संत गाडगेबाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा
(FACULTY OF SCIENCE)

अभ्यासक्रमिका

विज्ञान स्नातक अंत्य परीक्षा

सत्र-५-हिवाळी-२०१५

सत्र-६-उन्हाळी-२०१६

PROSPECTUS
OF
The Examination for the Bachelor of Science
Semester-V, Winter-2015, and
Semester-VI, Summer-2016
& Onwards

2015

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I N D E X
B.Sc. Final (Semester-V & VI)
(Prospectus No.2016123)

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Syllabus Prescribed for B.Sc. Final Examination
Semester- V & VI

1. Mathematics

5S Mathematics - Paper – IX
(Analysis)

Unit I : Riemann Integral. Integrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus. Improper integrals and their convergence. Comparison and limit tests .

Unit II : Continuity and differentiability of complex functions. Analytic functions. Cauchy-Riemann equations. Harmonic and Conjugate functions. Milne Thompson method

Unit III : Elementary functions Mapping by elementary functions. Mobius transformations. Fixed points. Cross ratio. Inverse points and critical points. Conformal mappings.

Unit IV : Metric Spaces **:**Countable and uncountable sets. Definition & examples of metric spaces. Neighbourhoods. Limit points. Interior points. Open and closed sets. Closure, Interior & boundary points. Sub-space of a metric space. Cauchy sequences. Completeness. Cantorøs intersection theorem. Baire category theorem.

Unit V : Compactness. Connectedness. Limit of functions. Uniform continuous functions. Continuity and compactness. Continuity and connectedness.

Reference Books :
1. R. R. Goldberg:Methods of Real Analysis, Oxford IBH publishing Co. New Delhi, 1970.
2. T. M. Karade, J. N. Salunke, K. S. Adhav, M. S. Bendre : Lectures on Analysis, Sonu Nilu Publication, Nagpur.
3. Walter Rudin: Principles of Mathematical Analysis, International students edition (Third edition)
4. T. M. Apostol :Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.,
5. S. Lang : Undergraduate Analysis, Springer-Verlag New York, 1983.
6. D. Somasundaram & B. Choudhari : A First Course in Mathemati

cal Analysis, New Delhi. 1997.
7. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.
8. P. K. Jain & S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000.
9. R. V. Churchiln and J.W.Brown, Complex Variables and Applications, 5th Edition, McGraw Hill, New York,1990
10. Mark J Ablowitz and : A.S. Fokas, Complex Variable Introduction and Application ,Cambridge University Press ,South Asian Edition ,1998.
11. Shanti Narayan : Theory of functions of Complex Variable,,S.Chand and Co. New Delhi.
12. E.T.Coption,:Metric Spaces, Cambridge University Press ,1968.
13. P.K.Jain and K.Ahmed ,:Metric Spaces ,Narosa Publishing House, New Delhi 1996.
14. G.F.Simmons :Introduction to Topology and Modern Analysis, McGraw Hill, New York,1963

Semester V
5-S Paper - X
(Modern Algebra)

Unit I : **Normal Subgroups**: Definition, examples. Different characterizations of normal subgroups, Algebra of normal subgroups, Quotient group.

Unit II : **Homomorphism and Isomorphism:** Homomorphism, Homomorphic image, Kernel of homomorphism, Isomorphism of groups, Fundamental theorem of homomorphism, Natural homomorphism.

Unit III : **Ring:** Definition, Examples , Properties of ring, Commutative ring, Ring with unity, Zero divisor, Without zero divisor, Boolean ring, Cancellation laws in rings, Subring.

Unit IV : **Integral domain and field:** Definition, examples, field, Subfield, Prime field, The field of quotients of an integral domain, Characteristics of a ring.

Unit V : **Polynomial rings:** Division Algorithm theorem, Unique factorization theorem for polynomials over a field,

Polynomials over rational field, Gauss Lemma, The Eisenstein Criterion. Unique factorization domain (UFD) (only Definition).

Reference Books:

1. I.N.Herstein:Topics in Algebra, Wiley Eastern Ltd., New Delhi,1975.
2. N.Jocobson: Basic Algebra ,Vol. I and II W.H.Freeman,1980(Hindustan Publishing Co.
3. Shanti Narayan :A Text Book Of Modern Abstract Algebra, S. Chand and Co. ,New Delhi
4. K.B.Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd.New Delhi,2000
5. P.B.Bhattacharya, S.K.Jain and S.R.Nagpal : Basic Abstract Algebra (IInd Edition)Cambridge University Press Indian Edition,1997
6. K.Hoffman and R.Kunze :Linear Algebra ,II nd Edition Prentice Hall,Englewood Cliffs, New Jersey,1971.
7. S.K.Jain, A Gunawardhana and P.B.Bhattacharya : Basic Linear algebra with MATLAB, Key College Publishing (Springer-Verlag)2001
8. S. Kumaresan : Linear Algebra, A Geometric Approach,P Prentice Hall of India Pvt.Ltd.New Delhi,2000
9. Vivek Sahai and Vikas Bisht :Algebra, Narosa Publishing House ,1997.
10. D.s.Malik,J.N.Mordeson and M.K.Sen :Fundamentals of Abstract Algebra ,McGraw Hill International Edition 1997
11. T.M.Karade, J.N.Salunke, K.S.Adhav, M.S.Bendre :Lectures on Abstract Algebra.Sonu Nilu Publication.Nagpur(IInd Publication)

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Semester VI
6 S - Paper XI
(Linear Algebra)

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Unit I   :   Vector Space : Definition and example of vector spaces. Subspaces. Sum and direct sum of subspaces. Linear span.

Linear dependence, Independence and their basic properties.Basis , Finite dimensional vector spaces . Existence theorem for bases. Invariance of the number of elements of a basis set. Dimension.

Unit II   :   Linear Transformations: Linear transformation and their representation as matrices. The algebra of linear transformations. The rank nullity theorem. Change of basis.

Unit III :   Dual Spaces : Dual space. Bidual space and natural isomorphism. Adjoint of a linear transformation. Eigen values and eigenvectors of a linear transformation.

Unit IV :   Inner Product Spaces : Inner product spaces. Cauchy-Schwarz inequality. Orthogonal vectors. Orthogonal complements. Orthonormal sets and bases. Bessel's inequality for finite dimensional spaces. Gram Schmidt Orthogonalisation process.

Unit V :   Modules : Modules, Submodules, Quotient modules. Homomorphism and Isomorphism theorems.

Reference Books:

1. I.N.Herstein:Topics in Algebra, Wiley Eastern Ltd., New Delhi,1975.
2. N.Jocobson: Basic Algebra ,Vol. I and II W.H.Freeman,1980 (Hindustan Publishing Co.)
3. Shanti Narayan :A Text Book Of Modern Abstract Algebra, S. Chand and Co. ,New Delhi
4. K.B.Datta:Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd.New Delhi,2000
5. P.B.Bhattacharya, S.K.Jain and S.R.Nagpal :Basic Abstract Algebra (IInd Edition) Cambridge University Press Indian Edition,1997
6. K.Hoffman and R.Kunze,:Linear Algebra ,IInd Edition Prentice Hall,Englewood Cliffs, New Jersey,1971.
7. S.K.Jain, A Gunawardhana and P.B.Bhattacharya:Basic Linear algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001
8. S. Kumaresan :Linear Algebra, A Geometric Approach,P Prentice Hall of India Pvt. Ltd. New Delhi,2000
9. Vivek Sahai and Vikas Bisht :Algebra, Narosa Publishing House, 1997.
10. D.S.Malik,J.N.Mordeson and M.K.Sen :Fundamentals of Abstract Algebra ,McGraw Hill International Edition 1997
11. T.M.Karade, J.N.Salunke, K.S.Adhav, M.S.Bendre :Lectures on Abstract Algebra.Sonu Nilu Publication. Nagpur (IInd Publication)

Semester – VI
6 S - Paper-XII (Optional)
(Graph Theory)

Unit I : Graph. Application of graphs, finite and infinite graphs, incidence and degree, isolated vertex, pendent vertex and null graph, isomorphism, subgraphs, walks, path and circuits, connected graphs and components, Euler graph, operation on graphs, Hamiltonian paths and circuits, travelling salesman problem.

Unit II : Trees, some properties of trees, pendent vertices in a tree, distance and centres in a tree, Rooted and binary trees, On counting trees, spanning trees.

Unit III : Fundamental circuits, Cutsets, Some properties of cutesets, all cuteset in a graph, fundamental circuits and cutsets, connectivity and separability, planer graphs, Kurutowski's two graphs, different representation of planer graph, detection of planarity.

Unit IV : Vector space associated with a graph, circuit and cuteset subspaces, Orthogonal vectors and spaces, Intersection and joint of W_r and W_S.

Unit V : Incidence matrix, Submatrix of A(G), Circuit matrix, Fundamental circuit matrix B, Rank of B, an application to a switching network, cuteset matrix, path matrix, adjacency matrix, the relationship among A_f , A_f and C_f.

Reference Books:

1. Narsingh Deo: Graph Theory with Application to Engineering and Computer Science, Prentice Hall Of India, New Delhi.,
2. Richard Johnson- Baugh : Discrete Mathematics,Macmillan Publishing Company 886,Third Avenue New York 10022
3. Olympia Nicodemi : Discrete Mathematics,C.B.SPubl.and Distributors 485,Jain Bhavan Bholanath Nagar Shahadara New Delhi-32 India
4. Frank Harare : Graph Theory ,Narosa Publishing House ,307 ,Shiv Centre D.B.C. Sector Ku Bazar New Bombay 400704,
5. S.A.Choudum: A first Course In Graph Theory, McMillan India Ltd. Mercatile HouseMagazine Street Bombay 10

6. E.L.LIU : Elements of Discrete Mathematics, McGraw Hill Book Company,New York
7. Seymour Lipschiutz and Marc Lipson : Discrete Mathematics ,TMH NewDelhi (Schaum Outline series) IInd Edition.
8. J.N.Salunke :Boolean Algebra and Graph Theory Laxmi Publication Akot.

Semester VI
6 S – Paper XII (Optional)
(Special Theory of Relativity)

Unit I : Review of Newtonian Mechanics:

Inertial frames. Speed of light and Galilean relativity Relative character of space and time. Postulates of Special theory of relativity. Lorentz Transformations and its geometrical interpretation. Group properties of transformation.

Unit II : Relativistic Kinematics:

Composition of parallel velocities. Length contraction. Time Dilation. Transformation equation for components of velocities and acceleration of a particle and Lorentz contraction factor.

Unit III : Geometrical representation of Space-Time:

Four dimensional Minkowskian space-time of relativity. Time like, Light Like and space like intervals. Proper time. World line of a particle. Four vector and tensors in Minkowskian space-time.

Unit IV : Relativistic Mechanics:

Variation of mass with velocity. Equivalence of mass and energy. Transformation equations for mass, momentum and energy. Relativistic force and transformation equations for its components. Relativistic Lagrangian and Hamiltonian.

Unit V : Electromagnetism:

Maxwell's equation in vacuum. Propagation of electric and magnetic field strengths. Transformation equations for electromagnetic four potential vector. Transformation

equations for electric and magnetic field strengths. Gauge transformation. Lorentz invariance of Maxwellø's equations. Lorentz force on a charged particle.

Reference Books:
1. T.M.Karade, K.S.Adhav and M.S.Bendre: Lectures on Spacial Theory of Relativity ,Sonu Nilu Publication, Nagpur
2. C.Molar : The Theory of Relativity, Oxford Clarendon Press, 1952
3. P.G.Bergman : Introduction to The Theory of Relativity, Prentice Hall of India,Pvt.Ltd.1969
4. J.L.Anderson :Principles of Relativity Physics, Academic Press, 1967
5. V.A.Ugarov : Special Theory of Relativity, Mir Publishers, 1979
6. R.Resnick :Introduction to Special Relativity Wiley Eastern,Pvt.Ltd.1972

Semester – VI
6 S – Paper XII (Optional)
(Mathematical Modelling)

Unit I   :   The Process of applied mathematics. Setting of First-order differential equations ó Qualitative solutions Sketching.

Unit II   :   Difference and Differential Equation growth models. Singled species population models. Population growth ó An age structure model. The spread of Technological innovation.

Unit III :   Higher order linear models : A model for the detection of diabetes. Combat modes. Traffic models-Car-following models. Equillibrium speed distributions.

Unit IV :   Non-linear population growth models. Prey-Predator models. Epidemic growth models. Models from political Science Proportional representation ó cumulative voting, comparison voting.

Unit V   :   Applications in Ecological and Enviornmental subject areas. Urban waste water management planning.

Reference Books :
1. Vol. 1 Differential equation models, Eds. Martin Barun, C. S. Coleman D. A. Drew.
2. Vol. 2 Political and Related Models. Steven J. Brams, W. F. Lucas, P. D. Straffin (Eds.)
3. Vol.3 Discrete and System models. W. F. Lucas, F. S. Roberts, R. M. Thrall.
4. Vol. 4 Life Science Models. H. M. Roberts & M. Thompson.
5. All Volumes published as modules in Applied Mathematics, Springer-Verlag, 1982.

2 : PHYSICS
Semester-V
5S PHYSICS

Unit I   :   **Origin of Quantum Mechanics**   (12 L)

1. Historical Background: Failure of classical wave theory in explaining Black body radiation and Photoelectric Effect; Compton Effect Qualitative explanation only
2. Assumptions of Planckø's Quantum Theory
3. Wave Particle Duality
4. Matter Waves: De Broglie Hypothesis, Davisson Germer experiment
5. Concept of Wave Packet, Phase velocity, group velocity and relation between them.
6. Heisenbergø's uncertainty principle: Different forms of uncertainty principle; Thought experiments: single slit diffraction and Gamma ray microscope

Unit II   :   **The Schrodinger equation and its applications**   (12 L)

1) Wave function and its physical significance
2) Schrodinger time dependent equation
3) Separation in time dependent and time independent parts

4)   Operators in quantum Mechanics

5)   Eigen functions and Eigen values

6)   Particle in one dimensional and three dimensional box (Energy eigen values)

7)   Qualitative analysis of potential barrier Tunneling effect)

8)   Simple Harmonic Oscillator (Qualitative analysis of Zero point energy)

Unit III :   Atomic and Molecular Spectrocopy   (12 L)

Vector Atom Model: Quantum Numbers, Stern Gerlach experiment; selection rules, l-s and j-j coupling, Types of spectra ó Emission & absorption spectra.

X-rays: Continuous X-ray spectrum, Duane and Hunt's law, characteristic X-ray spectra, Mosley's law.

Raman Effect: stoke's and anti-stoke's lines, Quantum theory of Raman effect, Experimental arrangement for Raman Spectroscopy.

Unit IV :   Nuclear Physics   (12 L)

Detection of charged particles; G. M. counter, Binding energy and Mass defect, stability of nuclei

Alpha Decay: Range of Alpha particles, Geiger - Nuttal law and Gamow's explanation of alpha decay (qualitative)

Beta decay: Types and Pauli's Neutrino Hypothesis

Nuclear Fission, Nuclear fusion (concepts only), Nuclear reactors.

Unit V : Hybrid parameters- low frequency equivalent of CE amplifier & its analysios., Bais stability & thermal runway (qualitative). General principles of amplifier classification, RC coupled amplifier, equivalent circuits & gain at low, medium & high frequency (qualitative), gain-frequency response. Noise & distortion in electronic circuits.

Unit VI : Feedback in amplifiers- negative feedback, advantages of negative feedback, positive feedback. Phase shift, Wein bridge, Hartley & Colpits Oscillators. Multi-vibrators ó astable, monostable & bistable.

Practical : The distribution of marks for practical examination will be as follows:

Record Book	10 marks
Viva-voce	10 marks
Experiment	20 marks
Assignment	10 marks

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Total   50 marks

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a)   A student will have to perform at least ten experiments per semester.

b)   The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.

c)   In assignment, every student should be asked to submit the detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment.

1.   To study RC coupled amplifier- variation of gain with load.
2.   To study phase shift oscillator.
3.   To study Wein bridge oscillator.
4.   To study Hartlay oscillator.
5.   To study Colpits oscillator.
6.   To determine ÷e'by Millikan's oil drop experiment.
7.   To determine ÷e'by Thomsons method.
8.   Determination of Rydberg's constant.
9.   To study absorption spectrum of Iodine vapors.
10.   To study Raman spectrum.
11.   To identify elements in optical line spectrum.
12.   To determine absorption coefficient of material for gamma rays.
13.   Determination of Hybrid parameters.
14.   Study of monostable multivibrator.
15.   Study of astable multivibrator.
16.   Study of an amplifier - with & without feedback.
17.   Determination of Plank's Constant by using LED.

18. To study characteristics of Zener diode.
19. Study of LED characteristics.
20. Study of characteristics of Laser.
21. Study of Emitter follower.

6S PHYSICS
STATISTICAL MECHANICS AND SOLID STATE PHYSICS

UNIT-I : Statistical Mechanics

Phase space, unit cell, microstates, macrostates, energy states, density of energy states, probability & thermodynamic probability, principle of equal a priori probabilities, most probable distribution, Boltzman entropy relation.

Maxwell Boltzman statistics, and its application to molecular speed distribution, Average speed, rms speed & most probable velocity.

UNIT-II : Distinguishable & indistinguishable particles, concepts of boson &fermions.

Bose ó Einstein statistics : Thermodynamic probability, most probable distribution, application of BE statistics to black body radiation.

Fermi- Dirac distribution : Thermodynamic probability, Most probable distribution ,Fermi function, Fermi energy & Fermi temperature.

UNIT-III : Crystallography

Solids: - Amorphous and Crystalline Materials; Unit Cell. Millar Indices, Reciprocal Lattice, Coordination Number. Types of Lattices: Diffraction of x-rays by Crystals. Braggøs Law: Determination of lattice parameters of NaCl crystal.

Defects in solids ó points, line & plane defects.

UNIT -IV :Electrical Properties of Materials

Motion of electron:- Free electrons; conduction electrons, electron collision; mean free path, conductivity & Ohmøs law; density of states; concept of Fermi energy.

Band structure : Electron in periodic potential, nearly free electron model (qualitative), energy band, energy gap, metals, isulators and semiconductors.

UNIT-V : Magnetic Properties of Materials

Atomic magnetic moment; magnetization vector; magnetic susceptibility; Dia -, Para-, and Ferromagnetic Materials; Classical Langevin Theory of dia and Paramagnetic Domains; Quantum Mechanical Treatment of Paramagnetism; Curieøs law, Weissøs law;. Hysteresis and Energy Loss.

UNIT-VI: Superconductivity & Nano Technology

Superconductivity: Introduction to Superconductors; Critical Temperature; Critical magnetic field; Meissner ó effect; Type I and type II Superconductors, Idea of BCS theory (No derivation), Cooper pair; Applications of superconductors.

Nano Technology: Introduction to nano size materials, brief History of Nano materials, Effect of reduction of dimensions on physical properties; quantum size effect; Applications of nano materials in different fields.

Practical : The distribution of marks for practical examination will be as follows:

Record Book	10 marks
Viva-voce	10 marks
Experiment	20 marks
Assignment	10 marks
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Total	50 marks
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a) A student will have to perform at least ten experiments per semester.
b) The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.
c) In assignment, every student should be asked to submit the

detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment.

LIST OF EXPERIMENTS:

1. To study crystal models and identification of crystal planes.
2. To study Characteristics of Photocell
3. To determine Planck's constant using photocell
4. To determine energy gap of semiconductor using four probe method.
5. To determine activation energy of Thermister.
6. To determine energy gap of semiconductor using reverse bias method
7. To study hysterisis losses in transformer core and plot B-H curve.
8. To measure magnetic susceptibility of solids.
9. To study thermo emf using thermocouple.
10. To Determination of temperature coefficient of resistance of platinum using platinum resistance thermometer.
11. To determine lattice parameter using X-ray diffraction pattern.
12. To determine half life period of radioactive substance by GM counter
13. Determination of dislocation density in alkali halide crystals.
14. Demonstrations- Any 4 demonstrations equivalent to 2 experiments
15. Mini project equivalent to 2 experiments.
16. Computer aided demonstrations (Using computer simulations or animations) (Any 2 demonstrations equivalent to 2 experiments)
17. To study characteristics of Photo diode.
18. To study Zener regulated power supply.
19. Study of transistorized regulated power supply, series pass transistor.
20. Determination of velocity of sound by using sonometer wire.
21. Determination of velocity of ultrasonic wave in liquids.
22. Determination of Band gap energy of a pn junction / zener diode.

REFERENCE BOOKS:

1. Thermodynamics and statistical mechanics-Brijlal Subramanium
2. Statistical Mechanics – An Elementary Outline – Avijit Lahiri – Universities Press
3. Statistical and Thermal physics - By Lokanathan, R.S. Gambhir,
4. Fundamentals of statistical and thermal physics - By F.Reif
5. Perspectives of modern physics - By A. Beiser
6. Fundamental of Statistical Mechanics - By B.B. Laud
7. A primer of Statistical Mechanics - By R.B. Singh
8. Statistical Mechanics - By Gupta, Kumar
9. Solid State Physics, S.O.Pillai, 3rd Edition, New Age International (P) Ltd, Publisher, (1999).
10. Solid State Physics – By Kakani and Hemrajani, S. Chand Publication.
11. Solid State Physics - By Saxena, Gupta and Saxena, Pragati Prakation.
12. Introduction to Solid State Physics, Charles Kittel, John Wiley and Sons, 7th Edition.
13. Solid State Physics, A.J.Dekker, Macmillan India Ltd, (1998).
14. Solid State Physics, R.K. Puri, V.K. Babbar, S. Chand Publication.
15. Problems in Solid State Physics, S.O. Pillai, New Age International (P) Ltd.
16. Solid State Physics, Palanyswamy.
17. Solid State Physics, David, Snoke, Pearson Publication.
18. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N.Banerjee, Publisher: PHI Learning and Private Limited
19. Nanotechnology, Rakesh Rathi, S Chand & Company, New Delhi
20. Nanotechnology: Principles and Practices by Sulbha K Kulkarni, Capital Publishing Co. New Delhi.

References:

1. IGNOU : Practical Physics Manual
2. Saraf : Experiment in Physics
3. S.P. Singh : Advanced Practical Physics
4. Melissons : Experiments in Modern Physics

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3 : CHEMISTRY
Semester-V
5S Chemistry
(Effective from session 2015-16)

The examination in Chemistry of Fifth semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-V (8 marks).

5S Chemistry

Total Lectures: 84   *Marks: 80*

Note: Figures to the right hand side indicate number of lectures.

