture and its applications- ovule, anther, pollen, embryo culture; uses in agriculture

UNIT II
Protoplast culture: Isolation, purification, protoplast fusion; somatic hybrid, somaclonal embryos; synthetic seeds

UNIT III
Hybridoma technology: Definition, Antibody, Antigen, Hybridoma, Monoclonal and Polyclonal antibody; Production of monoclonal antibody-Immunization, splenectomy, Cell fusion, selection of clones, cloning and production of antibody

UNIT IV
Fermentation: Principle, basic design and working mechanism of a simple fermentor (bioreactor); microbial products-primary and secondary metabolites, enzymes; downstream processing-definition, separation of biomass, cell disruption, concentration of broth, initial purification of metabolites, metabolite-specific purification, de-watering, polishing of metabolites

UNIT V

REFERENCES
UNIT I
Laboratory requirements: General laboratory requirements, types of solutions and buffers, safety aspects in laboratory, Quality control in laboratory-chemicals, glassware, water, solvents

UNIT II
Microscopy – Working principles of Dissection, Compound, Phase contrast, Dark-field, Transmission Electron and Scanning Electron Microscope

UNIT III
Chromatography- Principles, types and applications- Paper, Thin Layer and Column Chromatography; Centrifugations-Principles, types and applications of Hand, Ultra and Differential centrifugation

UNIT IV
Colorimeter-Principles, types and applications. Spectrophotometer-Principles, types and applications.

UNIT V
DNA extraction. Electrophoresis-Principles, types and applications- Agarose, SDS-PAGE and Native Gel

REFERENCES
CORE PRACTICAL - III
(120 Hours)

SUBJECT CODE:

CELL BIOLOGY AND MOLECULAR BIOLOGY
1. Study of ultra structure of cell organelles
2. Study of Mitosis stages in Onion root tip
3. Study of Meiosis in Flower bud

REFERENCES
1. Geraald Karp Cell biology
5. Old and Primrose 2000 Principles of Gene manipulation

PHYSIOLOGY AND BIOCHEMISTRY
Experiments to be performed by the students individually:
1. Determination of solute potential by gravimetric method.
2. Effect of temperature and chemicals on membrane permeability
3. Comparison of relative rate of transpiration in xerophytes and mesophytes.
4. Separation of plant pigments by paper chromatography.
5. Study of rate of photosynthesis under different light intensities.
6. Study of rate of photosynthesis under varying concentration of carbon dioxide
7. Comparison of rate of respiration in germinating seeds and flower buds using respiroscope.
8. Determination of water absorption and transpiration by weighing method.
9. Comparison of rate of stomatal and cuticular transpiration by four leaves method.

DEMONSTRATION EXPERIMENTS
1. Test for starch
2. Activity of catalase.
3. Test for carbohydrates.
4. Test for proteins.

REFERENCES

GENETICS, PLANT BREEDING, EVOLUTION
1. Monohybrid and Dihybrid crosses
2. Test and back crosses
3. Complementation, supplementary and epistasis
4. Linkage and crossing over
5. Gene mapping

REFERENCES


**PLANT PATHOLOGY**
1. Identification of diseases and pests of common crops
2. Sectioning of the Pathological specimen

**REFERENCES**
CORE PRACTICAL – IV
(120 Hours)

SUBJECT CODE:

PLANT ECOLOGY AND ENVIRONMENTAL BOTANY
1) Morphological, anatomical adaptations of Hydrophytes, mesophytes and xerophytes
2) Identification of vegetational zones using maps.
3) Study of Soil Profile, Soil pH.

REFERENCES

MICROBIOLOGY
1. Preparation of culture media for bacteria, fungi - sterilization procedures.
2. Isolation of rhizosphere, rhizoplane, phylloplane microorganisms.

REFERENCES

BIOTECHNOLOGY
1. Demonstration of Tissue culture (Visit to Tissue culture lab).

REFERENCES

BIOTECHNIQUES
1. Separation of Pigments using Paper and Thin Layer Chromatography
2. Demonstration of Instruments like Centrifuge, Colorimeter, Spectrophotometer, Electrophoresis.