Unit I   **14L**

A]   Coordination Compounds: Important terms namely molecular or addition compounds, double salts, complex salts, complex ion, ligand, coordination number, central metal ion, etc. Werner's theory of coordination and its experimental verification on the basis of conductance data and formation of AgCl precipitate in case of cobaltammines. Sidgwick's electronic interpretation and its drawbacks, effective atomic number. IUPAC rules for nomenclature of coordination compounds. Structural isomerism-ionization, linkage and coordination in complexes. Geometrical isomerism in octahedral complexes of the type Ma_4b_2, Ma_3b_3, $Ma_2b_2c_2$, Ma_4bc, $M(AA)_2b_2$. Square planar complexes of the type Ma_2b_2 and Ma_2bc. Optical isomerism in octahedral complexes of type $Ma_2b_2c_2$, Mabcdef, $M(AA)_3$, $M(AA)_2b_2$ and tetrahedral complexes of the type Mabcd and $M(AA)_2$. Optical isomerism in square planar complexes. Valence bond theory as applied to structure and bonding in complexes of 3d-series elements (Only 4 and 6 coordinates complexes). Inner and outer orbital complexes. Magnetic properties of complexes of 3d series elements. Limitations of VB theory.   **[11]**

B]   Chelates : Definition, classification and applications of chelates in analytical chemistry. Stability of chelate with special reference to chelate effect.   **[3]**

Unit II   **14L**

A] Crystal Field Theory (CFT): Postulates of CFT, Crystal field splitting in octahedral, distorted octahedral, square planar tetrahedral complexes, concept of CFSE, high spin and low spin complexes on the basis of $Ä_0$ and pairing energy, distribution of electrons in t_{2g} and e_g orbitals in high spin and low spin octahedral complexes. Factor affecting magnitude of crystal field splitting in octahedral complexes.   **[8]**

B] Electronic Spectra of Transition Metal Complexes : Introduction to spectra, selection rules for d-d transitions, spectroscopic terms-determination of ground term symbols for d^1 to d^{10}, spectra of d^1 and d^9 octahedral complexes, Orgel diagram for d^1 and d^9 states, electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. Spectrochemical series.   **[6]**

Unit III   **14L**

A] Heterocyclic compounds: Nomenclature, Pyrrole: Synthesis from acetylene, succinimide and furan, Basicity, Electrophilic substitution reactions (orientation) ó nitration, sulphonation, acetylation and halogenation , Molecular orbital structure. **[4]**

Pyridine: Synthesis from acetylene and pentamethylene diamine hydrochloride, Basicity, Electrophilic substitution reactions (orientation) ó nitration, sulphonation, Nucleophilic substitution reactions (orientation)- with $NaNH_2$, C_6H_5Li and KOH. **[3]**

B] Organometallic compounds: Grignard reagents: Methyl magnesium bromide- Synthesis from methyl bromide (only reaction) Synthetic applications: Electrophilic substitution reactions-formation of alkanes, alkenes, higher alkynes and other organometallic compounds, Nucleophilic substitution reactions- Reaction with aldehydes and ketones, ethylene oxide, acetyl chloride, methyl cyanide and CO_2.   **[4]**

Methyl lithium-Synthesis and reaction with water, formaldehyde, acetaldehyde, acetone, ethylene oxide and CO_2.   **[3]**

Unit IV 14L

A] **Dyes:** Classification on the basis of structure and mode of application, Preparation and uses of Methyl orange, Crystal violet, Phenolphthalein , Alizarin and Indigo. **[5]**

B] **Drugs:** Analgesic and antipyretics: Synthesis and uses of phenylbutazone. Sulpha drugs: Synthesis and uses of sulphanilamide and sulphadiazine. Antimalarials: Synthesis of chloroquine from 4,7-dichloroquinoline and its uses. **[5]**

C] **Pesticides:** Insecticides:Synthesis and uses of malathion. Herbicides: Synthesis and uses of 2,4-dichloro phenoxy acetic acid (2,4-D). Fungicides: Synthesis and uses of thiram (tetramethyl thiuram disulphide**. [4]**

Unit V- Photochemistry 14L

(i) Photochemical and thermal reactions. (ii) Lambert's law - Statement and derivation. Beer's law - Statement and derivation. Reasons for deviation from Beer's law. (iii) Laws of photochemistry. (iv) Quantum yield of photochemical reaction. Reasons for high and low quantum yield. Experimental determination of quantum yield. Photosensitized reaction. (v) Kinetics of photochemical decomposition of HI. (vi) Fluorescence and Phosphorescence. Selection rule for electronic transition. Internal conversion and inter-system crossing. Explanation of fluorescence and phosphorescence on the basis of Joblonski diagram. (vii) Chemiluminescence and Bioluminescence with examples. (viii) Numericals. **[14]**

Unit VI- Molecular Spectroscopy 14L

(i) Electromagnetic radiation, characteristics of electromagnetic radiation in terms of wavelength, wave number, frequency and energy of photon. Spectrum of electromagnetic radiation. (ii) Types of spectra - Emission and absorption spectra, atomic and molecular spectra, line and band spectra (iii) Translational, vibrational, rotational and electronic motion. The degree of freedom in each motion. (iv) Energy level diagram of a molecule indicating electronic, vibrational and rotational transitions. (v) Condition for pure rotational spectrum (i.e. microwave active molecules), selection rule for rotational transition. Derivation of expression for moment of inertia of a diatomic rigid rotor. Isotope effect. Applications of microwave spectroscopy for the determination of moment of inertia and bonding. (vi) Condition for exhibiting vibrational spectra (i.e. IR active molecule), selection

rule for vibrational transition. Vibrational energy levels of a simple harmonic oscillator. Zero point energy, position of a spectral line. Determination of force constant of a covalent bond. (v) Raman effect - Raman's spectrum of a molecule. Condition for exhibiting Raman spectrum (i.e. Raman active molecule), selection rule for rotational transitions. Pure rotational spectrum of diatomic molecule, vibrational Raman spectrum of a diatomic molecule. (vii) Numericals. **[14]**

Semester- V
5S Chemistry Practicals

Total Laboratory sessions: 26 **Marks: 50**

Exercise 1: Inorganic Preparations **12 Laboratory sessions**

1. Preparation of tetraamminecopper(II)sulphate.
2. Preparation of hexaamminenickel(II)chloride.
3. Preparation of potassiumtrioxalate aluminate(III).
4. Preparation of Prussian blue.
5. Preparation of chrome alum.
6. Preparation of sodium thiosulphate and dithionite.

(Comment on VB structure, magnetic properties and color of 1, 2 and 3 complexes)

Exercise II: Physical Chemistry experiments 14 Laboratory sessions

(Standard oxalic acid solution should be prepared by the students)

1. To determine strength of given HCl solution conductometrically.
2. To determine strength of given CH_3COOH solution conductometrically.
3. To determine strength of given HCl solution potentiometrically.
4. To determine strength of HCl and CH_3COOH in a given mixture conductometrically.
5. To determine redox potential of Fe^{+2}/Fe^{+3} system potentiometrically.
6. To determine molecular weight by Rast's method.
7. To determine specific rotation of optically active compound by Polarimeter.

Distribution of Marks for Practical Examination
Time: 6 hours (One Day Examination)   Marks: 50

Exercise-I   í í í   18
Exercise-II   í í í   18
Viva-Voce   í í í   07
Record   í í í   07
ô ô ô ô ô
Total: 50

Semester- VI
6S Chemistry

Total Lectures: 84   *Marks: 80*
Note: Figures to the right hand side indicate number of lectures.
Unit I   **14L**
A] Kinetic Aspects of Metal Complexes :   **[6]**
    Thermodynamic and kinetic stability of the complexes, factors affecting stability of complexes. Brief idea about substitution reactions, SN^1-dissociative and SN^2-associative mechanism. Labile and inert complexes. Factors affecting lability of complexes namely arrangement of d-electrons (on the basis of VB theory), size of central metal ion, charge of central metal ion, geometry of complexes. Substitution reactions in square planar complexes mechanism.

B] Analytical Chemistry :
1) Spectrophotometry and Colorimetry :-   **[4]**
    Concept of $ë_{max}$, Beer-Lambertøs law (Only statement and final equation, no derivation). Calibration curve and its importance. Validity and limitations of Beer-Lambertøs law. Verification of Beerøs law. Block diagram of colorimeter and spectrophotometer with brief description of each component and its function. Difference between colorimetric and spectrophotometric technique for determination of concentration of metal ion (Example of determination of Cu(II).

2) Paper Chromatography :-   **[4]**
    Definition and classification of chromatographic techniques. Principle of differential migration. Principle and technique of paper chromatography -ascending, descending and circular , R_f value and factors affecting R_f value.

Unit II   **14L**
A] Organometallic Chemistry :   **[5]**
    Definition, nomenclature and classification of organometallic compounds. Metal carbonyls- definition and classification. Preparation, properties, structure and bonding in $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$. Nature of M-C bond in metal carbonyls.

B] Inorganic Polymers: **[5]**
    Definition and classification. Silicones: preparation, properties structure and bonding and applications. Phosphonitrile halides polymers- preparation, properties, structure and bonding in cyclic polymers.
C] Bio-inorganic Chemistry: **[4]**
    Essential and trace elements in biological processes. Biological role of Na^+, K^+, Ca^{2+} and Mg^{2+} ions. Metalloporphyrins-Haemoglobin and Myoglobin and their role in oxygen transport.
Unit III   **14L**
A] Electronic spectroscopy:
    Introduction, theory, instrumentation, types of electronic transitions, presentation of electronic spectrum, terms used- chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic effect and hypochromic effect , Applications in the structure determination of dienes, á,â-unsaturated aldehydes and ketones, aromatic compounds.   **[7]**
B] Infrared spectroscopy:
    Introduction, Types of molecular vibrations- stretching and bending, Calculation of vibrational modes, force constant, instrumentation, interpretation of IR, H-stretching, triple bond, double bond and Finger print regions, IR spectra of H_2O, CO_2, C_2H_5OH, CH_3CHO, CH_3COOH and CH_3CONH_2.   **[7]**
Unit IV   **14L**
A] NMR spectroscopy: Introduction, spin quantum number, instrumentation, Aspects of NMR- number of signals(equivalent and non-equivalent protons), positions of signals(chemical shift), intensities of signals, splitting of signals(spin-spin coupling), coupling constant, applications.   **[8]**

B] Mass spectroscopy:
    Introduction, theory, instrumentation-(ion sources), Mass spectra of neopentane and methanol, molecular ion peak, base peak, metastable peak, Rules of fragmentation, applications**.**   **[6]**

Unit V- Elementary Quantum Mechanics   **14L**
(i) Limitations of classical mechanics. Plankøs quantum theory (postulates only). Photoelectric effect - Experiments, observation and Einsteinøs explanation. Compton effect and its explanation. (ii) de Broglie hypothesis of matter waves. de Broglieøs equation. Heisenbergøs uncertainty principle. (iii) Classical wave equation, derivation of time independent Schrodingerøs wave equation in one-dimension and its extension to a three-dimensional space. Well behaved wave function, physical significance of wave function (Born interpretation). (iv) Application of Schrodinger wave equation to a particle in one-

dimensional box and its extension to a three-dimensional box. Concept of atomic orbital. (v) Numericals. **[14]**

Unit VI **14L**

A] Electrochemistry: (i) Types of electrode - Standard hydrogen electrode, Calomel electrode, Quinhydrone electrode and Glass electrode. Principle of Potentiometric titration. Study of acid-base, redox and precipitation titration. (ii) pH of a solution and pH scale. Determination of pH of a solution using hydrogen, quinhydrone and glass electrodes. Advantage and disadvantage of these electrodes. pH-metric titrations. Determination of pka of a weak acid by pH-metric measurement. (iii) Concentration cells - Types of concentration cells, concentration cell without transfer and determination of its emf. (iv) Numericals **[6]**

B] Nuclear Chemistry: (i) Shell model of a nucleus - Assumptions, evidences for existence of magic numbers, advantages and limitations. (ii) Liquid drop model of a nucleus - Assumptions, similarities between nucleus and liquid drop, advantages and limitations, explanation of nuclear fission reaction on the basis of liquid drop model. (iii) Nuclear force and its explanation on the basis of Meson theory. (iv) Characteristics of nuclear reaction, difference between nuclear and chemical reactions. Calculation of Q value of a nuclear reaction. (v) Characteristics of nuclear fission reaction, fission yield. Fission reaction as an alternative source of energy. (vi) Nuclear fusion reaction - Characteristic of a nuclear fusion reaction. Thermonuclear reactions as a source of energy of sun and other stars. Fusion reactions as a potential future source of energy. (vii) Applications of radio isotopes in industry, agriculture, medicines and bio-sciences with two examples each. (viii) Numericals.
[8]

Semester- VI **6S Chemistry Practicals**
Total Laboratory sessions: 26 **Marks: 50**
Exercise I: Organic Chemistry Experiments: **16 Laboratory sessions**
1. Estimation of formaldehyde.
2. Estimation of glycine.
3. Estimation of ascorbic acid (vitamine C).
4. Estimation of phenol by bromination method.
5. Estimation of aniline by bromination method.
6. Estimation of urea by hypobromite method.
7. Estimation of unsaturation by bromination method.
8. Determination of iodine value of oil.
9. Determination of equivalent weight of an ester by saponification.
10. Separation of a mixture of methyl orange and methylene blue by thin layer chromatography (using benzene).

11. Separation of a mixture of 2,4-dinitro phenyls of acetaldehyde and benzaldehyde by thin layer chromatography(using benzene : petroleum ether = 3:1).
12. Separation of a mixture of dyes by thin layer chromatography (using cyclohexane:ethyl acetate = 8.5:1.5).
13. Separation of a mixture of 2,4-dinitro phenyls of acetaldehyde and benzaldehyde by thin layer chromatography (using toluene: petroleum ether).

Exercise II: Physical Chemistry experiments **10 Laboratory sessions**
1. To determine dissociation constant of weak acid by conductometry.
2. To determine dissociation constant of weak acid by potentiometry.
3. To study potentiometric titration of KCl and $AgNO_3$.
4. To determine dissociation constant of dibasic acid by pH-metry.
5. To verify Beer's Lambart's law using $KMnO_4/K_2Cr_2O_7$.
6. To determine pH of a soil sample by pH-meter.
7. To determine solubility and solubility product of sparingly soluble salts conductometrically.
8. To study strong acid and strong base titration by pH-metry.

Distribution of Marks for Practical Examination
Time: 6 hours (One Day Examination) **Marks: 50**
Exercise-I í í í .. **18**
Exercise-II í í í .. **18**
Viva-Voce í í í . **07**
Record .í í í . **07**
ô ô ô ô ô
Total: 50

Books Recommended: (Common for Semester V and Semester VI)
1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.
2. Text book of Inorganic Chemistry by A.K. De, Wiley East Ltd.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan- S. Chand & Co.
4. Modern Inorganic Chemistry by R.C. Agrawal, Kitab Mahal.
5. Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
6. Concise Inorganic Chemistry by J.D. Lee, ELBS.
7. Inorganic Chemistry by J.E. Huheey- Harper & Row.
8. Fundamental concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill book Co.
9. Modern Inorganic Chemistry by W.L. Jolly, McGraw Hill Int.
10. Chemistry Facts, Patterns & Principles by Kneen, Rogers and Simpson, ELBS.

11. Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
12. Inorganic complex compounds by Murmann, Chapman & Hall.
13. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
14. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Pulishing House, Meerut.
15. Co-ordination Chemistry by D. Banerjee, TMH Publication.
16. Text book of Inorganic Chemistry by B.J. Joshi, P.J. Bahad, P.R. Mandlik, R.M. Kedar, C.B. Deshpande, V.V. Parhate published by Amravati University Chemistry Teachers Association with Bokey Prakashan, Amravati.
17. Text book of Inorganic Chemistry by Bhadange, Pagariya, Deshmukh, Joshi, Bombatkar, Mandlik, Bokey Prakashan, Amravati.
18. Organic Chemistry by R.T. Morrison & R.T. Boyd, 6th edition, PHI.
19. Organic Chemistry by Pine, 5th edition.
20. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor-Wiley Eastern.
21. Organic Chemistry by S.K. Ghosh.
22. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
23. Spectroscopy of Organic Compounds by P.S. Kalsi.
24. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
25. Organic Chemistry by TWG Solomons, 4th edition, John Wiley.
26. Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
27. Text book of Practical Organic Chemistry by A. I. Vogel.
28. Text book of Organic Chemistry by P.R. Rajput, S.N. Bhosale, Y.K. Meshram, V.G. Thakre, Dr. S.P. Deshmukh, A.R. Mankar, published by Amravati University Chemistry Teachers Association with Bokey Prakashan, Amravati.
29. Text book of Organic Chemistry by P.S. Kalsi published by Macmilllan India Ltd., 1999, Delhi.
30. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
31. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
32. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
33. Physical Chemistry: Walter, J. Moore, 5th edn., New Delhi.
34. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.
35. Principles of Physical Chemistry: Maron and Prutton.
36. Principles of Physical Chemistry: Puri, Sharma and Pathaniya.
37. Physical Chemistry: P.W. Atkins, 4th Edn.
38. Text book of Physical Chemistry: P.L. Sony, O.P. Dharma.

39. Physical Chemistry: Levine.
40. Practical Physical Chemistry: Palit and De.
41. Practical Physical Chemistry: Yadao.
42. Practical Physical Chemistry: Khosla.
43. Laboratory Mannual of Physical Chemistry: W.J. Popiel.
44. Practical Chemistry: Dr. S.B. Lohiya, Bajaj publication, Amravati.
45. Text book of Physical Chemistry by S.B. Phadke, G.N. Chaudhari, S.S. Kabra, R.G. Bhangale, A.B. Patil, S.K. Rithe published by Amravati University Chemistry Teachers Association with Bokey Prakashan, Amravati.

List of equipments/apparatus required for the Chemistry Practicals for B.Sc.

No.	Equipment		Quantity
1.	Abbe's Refractometer		02 nos./batch
2.	Viscometer		10 nos./batch
3.	Stalagmometer		10 nos./batch
4.	Melting Point Apparatus		10 nos./batch
5.	Thermometer 0-360ºC		20 nos./batch
6.	Thermometer 0-110ºC		20 nos./batch
7.	Analytical balance		15 nos./batch
8.	Weight box		15 nos./batch
9.	Density Bottles		20 nos./batch
10.	Kipp's Apparatus		02 nos./batch
11.	Quick fit Distillation Assembly/Multipurpose assembly		10 nos./batch
12.	Sintered Glass Crucible		20 nos./batch
13.	Silica Crucible		20 nos./batch
14.	Vacuum Suction Pump		02 nos./lab.
15.	Potentiometer		02 nos./batch
16.	Metzer Electronic one pan balance		01 nos./lab.
17.	Filtration flask with Buckner Funnes	100ml	10 nos./batch
		250ml	05 nos./batch
		500ml	02 nos./batch
18.	Desiccators		10 nos./batch
19.	Magnetic Stirrer		10 nos./batch
20.	Water Suction		10 nos./batch
21.	Conductometer with Conductivity Cell		04 nos./batch
22.	Colorimeter		02 nos./batch
23.	pH Meter		02 nos./batch
24.	Chromatographic Jar		05 nos./batch
25.	Separating funnels 250ml, 500ml		05 nos./batch
26.	Hot Air Oven		02 nos./lab.
27.	Hot-Cold Air Blower		01 no./lab.
28.	Centrifuge machine (Electrically Operated)		02 nos./lab.
29.	Deioniser/ Water Still (Electrically Operated)		01 no./lab.

30. Hot Plate/ Heating Mantle   05 nos./batch
31. Models of Elements
   (Seven Crystal types and their symmetry)   01 no./batch
32. Flame Photometer   02 nos./batch
33. Spectrophotometer   02 nos./batch
34. Shaking Machine   01 no./batch
35. Polarimeter   02 nos./batch

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4. INDUSTRIAL CHEMISTRY (REGULAR/VOCATIONAL)

The examination in Industrial Chemistry (Regular/ Vocational) of Fifth semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-V (8 marks).

B.Sc. Part- III (Semester- V)
5S Industrial Chemistry (Regular/ Vocational)
Chemical Process Economics, Heavy and Fine Chemicals

Total Lectures: 84   *Marks: 80*
Note: Figures to the right hand side indicate number of lectures.

Unit-I :   **[14]**

Manufacturing of the following:- Ammonia, nitric acid, ammonium sulphate, ammonium nitrate, caustic soda, chlorine, ammonium phosphate, superphosphate, triple superphosphate with reference to following considerations:

i) Consumption pattern   ii) Raw materials
iii) Major engineering problems.

Unit-II :   **[14]**

Manufacturing of the following:- Lime, calcium carbide, silicon carbide, fluorine, sodium carbonate, sulphuric acid, hydrochloric acid, soda ash by Solvay process, urea with reference to following considerations-:

i) Consumption pattern   ii) Raw materials

iii) Major engineering problems.

Unit-III :   **[14]**

A) **Essential Oils –** Introduction, extraction methods of essential oils -: Steam distillation, solvent extraction, and expression.

Uses of following essential oils- menthol, citral, camphor, turpentine.

B) **Edible Oil –** Manufacturing of Soyabean oil by solvent extraction process, refining of crude vegetable oil. Hydrogenation of vegetable oil (Dry and wet processes), saphonification value, iodine value, acid value and ester value.

C) Manufacturing of soap, recovery of glycerin, cleansing action of soap.

Unit-IV :   **[14]**

Fischer Tropsch synthesis with examples, chlorination of methane and its major engineering problems, manufacturing of mono, di, triethanolamines and its uses. Manufacturing of acetylene, ethylene, vinyl acetate, isopropanol, vinyl chloride with reference to following considerations-:

i) Raw materials   ii) Major engineering problems
iii) Uses.

Unit-V :   **[14]**

A) **Industrial gases-** Introduction, Manufacturing and uses of following industrial gases - Oxygen and nitrogen, carbon dioxide liquification of CO_2 (Dry Ice).

B) **Safety-** Introduction, concern for chemical safety, hazards and their control in petrochemical industries, hazards in storage, handling and uses of chemicals.

Unit-VI : Process Economics   **[14]**

A) **Cost Estimation-** Cash flow for industrial operations, cumulative cash position, factors affecting investment and production cost.

B) **Interest-** Simple and compound interest, nominal and effective interest

C) Depreciation- Introduction, service life, salvage value. Methods for depreciation- straight line method, declining balance method, sum of years digits method.

D) Profitability, profitability evaluation: Rate of return on investment and discounted cash flow method. Break even point.

5S Industrial Chemistry Practical
List of Experiments

Unit I

1) Determination of acid value of edible oil.
2) Determination of saphonification value of edible oil.
3) Determination of iodine value of edible oil.
4) To determine the strength of hydrogen peroxide solution.
5) To determine the strength of aniline solution.
6) To determine the strength of formalin solution.

Unit II

1) Preparation of 3- nitroaniline.
2) Preparation of 4- bromoaniline.
3) Preparation of 4- nitrobenzoic acid.
4) Preparation of soap.
5) Preparation of phthalamide.
6) Extraction of oil from oil seeds.

Distribution of Marks for Practical Examination

Time: 6 – 8 hours   (One Day Examination)

Marks: 50

Unit – I :	(Exercise No. 1)	í í í ..15
Unit – II :	(Exercise No. 2)	í í í ..15
	Viva-Voce	.í í 10
	Record	.í í í .10
		ô ô ô ô ô ô ô
	Total:	**50**
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Books Recommended

1) Handbook of industrial chemistry – K.H. Davis and F.S. Berner Vol. I and II. CBS publishers and distributors New Delhi.

2) Shreves chemical process industries – George T. Austin. Mc GRAW HILL International Edition.

3) Industrial Chemistry- B.K. Sharma. Goyal publishing house.

4) Heavy organic chemicals- A.J. Gartc. Pargmon Process U.K.
5) A Text book of Engineering chemistry- S.S. Dara.
6) Chemical process industries- S.C. Bhatiya. CBS publishers and distributors New Delhi.
7) Plant design and economics for chemical engineers. Max S. Peters, K.D. Timmerhaus. Mc GRAW HILL International Edition.

List of equipments/ Apparatus/ glassware's required for the B.Sc. Industrial Chemistry practical for a batch.

1.	Melting point apparatus	02 nos.
2.	Thermometer 0 to 360^{0C}	10 nos.
3.	Thermometer 0 to 110^{0C}	10 nos.
4.	Analytical balance	02 nos.
5.	Weight box	02 nos.
6.	Silica crucible	20 nos.
7.	Sintered glass crucible	20 nos.
8.	Measuring cylinder 100 ml	05 nos.
9.	Separating funnels 250 ml	05 nos.
10.	Burette 25 ml	20 nos.
11.	Burette 50 ml	20 nos.
12.	Volumetric flask 100 ml	10 nos.
13.	Volumetric flask 250 ml	10 nos.
14.	Round bottom flask with reflux Condenser	10 nos.
15.	Beaker 100 ml	20 nos.
16.	Beaker 250 ml	20 nos.
17.	Beaker 500 ml	05 nos.
18.	Burette Stand	20 nos.
19.	Pipette 10 ml and 25 ml	20 nos.
20.	Conical Flask 100 ml and 250 ml	20 nos.

Semester-VI

6S Industrial Chemistry (Regular/ Vocational)

Instrumental Methods of Chemical Analysis, Green chemistry

Total Lectures: 84   *Marks: 80*

Note: Figures to the right hand side indicate number of lectures.

Unit-I :   **[14]**

A)   Sampling procedures, sampling of bulk materials,

techniques of sampling solids, liquids, gases. Collecting and processing of data.

B) **Errors-** Types of errors, nature and origin of error. Accuracy, precision, mean deviation, standard deviation, relative standard deviation and confidence limits.

Unit-II : [14]

Chromatography - Theories of chromatography- plate and rate theory, classification of chromatographic techniques.

Paper chromatography and TLC- Introduction, principles, types of migration parameter (Rf value). Experimental details, applications.

GLC and HPLC- Introduction, principles, instrumentation, apparatus and materials, column efficiency and selectivity, applications.

Liquid-Liquid partition chromatography and adsorption chromatography

Unit-III : [14]

A) **Column chromatography-** Principle, experimental details, column efficiency, factors affecting column efficiency, applications.

B) **Ion Exchange-** Classification of ion exchangers, ion exchange equilibria, ion exchange capacity, chelating ion exchanger, factors affecting the separation of ions and applications in analytical chemistry.

C) **Solvent Extraction-** Classification of solvent extraction systems, basic principles involved in extraction. Factors affecting extraction, techniques of extraction, applications of solvent extraction in industries.

Unit-IV : [14]

A) **Flame Photometry-** Elementary theory, instrumentation and experimental techniques, combustion flames and applications.

B) **I.R. Spectroscopy-** Principles, techniques,

instrumentation and applications in chemical analysis of industrial materials.

C) **X-ray fluorescence-** Principles, techniques, flow sheet, applications for determination of heavy metals in environmental sample.

Unit-V : [14]

Dye- Introduction, classification of dyes- on the basis of mode of applications and on chemical constitutions. Acid dyes, basic dyes, sulphur dyes, pigment dyes. Dye intermediates. Preparation and uses of methyl orange dye, picric acid and aurine dye, indigo dye, congo red, crystal violet and alizarin dye. Non textile use of dye stuffs.

Unit-VI : [14]

Green Chemistry- Introduction, Goals of green chemistry, principles of green chemistry. Basic components of green chemistry research- Alternative starting materials or feed stock, alternative reagents or transformations, alternative reaction conditions and alternative final products or target molecules. Optimization of framework for the design of greener synthetic pathway. Green solvents, ionic liquids green fuels and E- green propellants, biocatalysis.

6S Industrial Chemistry Practical

List of Experiments :

Unit I

1) Separation of Cu^{+2}-Ni^{+2} ions by paper chromatography.
2) Separation of plant pigments xanthophylls, chlorophyll by paper chromatography.
3) Separation of dyes by T.L.C.
4) Estimation of sodium and potassium by flame photometry.
5) Separation of amino acids by paper chromatography.
6) To detect the impurities in organic compounds by T.L.C.

Unit II

1) Removal of hardness by ion exchange resins.
2) Separation of Cu^{+2}-Ni^{+2} ions by solvent extraction.

3) Separation of Co^{+2}-Ni^{+2} ions by ion exchange.

4) Preparation of picric acid dye.

5) To determine the capacity of an anion exchange and cation exchange resin by column method.

6) Separation of Fe^{3+} and Mg^{2+} by solvent extraction.

Distribution of Marks for Practical Examination   Time:

6 – 8 hours (One Day Examination)   Marks: 50

Unit – I :   (Exercise No. 1)   í í í ..15
Unit – II :   (Exercise No. 2)   í í í ..15
            Viva-Voce   .í í 10
            Record   .í í í .10
                                      ô ô ô ô ô ô ô
                              Total: 50
                                      ô ô ô ô ô ô ô

Books Recommended

1) Instrumental methods of Chemical Analysis – Gurudeep Chatwal and Anand

2) Quantitative Inorganic Analysis – A.I. Vogel

3) Handbook of Industrial Chemistry – K.H. Davis and F.S. Berner Vol. I and II. CBS publishers and distributors New Delhi.

4) A Text book of Engineering Chemistry- S.S. Dara.

5) A Text book of Synthetic Dyes- O.D. Tyagi, M. Yadav. Anmol publications Pvt. Ltd.

6) Chromatography- Shrivastava and Shrivastava.

7) Experiments in Chemistry – D.V. Jahagirdar.

8) A text book on experiments and calculations in Engineering Chemistry – S. S. Dara.

List of equipments/ Apparatus/ glassware's required for the B.Sc. Industrial Chemistry practical for a batch.

1.   Melting point apparatus   05 nos.
2.   Thermometer 0 to 360^{0C} 10 nos.
3.   Thermometer 0 to 110^{0C} 10 nos.
4.   Analytical balance   05 nos.
5.   Weight box   05 nos.
6.   Silica crucible   20 nos.
7.   Sintered glass crucible   20 nos.
8.   Chromatographic jar   05 nos.
9.   Separating funnels 250 ml   05 nos.
10. Burette 25 ml   20 nos.

11. Burette 50 ml   20 nos.
12. Volumetric flask 100 ml   10 nos.
13. Volumetric flask 250 ml   10 nos.
14. Round bottom flask with reflux Condenser   10 nos.
15. Beaker 100 ml   20 nos.
16. Beaker 250 ml   20 nos.
17. Beaker 500 ml   05 nos.
18. Burette Stand   20 nos.
19. Pipette 10 ml and 25 ml   20 nos.
20. Conical Flask 100 ml and 250 ml   20 nos.
21. Ion exchange column   01 no.
22. Flame photometer   01 no.

5. PETROCHEMICAL SCIENCE

The examination in Petrochemical Science of Fifth semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-V (8 marks).

Semester- V
5S Petrochemical Science

Total Lectures: 84   *Marks: 80*

Note: Figures to the right hand side indicate number of lectures.

Unit-I   : Basic concepts in polymerization   [14]

- What are polymers
- How are polymers made
- Classification of polymers
  - Thermosetting and Thermoplastic
  - Homo and Co-polymers
- Methods of polymerization
  - Cationic
  - Anionic
  - Radical

- Polymerization techniques
  - o Bulk
  - o Solution
  - o Suspension
  - o Emulsion
- Examples of polymerization catalysts, Introduction to cross linking and agents

Unit-II: Ethylene (C_2) and propylene (C_3) polymers   **[14]**

- Chemistry(reaction mechanism , catalysts), properties, manufacture (Flow scheme, and operating variables) and applications of
  - o High Density Poly-Ethylene (HDPE)
  - o Low Density Poly-Ethylene (LDPE)
  - o Poly propylene
- Introduction to Ethylene- Propylene co-polymers (EPM rubber)

Unit-III: C_4 based polymers   **[14]**

- Chemistry(reaction mechanism , catalysts), properties, manufacture (Flow scheme, and operating variables) and applications of:
  - o Poly butylenes (Butyl rubber)
  - o Di-iso butylenes
  - o Poly butadiene
  - o Poly isoprene
  - o Poly chloroprene(Neoprene)
- Introduction to
  - o Butadiene- Styrene co-polymers (SBR)
  - o Butadiene- Acrylonitrile co-polymer (ABN)

Unit-IV : Vinyl and styrene polymers   **[14]**

- Chemistry(reaction mechanism , catalysts), properties, manufacture (Flow scheme, and operating variables) and applications of:
  - o Poly vinyl chloride (PVC)
  - o Poly vinyl acetate (PVA)
  - o Polystyrene
- Introduction to co-polymers of styrene
  - o Acrylonitrile óButadiene-Styrene co-polymer (ABS)

  - o Styrene-Acrylonitrile co-polymer (SAN)

Unit-V : Condensation polymers   **[14]**

- Chemistry (reaction mechanism , catalysts), properties, manufacture (Flow scheme, and operating variables) and applications of:
  - o Nylon- 6
  - o Nylon- 6,6
  - o Phenol-Formaldehyde resin
  - o Urea-Formaldehyde resin
- Introduction to
  - o Nylon- 6, 10
  - o Nylon-12
  - o Nylon-11
  - o Saturated polyesters
  - o Unsaturated polyesters

Unit-VI : Waxes/Bitumen/Greases   **[14]**

- Petroleum Waxes
  - o Types and Sources of waxes
- Paraffin waxes
- Microcrystalline waxes
  - o Important properties of petroleum waxes
  - o Manufacture of petroleum waxes
- Chilling and pressing process
- De-waxing with solvents
- MEK de-waxing process
  - o Uses of petroleum waxes
  - o Petroleum Jellies
- Bitumen
  - o Bitumen
  - o Asphalts
  - o Chemical Structure of asphalt
  - o Classes of Bitumen
  - o Quality specification of bitumen
  - o Uses of Bitumen
- Greases
  - o Type of greases
  - o Manufacture various type of grease
  - o Properties, testing and uses of grease

5S Petrochemical Science Practical

List of Experiments

1. Preparation and melting point determination of Nylon-6
2. Preparation and melting point determination of Nylon-6 ,6
3. Preparation and melting point determination of polystyrene
4. Preparation and melting point determination of Phenol-formaldehyde resin
5. Preparation and melting point determination of urea - formaldehyde resin
6. Molecular weight determination of plastic material
7. Determination of drop point and dropping point of grease
8. Oil in wax determination in given oil sample
9. Determination of saponification value of plastic material
10. Determination of acid value of plastic material
11. Determination of bromine number of plastic material
12. Study of vulcanization of rubber using sulfur powder
13. Preparation and melting point determination of some rubber materials

  Distribution of marks for practical examination
  Time: 6 hours   (One Day Exmination)   Marks : 50
  Exercise No. I : (Practical Expt.)í í í .... 15 Marks
  Exercise No. II: (Practical Expt.)í í í .... 15 Marks
  Viva-Voce:í í í í í í í í í ..í í í í   10 marks
  Recordí í í í ..í í í í ...í .í .í .... 10 Marks
                      Total ... 50 Marks

Semester- VI
6S Petrochemical Science

Total Lectures: 84   *Marks: 80*
Note: Figures to the right hand side indicate number of lectures.

Unit-I   :   Advanced Instrumental Techniques for Petroleum and Petrochemical Product Characterization

  SPECTROSCOPY-I   **[14]**
  - Introduction to
    o   Electromagnetic radiations
    o   UV-Visible, Infra-red region
    o   Electronic spectrum and absorption radiations

    o   Definition of spectroscopy
    o   Difference between absorption and emission spectroscopy
  - Principle, Theory, working (Instrumentation) and application (Hydrocarbon Compound)of following spectroscopic techniques
    o   UV-Visible (Calculation of ë $_{max}$ value of ethanol)
    o   IR(study of model spectra of : Benzene, Phenol, Aniline)

Unit-II :   Advanced Instrumental Techniques for Petroleum and Petrochemical Product   Characterization- SPECTROSCOPY-II   **[14]**
  - Principle, Theory, working (Instrumentation) and application (Hydrocarbon Compound)of following spectroscopic techniques
    o   NMR(study of model spectra of : Benzene, Phenol, Aniline)
    o   Mass (study of model spectra of: Dodecane, cyclohexene, ethyl benzene)

Unit-III :   Advanced Instrumental Techniques for Petroleum and Petrochemical Product Characterization- CHROMATOGRAPHY   **[14]**
  - Basic principles involved in chromatography
    o   Definition of chromatography
    o   Stationary phase
    o   Mobile phase
    o   Concept of Polarity
    o   Polarity of different liquid samples
    o   Role of detectors
    o   Various detectors
  - Principle, Theory, working (Instrumentation) and application (Hydrocarbon Compound)of following chromatographic techniques
    o   GLC
    o   HPLC

Unit-IV : Catalysts in petroleum refining and petrochemical processes

[14]

- Introduction
- Homogeneous and heterogeneous catalysts
- Catalysts morphology and activity
- Catalysts for petroleum refining
  - o Cracking catalysts
  - o Reforming catalysts
  - o Hydro-treating catalysts
- Catalysts for petrochemical Industry
  - o Catalysts for synthesis gas
  - o Hydrogenation catalysts
  - o Hydrocarbon oxidation catalysts
  - o Polymerization catalysts
- Recent advances in industrial catalysis
- Role of polymers in catalysis

Unit-V : Future of petrochemicals   **[14]**

- Integrated petrochemical complexes
- Energy crises and the petrochemical industry
  - o Natural gas as petrochemical feedstock
  - o Impact of heavy feedstocks on petrochemicals
  - o Ecology and energy crisis
  - o Coal as an alternative to oil
- Energy crisis and the industrial fuels
  - o Natural fuels
  - o Synthetic fuels
  - o Hydrogen: Fuel of tomorrow
  - o Bio-Fuels
- Trends in petrochemical industries

Unit-VI : Pollution control in petroleum refineries and petrochemical processing units   **[14]**

- Definition of pollution
- Kinds of pollution
- Air pollution
  - o Sources of air pollution in refineries and petrochemicals manufacturing units
  - o Air pollution control techniques and options
- Water pollution
  - o Sources of water pollution in refineries and

   petrochemicals manufacturing units
  - o Control of Water pollution
  - o Indian standards for liquid effluents and Inland surface water (Most considerable characters like TSS, $_pH$, TDS, BOD, COD, DO, Temperature, sulphates, chlorides, sodium.)
- Soil pollution
  - o Sources of soil pollution in refineries and petrochemicals manufacturing units
  - o Soil pollution control techniques

6S .   Petrochemical Science Practical
   List of Experiments

1. Determination of purity of a chemical compound using TLC
2. Separation of a chemical compound using column chromatography
3. Determination of pH of soil (Soil near any chemical laboratory waste outlet).
4. Determination of B.O.D. of given sample
5. Determination of C.O.D. of given sample
6. Determination of D. O. of given sample
7. Use of UV-Visible spectrophotometer for determination of % transmission, O.D. Concentration and adsorption
8. Determination of hardness of given water sample
9. Extraction of oils from oil bearing seeds
10. Determination of given specific refraction and molar refraction of given sample using Abee's refractometer
11. Determination of Calorific value of given sample

   Distribution of marks for practical examination
   Time: 6 hours   (One Day Exmination)   Marks : 50
   Exercise No. I : (Practical Expt.)í í í .... 15 Marks
   Exercise No. II: (Practical Expt.)í í í .... 15 Marks
   Viva-Voce:í í í í í í í í í ..í í í í 10 marks
   Recordí í í í ..í í í í ....í .í .í ....10 Marks
                       Total .... 50 Marks

List of books
1.   Petroleum refining and petrochemicals, N.K. Sinha, Umesh Publications, Delhi

2.   Advanced petrochemicals , Dr. G. N. Sarkar, Khanna Publications, Delhi

3.   A text on petrochemicals , B.K. B Rao, Khanna Publications, Delhi

4.   Introduction t o petrochemicals, S. K. Maiti, Oxford-IBH Publications

5.   Fuels and Combustions, Sameer Sarkar, Orient- Longman Ltd. Hyderabad

6.   Catalysis and chemical processes , Ronald Pearce and William Patterson, Leonad-Hill Publication, Glasgow

7.   Systematic experimental physical chemistry, S.W. Rajabhoj, Dr. T. K. Chondhekar, Anjali publications Aurangabad

8.   Advanced Petroleum refining , G. N. Sarkar, Khanna Publications, Delhi

9.   Petroleum refining technology, Dr. Ram Prasad, Khanna Publications, Delhi

10. Unit operations II , K.A. Gavane, Nirali prakashan, Pune

11. Modern petroleum refining processes, Dr. B. K. Bhaskarrao, oxford-IBH publication New Delhi

12. Chemicals from petroleum, A.L. Waddams, Murray, London

13. An Introduction to industrial organic chemistry, P. Wiseman, Applied Science, London

14. Modern Petroleum Technology, J.D. Hobson, Jon-Wiley Chester

15. Chemicals form synthesis gas, R.A. Sheldon, B. Reidel Publishing Company. Dordrecht

-19-

16. Text book of polymer, volume I, II, III , M.S. Bhatnagar, S.Chand Publi., Delhi

17. Dryden's outline of chemical technology, M. Gopalrao, Marshall Stings, East-west Publications

18. Shreve's Chemical process industries, J. Austin, Mc.GrowHill, New Delhi.

19. Petroleum processing handbook , edited by John J. Meketta-Marcel Dekkker, Inc.-1992

20. Handbook of petroleum refining process, Robart A. Mayers, Mc.Graw-Hill, second edition-1996

21.   Modern petroleum technology, Volume I Upstream by Rechard A. Dawe, 6th Edition IP-2002

22.   Modern petroleum technology, Volume IIdownstream by Rechard A. Dawe, 6th Edition IP-2002

23. The chemistry and technology of petroleum, 2nd edition by James

G. Speight-1991 vol. I & II

24. Petroleum refining technology and economics by J.H. Gary, G.E.Handwert, Marcel Dekker inc. 1987

25. Standard method for analysis and testing of petroleum and related product, IP-Volume II, Institute of Petroleum , London 1993 Vol. I, II

26. Environmental chemistry by S.S. Dara, S.Chand and Company pub., New Delhi

27. Pollution monitoring and control, Dr. Priya Rajan Trivedi,

28. Air pollution Vol. I-IV, A.C. Stern

29. NEERI manuals

30. Chemical Methods for Environmental Analysis, R. Rameth

31. Instrumental method of chemical analysis, Willard Merit and Dean.

32. Chromatography, Shrivastav and Shrivastav.

LIST OF APPARATUS AND EQUIPMENTS FOR A BATCH OF 20 STUDENTS FOR
B.SC. 5th and 6th semester
PETROCHEMICAL SCIENCE

Sr No.	Item	Quantity
1.	Burette	20 Nos.
2.	Pipette 10ml, 25ml	20 Nos.each
3.	Mohr pipette2ml, 5ml	10Nos. each
4.	Conical flask with stopper	50 Nos.
5.	Standard volumetric flask	20 Nos.
6.	Density Bottle	20 Nos.
7.	Balance (Electronic/Digital)	02 Nos.
8.	Aniline Point Apparatus	01 No
9.	U-tube viscometer of different capillary size	02 Nos.
10.	Thermometer (0 to 110oC I P Grade)	10 Nos.
11.	Thermometer (0 to360oC I P Grade)	10 Nos.
12.	Test tube (20 and 50 ml with rubber cork)	50 Nos.
13.	Smoke Point Apparatus (I P Grade)	01 No.
14.	Abel Flash Pont apparatus (I P Grade)	01 No.
15.	Pensky Marten's Flash Point apparatus	01 No.

16.	Cleveland Open Cup Flash point Apparatus	01 No.
17.	Porceline dish	10 Nos.
18.	Constant Temperature bath	02 Nos.
19.	Hot Plate	01 No.
20.	Air condenser	20 Nos.
21.	Glass tubing 6mm, 10mm	20ft. Each
22.	Glass rod 4mm, 8mm	20 ft. Each
23.	Stop watches	04 Nos.
24 .	LPG Cylinder with regulator	01 No.
25.	Refractometer	01 No.
26 .	Refrigerator	01 No.
27.	Water Distillation Plant	01 No.
28 .	Beaker 250 ml	20 Nos.
29.	Beaker 50, 100, 500, 1000 ml	07 Nos.
30.	Hot Air Oven	01 No.
31.	Heating Furnace	01 No.
32.	Karl Fisher Auto Titrator	01 No.
33.	Dean and Stark Apparatus	01 No.
34.	Flame Photometer	01 No.
35.	Colorimeter	01 No.
36.	Bomb Calorimeter	01 No.
37.	Spectrophotometer	01 No.
38.	Oxygen Cylinder with pressure regulating valve	01 No.
39.	Vacuum Pump	01 No.
40.	Air source	01 No.
41.	Air Flow meter	01 No.
42.	Dessicators	06 Nos.
43.	Water Suction	04 Nos.
44.	Filtration Flask with Buckner Funnel 100, 250ml, 500ml Heating Mental	20 Nos.
45.	ASTM Distillation apparatus	06 no.
46.	Viscometer and Constant temperature bath	01 No.
47.	Apparatus for oil determination in given sample as per I P norm	01 Set of viscometer
48.	Reid Vapor Pressure Apparatus with const. temp. Bath	01 No.

49	Ductility measuring meter	01 No.
50.	Penetrometer	01 No.
51.	Copper Corrosion Test Apparatus	01 No.
52.	Crankcase Oil Dilution Apparatus	01 No.
53.	Redwood Viscometer No. I & II	01 No. each

6. GEOLOGY
Semester-V
5S- Geology

UNIT I : Attitude of bed. Clinometer and Brunton Compass and its use, Outcrop- its true and apparent thickness, width of outcrop, Outcrop in relation to topography and structure.

Erosional structures ó Unconformity: Formation, Types and Recognition.
Outlier-Inlier, Onlap, Offlap, windows and Klippe.

UNIT II : Fold: Nomenclature or Parts, Classification ó Genetic and Geometric, recognition of fold in field and map. Causes of folding.

Joints: Classification ó Genetic and Geometric, Significance of Joints.

UNIT III: Interior of the earth as reveled by Seismic waves.

Isostasy – Airyós Hypothesis, Prattós Hypothesis and Heisskinnanós Hypothesis.

Geosyncline ó Definition, Classification and evolution.

UNIT IV: Continental Drift ó Evidences of drift.

Plate Tectonics ó Types of plate margins, Causes of Plate Movement and Evidences- Sea Floor Spreading and Palaeomagnetism.

UNIT V : Hydrologic Cycle and its Components, Occurrence and distribution of Ground water, Water Table. Aquifer and its types ó Confined, Unconfined and Semi-confined. Properties of Aquifer:- Porosity, Permeability, Storage Coefficient and Conductivity.

UNIT VI: Recharge and Discharge, Darcyós Law and its validity, Cone of Depression, Influent and Affluent Seepages, Ground

water Provinces of India

PRACTICALS:
1. Use of Clinometer and Brunton Compass.
2. Problems on Dip, Strike, Thickness of Beds and width of outcrop maps.
3. Completion of outcrop problems for conformable series and unconformity.
4. Elementary problems on determination of Aquifer Parameters,
5. Plotting of Ground water provinces on outline map of India.
6. Water table contour maps and its interpretation for groundwater structure.
7. Morphometric Analysis from topographic maps.
8. Field Work.

PRACTICAL EXAMINATION:
The Practical Examination will be four hour duration and carries 50 marks. The distribution of marks will be as follows-

I.	Problems on Dip, Strike, Thickness of Beds and width of outcrop maps.	6 Marks
II.	Completion of outcrop maps	8 Marks
III.	Problems on determination of Aquifer Parameters	6 Marks
IV.	Plotting of Ground water provinces on outline map of India.	4 Marks
V.	Water table contour maps and its interpretation for groundwater structure.	6 Marks
VI.	Morphometric Analysis from topographic maps.	6 Marks
VII.	Field Work.	4 Marks
VIII.	Practical Record and Viva Voce	10 Marks
		50 Marks.

Semester-VI
6S- Geology

UNIT I : Stress ó Strain and deformation, Interrelationship of Stress-Strain and Time, Mohrøs Circle, Determination of strain by using Initial Spherical Objects, Deformed Conglomerate and Bilateral symmetrical fossils.

UNIT II : Faults: Nomenclature or Parts, Classification ó Genetic & Geometric, recognition of fault in field and map. Causes of faulting. Foliation and Lineation ó kinds and origin.

UNIT III: Photo geology and Remote Sensing, Aerial Photographs and its types, Satellite Imageries. Methods of studying aerial photographs in the form of Stereo-pairs and Mossaic. Pocket and Mirror stereoscope, Overlap and Sidelap, Drift and Crab.

UNIT IV: Elements of Photorecognition:- Tone, Texture, Shape, Size, Pattern, Scale of Photograph and Vertical exaggeration. Guidelines for Lithological, Structural and geomorphic interpretation. Applications of Photo geology and Remote Sensing.

UNIT V : Prospecting and Exploration-Criteria and guides to ore search, Structural control of ore localization.

Sampling methods- Channel, Chip, Muck, Car and Drill hole sampling. Coning and quartering. Calculation of grade and ore reserves.

UNIT VI: Surface geophysical methods- Gravity, Magnetic, Electrical and Seismic. Geochemical and Geo-botanical Method-Geochemical cycles and dispersion.