REFERENCES

III YEAR
UNIT I
Theories of preformation, epigenesis and germplasm, germ layers and derivatives.
Spermatogenesis and Oogenesis

UNIT II
Fertilization Mechanism and Physiology. Parthenogenesis - Definition & types Cleavage - Types. Different types of blastulae. Gastrulation: General principles

UNIT III
Development of Frog: Fertilization, Cleavage, Blastulation, Morphogenetic movement and formation of germ layers, neurulation & notochord formation, mesoderm and coelom formation, organogenesis of brain and eye, hormonal control of amphibian metamorphosis

UNIT IV
Development of chick: Structure of egg, fertilization, cleavage, blastulation, gastrulation and formation of germ layers. Salient features of chick embryo at primitive streak stage, 24, 33, 48 hour stage

UNIT V

REFERENCES

UNIT II  Ideas of evolution before Darwin – Lamarckism and Neo-Lamarckism – Darwinism and Neo-Darwinism – Germplasm theory – Mutation Theory – Modern Synthetic theory


UNIT IV  Isolating mechanisms – different types – species concepts – definition of species – Origin of species – Allopatric and Sympatric speciation. Hardy Weinberg law


REFERENCES
CORE PAPER VII
ANIMAL PHYSIOLOGY
(120 Hours)

UNIT I
Nutrition – Types and food requirements Enzymes - classification and nomenclature-
Properties of enzymes. Factors affecting enzyme action.; Metabolism of carbohydrates,
proteins and lipids - Glycogenesis, glycogenolysis, glycolysis, Kreb's cycle, Beta oxidation
of fatty acids, deamination, transamination and decarboxylation of amino acids

UNIT II
Respiration – respiratory organs in animals - Respiratory pigments - Adaptations to high
altitude and diving. Transport of oxygen and carbondioxide – Anaerobiosis. Circulation -
types - Composition, Properties and functions of blood - Types of Heart. Human - Cardiac
cycle - Cardiac rhythm - origin of heart beat - regulation of heart beat - ECG - Blood pressure

UNIT III
Excretion – Excretory organs in animals – Kinds of excretory products – ornithine cycle -
mechanisms of urine formation in mammals – hormonal regulation of excretion. Osmo-
conformers & osmo-regulators – organs concerned with osmo-ionic regulation (skin, gills and
kidneys) – osmo-ionic regulation in aquatic and terrestrial vertebrates. Thermoregulation -
acclimation and acclimatization

UNIT IV
- synapse - synaptic transmission of impulses - Neurotransmitters, Autonomic nervous
system. Muscle tissue: Mechanism of contraction - Theories of muscle contraction

UNIT V
Reproduction- male and female reproductive system in mammals, menstrual cycle
Endocrine glands - structure, hormones and their functions in vertebrates - Gastrointestinal
hormones. Receptors - Photoreceptor - vertebrate mammalian eye - Structure - Physiology of
vision - Phonoreceptors - Mammalian ear - working mechanism

REFERENCES
1. Parameswaran, Anantha Krishnan and Anantha Subramaniam, 1975. Outlines of
2. General and comparative Animal Physiology , 1966, William Hoar, California ,
OF_ANIMAL_PHYSIOLOGY
physiology-with-introductory-chapters-on-general-biology--lli.shtml
5. http://www.freebookcentre.net/biology-books-download/ANIMAL-
PHYSIOLOGY.html
UNIT I
Aqueous solutions - properties of water, Acids, Bases Concept and their relevance to Biological system, Buffers and electrolytes their functions in biological system, acidity, alkalinity determination

UNIT II
Biochemistry of carbohydrates, - structure, classification and biological significance, Protein structure - Primary, Secondary, Tertiary and quaternary, characteristics of proteins, Biological significance

UNIT III
Biochemistry of lipid - classification and functions, Vitamins -classification, function, source, deficiency

UNIT IV
Enzymes – classification – physico- chemical properties – enzyme kinetics – mechanism of enzyme action, factors affecting enzyme activity

UNIT V
Biochemistry of hormones and their mode of action – biochemistry of antibiotics and their mode of action – biochemistry of visual pigments and their mode of action- biochemistry of pheromones and mode of action

REFERENCES
2. Lehninger , 1992 Biochemistry worth publications, New Delhi, Inc Cbs publication
3. H.S. Srivastava , 2013, Elements of Biochemistry, Meerut, Rastogi Publications
CORE PAPER IX
ENVIRONMENTAL BIOLOGY
(120 Hours)

SUBJECT CODE:

UNIT I

UNIT II
Habitat ecology: Terrestrial, Freshwater, Marine, Mangrove ecosystem; Population Ecology- properties and population interactions: Intraspecific and interspecific

UNIT III
Pollution: Pollutants - Degradable & Non-degradable ; Causes, effect and control of air, water, land, noise, thermal and radioactive pollution ; Green house effect, Global warming, Acid rain.

UNIT IV
Wild life management and laws – sanctuaries and national parks; Natural resources: renewable and nonrenewable resources; Biodiversity: Hot spots of biodiversity- Threats to biodiversity - Conservation of biodiversity - in situ and ex situ conservations

UNIT V

REFERENCES
UNIT I
Biostatistics - Definition and Scope – Collection of data – Census and sampling methods, variable : Discrete and continuous , Concept of statistical population and sample , characteristics of frequency distribution

UNIT II
Presentation of Data : Classification and tabulation – Types of classification , Diagrammatical and Graphical representation of statistical data – types : Bar , Pie , Histogram , Line graph

UNIT III
Measures of central tendency : Mean , median , mode and weighted arithmetic mean, Harmonic mean, Geometric mean

UNIT IV
Measures of dispersion: range, Quartile deviation, mean deviation and standard deviation , correlation and regression

UNIT V
Sampling and test of significance of small sample - Student’s T Test, F test , $X^2$

REFERENCES
7. https://www.amazon.in/Introduction-Biostatistics-Gurumani-N-ebook/dp/B00U9I5YBS
Unit I.

Unit II
Cells and Organs of the Immune System: Haematopoiesis, Cells of the immune system, Organs of the Immune system: Primary and Secondary lymphoid organs: structure and their role.

Unit III
Antigens, Antigenicity and immunogenicity, Immunogens, Adjuvants and Haptens, Factors influencing immunogenicity, Immunoglobulins: Structure, classes and function, Antigenic determinants on immunoglobulins, Antigen-antibody interactions, Monoclonal antibodies, Hybridoma technology.

Unit IV.
Major Histocompatibility Complex: MHC and immune responsiveness; Cytokines: properties and functions; Complement system: components, activation and functions.

Unit V
Hypersensitivity – classification; Vaccines: Types; Immunodeficiency diseases and Autoimmune diseases

REFERENCES
UNIT I
Biotechnology – Definition, scope, ethics and regulations of Biotechnology; Tools of Genetic Engineering – Enzymes- nuclease, ligase, alkaline phosphatase, restriction endonucleases, polymerase; Vectors – Plasmids, Phage vector, insertion vector, Replacement vector, Cosmids and Transposans, linkers, adapters

UNIT II
Techniques of Genetic Engineering – Isolation of DNA, isolation of plasmid, r plasmid formation, transformation of rDNA into host cells, direct gene transfer methods; identification and selection of recombinants: markers, immunochemical methods, nucleic acid hybridization methods, blotting techniques, PCR technique, DNA fingerprinting, RAPD, RFLP, Microarray

UNIT III
Transgenic animals – GEO, bio safety and regulations- TRIPS, GATT, IPR, patent, copyright, trade mark

UNIT IV
Principles and techniques of animal cell culture – sterilization, media preparation, primary culture, cell line culture, applications

UNIT V
Applications of genetic Engineering: Industry - Production of single cell protein (SCP), Alcoholic Fermentation, Fermenter design and types - Biogas production; Medicine Monoclonal Antibodies, Insulin and Vaccine production; Agriculture - N$_2$ fixation-agrobacterium; Bio-fertilizers and Bio-Insecticide, Environment– waste and sewage management.