PRACTICALS:
1. Drawing of Sections and interpretation.
2. Interpretation of Aerial Photographs and Satellite Imageries.
3. Laboratory exercises in solving exploration related problems.
4. Exercises on calculation of grade and ore Reserves.
5. Field Work.

PRACTICAL EXAMINATION:
The Practical Examination will be four hour duration and carries 50 marks. The distribution of marks will be as follows-

I.	Completion of Section maps (2 Nos.)	10 Marks
II.	Interpretation of Aerial Photographs and Satellite Imageries.	10 Marks
III.	Laboratory exercises in solving exploration related problems.	10 Marks
IV.	Exercises on calculation of grade and ore Reserves	06 Marks
V.	Field Work.	04 Marks
VI.	Practical Record and Viva Voce	10 Marks
		50 Marks

Text Books for Sem V & VI :

1. Bilings, M.P. (1997) Structural Geology. Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Park, R.G. (1989) Foundations of Structural Geology. Blackie, New York.
3. Gokhale, N.W.(2001) Theory of Structural Geology. Blackie, New York.
4. Gokhale, N.W.(1991) A Manual of Problems of Structural Geology. CBS Publishers.
5. Lahi, F.H. (1987) Field Geology, CBS Publishers.
6. Gokhale, N.W. (2001) A Guide to Field Geology. CBS Publishers.
7. Chiplonkar G.W.: Geological Maps, Dastane Ramchandra Publication, Pune
8. Valdiya, K.S. (1987) Environmental Geology - Indian Context, Tata McGraw Hill.
9. McKinstry, H.E. (1972) Mining Geology. Prentice- Hall Inc.
10. Arogyaswamy, R.N.P. (1995) Courses in Mining Geology. Oxford and IBH Publishing Co., New Delhi.
11. Bagchi, T.C., Sen Gupta, D.K. and Rao, S.V.L.N. (1979) Elements of Prospecting and Exploration. Kalyani Publishers, New Delhi.
12. Dobrin, M.B. (1952) Introduction to Geophysical Prospecting. McGraw Hill.
13. Pande, S.N. (1987) Principles and Applications of Photogeology . Wiley Eastern Limited.
14. Sabisn, F.F. (2000) Remote Sensing Principles and Interpretations. W.H. Freeman and Company, USA.
15. Lilesand, T.M. and Kiefer, R.W.(2000) Remote Sensing and Image Interpretation. John Wiley and Sons Inc., New York.
16. Drury, S.A. (1997) Image Interpretaton in Geology. Chapman and Hall, London.
17. Todd, D.K. (1980) Ground Water Hydrology. John Wiley and Sons Inc. New York.
18. Karanth, K.R. (1989) Hydrogeology. Tata McGraw Hill Pub.Co.Ltd., New Delhi.
19. Nagabhushaniah, H.S. (2001) Groundwater in Hydrosphere (Groundwater Hydrology) CBS Publisher, New Delhi.
20. Karanth K.R. Groundwater, Assessment, Development and Management. Tata McGraw Hill Pub. Co. Ltd., New Delhi.
21. Raghunath : Ground Water Hydrology, New Age Publication, Pune

22. Dynamic Earth - Skinner Potter - Pub.John, Wiley.
23. Text Book of Physical Geology - G.B.Mahaptra- Pub. C.B.S., New Delhi.
24. Dynamic Earth ó Patwardhan A.M., E E.E Publications, New Delhi.
25. Physical Geology ó A. Holmes, Orient Longman Publications.
26. Concepts in Geology - Chakranarya, Kulkarni, Pub. Scientific Publication, Pune.
27. Dynamic Earth- Whiley, John Wiley and Sons, New York.
28. Radhakrishnan N. General Geology, V.V.P Pub, Vellore.
29. Text Book of Engineering Geology - Parbin Singh, Katson Publishing, Ludhina.

B.Sc. Final Year, Semester-V
7: BOTANY

The examination in Botany of fifth Semester shall comprise of one theory paper, internal assessment and practical examination. Theory Paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 4 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lecturers per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-V (8 marks).

5S - BOTANY
PLANT PHYSIOLOGY AND ECOLOGY
Unit - I: Plant Water Relations

1.1 Importance of water to plant life.
Imbibition , Diffusion,Osmosis, Plasmolysis.
1.2 Active and passive Absorption of water.
1.3 Ascent of sap - Root Pressure and Transpiration Pull Theory.
1.4 Transpiration - Types of transpiration, Stomatal movements, Mechanism of transpiration (Starch) sugar hypothesis), Significance. Antitranspirant, Guttation.
1.5 Mineral uptake - Active uptake - Career Concept, Passive up take - Ion
Exchange.

Unit - II: Metabolism-
2.1 Photosynthesis - Introduction, Role of Light, Photosynthetic Apparatus and Pigments, Two Pigment Systems, Photophosphorylation, C3 and C4 cycle, CAM Pathway.
2.2 Respiration **-** Introduction, Mitochondria as a Respiratory centre, Types of Respiration - Aerobic and Anaerobic, Mechanism of aerobic respiration- Glycolysis, Kreb cycle, Electron transport system and Chemiosmotic ATP generation, Respiratory Quotient.

Unit - III: Metabolism and growth
3.1 Nitrogen Metabolism- Sources of nitrogen, Symbiotic nitrogen fixation, Role of Nitrate reductase.
3.2 Growth - Phases of growth, Growth curve, Physiological role of growth hormones (Auxins, Gibberellins, Cytokinins, Abscisic acid, and Ethylene).
3.3 Physiology of Senescence and Abscission.

Unit – IV: Plant responses
4.1 Photoperiodism - Concept of Florigen, Role of Phytochrome,
4.2 Vernalization- Concept and Significance.
4.3 Plant movement- Tropic (Phototropic and Geotropic) and Nastic (Epinasty, Hyponasty and Seismonasty)
4.4 Stress physiology- Concept, Types of stress, Water and Salinity stress.

Unit – V: Ecology and Environment:
5.1 Concept of environment, Concept and scope of ecology.
5.2 Ecological factors- Climatic- Light, Temperature and Water.
5.3 Atmosphere and its composition.
5.4 Edaphic factor- Process of soil formation, soil profile, soil biota and their   role.
5.5 Ecological Adaptations - Morphological and Anatomical adaptation in Hydrophytes, and Xerophytes.

Unit – VI: Ecosystem:
6.1 Population Ecology- Natality and Mortality, Community characteristics ó Frequency, Density and Abundance
6.2 Ecological Succession **-** Hydrosere and Xerosere
6.3 Ecosystem ó Definition, Structure and Function,

Food chain, Food web, Energy flow model (Single channel model)
6.4 Types of Ecosystem- Pond ecosystem, Desert ecosystem.

LABORATORY EXERCISE :
Plant Physiology: Major experiment (Any Seven)
1. To study the effect of temperature and organic solvent on permeability of plasma membrane.
2. To study osmotic pressure of cell sap by plasmolytic method.
3. To determine water potential of plant tissue.
4. To determine the path of water (ascent of sap)
5. To determine the rate of transpiration by Ganongs photometer.
6. To determine rate of photosynthesis under varying quality of light and CO2 concentration.
7. To study the rate of photosynthesis in terrestrial plants with the help of Ganongs Photosynthometer.
8. Separation of chloroplast pigments by paper chromatography/ solvent extraction method.
9. Separation of amino acids by paper chromatography method.
10. To determine R.Q. using different substrates.
11. To determine the rate of respiration by Ganongs respirometer.
12. To study antagonism of salts.
13. To study phenomenon of adsorption.
14. To study effect of IAA and Gibberellins on seed germination.
15. Test for secondary metabolites- Alkaloid, Phenolics, Tannin, Flavonoids and Lignin
16. To study Endo and Exo-osmosis by egg membrane osmoscope

Plant Physiology: Minor experiment- (Any Three)
1. To demonstrate fermentation.
2. To demonstrate exo and endosmosis
3. To demonstrate transpiration by Bell jar.
4. To demonstrate light is necessary for photosynthesis
5. To demonstrate anaerobic respiration in germinating seeds.
6. To demonstrate the evolution of CO2 in respiration.
7. To demonstrate the phenomenon of nastic movement with help of *Mimosa pudica* / or *Biophytum sensitivum.*

Ecology: Major experiment (Any Three)
1. Study of morphological and anatomical adaptations in hydrophytes ó *Hydrilla, Eichhornia, Typha, Vallisneria* and *Nymphaea* (any two)

Study of morphological and anatomical adaptations in xero-
phytes -*Asparagus*, *Nerium, Casuarina, Euphorbia, Cycas, Opuntia* (any two)

3. Study of community characterstics by quadrat method.
4. Determination of water holding capacity of different soils.
5. To determine the texture of different soils by sieve method.

Ecology: Minor experiment (Any Two)

1. To determine the porosity of soil.
2. To determine the transparency and temperature of water bodies.
3. Estimation of salinity of different water samples
4. Determination of pH of different soils and water samples by pH papers/ pH meter.
5. Study of meteorological instruments -Rain gauge, Hygrometer, Barometer

PRACTICAL EXAMINATION

Time: 4 Hours   Marks: 50

Q. 1 - Physiology- major experiment-.   15
Q. 2 - Comment one Minor Physiology experiment-   5
Q. 3 - Ecology major experiment.   10
Q. 4 - Ecology minor experiment.   5
Q. 5 - Viva ó voce   5
Q.6 -   Class record.   5
Q. 7 - Co-curricular Activity Report   5

Co-curricular Activity Report ö which mean the report on the activity

Such as Study Tour, Industrial visit to Research Institute, Excursion Tour to be submitted by the students at the time of practical examination.

Books Recommended:

Plant Physiology and Ecology:

1. Curtis & Clark. : Introduction of Plant Physiology.
2. H.N.Shrivastav. : Plant Physiology
3. Devlin R.M. : Plant Physiology
4. Salisbury F.B and Ross C.W. (1992).: Plant physiology (Fourth Edition) Wadsworth Publishing Company, California,USA.
5. William G. Hopkins. (1995): Introduction to Plant Physiology, Published by ó John Wiley and Sons, Inc.
6. V.Verma : Plant Physiology Verlag, New York.Vol. II.

7. Mayer & Anderson.: Plant Physiology.
8. Lincoln Taiz and Eduardo Zeiger (2003). Plant Physiology (3rd edition), Published by Panima Publishing Corporation
9. Galston, A. W. 1989: Life processes in plants. Scientific American Library, Springer
10. Jain V.K.: Fundamental of plant Physiology. S. Chand Publication New Delhi.
11. Kocchar P.C.: Text Book of Plant Physiology.
12. Mohr, H. and Schopfer, P. 1995 : Plant Physiology 4th : Edition, Wordsworth
13. Moore, T.C. 1974: Research Experiences in Plant Physiology. A Laboratory Manual.
14. Mr./Mrs.Pillei : Plant Physiology New York, U.S.A.
15. P.S.Gill: Plant Physiology, S.Chand & Co. New Delhi, Edition - Pradipø, Botany
16. Purekar and Singh: Plant Physiology,
17. R. G. S. Bidwell (revised edn.)-Plant Physiology
18. Verma S.K. and Verma Mohit (2007). A.Text Book of Plant Physiology, Biochemistry and Biotechnology, S. Chand Publications.
19. Dennis D.T., Turpin, D.H. Lefebvre D.D. and Layzell D.B. (eds) 1997. Plant Metabolism (Second Edition) Longman, Essex, England.
20. Galstone A.W. 1989. Life processes in Plants. Scientific American Library, Springer Verlag, New York, USA..
21. Moore T.C. 1989. Biochemistry and Physiology of Plant Hormones Springer ó Verlag, New York,USA.
22. Singhal G.S., Renger G., Sopory, S.K. Irrgang K.D and Govindjee 1999. Concept in Photobiology; Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi
23. Verma S.K. and Mohit Verma 2007. A.T.B of Plant Physiology, Biochemistry and Biotechnology, S. Chand Publications.
24. Ambasht. R.S. 1988.0 A Text Book of Plant Ecology Students FriendsCo.Varanasi.
25. Sharma P. D. 2003. Ecology and environment. Rastogi publication.
26. Botkin, D.B. and Keller, E.A. 2000. Environmental Plane (2nd edition).JohnWiley & Sons Inc. New York.
27. Chapman. J.L. and Reiss. M.J. 1995. Ecology: Principles and ApplicationsCambridge University Press. College Publishers, USA.

28. Cunningham.W.P. and Saifo S.W. 1997. Environmental Science: A Global Concern WCB. McGraw Hill.

29. Dash M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

30. Kumar.H.D. 1996. Modern Concepts of Ecology (3rd edition). Vikas Publishing House Pvt., Ltd. Delhi.

31. Kumar.H.D. 1997. General Ecology. Vikas Publishing Pvt. Ltd., Delhi.

32. Miller.W.R. and Donahue. R.L. 1992. Soils-An Introduction to Soil and Plant Growth (6th edition). Prentice Hall of India Pvt. Ltd., New Delhil.

33. Odum.E.P. 1996. Fundamentals of Ecology. Natraj Publishing, Dehradun.

34. Pickering.K.T. and Owen L.A. 1997. An Introduction to Global Environmental Issues (2nd edition). Butter and Tanner Ltd., Great Britain.

35. Smith L.R. and Mith T.M. 1998. Elements of Ecology. (4th edition). Animprint of Addison Wesley, Longman ink. California.

36. Smith.L.R. 1996. Ecology and Field Biology (5th edition). Harper Collns

37. Tyler. M.G. Jr. 1997. Environmental Science: Working with Earth (6th edition). Wordsworth Publishing Co.

38. Weaver. J.E. and Clements. S.E. 1966. Plant Ecology. Tata McGraw publishing Co. Ltd. Bombay.

39. Chaudhari M.A. and Gupta K.K. 2009. Practical plant physiology. New Central Book agency Ltd. Kolkata.

40. Bendre: Practical Botany for B.Sc.III year. Rastogi Publications, Meerut.

Semester-VI

6S Botany

The examination in Botany of sixth Semester shall comprise of one theory paper, internal assessment and practical examination. Theory Paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 4 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lecturers

per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-VI (8 marks).

SEMESTER VI – MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Unit-I : DNA the genetic material :
1.1 Historical account ó Giffith's Expt, Hershy and Chase Expt.
1.2 DNAó Chemical composition and Double Helical model,
1.3 DNA replication in Eukaryotes;
1.4 DNA Packaging - Nucleosome and Solenoid
1.5 Satellite, Repetitive DNA and Transposable element in plants (AC-DS system)

Unit-II : Gene Structure and Expression -
2.1 Concept of gene, Fine structure of Gene
2.2 Gene Expression ó
Central Dogma, Types of RNA, Genetic code, Ribosome as a translation machine
2.3 Transcription in Eukaryotes ó Mechanism of Transcription and RNA Processing
2.4 Translation in Eukaryotes.
2.5 Endomembrane system (Flow of Peptide)

Unit – III : Regulation of Gene Expression
3.1 Regulation of Gene Expression in Prokaryotes ó Operon concept with special reference to Lac Operon
3.2 Regulation of gene expression of Eukaryotes ó Britton Davidson Model
3.3 Protein Folding Mechanism and Structure (Primary, Secondary, Tertiary and Quaternary)
3.4 Protein Sorting ó Targeting to proteins to organelles
3.5 Protein Trafficking

Unit-IV : Genetic Engineering -
4.1 Tools and techniques of recombinant DNA technology,
4.2 Restriction Enzymes ó Nomenclature and Types
4.3 Cloning vectors ó Plasmids, Phages, Cosmids
4.4 Gene Source- Genomic and c-DNA library

4.5 Gene Transfer Techniques ó
Direct - (1) Chemical method, (2) Electroporation, (3) Gene gun method
Indirect ó Agrobacterium mediated gene transfer
4.6 Gene Amplification - _Polymerase Chain Reaction (PCR)

Unit-V : Plant Tissue Culture -

5.1 Basic aspects of plant tissue culture
5.2 Laboratory Requirement ó
Infrastructure,
Instruments (laminar air flow, autoclave, growth chamber),
Culture Media (MS Media),
Growth Hormone (Auxin, Cytokinin and Gibberellins)
Sterilization Techniques
5.3 Tissue Culture Technique - Cellular totipotency, differentiation and morphogenesis; Callus Culture; Micro propagation

Unit-VI : Applications of Biotechnology -

6.1 Agriculture ó Haploid plant production (Anther and Pollen Culture); Protoplast Culture and Somatic Hybridization; Transgenic Plant - BT Cotton, Synthetic seed. Salient achievements of crop biotechnology
6.2 Industry ó Fermentation Technology- Bakery Products and Alcohol Productions.
6.3 Health Care ó Edible Vaccines
6.4 Conservation ó Cryopreservation, Genetically Modified Organisms: - Pros and Cons

LABORATORY EXERCISE

1) **Molecular biology (Major) (Any One)**
   1. Isolation of DNA by crude method
   2. Estimation of DNA by Diphenylamine method
   3. Estimation of RNA by Orcinol method
2) **Molecular biology (Minor) (Any One)**
   1. Demonstration of DNA Electrophoresis,
   2. Demonstration of double helical model of DNA
   3. Demonstration of AC-DS System in Maize kernel
   4. Demonstration of Centrifugation
3) **Biotechnology (Any Six)**
   1. Working Principle and application of Autoclave

2. Working Principle and application of Laminar Air Flow
3. Cleaning and Sterilization of Glassware
4. Sterilization of Explant
5. Inoculation of Explant
6. Demonstration of in vitro culture techniques ó anther and pollen culture
7. Isolation of Protoplast by Mechanical Method
8. Isolation of Protoplast by Enzymatic Method
9. Demonstration of technique of Micropropogation
10. Preparation of Artificial Seed
11. Demonstration of hardening of tissue culture plant
12. Preparation of Tissue culture media
13. Pollen viability test.

Note: Visit to molecular biology, biotechnological research institute/industry

PRACTICAL EXAMINATION

Time : 4 hours. **Marks : 50**

Que.1 : To perform given Molecular Biology experiment   15 Marks
Que.2 : Comment on minor molecular Biology Experiment 05 Marks
Que.3 : To perform given Biotechnology experiment   15 Marks
Que.4 : Comment on any one Biotechnology Experiment   05 Marks
Que.5 : Visit report   05 Marks
Que.6 : Class record/ and viva-voce   05 Marks

1. Pradipø Botany Vol. V, Biochemistry and Biotechnology- New Millenium Edition
2. Alberts, B.Bray, D.Lewis, J.Raff, M.Roberts, K. and Watson, I.D. 1999. Molecular Biology of Cell - Garland Publishing Co. Inc New York, U.S.A.
3. Gupta, P.K. 1999 : A Text book of Cell and Molecular Biology, Rastogi Publication, Meerut, India.
4. Wolfe, S.L. 1993. Molecular and Cell Biology. Wordsworth Publishing Co., California, U.S.A.
5. Fakui, K. and Nakayama S. 1996. Plant Chromosomes. Laboratory Methods. CRC Press, Boca Raton, Florida.
6. Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes : Analysis; Manipulation and Engineering. Harwood Academic Publishers, Australia.
7. Bhojwani, S.S. 1990. Plant Tissue Culture : Applications and Limi-

tations, Elsevier Science Publishers, New York. U.S.A.

8. P.K.Gupta Biotechnology.
9. Lea, P.J. and Leegood, R.C. 1999. Plant Biochemistry and Molecular Biology. John Wiley & Sons, Chichester, England.
10. Old, R.W. and Primrose, S.B. 1989 : Principles of Gene Manipulation. Blackwell Scientific Publications, Oxford, U.K.
11. Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue culture, Kluwer Academic Publications, the Netherlands.
12. Devi, P. 2000. Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics, Agrobios, Jodhpur, India.
13. Smith, R.H. 2000. Plant Tissue Culture; Techniques and Experiments. Academic Press, New York.
14. Satyanarayan- Biotechnology.
15. An introduction to industrial Microbiology- Dr. P.K. Sivakumaar & Dr. M.M. Joe & Dr. K. Sukesh- S. Chand publication.
16. Practical Biotechnology and plant tissue culture- Prof. Santosh Nagar & Dr. Madhavi Adhav- S. Chand Publication.
17. Modern practical Botany (Volume-III)- Dr. B.P.Pandey- S. Chand publication.
18. Molecular Biology and Biotechnology- K.G. Ramawat & Dr. Shaily Goyal- S. Chand publication.
19. Comprehensive Biotechnology- K.G. Ramawat & Shaily Goyal- S. Chand publication.
20. Botany for degree students - B.P. Pandey- S. Chand publication.
21. A Textbook of Biotechnology- R.C. Dubey- S. Chand publication

Semester-V
8 : Environmental Science
5S : Environmental Science
(Pollution control technology)

UNIT-I : **General approaches of air pollution.**

A. Sampling- Ambient and indoor, techniques. Analysis - Cox, Nox, Sox, Spm. Air quality standards, emission standards.

B. Integrated approach of air pollution control: City planning, zoning, source correction methods. National and International steps to control green house gases.

UNIT-II : **Air Pollution control Techniques.**

A. Control devices : Gravitational settling chambers; cyclone separators; fabric filters; electrostatic precipitators; wet collectors and scrubbers. Combustion-flaring, thermal incineration, catalytic oxidation. Control of other gaseous pollutants-odour, VOCs, oxides of sulphur and nitrogen emissions.

B. Auto Gaseous Emission Control - Control of auto-exhausts emissions. Use of after burners, catalytic converters, engine modifications; tuning, importance of good maintenance and driving habits. Alternative fuels.

Unit-III : **Physico-chemical Waste Water Treatment Processes :**

A. (i) Physical Process - Screening, grit chamber, aeration, oil and grease removal, sedimentation, coagulation, flocculation.

(ii) Chemical Process - Neutralization, chemical precipitation, adsorption, demineralization.

(iii) Biological Process - Activated sludge process, trickling filter, UASB (upflow anaerobic sludge blanket).

B. Sludge - Origin, nature, type, characteristics, treatment and disposal.

Unit-IV : **Solid Waste Disposal**

A. Management of municipal solid wastes (MSW): Sources, physical composition and characteristics.

B. Disposal methods; Open-dumping and sanitary landfills. Reduction, reuse and recycling of materials. Optional technologies for processing of MSW: Incineration, gasification, pyrolysis

C. Hazardous wastes: Sources and characteristics. Safe storage, transport. Treatment of hazardous waste-Stabilization. Disposal of hazardous wastes. Introduction to Biomedical waste-Concept & classification.

D. Radioactive waste: sources, classification, health and safety aspects. Management of radioactive wastes.

UNIT-V : Biomedical and Radioactive Waste Treatment

    A. Biomedical - Introduction, concept, classification, treatment and disposal (Pit, composting and Incineration).

    B. Radioactive waste - Handling, storage and disposal.

    C. Case Studies

UNIT-VI : Indoor Safety

    A. Definition and concepts: Precautions in the processes and operations involving explosives, flammables, toxic substances.

    B. Health Safety : Respiratory personal protective equipment (RPPE) & non respiratory personal protective equipment (NRPPE). Selection, use care and maintenance of non respiratory protective equipment. NRPPE: head protection , ear protection , face and eye protection , hand protection, foot protection and body protection.

Practical – 5

1. Preparation of windrose diagram of an area.
2. Determination of NOx, SO_2 in an ambient air .
3. Measurement of Smoke Density.
4. Elemental analysis of sludge.
5. Estimation of organic matter from soil/sludge.
6. Determination of CO_2 in the atmosphere by volumetric method.
7. Determination of energy content of plants by Bomb Calorimeter.
8. Determination of physical parameters of
   i) well water   ii) Industrial or given type of effluent
   iii) River Water   iv) Sea wa
9. Determination of heavy metals (Fe/ Cr /Cu) by spectrophotometric methods from waste water.
10. Detection/ estimation of Cr (VI) in presence of Cr III
11. Determination of hydrocarbon from fuel gas using Orsatøs apparatus
12. Determination of Chemical Oxygen Demand value for industrial waste effluent.
13. Determination of NO2 from the atmosphere by colorimetric method using high volume sampler
14. Estimation of mixed liquor suspended solids (MLSS) in activated

    sludge.