REFERENCES
DEVELOPMENTAL BIOLOGY
Study of the following prepared slides, museum specimens and materials.
1. Sections of mammalian testis and ovary showing the maturation stages of gametes.
2. Slides of mammalian Sperm and Ovum.
4. Slides of cleavage stages, blastula, gastrula and neurula of frog.
5. Slides of different stages of chick embryo. 18 Hours (primitive streak stage), 24 Hours, 48 Hours, 72 hours and 96 Hours.
6. Placenta of sheep, Pig and Man.

REFERENCES

EVOLUTION
1. Fossils : Ammonite , Trilobite , Archaeopteryx
2. Study of evolution of man with the help of Model/chart.

REFERENCES

ANIMAL PHYSIOLOGY
1. Influence of body weight on oxygen consumption of fish

III YEAR
2. Influence of temperature on oxygen consumption of fish
3. Determination of oxygen uptake by a terrestrial animal.
4. Qualitative tests for ammonia, urea and uric acids
5. Determination of bleeding time
6. Determination of clotting time
7. Measurement of arterial blood pressure in man using sphygmomanometer
8. Determination of amylase activity with starch

REFERENCES


BIOCHEMISTRY

1. Qualitative identification of carbohydrate, protein and lipoid.
2. Analysis of urine for identification of sugar, albumin, ketone bodies

REFERENCES

2. Lehninger , 1992 Biochemistry worth publications , New Delhi ,Inc Cbs publication
3. H.S. Srivastava , 2013 , Elements of Biochemistry ,Meerut , Rastogi Publications
CORE PRACTICAL IV
(120 Hours)

SUBJECT CODE:

ENVIRONMENTAL BIOLOGY
1. Estimation of Dissolved oxygen, salinity, pH, free CO2 in water samples.
2. Use of Rain gauge, Maximum & minimum thermometer, Hygrometer, photometer
3. Plankton study – Fresh water and marine water zooplankton.
4. Study of Adaptations of aquatic and terrestrial animals, rocky, sandy, muddy shore animals, flying and burrowing animals with museum specimens
5. Study of wild animals with the help of stuffed preparations/ models/ charts/ photographs.
6. Study of natural ecosystem and field report of the visit.

REFERENCES

BIO STATISTICS
1. Calculation regarding mean, median, mode, SD and SE from given plant/animal specimens.
2. Preparation of histogram and pie diagram with the help of plant/animal specimens provided.

REFERENCES
7. https://www.amazon.in/Introduction-Biostatistics-Gurumani-N-ebook/dp/B00U9I5YBS

IMMUNOLOGY
1. Study of T.S. of primary and secondary Lymphoid organs using prepared slides
2. Study of ABO blood group
3. Spotters- Principle and application of immunoelectrophoresis (using animated videos/ kits)
4. Spotters - Principle and application of antigen –antibody reactions – agglutination, precipitation; Immunodiffusion, ELIZA, RIA (using animated videos/ kits)

III YEAR
REFERENCES

BIOTECHNOLOGY
1. Identification of vectors (diagrams/slides)
2. Spotters - Autoclave, Refrigerated centrifuge, Micropipette, Electrophoretic apparatus, Trans illuminator, PCR, Laminar flow hood, CO2 incubator

REFERENCES
Course objectives:

At the end of the course, the student-teachers will be able to:

1. develop an understanding of the nature of learning and teaching.
2. develop an understanding of the behavioural theories, cognitive and humanistic theory.
3. critically evaluate the theory of constructivism.
4. understanding the teaching diverse classroom.
5. identify the need and importance of teacher student relationship
6. discuss the importance of teaching as a profession.

Unit I  Nature of learning


(Suggested Instructional approaches/ methods:
   i) Student seminar on principles of active learning.
   ii) Invited talk by experts based on the nature of learning.)

Unit II  Nature of Teaching

Teaching: Definition and meaning – Characteristics of good teaching – Views of great thinkers and philosophers on teaching - Becoming a reflective teacher and his characteristics - My goals as a teacher.

(Suggested Instructional approaches/ methods:
   i) Group discussion on characteristic of a good teacher.
   ii) Student seminar on becoming a reflective teacher.)

Unit III  Behavioral Theories of Learning

Learning – meaning of learning as defined by behaviourists – classical conditioning (Pavlov) – Law of effect (Thorndike) – operant conditioning and shaping (Skinner) – social learning (Bandura) - Basic assumptions of behavioural theory – strengths and limitations.

(Suggested Instructional approaches/ methods:
   i) Invited talk by the experts on the behavioural theories of learning.
   ii) Student seminar on basic assumptions of behavioural theory.)

Unit IV  Cognitive and humanistic theories of learning

Learning – meaning of learning as defined by cognitive psychologists – Insight learning (Kohlberg) - Modes of cognitive development (Bruner) – Stages of intellectual
development (Piaget) – Learning styles (Kolb) – Self-actualization (Maslow) - Theory of a fully functioning person (Carl Rogers).

(Suggested Instructional approaches/ methods:
 i) Student seminar on the cognitive theories of learning.
 ii) Invited talk by experts on the humanistic theory of learning.)

Unit V Theory of Constructivism

Constructivism – meaning and definitions - The nature of constructivist learners the role of teachers, the nature of learning process, collaboration among learners and pedagogical approaches to constructivism - Gagne’s eight levels of learning.

(Suggested Instructional approaches/ methods:
 i) Presentation of a report based on the group discussion on constructivism.
 ii) Group discussion on Gagne’s eight levels of learning.)

Unit VI Learner- centered teaching

Meaning - characteristics of learner-centered teaching/learner-centered learning. Need for learner-centered approaches in teaching advantages of learner-centered teaching vs teacher-centered learning, teaching – Learner - centered techniques of teaching and their advantages.

(Suggested Instructional approaches/ methods:
 i) Student seminar on learner - centered teaching.
 ii) A debate on learner-centered teaching vs teacher-centered learning.)

Unit VII Teaching in Diverse classrooms

Meaning and definitions of diverse classroom-Teaching in a diverse classroom-preparations of teachers of diverse classroom-Techniques of teaching in a diverse classroom/Diverse teaching strategies for diverse learners-effective teaching in a diverse classroom-Diversity in the classroom.

(Suggested Instructional approaches/ methods:
 i) Talk by the expert on preparation of teachers for diverse classroom.
 ii) Student seminar on effective teaching in a diverse classroom.)

Unit VIII Learning in and out of School

Purpose of learning in and out of school: what we know? and what we need to know? Importance of observation learning out of school- out of school learning: extending curriculum learning to the local area -approaches to learning outside the class room- learning for outside the classroom-advantages of learning outside the classroom.

(Suggested Instructional approaches/ methods:
 i) Teacher talk on importance of observation learning.
 ii) Discussion on approaches to learning outside the school.)
Unit IX  Teacher- Student Relationship
   (Suggested Instructional approaches/ methods:
   i) Invited talk by experts on the effective teacher student relationship.
   ii) Seminar on healthy classroom management and academic achievement.

Unit X  Teaching as a profession
   Nature of teaching - Teaching as a profession - characteristics of effective and ineffective teaching - why teaching is the most important profession - Attitude of student-teachers towards teaching profession - Qualities of a professional teacher - Faculty development programmes - Teaching and Learning for sustainable future.
   (Suggested Instructional approaches/ methods:
   i) Teacher talk on qualities of a good teacher.
   ii) Student seminar on “teaching as the noblest profession”).

Tasks and Assignments:
1. Prepare a report based on the interaction/interview with expert(s) for the theories of learning and teaching, teaching as a profession.
2. Prepare records that capture a variety of images of learning and teaching.

REFERENCES
PEDAGOGY OF A SCHOOL SUBJECT PART – I (METHODOLOGY)

1. PEDAGOGY OF MATHEMATICS

(Part - I Methodology)

(60 Hours)

SUBJECT CODE:

Course objectives:
At the end of the course, the student-teachers will be able to:
1. understand the aims and objectives of teaching Mathematics.
2. formulate instructional objectives for a lesson.
3. gain mastery of the teaching skills.
4. apply various methods in teaching of Mathematics.
5. use various resources in teaching Mathematics.