15. Reduction of hardness by ion exchange method.
16. Estimation of fluoride in waste water.
17. Determination of energy content in biomass (Bomb Calorimetry).
18. Estimation of Na+ and K+ in water / effluent samples using flame photometer
19. Calibration of air sampling equipments.
20. Noise, illumination, ventilation and heat stress measurements - Industry.
21. Preparation of Material Safety Data Sheet for laboratory chemicals.

Note:
1. Visit to Drinking / effluent treatment plant.
2. Industrial visit

Distribution of practical Marks (Duration 6 hours)
    1. Long Experiments (Water & air)-   20
    2. Short Experiment-   10
    3. Study visit-   10
    4. Practical record-   05
    5. Viva-voce-   05
                    ô ô ô ô ô ô ô ô ô ô ô
           Total   **50**

Equipments :-
1) Flame photometer
2) Orsat Apparatus
3) COD Reflux assembly
4) High volume sampler
5) Bomb Calorimeter
6) Noise level meter
7) Lux meter.

Reference Books:
1. Environmental Sciences - Jackson and Jackson
2. Environmental Sciences - Tuckeer (1990)
3. Introduction to Environmental Chemistry ó A.K.De
4. Pollution control in process industries ó S.P.Mahajan. Tata McGraw Hill pub. New Delhi
5. Water and Waste water technology ó M.J.Hammer, John Wiley A & sons, New York 1986.
6. Introduction to wastewater treatment process ó R.S.Ramalho.

7. Current practices in Environmental Engineering. (Vol. I & II) Alam Singh and U.S. Sharma. International Book Traders, Delhi-1997.
8. Basic environmental technology : Jerry ;A. Nathanson.
9. Handbook of environmental management and technology : Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.
9. Environment and Health ó Anthony I. Rowland & Paul Cooper, 3rd edition -1989.
10 Air quality management by Stern, A.C. (Ed) 1974.
11. Air pollution theory by Crawford.
12. Land pollution , causes and control by Harrusson and Laxon.
13. Soil and water conservation engineering by Schwab, S.D. Frevert, R.K. Edminster, T.W. and Barns, John Willey and sons.
14. Standard Methods for the Examination of water and waste water (1984) APHA,

Semester-VI
Environmental Science

6S : Environmental Science
(ENVIRONMENTAL CONSERVATION & MANAGEMENT)

Unit-I : **A) Environmental Education:** Definition, need, principles and objectives of environmental education, Types of environment education (Formal & Non Formal), stages of environment education, current status of environment education in India.

B) Environmental Education & Awareness: Concept of environmental awareness, methods of environmental awareness, role of environmental education in awareness programmes, Role of NGOs in environmental education; environmental awareness thorough mass media.

Unit-II : **A) Mining Environment** : A)Types of mining, issues related with mining management, strategies for conservation of minerals.
Land Use Pattern, land degradation and land management.
B) Conservation of wetland, wastelands and mangroves

Unit-III : **A) Wild Life Management** - Wild life as a resource. Threats to wild life. Indian board for wild life (IBWL).

WWF, Wild life institutes in India. Wildlife poaching. Wild Life Protection Act, 1972, Environmental Protection Act, 1986.

B) Biodiversity Conservation :
Need of conservation; National policy and goals; methods of biodiversity conservation - in situ conservation(sanctuaries, national parks and biosphere reserve); ex situ conservation(zoo, botanical gardens) convention on biological diversity (CBD) ,Biodiversity Act 2002.

Unit-IV : **Role of National and International Organization in Environmental Protection :**
A) IUCN, UNEP, Man and Biosphere Programme (M.B.P.), State Pollution Control Board . Ministry of Environment and Forest (MOEF) .
B) Environmental Impact Assessment - Concept, scope and objectives, EIS, Public participation in EIA, advantages and disadvantages of Public participation.

Unit-V : **A) Environmental Audit** : Definition, purpose, advantages, general approach to environmental audit.
B) Introduction to Remote Sensing : Study of Arial Photographs and Satellite Images. Geographical Information System (Concept and Advantages).

Unit-VI : **A) Sustainable Development:** Concepts and principles of sustainable development.
B) Statistical Methods : Mean, mode, media, standard deviation, tabulation of data, types of data, diagrammatic representation and graphical representation of data, regression analysis.

Practicals based on Papers :
A) **Experiments on Biodiversity:**
1) Determination of Shannon Weiner Species diversity index to terrestrial animal communities.
2) Determination of Margalef diversity index to terrestrial animal communities.
3) Determination of Kothes Species Deficit index to aquatic organisms.
4) Photographic submission of flora and faula.

B)   Experiments on Environmental Management :
1)   Characterization of wasteland soil.
2)   Characterization of wetland water.
3)   Characterization of wetland sediments.
4)   Visit to nearby mine / quarry
5)   Survey of Environmental literacy in nearby community.

C)   Experiments on GIS & Remote Sensing:
1)   Study of Satellite Images or Arial Photographs.
2)   Study and Applications of GPS
3)   Marginal information of Topo sheet.
4)   Indexing of Topo sheet.
5)   To study the conventional signs and symbols from Topo sheet.
6)   Interpretation of Topo sheet.
7)   To study of conventional signs and symbols from weather map.
8)   Interpretation of weather map.
9)   Scale determination of aerial photograph.
10) Mapping of the land use patterns with the help of aerial photographs.
11) To study the change in land use pattern of an area with help of aerial photographs and survey if India Topo sheet.

D)   EXPERIMENTS ON EIA:
1)   Evaluation of impact of refuses on soil quality.
2)   Impact of air pollutants on plants leaves.
3)   To examine the effects biofertilizers versus chemical fertilizers on root ramification and plant growth.
4)   To evaluate the impact of traffic density on environment.

Reference Books:

1)   Environmental economics for sustainable development ó Kumar
2)   Ecology and economics: an approach to sustainable development ó Sengupta
3)   Environment, Development and sustainability ó Bhaskar nath
4)   Water technology management challenges and choices ó A.K. Barua. Biodiversity and environment ó S. K. Agarwal
5)   The Biological Diversity Act. 2002 and Biological Diversity rules 2004 ó National Biodiversity Authority India. 475, 9th South cross street, Kalpalocwar Nagar, Neelangarai, Chennai ó 600041.
6)   Biodiversity measurement and estimation ó D. L. Hawks

7)   Biodiversity conservation ó Global agreements and national concerns. RAMSAR sites CBD, Quarantine, Regulation, National Forestry policy, Biodiversity Act, Wild life protection Act.
8)   Environmental Problems and Solutions by Asthana D.K.
9)   Environmental Management by G.N.Pande
10) Pollution Management in Industries by R.K.Trivedi.
11) Indian Economy in International Perspective, 1994: Gaur K. D, Meshram P. J. Shashidharan K.L. ed. Sarup and Sons publishers Ansari Road, Darya Ganj New Delhi.
12. Environmental Economics, 2001: Madhu Raj ; Sarup and sons publishers, New Delhi.
13. Environment & Social Issues, 2000: Sunit, Gupta Sarup and Sons Publishers, New Delhi.
14. Global Environment: Current Status, 2000: Sunit, Gupta Sarup and Sons Publishers, New Delhi.
15. Environmental economics for sustainable development accounting and valuation 2001: Some issue in modeling Kumar (Pushpam).
16. Environmental Crisis and Management: Sunit, Gupta Sarup and Sons Publishers, New Delhi.
17. Ecology & economics: An approach to sustainable development and sustainability: Bhaskar Naath, Luc Hens, David Pimental.
18. Environmental Remote sending By: Saumitra Mukharajee.
19   Hand Book of Env. Laws, Acts, Rules, Guidelines, Compliance and Standard Vol. 1 & 2: R. K. Trivedy Environmental Edition: 1st 1996.
20. Pollution control Acts, Rules and notifications issued there under: Central Pollution Control Board April. 1995.
21. Environmental Protection and the Laws: C. N. Mehta, 1991.
22. Legal aspects of Environmental Pollution and its Management: Ed. S. M. Ali, 1992.
23. International Environmental Policy Emergence and Dimensions: by L. K. Caldwel 1990.
24. Laløs Commentevis on water, Air pollution laws along with the environmental (Protection) Act and rules 1986, 3rd Rd. 1992: Law Publisher India.
25   Environmental Problems, protection and control Vol I & Vol II Ed: Arun Kumar.
26   Remote Sensing and Image Interpretation:-Tomas M.Lillesand and

Ralph W.Keifer john Wiley and sons Inc.New Yark.

27. Introduction to Remote sensing:-James B. Campbell, Tylor and Franeis Ltd.Londan.
28. Fundamentals of GISN:-Michael N.Demers..
29. Remote Sensing application in applied geosciences:-Sumitra Mukherjee, Milton Book Company.
30. Environmental Geography:-H.M Saxena, Milton Book Company.
31. Principles of Photogeology:-Singh.
32. Principles of Remote Sensing:-Currain.
33. Fundamentals of Photogeology:-S.N.Pandey.
34. Environmental Impact Assessment, L. W. Canter, McGraw Hill publication, New Delhi.
35. Proceedings Indo-US workshop on environment impact analysis and assessment (1980) NEERI, Nagpur.
36. Environment & Social impact assessment, Vlcany, F., Bronsetin DA (1995), John Wiley & Sons, New York.
37. EIA ó A Biography. B. D. Clark, B. D. Bissel, P. Watheam

DISTRIBUTION OF PRACTICAL MARKS: MAX.MARKS :50
Duration : 6 Hrs

Q.1 Any one Experiment on Biodiversity conservation.-10 Marks
Q.2 Any one Experiment on GIS OR Remote sensing. -10 Marks
Q.3 Any one experiment on EIA / Environmental -   10 Marks.
     Management
Q.4 Class Record + Viva-Voce -   10 Marks
Q.5 *Co-Curricular Activity Report -   10Marks.
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     Total   50 Marks

Note: Visit to - 1) Wild life Sanctuary, 2) Industries, 3) National Park, 4) Meteorological Station.

*öCo-curricular Activity Reportö which mean the report on the activity such as Seminar, Study Tour, Industrial visit to Research Institute, Group Discussion, Excursion Tour to be submitted by the students at the time of practical examination.

Required Instruments or Equipments for Practical Work :
1. Spectrophotometer
2. COD reflux assembly

3. BOD bottles.
4. Incubator
5. Kjeldhal Nitrogen Assembly
6. Paper Chromatograph
7. Flame Photometer
8. Dust Fall Jar
9. Sound Level Meter
10. Water Sampler
11. Lovered Box
12. Air Sampler - Tilak
13. Zincondroff Apparatus
14. Stereo Scope
15. Aerial Photograph.

Instructions for Project Work :

The objective of assigning of project work to student is to provide an opportunity to understand and appreciate environmental problems and explore probable solutions based on Empirical Studies. With a view to achieve these objectives. It is Expected that students in consultation with the concerned member of teaching faculty identifies an environmental problem and under take studies during specific period. While defining aim and the scope of the project, feasibility in terms of available time should be duly considered. It would be desirable that the initiation of project work begins in first session by under taking library work under the guidance of concerned teacher. The theme of project should be finalize in all respects at a convenient.

A student is expected to carry out studies as preplanned by going on periodic field visits and carry experimental studies. It is visualize that continuous to the teacher and consultations with him is the essence of successful work on completion of the field work and laboratory work, the

Semester-V
9 : SEED TECHNOLOGY

5S : Seed Technology(Vocational)

There shall be one theory paper of 80 marks and practical examination of 50 Marks for each semester. Duration of theory paper shall be 3 hours and practical examination shall be of 4 hours.

The syllabus in based on 6 lectures and 6 practical periods

perweek.

Seed Pathology and Seed Entomology.

Unit-I : History of seed pathology
Economic significance of seed borne diseases.
Seed-borne fungi ,bacteria, viruses and nematodes
Storage fungi and its impact on animal and human health
Mechanisms of seed transmission
Entry point of seed infection

Unit-II : Influence of environmental factors on seed borne diseases
seed crop management
Seed treatment, procedures and equipments
Quarantines of seed health testings
Procedures of sampling for seed health testing

Unit-III : Methods of seed health testing
Inspection of plants beyond the seedling stage
seed certification and tolerance limits of seed borne pathogens
Seed act in relation to Seed borne diseases
National and international cooperation in seed pathology

Unit-IV : Introduction
Methods of insect classification
Orders of insects of economic importance
Insect body & appendages
Life-cycle of insect
Economic entomology Important insect-pests of seed crops, their nature of damage and management
    1. Cereal-paddy, maize and sorghum
    2. Pulses-Kharif pulses-pigeonpeas, mung, Rabbipulses-chickpea, fieldpea linseed
    3. Oil seeds-mustard, castor, linseed groundnut
    4. Vegetables and dry fruits

Unit-V : Beneficial Insects
Type of beneficial insects and their role in seed production
Type of insect pollinators, their usage in crop pollination

Honey bees, their social structure and management (bee Keeping)
Insect control
Definition and methods of insect control
Cultural, mechanical, physical, quarantine
Chemical control/pre harvest sanitations spray
Insecticide formulation and preparation of Spray Solution.
Safe application of pesticide

Unit VI : **Storage Entomology**

Types of insect pests and mites in storage - Nature of damage and losses caused and factors influencing them Sources and development of infestation, Detection of infestation.

Fumigants and methods of fumigation Seed protectants and their impact on seed viability   etc.

IPM strategies for important pests Plant Protection Equipments

Type of equipments & their principles Safe handling, maintenance and use of machines Rodents and their control in field and seed godowns

Practical :
Seed Pathology

1. Demonstration and handling of stereobinocular microscope
2. Symptoms of important seed borne pathogens
3. Visual examination of dry seeds for disease symptoms
4. Examination of suspensions obtained from washings of seeds
5. Viability test-space germination test and tetrazolium test.
6. Detection of important seed-borne bacteria-various methods.
7. Detection of important seed borne viruses various-methods.

Seed Entomology

1. External morphology of insect, type of mouth parts, antenna and legs.
2. Identification of important storage pests, stages of insects.

3. Detection of seed borne insects and estimation of infestation
4. Plant protection equipments, their safe handling and use.
5. Handling of bees for pollination.
6. Collection and submission of stored product pests visit to ware-houses and godowns.

Practical Examination :
Distribution of Marks   **Marks 50**
1. Diagnosis of Symptoms of seed-borne pathogens   10
2. To Calculate the viability of seed by tetrazolium test   10
3. Study of mouth parts, antena and legs of given insect   05
4. Identify and describe the seed specimen & equipments   10
   A, B, C,D, E,
5. Submission of field report   05
6. Submission of seed specimen and viva-voce   05
7. Record book   05

Books Recommended :
1. Seed Pathology Vol-I & II   P. Naeergaard
2. Principles of Seed Pathology Vol-I & II V.K. Agarwal & J.B.Sinclair
3. Seed Treatment K.L. Jeffs.
4. Seed Technology - R.L. Agrawal
5. Introductory Mycology C.J.Alexopoulos
6. An introduction to fungi J.P. Srivastava
7. Systemic Fungicides R.W. Marsh
8. Fungicides in plant diseases control Y.L.Nene and P.N.Thapliyal
9. Destructive and useful insects by Metcalf and Flint
10. Insect Pollination of field crops by J.B.Free
11. Agricultural Entomology by A.S. Atwal
12. Plant Protection Equipments by O.S. Bindra

B.Sc. Part - III
Semester-VI
6S : Seed Technology(Vocational)

Seed Processing, Farm Management and marketing

Unit-I : Seed drying : Importance and advantage of seed drainage, moisture content recalcitrtrant orthodox-and methods of seed moisture measurement, theory of seed moisture measurement, theory of seed drying, specific gravity separators , adjustment of intentented disc and intented

cylinder separators.

Unit-II : Surface texture separation : The roll mill, parts of the machine, Separating action and the adjustments, cleaning roll mills. Seed treatment : Seed treatment equipment, slurry treater, mist-o-matic seed treater, parts of the machine, construction and operation, Labeling of treated seeds and related precautions, storage of treated seeds, machine operation, and seed users safety. Site selection for seed processing plant on a seed production farm, Layout of machines in a seed processing plant for efficient production and main movement, mechanical inquiry of seeds in post harvest phase, conservation of energy and production in seed processing, maintenance and repair of seed processing equipment. Seed conveyors and elevators, bucket elevators belt conveyors screen conveyors. oscillation conveyors, pneumatic conveyors, difference between a specific gravity separators and oscillating conveyors installation of bucket elevator, computing the required height of bucket elevators capacity determination of bucket elevators.

Unit-III : Packaging of seeds. bager weigher, bag closing, labelling and main taining lot identity, lot numbers, seed pellets, handling and stacking, maintenance of seed processing records. seed storage structures : construction, operation and maintenance, insulation storage aeration air conditioning, dehumidification and stacking, moisture and heat proofing of seed storage structures, seed storage management.

Unit-IV : Field of farm management, scope basic principles in farm management, decision making operation and control Decision making approaches ,Decision making based on production, cost and capital investment, cost analysis law of diminishing return, opportunity cost, most profitable combination of input and output.

Unit -V : Planning and management of crops, Building and machinery Important crops of India, concepts pertaining to various crop production operations viz tillage, irrigation, sowing plant protection, harvesting and threshing maintenance of

soil fertility, weeds and their control, mixed cropping, multiple cropping and dry land farming Machinery selection and their management determination of field capacity and field efficiency, machinery adjustments. Consideration in farm buildings implement shed, storage structures.

Unit -VI: Farm Business : Farm business analysis, Farm size, factors affecting profit and economic size of farm, Budget and Record Keeping : Farm budgeting, procedure and use, Farm efficiency measures, farm records and their use. Acquisition and Management of Land Labour and Capital Farm Surveys-Data Collection analysis Marketing Basic concepts, supply and demand price equilibrium, seed transportation and storage cost and returns, cost of processing and packaging, marketing organization for seed marketing, seed markets in India, Structure and working. Seed market surveys, Projections of supply and demand for different kinds of seed in India-Seed pricing of Breeder/Foundation/Certified Seeds.

Practicals :
Seed Processing.
1. Visit to a seed processing and storage complex and familiarization with different machines.
2. Study of physical characteristics of different crop seeds and their shapes.
3. Determination of physical properties of seeds of different crops
4. Measurement of seed moisture content by direct and indirect methods of Dring.
5. Study of air screen cleaner cum grader
6. Study of specific gravity separator
7. Study of seed treatment machines
8. Study of seed packaging equipments.
9. Study of bucket elevator, screw conveyors and pneumatic elevators.

Seed farm management and marketing.
1. Identification of farm machines and their use
2. Determination of field capacity and field efficiency

3. Soil sampling fertility and moisture content
4. Calibration and adjustment of various farm machines
5. Cost analysis.
6. Farm planning and Budgeting
7. Record Keeping

Practical Examination :
Distribution of Marks :   **Marks 50**
1. Determination of physical properties of seeds   10
   of different crops
2. Identification of farm machine and their use   10
3. Study of operations of seed treatment equipment   05
4. Identify and describe equipments A,B,C,D,E,   10
5. Submission of field Report   05
6. Submission of seed specimen & Viva -voce   05
7. Record book   05

Books Recommended :
1. Hand book of Agriculture, Indian Council of Agricultural Research,Krishi Bhavan, New Delhi
2. Farm Power and Machinery Management, Vth edition, 10WA State, U.S.A. Hunt, D,1968
3. Farm Management Decision, Operation Control.John E Kadlec, Prentice Hall, Inc Englwood, Chiffs, New jersey, U.S.A.
4. Fundamentals of farm Management S.S. Joshi and T.R. Kapur, Kalyani Publishers, India, Ludhiana.
5. Fundamentals of farm Management A.S.Kahlon and Karam Singh, Kalyani Awed Publishers PVT.Ltd. 13/14 Asaf Ali Road New delhi/ Madras/Bombay/Calcutta/Bangalore.
6. Economics of farm Production and Management, V.T. Raju and DVS Rao, IBH Publishing Co Pvt.Ltd.New Delhi.
7. Agricultural Marketing in India, S.S.Achary Oxford and I.B.H., New Delhi.
8. Seed Technology - R.L.Agrawal

B.SC. FINAL, SEMESTER-V
10 : ZOOLOGY

There shall be the following paper and practical for B.Sc. Part-III Semester V examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory sessions and 25 practical sessions during the complete semester). There shall a compulsory theory paper of 3 hours duration, as stated below and a practical examination extending for five hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

Theory -5 S-ZOOLOGY:
(ANIMAL PHYSIOLOGY AND ECONOMIC ZOOLOGY)

		Marks Allotted
1)	Written examinationí í í ..	80
	Internal assessmentí ..í í .	20
2)	Practical:	50
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	Total: í í	150 Marks

Paper 5 S-ZOOLOGY
(ANIMAL PHYSIOLOGY AND ECONOMIC ZOOLOGY)
Max. Marks - 100 Total   **Period - 75**

UNIT I : Respiration:

Structure of respiratory organs: Gills and Lungs

Mechanism of respiration: regulation of ventilation in lungs, exchange of gases at respiratory surface, Respiratory pigments in animals: Haemoglobin, Haemocyanin, Haemerythrin, chlorocruorin. Transport of gases: O_2 and CO_2 transport, Neurophysiologic control of respiration,

Circulation:

Blood : Definition and its constituents, functions of blood. Heart: Structure of human heart, pace maker, Cardiac cycle. Blood coagulation factors, blood groups A, B, O system and Rh-factor.

UNIT II : Muscle Physiology:

Types of Muscles: striated, non-striated and cardiac muscles

E.M. Structure and **Chemical** Composition of striated muscle, Neuromuscular junction.

Mechanism of muscle contraction by Sliding filament theory

Physical and Chemical changes during muscle contraction: muscle twitch, tetanus, isometric and isotonic contraction, summation of Stimuli, all or none law, fatigue, rigor mortis.

UNIT III : Nerve Physiology: Neuron: E.M. Structure of nuron andTypes : Myelinated and non-Myelinated nerve fibres.

Conduction of Nerve impulse, Resting potential, initiation and propagation of action potential, Saltatory transmission, Neurotransmitters (Acetylcholine, dopamine, GABA, Serotonin, Epinephrine, Nor-Epinephrine), Synapse and synaptic transmission

Chemical co-ordination: Endocrine system: Hormones and their physiological roles of-

Pituitary, Thyroid, Parathyroid, Adrenal, Islets of Langerhanøs,
Hormonal disorders: Dwarfism, Gigantism, Acromegaly , Goiter, Myxoedema, Cretinism, Osteoporosis ,

UNIT IV : Reproductive Physiology: Estrous and menstrual cycle, hormonal control of reproduction in males and female, Structure and physiology of mammalian Placenta.

Homeostasis and conservative regulation: Osmoregulation and ionic regulation in aquatic animals. Osmoregulation in terrestrial animals Ammonotelism, ureotelism and uricotelism.

Thermoregulation in Poikilotherms and Homeotherms.

UNIT V : Agricultural Zoology: Economic importance of Insects

Beneficial insects ó Spider, Mantis, Ladybugs, Damsel bug, Mealybug destroyer, Soldier beetle,

Green lacewing, Syrphid fly, Tachinid fly, Ichneumon wasp

and Trichogramma wasp.

Harmful Insects óStired food grain pests, their injuries and control

Pests of,ó Cotton, Sugarcane and Jowar. Damage and Control Economic importance of Rodents, Snakes, Owls and Bats. Apiculture - Sericulture -

Unit VI :   Aquaculture

Aquaculture: definition, scope, importance and present status in India.

Fresh water fish culture: types of fish ponds:Nursary, rearing and stocking, design and construction of fish pond, fertilizers used for fish development.

Hatching Happas, Chinease Circular Hatchery, CIFE, Mumbai, hatching model, Induced breeding and hypophysation, Modern drugs used in fish breeding.