Unit I Aims and objectives of teaching Mathematics
Mathematics: Meaning, nature and scope - Aims and objectives of teaching Mathematics in schools – Need and significance of teaching Mathematics - Values of teaching Mathematics.

(Suggested instructional approaches/methods:
   i) Teacher talk/ Invited lecture on the place of Mathematics in school curriculum.
   ii) Student seminar on the need, significance and values of teaching Mathematics.)

Unit II Planning for Instruction
Steps in planning a lesson: Setting lesson goals - Designing a unit plan - Designing a lesson plan - Bloom’s Taxonomy of educational objectives - Formulating Instructional objectives at cognitive, affective and psychomotor levels - Structure of a four-fold lesson plan - Preparation of a model lesson plan - Types of test-items - Constructing test-items for formative evaluation in class.

(Suggested instructional approaches/methods:
   i) Write instructional objectives for a lesson in Mathematics for Level I & II.
   ii) Prepare a model lesson plan for Level I & II in Mathematics.)

Unit III Practising the Teaching Skills in Mathematics

(Note: Teacher-Educators should give a demonstration of a mini-lesson by integrating major teaching skills (for 20 minutes) and they should demonstrate a mini-lesson by integrating major teaching steps in teaching.)

(Suggested instructional approaches/methods:
   i) Prepare a report on the practising of a mini-lesson with multiple-teaching skills by observing peers.

III YEAR
ii) Prepare two mini-lessons and practise them in front of peers in the class for Level I and Level II.)

Unit IV Methods of Teaching Mathematics

**Teacher-centered methods:** Lecture method – Analytical and Synthetic methods - Deductive and Inductive methods - Demonstration method - Team-teaching. **Learner-centered methods:** Project method - Peer tutoring/teaching by students- Individual activities - experiential learning- Teacher-guided learning- Problem-solving method- Small group/whole-class interactive learning: Student seminar - group discussion - Mixed-ability grouping - Maths through games and puzzles. **Recent trends:** Constructivist learning - Problem-based learning - Brain-based learning - Collaborative learning - Flipped learning - Blended learning - e-Learning trends - Video conferencing.

*(Suggested instructional approaches/methods:)*

i) Teacher talk/Expert talk on different methods of teaching Mathematics.

ii) Preparation and presentation of a report on different methods of teaching Mathematics.)

Unit V Resources for Teaching Mathematics


*(Suggested instructional approaches/methods:)*

i) Teacher talk/Invited lecture talk on different resources for teaching Mathematics.

ii) Preparation and presentation of a report on different resources for teaching Mathematics.)

**Tasks and Assignments:**

1. Prepare and submit an evaluative report on different methods of teaching Mathematics.

**REFERENCES**


10. [http://www.mathematics.com](http://www.mathematics.com)
PEDAGOGY OF A SCHOOL SUBJECT PART - I (METHODOLOGY)
2. PEDAGOGY OF PHYSICAL SCIENCE
(Part - I Methodology)
(60 Hours)

SUBJECT CODE:

Course objectives:

At the end of the course, the student-teachers will be able to:

1. understand the aims and objectives teaching of physical science.
2. formulate instructional objectives for a lesson.
3. gain mastery of the teaching skills.
4. apply various methods in teaching physical science.
5. use various resources in teaching physical science.

UNIT I Aims and objectives of teaching Physical Science
Physical Science: Meaning, nature and scope – Aims and objectives of teaching Physical Science in schools - Need and significance of teaching Physical Science - Values of teaching Physical Science.

(Suggested instructional approaches/methods:

i) Teacher talk/Invited talk on the place of Physical Science in the school curriculum.
ii) Student seminar on the need, significance and values of teaching Physical Science.)

UNIT II Planning for Instruction
Steps in planning a lesson: Setting lesson goals – Designing a unit plan – Designing a lesson plan – Bloom’s Taxonomy of educational objectives: Formulating educational objectives at cognitive, affective and psychomotor levels – Structure of a four-fold lesson plan – Preparation of a model lesson plan – Types of test-items - Constructing test-items for formative evaluation in class.