Freshwater system: monoculture, polyculture, integrated aquaculture, cage culture, pen culture . Fish products and byproducts: Fish liver Oil, Fish body oil, Fish manure, Fish leather

Special Note : (Common for B.Sc.Sem-I & VI)

(i)   Use of animals for practical purpose in this curriculum is subject to the conditions, under the Wild Life (Protection) Act 1972 and should abide by the prevention of cruelty to animals Act 1960. No any scheduled animal species should be used in the laboratory.

ii)   The research based project on animals should strictly abide by the rule as mentioned in para-6 of U.G.C. Notification No.F.14-6/2014 (CPP-II), dated 1st August, 2014, which state that ó

6.1   All institutions of Higher Education shall constitute õDissection Monitoring Committeesö (DMC) to ensure strict compliance of instructions relating to the use of animals for research purposes only;

6.2   The Head of the concerned department shall be the Convener and Chairperson of DMC. Two Senior faculty members of the concerned department, one faculty member

of a related department from the same institution and one or two Faculty members of the concerned department from the neighboring institution(s) shall be members of DMC.

6.3   The tenure of DMC shall be two years and on expiry of a term, the DMC should be reconstituted wherein only the Convener and Chairperson (The Head of the Department) may continue for two or more terms if he/she happens to continue to be the Head of the Department. A vacancy arising during the tenure of DMC shall be filled with a faculty belonging to the respective category. The quorum for the meeting shall be 3 out of 6, where in at least one member from the neighboring institution must be present. The DMC shall meet at least once each semester/ half year and approve/ review alternative experimentation of animals for laboratory exercises.

6.4   It shall be the responsibility of the DMC to ensure that animals that are permitted to be used for dissections / experiments in the instructions herein are procured from ethical sources, and not removed from the wild, transported to the laboratory without stress or strain to the animals, if live, and anaesthetized appropriately if they are to be used in dissections.

6.5   The DMC shall ensure that the institution maintains appropriate records of procurement of animals, their transport, number of animals used, use of anesthesia/ euthanasia etc.

6.6   The DMC shall be different from the Institutional Animal Ethics Committee (IAEC), under the purview of Committee for purpose of care and supervision of experimental animals (CPCSEA), Department of Environment and Forest, Govt. of India. However, the DMC shall not have powers to over-riding the powers of IAEC. For animals covered by the IAEC, with standard operating procedures (SOPS) for IAECs prescribed by CPCSEA will apply.

iii) Those Institutions which are already having Zoology museums should not procure museum specimens now onwards and should use charts / slides / models / photographs and digital alternatives in case of need. Those new institutions which are not having Zoology museum in their department should provide learning related to zoological specimens with the help of charts / slides / models / photographs and digital alternatives / and arrange visit of students to already established museums.

Practicals:

1. Detection of blood groups in human being.
2. Differential counts of blood.
3. Estimation of hemoglobin percentage with the help of haemometer.
4. R.B.C. count.
5. W.B.C. count.
6. Preparation of haemin crystals
7. Measurement of blood pressure.
8. Action of salivary amylase on starch.
9. Qualitative detection of nitrogenous waste products (Ammonia, urea, uric acid) in given sample.
10. Demonstration of kymograph unit, Respirometer through available resources.
11. Observation and identification of Insect Pests of local crops, and predator insects.
12. Life Cycles of Honey bee, Lac insect, Silk Moth.
13. Histological Slides of major organs of Respiratory systems, circulatory system, Nervous system, Different types of Muscles, Endocrine glands, testis, ovary.
14. Study of locally available fishes, Indian major carps, Exotic carps, Common carp.

Distribution of marks for practical examination :

Time: 5 Hrs.   Marks
01. Physiological Expt.
a) Major í í í í í í í í í í ...   10
b) Minor í í í í í í í í í í í í ...   05
02. Economic Zoology & Histology

a) Spotting (A-F)   12
b) Description and Comments
   on Topic from Unit V and VI   08
04. Class record duly signed by teacher
   in charge and certified by H.O.D.   05
05. Study tour report.   05
06. Viva - voce   05

Total Marks   50

REFERENCES

1. Prosser and Brown : Comparative Animal Physiology
2. Hisotlogical Slides of Respirator systems, circulatory system, Muscles, Nervous system Endocrine glands, Gonads, placentae
3. Guyton : Physiology
4. Best and Taylor : Physiological basis of Medical practice
5. C Hoar, W.S.. General and comparative Physiology. Prentice Hall of India.
6. Lehninger. L.. Biochemistry. W.H. Freeman & co.
7. Nagabushnam, R.. Animal physiology. S.Chand & co.
8. Martin, D.W. P.A. Mayes and W.W. Rodwell,.Harperøs Review of Biochemistry lange Medical Publications.
9. Prosser, C.L. and F.A.Brown Comparative Animal physiology. W.B. Suanders.
10. Rama Rao, A.V.S.S.. Biochemistry. UBSPD.
11. Stryer. L. Biochemistry Wiley International
12. Verma, P.S. and V.K. Agarwal.. Animal physiology. S.Chand & co.
13. Wilson, J.A., Principles of Animal Physiology, Macmillan
14. Chatterjee, C.J; Human Physiology(Vol-I and II)
15. Economic Zoology, G.S. Shukla, V.B. Upadhyay (2006)
16. Text Book of Applied Zoology, Pradip. V Jabde (2005).
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B.SC. FINAL, SEMESTER-VI
ZOOLOGY

There shall be the following paper and practical for B.Sc. Part-III Semester VI examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory sessions and 25 practical sessions during the complete semester). There shall a compulsory

theory paper of 3 hours duration, as stated below and a practical examination extending for five hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

Theory -6 S-ZOOLOGY

(MOLECULAR BIOLOGY AND BIOTECHNOLOGY)

	Marks Allotted
1) Written examinationí í í ..	80
Internal assessment í í í .	20
2) Practical:	50
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Total:	150 Marks

Paper- 6 S-ZOOLOGY
(MOLECULAR BIOLOGY AND BIOTECHNOLOGY)

Max. Marks - 100   **Total Period - 75**

UNIT – I : Genetic material-definition, Experiments to prove DNA as genetic material:Griffiths transformation experiments with bacteriophage infections, Avery and co-workers experiments, and Hershey and Chase experiment. Chemistry and types DNA(A,B,Z)Mitochondrial DNA; Chemistry, types and function of RNA: mRNA, tRNA and rRNA and Non Genetic RNA.

UNIT - II : DNA replication: semi conservative method; experiment by Messelson and Stahl.

Concept of genes, one gene one enzyme hypothesis, one gene one Polypeptide theory.; A brief account of Concept and action of cistron, split genes, overlapping genes, jumping genes, Genetic diseases: Spinocerebellar ataxia.

UNIT–III : Genetic code and its features, Protein synthesis-transcription and processing of mRNA, translation-different steps, Gene regulation: (promoter and operator), Operon models, and Lac-operon model of E.Coli. Genetic regulation in Eukaryotes-Britten Davidson Model.

UNIT–IV : Mutation: Definition-mutation theory of DeVries-different types of mutations, - molecular basis of mutation:

substitution and frameshift mutations, chromosomal aberrations-structural(deletion, addition, inversion and translocation),numerical (euploidy and aneuploidy). Natural and induced mutations-significance of mutations.

DNA repair process.

Polymerase chain reaction (PCR). Southern, Northern and Western blotting techniques, DNA finger printing.

UNIT – V : Biotechnology:. Genetic Engineering: Recombinant DNA technology and gene cloning-enzymes in recombinant DNA technology, Splicing and cloning of genes, vectors (plasmid and phage vectors), gene Transfer. Somatic cell hybridization, hybridoma technology, and monoclonal antibodies. Practical applications and suspected hazards of biotechnology and genetic engineering in animals.

UNIT-VI : Immunology: Introduction to immune system: Innate and adaptive immunity, Types and production of immune cells ; Complement system.

Humoral Immunity: Antigen and haptens, Antibody: types function, and production.

Cell mediated immunity: T-cell receptors, T helper cell and lymphocyte activation

Role of cytotoxic T-cell..ELIZA Technique RIA.

Practicals:
1. Microtechnique scope and importance.
2. Preparation of fixatives - Alcohol, Acetone, Formalin, Bouinøs fluid, Cornoy fluid, Formal sublimate.
3. Collection of various tissues/organs from slaughter house for micro-technique
4. Preparation of Alcoholic grades, dehydration and clearing of tissues
5. Use and care of Oven
6. Embedding and block making, trimming of block.
7. Use and Care of different types of Microtome.
8. Honing and stropping Knives
9. Section cutting and spreading,

10. Preparation of various stains -Borax carmine Acetocarmin, Aceto-orcein, Haematoxyline, eosin.
11. Staining of the sections, (Double Staining), mounting.
12. Camera Lucida. Use and Drawings
13. Oculomicrometer scale/ similar micro-measurements use
14. Introduction to models of PCR, Southern blotting through available resources.
15. Vital Staining of mitochondria by using Janus, Green B stain.
16. Extraction of DNA by using salt, detergent and enzymes from natural sources from any animal tissue / plant material
17. Study of Operon models through available resources.
18. Application of DNA finger printing through available resources.

Distribution of marks for practical examination:

Time: 5 Hrs.   Marks

01 Microtechnique.
   a) Trimming and Section cutting of the Paraffin blocks   05
   b) Spreading of ribbons.   05
   c) Staining of the given slide   10
   c) Use of camera Lucida/ Ocular micrometer scales   05
02. Any one practical based on Sr.14 to 18 of the practical list   10
03. Permanent slides submitted by the examinee (5 Slides)   05
04. Class record duly signed by teacher
   incharge and certified By H.O.D.   05
05. Viva - voce   05

Total Marks 50

REFERENCES
1. Friefelder. D. Microbial Genetics; Narosa Publishing, New Delhi.
2. Goodenough, U. Genetics. Saunders Coolege Publishing International, New York.
3. Klug, W.S. and M.R.Cummings. Concepts in Genetics; Charles E.Merrill Publishing Co. London.
4. Kumar, H.D. Molecular biology and biotechnology. Vikas Publishing House, New Delhi.
5. Lewin, B.. Gene VI . Wiley Eastern Ltd., New Delhi.
6. Rothwell, N.V. Human Genetics. Prentice Hall of India, New Delhi.
7. Sinnott, E.W.L.C.Dunn, and L.C.Dobzhansky, T. 1985. Principles of Genetics. Tata McGraw Hill. New Delhi.
8. Stern, C. Principles of Human genetics. S.Chand & Co. New Delhi.
9. Verma, P.S. and V.K. Agarwal.. Genetics. S.Chand & Co. New Delhi.
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11. Chopra, V.L and A.Nasim,. Genetic Engineering and Biotechnology. Oxford & I BH, New Delhi.
12. Dharmarajan, M. Genetic Engineering S.viswanathan & Co.
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17. Kumar, H.D.. A text book on Biotechnology. East West Affiliated Press Ltd.
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19. Primrose, S.M. Modern Biotechnology. Blackwell Scientific Publishers, Oxford.
20. Trevan, M.D. Biotechnology: The Biological principles. Tata McGraw Hill Publishing Co., New Delhi.
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24. W.J. Stadelman, V.M. Olson, GA. Shemwell & S. Pasch S.
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26. Bremner (2002) Fish as Food, Vol 1 & 2, HA
27. Ivan Roitt: Essential Immunology (6th Ed.) Oxford, Backwill, Science publication London.
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B.Sc. Final year (Semester V)

11 : STATISTICS

The examination in Statistics of fifth semester will comprise of one theory paper each, internal assessment and practical examination.

Theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 4 hours duration and carry 50 marks.

The distribution of marks for practical will be as follows:
1. Practical Record   08 Marks
2. Practical Viva voce   12 Marks
3. Practical Problems   30 Marks

The following syllabi is prescribed on the basis of six lectures per week and six practical periods per batch per week. Each theory paper has been divided into six units. There shall be one question in every unit with internal choice (either or type) for each of 12 marks and one compulsory question covering entire syllabus of fifth semester of 8 marks.

5S-STATISTICS

Unit I   :   Statistical Quality Control

    1.1: Importance of statistical methods in industrial research and practice.

    1.2: Determination of tolerance limits.

    1.3: General theory of control charts, causes of variation in quality, control limits, summary of out of control criteria.

    1.4: Control charts for variables - X bar and R Chart.

    1.5: Control charts for attributes-np charts, p-chart and c-chart.

Unit II   :   Acceptance Sampling Plan

    2.1: Problem of lot acceptance, stipulation of good and bad lots, producer's risk and consumer's risk.

    2.2: Single sampling plans and their OC functions.

    2.3: Double sampling plans and their OC functions.

    2.4: Concept of AQL, LTPD, AOQL, average amount of inspection and ASN function.

Unit III :   Basic Econometrics

    3.1: Theory of consumer behaviour.

    3.2: Utility functions.

    3.3: Indifference curves.

        3.3.1 Cardinal approach

        3.3.2 Ordinal approach

    3.4: Partial elasticities of demand.

    3.5: Income distribution Pareto Curve

    3.6: Concept of Auto regressive models.

Unit IV :   Sample Surveys

    4.1: Sample surveys-Concept of population and sample, need for sampling, sampling unit and sampling frame.

    4.2: Principal steps in sample surveys, census survey, advantages of sample survey over census survey.

    4.3: Sampling and non sampling errors.

    4.4: Types of sampling and limitations of sampling.

    4.5: Simple random sampling, properties of SRS, methods of selecting a random sample, merits and limitations of SRS.

    4.6: Concept of srswor and srswr, theorems on sample mean, sample variance and sample mean square, comparison of srswor and srswr.

Unit V   :   Stratified Random Sampling

    5.1: Concept of stratified random sampling and its advantages.

    5.2: Mean and variance of stratified sample mean.

    5.3: Various allocations in stratified sampling and their corresponding sample sizes.

    5.4: Comparison of various allocations with SRSWOR.

Unit VI :   Systematic sampling and Cluster Sampling

    6.1: Concept of systematic sampling with examples.

    6.2: Mean and variance of systematic sample mean.

    6.3: Comparison of systematic sampling with srswor and stratified random sampling.

6.4: Comparison of systematic sampling with srswor and stratified random sampling for a population with linear trend.

6.5: Concept of cluster sampling.

6.6: Mean and variance of cluster sample mean with equal cluster size.

References:

1. Brownlee K.A.(1960): Statistical Theory and Methodology in Science and Engineering, John Wiley and Sons.
2. Grant E.L.(1964):Statistical Quality Control, Mc Graw Hill.
3. Duncan A.J.(1974): Statistical Quality Control and Industrial Statistics, Taraporewala and Sons.
4. Damodar Gujrathi : Basic Econometrics
5. J.M.Henderson & R.E.Quandt : Microeconomics.
6. A.A.Walter : An Introduction to Econometrics
7. Gupta S.C. and Kapoor V.K.: Fundamentals of Applied Statistics, Sultan Chand and Sons.
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11. Des Raj (2000): Sample Survey Theory, Narosa Publishing House.
12. Singh D. Chaudhary F.S.: Theory and Analysis of Sample Survey Designs.
13. Primal Mukhopadhyaya: Theory and Methods of Survey Sampling, Prentice Hall.
14. Sukhatme P.V. and Sukhatme B.V. : Sampling Theory of Surveys with Applications.

List of Practicals: (5S Statistics)
1. Construction of control charts for variables.
2. Construction of control charts for attributes.
3. Drawing of OC curve for single sampling plan.
4. Drawing of OC curve for double sampling plan.
5. Drawing a random samples by Random number method.
6. Estimation of population mean and variance using simple random sampling.

7. Estimation of population mean and variance using various allocations of stratified random sampling.
8. Estimation of population mean and variance using systematic sampling.
9. Estimation of mean and variance using cluster sampling.
10. Calculation of various elasticities of demand.
11. Utility functions.
12. Estimation of single equation linear regression model.

Note : The above practicals may be performed by using various statistical softwares.

List of equipments and instruments required for a batch of students in U.G. statistics laboratory.

1. Twelve digit desk model electronic calculators.	20
2. Biometrica tables Vol.I and Vol. II	02
3. Seven figure logarithmic tables	10
4. Statistical tables (compiled)	10
5. Personal computer with printer	05
6. Random number tables	10
7. Statistical poster and chart	02
8. Statistical softwares like SPSS, SAS, MS Excel and R	

B.Sc. Final year (Semester VI)
6S : STATISTICS

The examination in Statistics of sixth semester will comprise of one theory paper each, internal assessment and practical examination. Theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 4 hours duration and carry 50 marks.

The distribution of marks for practical will be as follows:
1. Practical Record   08 Marks
2. Practical Viva voce   12 Marks
3. Practical Problems   30 Marks

The following syllabi is prescribed on the basis of six lectures per week and six practical periods per batch per week. Each theory paper has been divided into six units. There shall be one question in every unit with internal choice (either or type) for each of 12 marks and one compulsory question covering entire syllabus of fifth semester of 8 marks.

6S-STATISTICS

Unit-I : Linear Programming

    1.1: Convex sets and their properties.

    1.2: Definition of general LPP, mathematical formulation of LPP with examples.

    1.3: Examples of LPP, problems occurring in various fields.

    1.4: Slack, surplus and artificial variables.

    1.5: Graphical and simplex method of solving LPP.

    1.6: Concept of duality of LPP with examples.

Unit-II : Transportation Problem (T.P.)

    2.1: Definition and example of a T.P., mathematical formulation of a T.P.

    2.2: Existence of feasible solution to a T.P., matrix form of a T.P., the transportation table, loops in a T.P.

    2.3: The initial basic feasible solution, transportation problems with non degenerate and balanced cases only.

    2.4: Methods to find initial basic feasible solution to a T.P.
        2.4.1: The North-West corner rule
        2.4.2: The Row Minima method
        2.4.3: The Column Minima method
        2.4.4: Matrix Minima method
        2.4.5: Vogel's Approximation method.

Unit III : Assignment Problem (A.P.) and Sequencing Problem and theory of games.

    3.1: Definition and example of a A.P., mathematical formulation of a A.P.

    3.2: Hungarian assignment algorithm.

    3.3: Sequencing problem with n jobs and 2 machines.

    3.4: Introduction to theory of games, two person zero sum games, the maximin - minimax principle.

    3.5: Definition of a saddle point, games with saddle points.

Unit-IV : Analysis of Variance (ANOVA)

    4.1 Introduction to ANOVA.

    4.2: One way classification and its analysis.

    4.3: Two way classification with one observation per cell.

    4.4: Two way classification with multiple but equal number of entries per cell.

Unit –V : Design of Experiments

    5.1: Introduction to design of experiments, need for design of experiments.

    5.2: Fundamental principles of design of experiments:
        5.2.1: Replication
        5.2.2: Randomisation
        5.2.3: Local Control

    5.3: Uniformity trials.

    5.4: Analysis of Completely Randomised Design (C.R.D.).

    5.5: Analysis of a Randomised Block Design (R.B.D.).

    5.6: Comparison of C.R.D. with R.B.D. in terms of efficiency.

Unit –VI: Latin Square Design (L.S.D.) and Factorial Experiments

    6.1: Concept and complete analysis of L.S.D.

    6.2: Efficiency of LSD as compared with CRD and RBD.

    6.3: Introduction of Factorial Experiments, it's purpose, need and advantage.

    6.4: Definition of contrast and orthogonal contrast .

    6.5: Analysis of 2^2 and 2^3 factorial experiments, computation of main effects and interaction effects, Yate's method (up to three factors).

References:
1. Gauss S.L. (1975): Linear Programming Methods and Applications, Mc Graw Hill.
2. Taha H.A.(1989): Operations Research: An Introduction, Macmillan Publishing Company.
3. Kantiswaroop, Manmohan, Gupta: Operations Research.
4. Goyal and Mittal: Operations research.

5. S.C.Gupta, V.K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand and sons.
6. Cochran W.G. and Cox G.M.(1957): Experimental Designs, John Wiley and Sons.
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9. Kempthorne O. (1965):The Design and Analysis f Experiments, Wiley Eastern.
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List of Practicals : (6S Statistics)
1. Solution of LPP by graphical method.
2. Solution of LPP by simplex method.
3. Computation of initial basic feasible solution to transportation problem by various methods.
4. Problems on assignment problem.
5. Problems on sequencing problem with n jobs with two machines.
6. Problems on two-person zero sum games with saddle points.
7. ANOVA: One way classification.
8. ANOVA: Two way classification with one observation per cell.
9. ANOVA: Two way classification with multiple but equal number of observations per cell.
10. Analysis of completely randomised design.
11. Analysis of randomised block design.
12. Analysis of Latin square design.
13. Analysis of 2^2 and 2^3 factorial experiments arranged in RBD.

Note : The above practicals may be performed by using various statistical softwares.

List of equipments and instruments required for a batch of students in U.G. statistics laboratory.
1. Twelve digit desk model electronic calculators.   20
2. Biometrica tables Vol.I and Vol. II   02
3. Seven figure logarithmic tables   10
4. Statistical tables (compiled)   10
5. Personal computer with printer   05
6. Random number tables   10

7. Statistical poster and chart   02
8. Statistical softwares like SPSS, SAS, MS Excel and R

12 : COMPUTER SCIENCE

5S-COMPUTER SCIENCE
RDBMS AND VISUAL BASIC

UNIT-I : **Fundamental of DBMS :** Architecture of a database system,, data independence, database models; Relational Hierarchical, network; data dictionary.

UNIT-II: **Relational Model :** Relations, Domains and Attributes keys, E-R diagrams, Reducing E-R diagrams to tables, function dependency, Normalization Process, Normal forms : 1NF, 2NF, 3NF, 4NF, BCNF.

UNIT-III : **Introduction to SQL :** Components of SQL, data types, operators, DDL Commands : CREATE, ALTER, DROP, for tables & views. DML Commands : SELECT, INSERT, DELETE & UPDATE; Clauses : ORDER BY, GROUP BY and HAVING;

UNIT-IV : **Introduction to Visual Basic :** Visual programming, event driven programming, VB Environment : New Project window, property window, Form layout window, toolbar, menu bar, tool box, form window;
Managing Control : Form properties, pointer tool, label control, text box, command button, picture box, image control, event procedure.

UNIT-V: **Creating Menus :** Application wizard for menu, menu editor, creating menu, adding code to menus, data types & variables.
Operators : Conditional operators, logical operators, control structures : If-else, Nested Ifô else, select case, goto, do loop, for loop, nested for loop.

UNIT-VI : **Introduction to Internal Functions :** Msgbox(), named constant, default buttons, specifying icons.

Input box(), title, caption; using check box and option button in form.

VB Programmes : Private and public procedure, passing data by reference and value, passing control as arguments.

Internal Functions : Numeric functions, data type functions, string functions, special functions.

Books Recommended :
1. An introduction to database system, C.J.Date - Narosa Publication.
2. Database Management System : Mujumdar and Bhattacharya-TMH.
3. Essential of Oracle - Tom Lewis.
4. Oracle the Complete Reference - Koch & Loney.
5. Visual Basic 6.0 in 21 days - Greg Perry, Techmedia.
6. VB Guide 6.0, Black Book, Peter Norton, Techmedia.
7. Mastering VB 6.0 , Evangelous Petroustos, BPB.

Practicals :
Group A - Minimum 8 Practicals based on RDBMS.
                              AND
Group B - Minimum 8 Practicals based on VB.

Study Tour : Study tour may be arranged to Computer Industry or Software development, Organisation or Software Technology Park or IT Park.

Software : Softwareøs legal version based on syllabus.

Hardware : (1) A minimum 10 (Ten) Computer system per batch and with latest specification.

(2) Minimum 2 laser printer.

(3) Internet facility with Broad Band connections.

B.SC. FINAL COMPUTER SCIENCE
SEMESTER-VI

6S-COMPUTER SCIENCE
PL/SQL AND ADVANCED VISUAL BASIC

UNIT-I : Data Integrity, types of integrity constants.

Functions : Number Functions - AVG, MAX, MIN, SUM, COUNT, TO-NUMBER, GREATEST, LEAST, ABS, MOD, FLOOR, CEIL, TRUNC, SQRT, SIGN, SIN, COS, LOG, EXP.

Character Function : INITCAP, LOWER, UPPER, INSTR,

LENGTH, LTRIM, RTRIM, LPAD, RPAD, SOUNDEX, DECODE.

Joins and Unions : Self, equi and outer join, unions and intersection.

UNIT-II: PL/SQL : Features and block structure, variables and constant, data types, control structure.

Cursor : Concepts of cursor, types, declaring, opening, using cursors, fetching data, closing a cursor, cursor attributes.

Transaction : Rollback, commit and autocommit, save point, rollback segment.

UNIT-III : Securities of Database : Users, creating users, roles, creating roles, types of previleges, GRANT and REVOKE command, data locks.

UNIT-IV : Dialog Box Control : Need for dialog box control, adding the dialog box control, producing the color dialog box control, handling the cancel button, producing the font dialog box, producing the open dialog boxes, producing file save dialog boxes, producing the print dialog boxes.

Mouse and Control : Mouse response, list box controls, combo box control, timer control, working with arrays, declaring arrays, multiple list boxes.

UNIT-V : Working with Forms : Form collections, accessing the form collection using the subscripts, the count property, uploading forms, placing text on forms, format with print, positioning the print method, multiple forms, placing tool bars on forms.

UNIT-VI : Working with Files : Open statement, file modes, locking the file, close statement, working with sequential access file, print# statement, input# statement, write# statement, working with random access file, put statement, get statement, defining user defined data types, file control, file related commands.

Books Recommended :
1. Database Management System, Mujumdar & Bhattacharya, TMH.

2. Oracle the Complete Reference, Koch & Loney, TMH.
3. Understanding Oracle, Perry and Latic, BPB.
4. Essential of Oracle 8, Tom Lewis.
5. Visual Basic 6.0, The Complete Reference, Noel Jerke, TMH.
6. Guide VB 6.0 Black Book, Peter Nortan Techmedia.
7. Mastering VB 6.0, Evangelos Petroutsos, BPB.
8. Visual Basic 6.0 in 21 days, Greg Perry, Techmedia.

Practicals :
Group A - Minimum 8 Practicals based on Unit-I, II, III.
                               AND
Group B - Minimum 8 Practicals based on Unit-IV, V, VI.

B.Sc. Final Year
13 : COMPUTER APPLICATION/ INFORMATION TECH-
NOLOGY
Semester –V
Paper : 5S: Programming in C#

UNIT-I : Introduction to C # : Evaluation of C#, characteristics of C#, application of C#, difference between C++ and C#, Introduction to C# environment : The .NET strategy, the origins of the .NET technology, the .NET framework, .NET, .NET languages, benefits of the .NET approach, C# and .NET.

UNIT-II : Overview of C#: Programming structure of C#, editing, compiling and executing C# programs, namespace, comments, using aliases for namespace classes, using command line argument, maths function.

Literals, variables and data types : literals, variables, data types, value types, reference type, declaration of variables, initialization of variables, default values, constant variables, scope of variables, boxing and unboxing.

UNIT-III: Operators and expression : arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, Bitwise operators, special operators, arithmetic expressions, evaluation of expression, precedence of arithmetic operators,

type conversions, operator precedence and associativity, mathematical functions.

Decision making and branching : if statement, if....else statement, nesting of if....else statement, the else if ladder, switch statement, the ?: operator, Decision making and looping : while statement, do statement, for statement, for each statement, jumps in loops.

UNIT-IV : Methods in C# : declaring methods, the main method, invoking methods, nesting of methods, methods parameters, pass by value, pass by reference, the output parameters, variable arguments list, method overloading, Arrays : 1-D array, creating an array, 2-D array, variable size arrays, the system, array class, array list class, String handling : creating strings, strings method, inserting strings using systems, comparing strings, finding substrings.

UNIT-V : Structures and enumeration: structures, structs with methods, nested structs, difference between classes and structs, enumerations, enumerator initialization, enumerator type conversion, common program errors, Classes and Objects : Basic principles of OOPø, class, objects, constructors, static members, static constructors, private constructors, copy constructors, destructors, member initialization, the this reference, nesting of classes, constant members, read only members, properties, indexers.

UNIT-VI : Interfaces : Multiple Inheritance : defining an interface, extending an interface, implementing interface, interface & inheritance, explicit interface implementation, abstract class and interface, Operator overloading : overloadable operators, need for operator overloading, defining Operator overloading, overloading unary operators, overloading binary operators, overloading comparision operator. Delegates and Events : Delegate, delegate seclaration, delegate methods, delegates instantiation, delegate invocation, using delegates, multicast delegates, events, Managing Console I/O operations : console class, console input, console output, formatted output, numeric formatting, standard numeric format, custom numeric format.

Text Books:-
1. Programming in C# : E. Balguruswamy
2. Mastering in C# : BPB Publication
3. Programming C# : TMH Publication
4. Programming C# : PHI Publication

Practical: Minimum 16 programs should be prepared on above syllabi.

13 : COMPUTER APPLICATION/ INFORMATION TECH-NOLOGY
Semester –VI
Paper:

6S: Computer Graphics, Multimedia and Animation

Unit-I : **Overview of Graphics Systems:** Refresh Cathode-Ray Tubes (CRT), Raster-Scan Display, Random-Scan Display, color CRT monitor, Flat-Panel Displays,3D viewing system, stereoscopic and virtual reality system, raster scan system, graphics monitor and workstations, Input Devices, keyboards, mouse, trackball and spaceball, joysticks, image Scanners, Touch panels, light pen, voice system

Unit-II : **Output Primitives:** Points and lines, line drawing algorithm, DDA algorithm, Bresenham's Line Algorithm, parallel line algorithm, loading the frame buffer, line function ,circle generating algorithm, Attributes: line Attributes ,line type, line width, pen and brush option, line color, curve Attributes, color and grayscale level, color tables, grayscale

Unit-III : Areas fill Attributes, character Attributes, basic transformation, matrix representation, composite transformation: translation, rotation and scaling

Unit-IV : **Introduction to Multimedia:** What is multimedia, multimedia and hypermedia, overview of multimedia, software tools: music, sequencing and notation, digital audio, graphics and image editing, video editing, Animation, multimedia authoring, file format: GGIF, JPEG, PNG, TIFF, EXIF, graphics, animation files, PS and PDF, Window WMF, Window BMP.

Unit-V : **Multimedia Compression:** IZW,DCT run length coding, JPEG MPEG, Hypertext, MHEG, Hypermedia, Document

architecture, SGML, ooa Augmented and virtual reality and multimedia: Concept, VR devices, VR chair, CCD, VCR, 3D Sound System, head mounted display.

Unit-VI : Animation: Introduction, History of Animation, Anatomy study, Basic Sketching, Introduction to 2D animation, Animation with flash ó Tweening, Motion tweening, Shape twining

Text Books:-
1. Computer graphics ó C Versionö, Hearn D and Baker M.P , 2nd Edition, Pearson Education
2. Multimedia Computing, Communications and Applications , Ralf Steinmetz, Klara steinmetz, Pearson education, 2004.
3. Multimedia in Practice: Technology and Application óJudith (PHI)
4. Fundamental of Multimedia by DREW-Pearson(Practical Approach)
5. Multimedia : Making it Work: T. Vaughan
6. Multimedia programming :Siamon J. Gibbs and Dionysios C. Tsichritzis, Addison Wesley, 1995.
7. Multimedia Graphics : John Villamil, Casanova and Leony Fernanadez, Eliar, PHI, 1998.

Practical: Minimum 16 programs should be prepared on above syllabi.

B.SC. FINAL, SEMESTER-V
14 : COMPUTER APPLICATION (VOCATIONAL)

5S- COMPUTER APPLICATION (VOCATIONAL)

JAVA and ASP Programming

UNIT-I : Object Oriented Programming Paradigm, Basic Concepts of OOPs, Benefits and applications of OOPs.

Introduction to JAVA : History, Benefits and Applications, features, Java environment, Java Byte codes, Java virtual machine, Security Platform independence and portability, Java Support System.

UNIT-II : Java character set, keywords, Identifies, constants, variables, operators and expressions, separators, Data types, Type conversion and casting.

Java Statements : Assignment statements, control statements, structure of Java program.

Methods of Java programming : Application (main) and applet methods, simple Java program.

UNIT-III: Classes, defining a class, adding variables and methods, creating objects, accessing class members, constructors, the ―this‖ keyword, Garbage collection. The finalize() method, method overloading, static members, inheritance, method overriding, abstract methods and classes.

UNIT-IV: **HTML :** Introduction, Components, editor, entering Tags and attributes, Document structure tags : HTML, HEAD, TITLE, BODY tags; Text Formatting : Headings, BLOCKQUOTE, PRE, CODE, FONT tags, LIST tags : Unordered & ordered list, Table formatting tags; TABLE, TR, TH, TD tags; Anchor tags, Image tag.

UNIT-V : **ASP :** Introduction, Dynamic web pages, necessity, scripting languages : Server-side and client-side scripting, data types, variables, constants, operators, decision making and looping structure, functions, GET, POST.

UNIT-VI: **Object :** Introductions : Object terms - Instances & classes, properties, methods, events, encapsulation; Request object, request object collections : Form, Query string, Server variables collection; properties and methods; Response Object : Introduction, creating and managing output / information, content expiration and caching, redirection.

Books Recommended :
1. The Complete Reference JAVA2 by Herbert Schildt (Tata McGraw)
2. The Complete Reference JAVA by Patrik Noughton
3. Programming with JAVA - A Primer : By E.Balguruswamy (Tata McGraw)
4. Beginning ASP 3.0 : Chris Ulman, David Buser, Jon Drukelt, Shroff Publisher & Distributors P.L.
5. ASP3 Programming : Eric A Smith - Wiley Publication.

Practicals :
1) Computer Lab : Minimum 16 practicals based on above syllabus.
2) Softwares legal versions based on syllabus.

B.SC. FINAL, SEMESTER-VI
COMPUTER APPLICATION (VOCATIONAL)
6S- COMPUTER APPLICATION (VOCATIONAL)

ADVANCED JAVA AND ASP

UNIT-I : **Array :** Declaration and initialization of one dimensional and multidimension arrays, strings, different operations on arrays.

Packages : Introduction, Java API packages, creating accessing & using a package, adding a class to a package.

UNIT-II: **Multithreading :** Introduction, creating threads & multiple threads.

Error and Exception Handling : Introduction, Fundamental of exception handling, types of errors, types of exceptions, uncaught exception, using try and catch, multiple catch clauses, nested try statement, built-in exceptions, creating your own exception.

UNIT-III : Applet Programming : Applet basics, difference between applets and applications, writing applets, applet code, applet life cycle, creating an executable applet, and applet tag, running the applets.

UNIT-IV : **Cookies :** Introduction, creating, modifying and deleting, Applications Objects : Object Collection, object methods.

Session Object : Collection, properties and method.

UNIT-V : **Global.asa file :** Creating application event code and session event code, declaring object.

Error Handling : Types of error - Syntax error, logical error, ASP error, Debugging ASP script, using write and conditional tracing.

UNIT-VI : **ASP Components :** Server object, AD Rotator component, content linking component.

Introduction to Oledb and Odbc : Connection object and record set and field object command and parameter object.

Books Recommended :
1. Programming in JAVA : By S.S.Khandare (S.Chand)
2. Teach Yourself ¬Javaøin 2 Hrs : By Sams.
3. Java for You : By P. Koparkar
4. OOP with C^{++} by E.Balguruswamy.
5. Mastering HTML 4.0 - D.S.Ray, E.J.Ray, BPB.
6. Active Server Pages 3.0, N.Chare (Que)

Practical : Minimum 8 practical based on above syllabus.

Project : The student have to carry out a mini project work, with group of maximum 03 students at department and project report should be prepared of the same.

B.Sc. Final Year, Semester-V
15. ELECTRONICS

General Provisions/Instructions

Part A
(i) The Examination in Electronics of each semester shall comprise of one theory paper of 80 marks of three hours duration and internal assessment of 20 marks.
(ii) Theory paper of each semester shall comprise of six units. Each unit shall be completed in maximum 15 teaching periods of 48 minutes duration.
(iii) There shall six questions of twelve marks on each unit with alternate choice and One compulsory question (08 subquestions of 01 mark each) of 08 marks covering syllabi of all units (short answer type).

Part B
(i) The Practical examination of each semester of the B. Sc. (Electronics subject) shall be of 50 marks of 4 hours duration and shall be held at the end of each semester at the places as decided by the university.
(ii) Distribution of 50 marks assigned to practical for (Semester I to V) is as under-
    1. Experiment   : 30 Marks
       (Construction, testing and performance)
    2. Practical record   : 10 Marks
    3. Viva-voce   : 10 Marks
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                                        Total : 50 Marks
(iii) Distribution of 50 marks assigned to practical for semester VI is as under-

1. Programming (Writing and execution)   : 10 Marks
2. Project (Experimental)   : 10 Marks
3. Project Report and Seminar   : 10 Marks
4. Record   : 10 Marks
5. Viva-voce   : 10 Marks
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                                    Total : 50 Marks

(iv) Project will be given to a group of not more than four students.
(v) Teacher may adopt any innovative practice for demonstration of practicals on the aspects given.
(vi) College/ Department may prepare laboratory manuals of experiments

Semester-V
5S-Electronics
Measuring Instruments

Unit I   :   Basic Instrumentation:

Block diagram of generalized instrumentation system, Concept of transducers (Primary and secondary, active and passive, analog and digital). Resistive transducer - potentiometer, Inductive transducer - LVDT, capacitive transducer (by changing distance), measurement of displacement using capacitive transducer (By changing dielectric).

UNIT II :   Measurement of Temperature:

Thermocouple,Thermopile, Thermister, RTD, Total Radiation Pyrometer, IC DS 1621 ,IC LM34 , IC LM35 , Infrared Pyrometer,

UNIT III: Timer and PLL:

IC 555 timer: Block diagram and function of each block, application of 555 timer as astable, bistable and monostable multivibrator (construction, working and expression for time period).

PLL Block diagram and function of each block, concept of capture range, pull in time, lock in range, electrical

characteristics, applications of PLL as FM demodulator, AM detector and frequency synthesizer.

UNIT IV: Display, digital Instrument and ecorder:

Seven segment, 14 segment, dot matrix, 16x2 LCD display, advantage and disadvantage, Digital instrument: Digital frequency meter, Digital voltmeter (Ramp type), Digital capacitance meter (Block diagram and function of each block) .

Recorder: Classification, necessity of recorder, XY recorder, magnetic tape recorder.

Unit V : Sensors and Actuators:

Sensors: Definition, Methods of fabrication of Sensors, Types of sensors (Mechanical, Thermal, Optical, magnetic, chemical)

Actuators: Definition, Working principles of Electromechanical, Electro thermal, Electro-optical and Electrochemical Actuators.

UNIT VI: Biomedical electronics:

Introduction, Type of electrode, EEG, EMG, ECG-block diagram and function of each block, X ray machine, instantaneous heart rate meter-systolic and diastolic blood pressure meter, EAR oximeter, pulse Oximeter, range gated pulse Doppler blood flow meter, Laser Doppler blood flow meter.

Books Recommended:
1. Electrical and electronics measurement and Instrumentation by A.K. Sawhney
2. Linear integrated Circuits by Ramakant Gaikwad
3. Biomedical instrumentation by R.S.Khandpur

Practicals: Minimum Ten   experiments at least one on each of the following aspects.
1. LVDT , displacement measurement using C transducer , pot meter.
2. Temp measurement using thermister,RTD, LM34 ,LM35 .
3. Astable , monostable , bistable using IC555 .
4. FM demodulator ,AM detector using PLL .

5. 16 x 2 LCD display , seven segment display and other display devices .
6. Sensors and actuators and its applications .
7. ECG , EMG, EEG , heart rate meter ,oximeter etc .

Semester VI
6S-Electronics
Advance Microprocessor and Microcontroller

UNIT I : 8086 Architecture:

Block diagram of 8086 microprocessor, BIU and EU, operating modes of 8086, register of 8086-G.P.R,pointer and index register, segment register, concept of segmented memory, instruction pointer, status flag, pin diagram of 8086 microprocessor, physical and effective address.

UNIT II: Instructions and programming of 8086

Instructions: MOV, PUSH, POP, LEA, LDS, LES, Arithmetic & Logic Instructions. Addressing mode, 8086 instruction, Bus cycle, Programming: programs of data transfer, addition, subtraction, division, multiplication using various addressing mode.

Unit-III : 8051 Microcontroller Architecture :

Microcontroller Introduction, Difference between Microprocessor and Microcontroller, block diagram of microcontroller, CPU, registers, flags, PSW, PC, Data Pointer, SFR, SP, Internal RAM/ROM, External memory, I/O ports, counter & timers, interrupts.

Unit-IV: Instruction set of 8051 and Programming:

Addressing mode, Instruction set: Data transfer, arithmetic, logical operation, JUMP, Loop and CALL instructions. Assembly language programming examples: simple data transfer, arithmetic, logical and single bit.

Unit-V : 8051 Interfacing & Application

Basics of serial communication, interfacing with RS-232C, SCON and PCON registers, interfacing a DAC / ADC and

waveform generation, interfacing to the 8255, interfacing LED, power reduction mode.

Unit-VI : Advance microcontroller:

Introduction to AVR, Arithmetic and logic Unit, program and data memories, downloadable flash program memory, SRAM data memory, general purpose register file, I/O register, EEPROM data memory, peripherals, Timers/Counters.

Books Recommended:

1) Microprocessor Architecture and application by Dougulus Hall.
2) Intel Microproceesor 8086 by Brey: PHI
3) The 8051 Microcontroller architecture, Programming & Applications- Kenneth J.Ayala (Penram international)
4) The 8051 Microcontroller and Embedded Systems.- M. A. Mazadi, J. C. Mazadi (Pearson Education, Asia)
5) Microprocessor, microcontroller & applications- U. S. Shah (Tech-Max Publication Pune).
6) Programming and Customizing the 8051 Microcontroller- Mike Predko (TMH, New Delhi).

Practicals: Minimum Ten programmes at least five on each of the following aspects.
1. Programming on 8086(using kit/PC)
2. Programming on 8051 and/or C language.
                    AND
Minor project based on µP 8085, 8086, µC 8051, AVR, ARM, Communication, sensors, power amplifier, code converters, Biomedical Electronics, Digital Electronics or any advance topic of Electronics (Construction and Report).

16 : BIOCHEMISTRY
Semester - V

The examination in Biochemistry will comprise of one theory paper and one practical. Theory paper shall be of three hours duration and shall carry 80 marks each. The internal assessment will carry 20 marks. The practical examination shall be of six to eight hours duration for one day and shall carry 50 marks.

The following syllabus is prescribed on the basis of 6 lectures per paper per week and six practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks, one compulsory objective type question on whole syllabus of Semester-V carrying 8 marks.

Distribution of marks in practical shall be as follows:
1) Two short experiments   - 20 marks (10 each)
2) One long experiment   - 15 marks
3) Viva-voce   - 08 marks
4) Class work and practical record - 07 marks
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Total   -   50 marks
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5S BIOCHEMISTRY
MOLECULAR BIOLOGY AND BIOTECHNOLOGY

UNIT-I : A) Basic Concepts of Genetic Information

a. Nucleic acids as genetic information carriers, experimental evidence e.g. bacterial genetic transformation, Hershey-Chase Experiment,

b. Central dogma of molecular genetics - current version, reverse transcription and retroviruses.

c. Salient features of eukaryotic, prokaryotic and viral genomes; highly repetitive, moderately repetitive and unique DNA sequences.

d. Basic concepts about the secondary structures of nucleic acids, $5'$ ô $> 3'$ direction antiparallel strands, base composition, base equivalence, base pairing and base stacking in DNA molecule. Tm and buoyant density and their relationship with G-C content in DNA.

e. Waston and Crick model, A, B and Z types of DNA, major and minor grooves, chirality of DNA.

f. Structures and properties of RNA: Classes of RNA.

UNIT-II : DNA Replication

DNA Replication in prokaryotes-conservative, semiconservative and dispersive types, experimental evidence for semiconservative replication. DNA polymerases, other enzymes and protein factors involved in replication. Mechanism of replication. Inhibitors of DNA replication.

Transcription

Transcription in prokaryotes, RNA polymerase, promoters, initiation, elongation and termination of RNA synthesis, inhibitors of transcription, Reverse transcriptase, post-transcriptional processing of RNA in eukaryotes.

UNIT-III : Translation and Regulation of Gene Expression

a. Genetic code : Basic features of genetic code, biological significance of degeneracy. Wobble hypothesis, gene within genes and overlapping genes.

b. Mechanisms of translation : Ribosome structure, A and P sites, charges tRNA, f-met-rRNA, initiator codon, Shine-Dalgarno consensus sequence(AGGA), formation of 70S initiation complex, role of EF-Tu, EF-Ts, EF-G and GTP, non-sense codons and release factors, RF-1 and RF-2.

c. Regulation of Gene Expression in prokaryotes : Enzyme induction and repression, operon concept, Lac operon, Trp operon.

UNIT-IV : Basic Concepts of recombinant DNA technology & Nucleic Acid Sequencing.

a. r DNA technology, vectors.

b. Nucleic acid hybridization.

c. Sequencing : Restriction and modification system; sequencing of DNA and RNA.

UNIT-V : Basic Animal Biotechnology

a. History of Development of Cell cultures. Importance of growth factors of the serum, primary cultures, secondary cultures. Transformed animal cells ó

established continuous cell lines, commonly used animal cell lines their origin and characteristics. Growth kinetics of cell in culture.

b. Applications of animal cell cultures for studies on gene expression. Organ culture.

UNIT-VI : Basic Plant Biotechnology

a. Tissue cultures, introduction and history. Media preparation and compositions. Totipotency and cell suspension culture. Use of growth regulators. Practical applications of tissue culture.

b. In-vitro techniques in tissue culture. Induction of callus, ovary and ovule cultures, invitro pollination and fertilization. Practical applications of genetic transformation in plants.

Practicals :-
A) Molecular Biology :
1) Extraction of RNA
2) Estimation of RNA by Orcinol method.
3) Extraction of DNA
4) Estimation of DNA by Diphenyl method.

B) Biotechnology :
1) Immobilization of yeast cells.
2) Production of alcohol by utilizing immobilized yeast cells.
3) Estimation of alcohol by Iodometric method.
4) Development of plant tissue callus.

List of Books Recommended :
1) Molecular Biology of Gene (Latest Edition) by J.D.Watson Hopkins Robertis, Stertz, Weiner.
2) Genetics by Sandhya Mitra (TMH Publication)
3) Gene VII by Lewis (Oxford)
4) Gene Structure and Expression by John D. Hawkins (Cambridge)
5) Plant Biotechnology S.Ignacimuthu S.J. (Oxford & IBH)
6) Gene Structure by Hawkins (Cambridge.)
7) Biotechnology ó Application & Research edited by Paul Chere misinoff and Robert Ouellete (Technomic Publications)
8) An Introduction to Plant Tissue and Cell Culture Emkay Publication.

9) Essentials of Molecular Biology : D.Freifelder
10) Plant Cell, tissue and organ culture (ed) J.Reinert & YSP Bajaj.

6S BIOCHEMISTRY
IMMUNOLOGY AND CLINICAL BIOCHEMISTRY

The examination in Biochemistry will comprise of one theory paper and one practical. Theory paper shall be of three hours duration and shall carry 80 marks each. The internal assessment will carry 20 marks. The practical examination shall be of six to eight hours duration for one day and shall carry 50 marks.

The following syllabus is prescribed on the basis of 6 lectures per paper per week and six practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks, one compulsory objective type question on whole syllabus of Semester-VI carrying 8 marks.

Distribution of marks in practical shall be as follows:
1) Two short experiments   - 20 marks (10 each)
2) One long experiment   - 15 marks
3) Viva-voce   - 08 marks
4) Class work and practical record - 07 marks
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Total   - 50 marks
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UNIT-I : A) Immunology: Concept of immunity classification, humoral and cellular immunity.