(Suggested instructional approaches/methods:

i) Write the instructional objectives for a lesson in Physical Science at Level I & II.
ii) Prepare a model lesson plan in Physical Science for Level I & II).

III YEAR
UNIT III Practising the Teaching Skill in Physical Science

   Meaning of teaching – Understanding major teaching skills: Introducing-explaining –questioning - varying the stimulus - non-verbal cues- reinforcement - closure and fluency in communication – Practicing a mini-lesson with multiple-teaching skills (for 20 minutes): Observation and feedback on the practice of integration of teaching skills – Understanding major steps in teaching a mini-lesson: Motivation - presentation-interaction- reflection and summing up – Practicing a mini-lesson (for 20 minutes): Observation and feedback on mini-teaching. (Note: Teacher-Educators should give a demonstration of a mini-lesson by integrating major teaching skills (for 20 minutes) and they should demonstrate a mini-lesson by integrating major teaching steps in teaching.)

(Suggested instructional approaches/methods:
   iii) Prepare a report on the practising of a mini-lesson with multiple-teaching skills by observing peers.

   iv) Prepare two mini-lessons and practise them in front of peers in the class for Level I and Level II.)

UNIT IV Methods of Teaching Physical Science


(Suggested instructional approaches/methods:
   i) Teacher talk/ Invited lecture on different methods of teaching Physical Science.
   ii) Preparation and presentation of a report on different methods of teaching Physical Science.)

UNIT V Resources for Teaching Physical Science

-Science exhibition/ fair - Fieldtrip – Qualities of a good science textbook - Qualities of a Science teacher.

(Suggested instructional approaches/methods:

i) Teacher talk/ Invited lecture talk on different resources for teaching Physical Science.

ii) Preparation and presentation of a report on different resources for teaching Physical Science.)

Tasks and Assignments:

i) Prepare and submit an evaluative report on different methods of teaching Physical Science.

ii) Prepare and submit a report on Physical Science resource centre.

REFERENCES


PEDAGOGY OF A SCHOOL SUBJECT PART - I (METHODOLOGY)

3. PEDAGOGY OF BIOLOGICAL SCIENCE
   (Part - I Methodology)
   (60 Hours)

SUBJECT CODE:

Course objectives:
At the end of the course, the student-teachers will be able to:

1. understand the aims and objectives teaching of biological science.
2. formulate instructional objectives for a lesson.
3. gain mastery of the teaching skills.
4. apply various methods in teaching biological science.
5. use various resources in teaching biological science.

UNIT I Aims and objectives of teaching Biological Science

Biological Science: Meaning, nature and scope – Aims and objectives of teaching Biological Science in schools - Need and significance of teaching Biological Science - Values of teaching Biological Science.

(Suggested instructional approaches/methods:
   i. Teacher talk/Invited talk on the place of Biological Science in the school curriculum.
   ii. Student seminar on the need, significance and values of teaching Biological Science.)

UNIT II Planning for Instruction

Steps in planning a lesson: Setting lesson goals – Designing a unit plan – Designing a lesson plan – Bloom’s Taxonomy of educational objectives - Formulating educational objectives at cognitive, affective and psychomotor levels – Structure of a four-fold lesson plan – Preparation of a model lesson plan – Types of test-items - Constructing test-items for formative evaluation in class.

(Suggested instructional approaches/methods:
   i. Write the instructional objectives for a lesson in Biological Science at level I & II.
   ii. Prepare a model lesson plan in Biological Science for level I & II.)

UNIT III Practising the Teaching Skills in Biological Science

Meaning of teaching – Understanding major teaching skills: Introducing - explaining, questioning - varying the stimulus - non-verbal cues – reinforcement - closure and fluency in communication – Practising a mini-lesson with multiple-teaching skills (for 20 minutes): Observation and feedback on the practice of integration of teaching skills – Understanding major steps in teaching a mini-lesson: Motivation, presentation,
interaction, reflection and summing up – Practising a mini-lesson with five teaching steps (for 20 minutes): Observation and feedback on the integrating of teaching steps in mini-teaching. (*Note: Teacher-Educators should give a demonstration of a mini-lesson by integrating major teaching skills (for 20 minutes) and they should demonstrate a mini-lesson by integrating major teaching steps in teaching.*)

(Suggested instructional approaches/methods:

i. Prepare a report on the practising of a mini-lesson with multiple-teaching skills by observing peers.

ii. Prepare two mini-lessons and practise them in front of peers in the class for Level I and Level II.)

UNIT IV Methods of Teaching Biological Science


(Suggested instructional approaches/methods:

i. Teacher talk/ Invited lecture on different methods of teaching Biological Science.

ii. Preparation and presentation of a report on different methods of teaching Biological Science.)

UNIT V Resources for Teaching Biological Science

**Print Resources:** Newspapers - journals and magazines - Science Encyclopedias. **Audio Resources:** Radio talk - audio tapes - DVDs/CDs. **Visual resources:** Pictures - flash cards – charts - posters - photographs - models. **ICT Resources:** Radio – television - Internet, multimedia - interactive whiteboard. **Community resources:** Zoological gardens, Botanical gardens, eco-park - aquarium - science exhibition/fair - fieldtrip – Qualities of a good biology textbook - Qualities of a Biology teacher.

(Suggested instructional approaches/methods:
i. Teacher talk/Expert talk on different resources for teaching Biological Science.

ii. Preparation and presentation of a report on different resources for teaching Biological Science.

**Tasks and Assignments:**

1. Prepare and submit an evaluative report on different methods of teaching Biological Science.

2. Prepare and submit a report on Biological Science resource centre.

**REFERENCES**


9. [www.sciencesourcebook.com](http://www.sciencesourcebook.com)

10. [www.csun.edu/science/biology](http://www.csun.edu/science/biology)
EPC 3 - CRITICAL UNDERSTANDING OF ICT  
(30 Hours)  
SUBJECT CODE:

The aim of this course is to enhance the professional capacities of a student teacher in integrating Information and Communication Technologies (ICTs) with effective teaching and learning in a classroom.

Course objectives: To enable the student-teachers:

1. To teach effectively in a “technology enhanced classroom” (previously referred to as “smart classroom”).
2. To achieve knowledge-comprehension, practice skills and presentation skills in ICT.

How to prepare a student teacher for a technology enhanced classroom?
The teachers in Colleges of Education should train the student-teachers:

1. To operate /use various ICT tools such as computer, laptop/Internet, Interactive whiteboard, Tablet PC, iPad, iPhone, Mobile phones, Digital cameras, Multimedia equipments (audio/video), Skype and video-conferencing.
2. To browse the Internet, using a computer/laptop, identify and use education related websites and video/audio resources in teaching-learning.
3. To prepare teaching material/learning resource materials: e-content, e-booklet for selected school subject areas and to create edu(cational) blogs for individual/group students for strengthening sharing and learning.
4. To use a laptop/PC for preparing slides for PowerPoint presentations/lectures and also download the video resources available on the internet and use them embedded with slide presentations.
5. To teach a content/lesson using an Interactive whiteboard (by connecting a desktop computer to a whiteboard and project Google images onto it).
6. To use a visualizer/document camera (visual projector) to display and share an information to the whole class.
7. To use a mobile device/a camera phone to take a series of snapshots of children’s actions events/scenes/activities and prepare a photo documentary or photo album with explanatory notes/descriptions.
8. Prepare videos on different teaching styles of experienced teachers/peers and keep them available for viewing as a stream on a computer.
9. Organize a few video-conferencing classes (organize Skype-based video conferencing) inviting experts in school subjects and encourage the students to share the learning experiences through WhatsApp with their classmates and others.
10. To create educational blogs (Edublogs) for individual/group students for sharing and learning articles/class notes/assignments and participating in active blogging community.

Tasks and Assignments
1. Write a report based on your preparation of e-content and presentation of it to the class with different ICT tools.
2. Write a report on the organization of video-conferencing with an educational expert.