B) Antigen: Definition, factors determining antigenicity, complete antigen, types of antigens.

C) Antibodies: Definition, structure, classification, properties and differences.

UNIT-II : Antigen - Antibody reaction: Definition, mechanism and application of precipitation, agglutination, complement fixation and toxin - antitoxin reaction,ELISA,RIA.

UNIT-III: A) Monoclonal Antibodies: Hybridoma technology.

B) Complement: Components, Classical Pathway, Alternative Pathway.

C) Allergy and hypersensitivity: Cell and coombs classification, definition and description of I- IV types of hypersensitivity.

UNIT-IV : Clinical Biochemistry:

A) Basic concepts of clinical biochemistry. Definition and scope of clinical biochemistry in diagnosis. Brief review of units and abbreviations used expressing concentration and standard solution. Quality Control.

B) Manual versus automation in clinical laboratory, Analyzer-Semi and auto analyser.

UNIT-V : A) Collection and preservation of biological fluids (Blood, serum, plasma, urine and CSF).

B) Chemical analysis of blood, urine and CSF. Normal values for important constituents (in SI units) in blood (Plasma/serum) CSF and urine

C) Clearance test for urea and Cretinine.

UNIT-VI : Clinical Enzymology:

A) Definition of functional and non-functional plasma enzymes, isozymes and diagnostic applications of isozymes. Enzyme pattern in health and diseases with special reference to plasma lipase, amylase, choline esterase, alkaline and acid phosphatase, SGOT and SGPT, LDH and CPK.

B) Hypo and Hyper glycemia, glycogen storage diseases, lipid malabsorption and statorrhea, albinism.

Practicals :-
A) Clinical Biochemistry :
1) Glucose tolerance test
2) Liver function tests (SGPT/SGOT/Alkaline Phosphtase/Serum bilirubin)
3) Cardiac function tests (Serum Cholesterol, CPK, Triglycerides, LDL-Cholesterol, HDL-Cholesterol, LDH)
4) Kidney function tests (Blood urea, Serum creatinine, Serum Na^+, K^+)

B) Immunology :
1) Blood Grouping
2) HBsAg (Hepatitis/B/C)
3) Pregnancy test

List of Books Recommended :
1) Immunology by Roitt (Blackwell)
2) Cell and Molecular Biology : Darnell Lodish Baltimore.
3) Animal Cell Culture : Practical approach : R.J.Freshney.
4) Introduction to Practical Biochemistry by Plummer
5) Practical Manual in Biochemistry by Jairaman.
6) Text Book of Biochemistry and Human Physiology by J.P.Talwar.
7) Lehninger's Principles of Biochemistry (2000) by - Nelson, Cox, M.M.Macmillan, New York.
8) Text Book of Biochemistry by U.Satyanarayana.
9) Text Book of Biochemistry by Sucheeta Dandekar.
10) Practical Clinical Biochemistry by Hirowled Varle.

List of Instruments/Equipments/Glass-ware with specification required for B.Sc. Ist year Second yr. and Final (Biochemistry)Lab.

Instruments/Equipments:

Sr. No.	Name Required	Make	Specification	Quantity
1.	Photoelectric Colorimeter	Erma Japan J.Mitra Elico, Specol Systronic, Aimil Instrumentation or any one filters.	Single cell with either glass or quartz cuvettes vissible range with Coloured	1
2.	pH. Meter	Elico, Systronic J.Mitra	with glass electrode pH Scale from 0 to 14 Resistant to temp. change.	1

3.	Table centrifuge	"Remi Model R-8C" Tempo.	with replaceable Swing out rotor heads. One to hold 8-16 tuber of 15 ml capacity Another head to hold 4 tuber of 50-100 capacity.	1
4.	Incubator	Tempo. Lab.Hosp. Yarco.	Double walled insulated with double Foors. (Inner glass door) Tempo.upto 600C with thermostat. Sensitivity +0.50C Size: 455x605x455 mm.	1
5.	Hot-air Ovan	Yarco Tempo. Lab. Hosp.	Double walled Thermostal tempreture regulator. Size: 455x605x455mm.	
6.	Refrigerator	"Voltas" "Goderj" Allwyn Kelvinator or any make.	Double door with 300 Lit. capacity. having separate freezer.	1
7.	Serological water Bath	"Tempo" " Lab. Hosp" Yarco or any make.	Double walled Thermoregulated. Mix. temp.upto 800 C Size: 12x15x12 with cover.	1
8.	Magnetic Stirrer with Hot	"Tempo" "Remi" Lab Hosp. or any make	2 Lit. Capacity with 500 Wt. temp. regulated or any hot plate.	1
9.	Metal Water Distillation plant	"Remi" "Tempo" Lab.Hosp.	2 Lits/Hr capacity with metal condensor.	1

10.	Thin Layer Chromatography Assembly	--- --- ---	Chamberor of Glass Tank Spreader Glass Plates Stage for glass Plates.	1
11.	Hot Plate	"Tempo" "Remi" "Lab. Hosp." or any make.	Round 7 Diameter with 3 way control switch. 1000 watts.	2
12.	Mixer	"Remi" "Sumit" any make.	with 3 jars and timer.	1
13.	Single Pan Balance (Tripple beam)	National Scientific Work VARANASI	100gm. capacity	2
14.	One Pan Electric Balance	Umex Instraments works. VARANASI	100 gm. Capacity. Accury upto 4th decimal of gm.	1
15.	Cyclo-Mixer	"Vortex" "Remi"	For one test tube only	1
16.	Laboratory Microscope	"Olympus" or any make. scope with	Monacular Medicial micro- Sliding stage.	4
17.	Fingure pricking nedle.	"Auto Let" Japan	with Disposable Needler.	2
18.	Haemometer Sahil's	GDR make or Top.	with Comparator Glass, Tube and Hb pippet	2
19.	Neubauer's Counting Chamber.	---	with Bright rullings.	4
20.	RBC Pipettes	GDR or England mak or any make.	---	25 Nags.

21.	WBC Pipittes	-do-	---	25 Nags.
22.	lab. Cell Counter	any make	---	5 Nags.

GLASS-WARE:-

1	Test Tubes	Borosil/Corning/Vensil	20ml capacity	1000 Nos.
2.	Centrifuge	Borosil/Corning/Venisl	15ml capacity	100 Nos.
3.	Folin-Wu Tubes	Corning/ Borosil/ Vensil	25ml capacity with bulb.	50 Nos.
4.	Nesseler's Tubes	Corning/ Borosil/ Vensil	25 ml capacity with 12.5 ml mark.	50 Nos.
5.	Boiling Tubes (Hard glass)	Corning/ Borosil/ Vensil	50ml capacity	60 Nos.
6.	K.T. Tubes	Borosil/ Corning/ Vensil	5 ml capacity	20 Nos.
7.	Burettes	Emkay or any make	50 ml capacity with stop cock	20 Nos.
8.	Microburettes	Borosil/Emkay	10 ml	10 Nos.
9.	Pipettes	Corning/ Borosil/ Vensil	10 ml capacity with graducation	20 Nos.
			5 ml capacity with graduation zero at tip	20 Nos.
			1 ml capacity (graduated)	20 Nos.
			0.2 ml capacity (graduated)	20 Nos.
			0.1 ml capacity with graduation zero at tip.	20 Nos.

10.	Measuring Cylinders	Corning/ Borosil/ Vensil	1000 ml graduated	1 No.
			500 ml graduated	1 No.
			100 ml graduation	5 Nos.
			50 ml capacity with graduation	5 Nos.
			10 ml capacity graduation	3 Nos.
11.	Standard Volumetric Flasks	Corning/ Borosil/ Vensil	1 Lit. capacity	3 Nos.
			500 ml capacity	5 Nos.
			250 ml capacity	12 Nos.
			100 ml capacity	20 Nos.
12	Beakers	Corning/ Borosil/ Vensil	1 Lit. capacity	5 Nos.
			500 ml capacity	30 Nos.
			250 ml capacity	30 Nos.
			100 ml capacity	50 Nos.
13.	Conical Flasks	Corning Borosil Vensil	500 ml capacity	30 Nos.
			250 ml capacity	30 Nos.
			100 ml capacity	30 Nos.
			50 ml capacity	30 Nos.
14.	Reagent	Emkay	2 Lit. capacity	5 Nos.
			1 Lit. capacity	5 Nos.
			500 ml capacity	100 Nos.
			250 ml capacity	100 Nos.
15.	Dropping Bottle.	Emkay	100 ml capacity	10 Nos.
16.	Flat Bottom Round Flask	Emkay	500 ml capacity	20 Nos.
17.	Funneis	Emkay	2.5" diameter	20 Nos.
			3" diameter	20 Nos.
			6" diameter	3 Nos.
18.	Glass Tubings		1/2 mm.	1 kg.
19.	Glass Rods		1/2 mm.	1 kg.

MISCELLENIOUS:-

1.	Propipettes	Any make	Able to hold any pipettes from 0.1 ml to 10 ml capacity Rubber or Plastic.	5 Nos.
2.	Test tube Stands	Tarson	To hod 12 Tubes	20 Nos.
3.	Burette stands	--- ---	Metal rod and base with tarson clamp.	20 Nos.
4.	Rubber Crock		To fit in concial flasks of all capacity.	20 each
5.	Procelain Giazed tiles		6x6"	20 Nos.
6.	Mortor and Pestal	---	6" diameter	1 Nos.

B.SC. FINAL (SEMESTER-V)
17 : MICROBIOLOGY

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper have been devided into 6 units. There shall be one question on each unit, will internal choice and for each of 12 marks and one compulsory question covering all the syllabus of semester V(8 marks).

5S MICROBIOLOGY
(Environmental Microbiology and Bioinstrumentation)

Unit-I : Microbial Associations and Air Microbiology

   A.   Microbial Associations : Definition and examples of positive(Mutualism, Commensalism, Synergism), negative (Antagonism,Competition, Parasitism) and neutral association.

B. Air Microbiology

a) The atmosphere and its layers.

b) Different types of microorganisms in air.

c) Techniques for microbiological analysis of air:
   i) Solid impingement devices
   ii) Liquid impingement devices.

d) Airborne diseases : Etiology, symptoms and prevention.

e) Control of microorganisms in air.

Unit-II : Microbiology of Soil.

a) Microorganisms in soil.

b) Rhizosphere.

c) Decomposition of plant and animal residues in soil.

d) Definition, formation, function and microbiology of humus and compost.

e) Biological Nitrogen fixation : Type of nitrogen fixing microorganisms, factors affecting and mechanism of symbiotic and non-symbiotic nitrogen fixation. Process of nodulation, nitrogenase complex, recombinant DNA and nitrogen fixation, legume inoculants.

f) Cycles of elements in nature :
   i) Carbon cycle : CO_2 fixation, organic carbon degradation.
   ii) Nitrogen cycle : Proteolysis, amino acid degradation, Nitrification, Denitrification, Degradation of nucleic acids.
   iii) Sulphur cycle
   Iv) Phosphorus cycle.
   v) Biofertilizers, biological pest control.

Unit III : Water Microbiology

a) Planktons : Definition, types, factors affecting growth of planktons, methods of enumeration, beneficial and harmful activities of planktons.

b) Control of plankton problems

c) Eutrophication and its control.

Unit IV : Assessment of Water Quality and Treatment

Bacteriological analysis of water:

i) Significance of bacteriological analysis of water.

ii) Collection and handling of water sample from various sources.

iii) Indicators of excretal pollution.

iv) Multiple tube dilution technique, MPN.

v) IMViC classification of coliform.

vi) Membrane filter technique for coliform and faecal Streptococci.

vii) ICMR and WHO Bacteriological standards of drinking water.

Unit V : A) Water Treatment

a) Self purification of water : Various zones and factors responsible for self purification.

b) Treatment of water : Aeration, Coagulation, Flocculation, Sedimentation and Filtration.

c) Slow and Rapid sand filters : Construction, mechanism of filtration, differences.

d) Methods of chlorination : Plain, super chlorination, ammoniachlorine treatment, Break-point chlorination

B) Waste Water Treatment

a) Aims of sewage treatment, composition of sewage.

b) Muncipal sewage treatment plant.

c) Preliminary treatment (seiving and Grit chamber)

d) Primary treatment(sedimentation)

e) Secondary treatment (Aerobic)
   i) Trickling filter
   ii) Activated sludge process
   iii) Oxidation pond

f) Anaerobic sludge digestion

g)   Domestic sewage treatment by septic tank and Imhoff tank.

h)   Concept of COD,BOD.

i)   Outline of bio-gas production

Unit VI :   Bio-Instrumentation

a)   Spectroscopy- Definition, Principle, types (UV&IR) & its applications.

b)   Electrophoresis- Definition, Principle, types (Paper&Gel) & its applications.

c)   Chromatography- Definition, Principle, types (Paper&TLC) & its applications.

d)   I sotopic Tracer Techniques - Definition, Principle & applications.

Microbiology Practicals.

1.   Bacteriological analysis of water and Waste Water.

a)   Standard plate Count.

b)   Multiple tube dilution technique (MPN for Coliform)

i)   Presumptive test ii) Confirmatory test

iii)   Completed test.

c)   IMViC test for coliform

d)   Multiple tube dilution technique for faecal strepto cocci.

e)   Membrane filter technique for coliforms & faecal streptococci.

f)   BOD estimation.

g)   Isolation of Bacteriophage from Sewage.

h)   Determination of Chlorine demand and residual chlorine.

2.   Study of Soil Microbiology

a)   Enumeration of Soil microorganisms.

b)   Isolation of Azotobacter from Soil.

c)   Isolation of Rhizobium from Soil

d)   Isolation of Antibiotic producers from soil

3.   Effect of Ultra-violet/Filtration on micro-organism present in   water

4.   Separation of amino acids and sugars by paper chromatography.

Distribution of marks for Microbiology practical Examination:

1.   Major Experiment   - 15 marks

2.   Minor Experiment   - 10 Marks

3.   Viva Voce   - 10 marks

4.   Spotting   - 10 marks

5.   Laboratory Journals   - 05 Marks

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Total   - 50 marks

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List of Reference Books for 5S Microbiology:

1.   Introduction to Soil Microbiology : Alexander Martin

2.   Soil Microbiology : Subbaroa N.S.

3.   Introduction to environmental Microbiology: Mitchell, Ralph

4.   Sewage & Waste treatment : Hammer

5.   Water Pollution : Zajic J.E.

6.   Water Pollution Microbiology : Mitchell R.

7.   Air Pollution : Perlins H.L.

8.   Aquatic Microbiology : Stainner & Shewan

9.   Introduction to Waste Water Treatment processes: Ramalhr R.S.

B.SC. FINAL (SEMESTER-VI)
6 S. MICROBIOLOGY

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper have been devided into 6 units. There shall be one question on each unit, will internal choice and for each of 12 marks and one compulsory question covering all the syllabus of semester VI(8 marks).

(Industrial Fermentation, Food Microbiology and Metabolism)

Unit- I : Fermentation in General.

a) Definition and scope of Industrial microbiology and biotechnology.

b) Important classes of industrial microorganisms.

c) Fermentation :- Definition and types (batch and continuous, aerobic and anaerobic, surface and submerged fermentations)

d) Production strains

e) Screening :- Definition, Primary screening (crowded plate technique, auxonography, enrichment culture technique, use of indicator dyes), secondary screening.

f) Scale up process :- Definition and significance.

g) Inoculum buildup : Spore and vegetative inoculum.

h) General layout of fermentation plant :- Fermentation equipment and its uses.

i) Raw materials :- Composition and uses. Saccharine, starchy, cellulose raw materials, hydrocarbon and vegetable oils, nitrogenous material (corn steep liquor).

j) Antifoam agents.

k) Sterilization of media :- Batch and continous sterilization.

l) Detection and assay of fermentation products.

Unit- II : Industrial Productions I:

Microorganisms, raw material, inoculums buildup, fermentation conditions, recovery, uses and mechanism of the following products.

a) Ethyl-alcohol : From molasses and waste sulphite liquor.

b) Beer.

c) Wine (Red table and White table).

d) Acetone- Butanol from corn.

e) Citric acid

f) Vinegar- Frings process

Unit- III : Industrial Productions II:

a) Bakers yeast : From molasses, Definition of compressed and active dry yeast.

b) Single cell protein : From bacteria.

c) Penicillin.

d) Amylase : Bacterial and fungal.

e) Vitamin B12.

Unit-IV : Microbiology of Milk

a) Definition

b) Composition and types of milk.

c) Sources of microorganisms in Milk.

d) Types of microorganisms in milk.

e) Pasteurization of milk : LHT, HTST, UHT. Phosphatase test.

f) Grades of milk.

g) Concentrated milk and milk powder.

h) Preparation of fermented milk products, butter and cheese.

Unit-V : Food Microbiology

a) Sources of contamination of fresh food.

b) Microbial spoilage of foods.

c) Preservation of foods :- Low and high temperature, dehydration, high osmotic pressure, chemical preservation, radiations and canning.

d) Fermented foods : Idli, pickles and sauerkraut.

e) Food poisoning : Food infection and food intoxication.

f) Indicators of food contamination as per WHO.

Unit VI :   Enzymology and Metabolism

A Enzymology :

a) Nature and Definition.

b) Classification and nomenclature of enzymes.

c) Terminologies used in enzymology :- Enzyme, active site, substrate, co-enyme, cofactors, prosthetic group, poloenzyme, apoenzyme, activation energy, isoenzyme, allosteric enzyme, inhibitors, immobilised enzymes.

B Metabolism :

a) General strategies of metabolism.

b) EMP pathway, TCA cycle.

c) Oxidative phosphorylation and Electron transport chain.

Microbiology Practicals:

1. A) Microbiological Examination of milk:

a) Plate count

b) Methylene blue reduction test (MBRT)

c) Phosphatses test

d) Test for coliform bacteria

e) Estimation of fats in milk

f) Milk testing for Adulteration

B) Demonstration of microbes in Curd.

2. A) Laboratory scale production, recovery and quantitative estimation of following products:

a) Ethyl alcohol. b) Citric Acid c) Amylase

B) Immobilisation of Yeast.

C) Production of Curd/ Pickle/ Cheese by microorganisms

D) Production of wine from grapes/ other raw material

4. Microbiological Examination of Vegetables, fruits and Fast Foods by

a) Plate Count

b) Test for Coliform bacteria.

c) Yeast & Molds.

Distribution of marks for Microbiology Practical Examination:

1. Major Experiment - 15 marks
2. Minor Experiment - 10 Marks
3. Viva Voce - 10 marks
4. Spotting - 10 marks
5. Laboratory Journals - 05 Marks

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Total - 50 marks

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List of Reference Books for 6S Microbiology:

1. Food Microbiology : Fazier W.C. & Westhoff D.C.
2. Fermented Foods (Vol.7) : Rose A.A.
3. Industrial Microbiology : Prescott S.C. & Dunn C.G.
4. Industrial Microbiology : Miller B.M. & W. Litsky
5. Industrial Microbiology : A.H. Patel
6. Microbial Technology : Pepller H.J. (Vol. I & II)
7. Industrial Microbiology : Casida L.E.
8. Principles of Fermentation : Stanbury, Peter F. & Technology Allan. Whitaker
9. Outlines of Diary Bacteriology : Sukumar De
10. Modern Food Microbiology : Jay, Mames M.
11. Principles of Industrial : Rhodes & Fletcher.Microbiology
12. Industrial Fermentation : Under Kofler & Hick.Vol. I & II
13. Dairy Microbiology : Foster Etal
14. Industrial Microbiology : Rose

BOOKS RECOMMENDED FOR PRACTICALS :

1. Microbes in Action : Seely, Wander Mark, Taraporewala, Bombay.
2. Mannual of Microbiological : A.J. Salle, Methods
3. Microbiological Methods : Collins
4. Difco Mannual.

B.Sc. Final (Semester V)
18 : FOOD SCIENCE
5S. Food Science
Food Processing : I

Unit-I : Cooking & Food processing :

Importance of cooking, objectives of cooking, Advantages & disadvantages of preliminary preparation of cooking; cooking term, (cleaning, peeling, & stringing cutting & grating, sieving, soaking etc.)

Food processing : Physical, functional & growth property of foods. Cleaning, sorting, & grading of foods.

Mixing of liquids & solids (powder), mixing equipment.

Classification of cooking method (moist heat method e.g. Boiling , stammering, poaching etc.

Dry heat: roasting, toasting frying advantages & disadvantages.

Microwave cooking: Information diagram, advantages & disadvantages

Solar cooking : figure, advantage & disadvantages.

Unit-II : Food quality & Hygiene

General principle of food hygiene in rural & urban areas in relation to food preparation, personal hygiene & food handling habits, place of sanitation in food plant. Sanitary aspects of building & equipment.

Food quality: sensory evaluation; selection of panel of judges, types of test, judging

Objective ; measurement of colour , measurement of texture. Food quality & safety:

Food quality describing: composition , appearance, flavour attributes.

Nutritional quality of food, its assessment, content & quality of nutrient.

Sensory quality & its evaluation, subjective & instrumental measurements of sensory attributes of colour viscosity & texture etc.

Unit III : Cereals and legumes processing

Structure, type, composition, quality characteristics & physiochemical properties of wheat, milling processes for different wheat, milling product (Atta, semolina and refined flour). Flour grades & their suitability for baked goods. Quality characteristics and rheological properties of wheat milling products & its assessment by product utilization.

Rice ; types, composition processed rice products (flaked, expanded & puffed rice)

Corn: types of corn, dry wet milling of corn. Starch & its conversion products. Processed corn products (popped corn, corn flakes etc.

Legumes: composition & properties of legumes, milling of different legumes. Sweet & savoury products from legumes in India.

Sprouted grains, palatability & Nutritional quality.

Unit-IV : Oil and fat processing;

Importance of processing, Sources, chemical composition, physical & chemical properties, functional and nutritional importance of dietary fats & oils, Processing of oil seeds for direct use & consumptions, processing of refined oils hydrogenation .

Unit-V : Bakery & confectionary:

Bakery products ; Ingredients , assessing quality, ingredients, products like bread, biscuit, coolies & cakes & pastries. Equipment uses for above.

Confectionary products: Hard boil candies, toffees, chocolates etc. Ingredients, equipments & process, product quality parameters,

Unit-VI : Food additives& food safety: Introduction, definition, need of additives , types of additives like antioxidant , colouring agents, flavours, natural & synthetic , flour improver ,

leavening agents, nutrient supplements, non-nutritive sweeteners,

Speciality foods; Scope, importance on speciality food , health food, functional foods, infant food & baby food fortification & supplementary foods.

Practical: (semester V)

1) Carry out preservation of certain vegetables by dehydration.
2) Study the rehydration characteristic of dried vegetables.
3) Perform osmotic dehydration of certain fruits & vegetables by sugar & salt solution.
4) To determine the water absorption capacity of the wheat flour / Maida .
5) Assessment of market sample of wheat, rice & Pulses for conforming some PFA specifications
6) Storage studies of cereal & legumes grains.
7) Determination of gluten content in wheat flour.
8) Adulteration of edible fats & oils
9) Preparation of Bread & its assessment of sensory quality.
10) Preparation of cake & its assessment of sensory quality.
11) Preparation of candy & its assessment of sensory quality.
12) Preparation of toffee & its assessment of sensory quality.
13) Preparation of cookies & its assessment of sensory quality.

The distribution of marks in practical shall be as follows:

A) Two short experiment   - 20 marks (10 Each)
B) One long experiments   - 15 marks
C) Viva voce   - 10 marks
D) Practical records   - 05 marks
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Total   -   50 marks
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Book Recommended :

1) Food Science 3ʳ edition , B. Srilakahmi,New Age International publication .
2) Food Science & Nutrition , Sunetra Roday , Oxford.
3) Preservation of fruits & vegetables , Girdhari Lal, G. S. Siddappad & G. L. Tandon, Publication & Infromation Division Indian council of Agricultural Research.

4) Outline of food Technology , Harry W. Volonesecke, Agrobios.
5) A Hand book of Food & Nutrition , F. C. Blank; Agrobios.
6) Laboratory Techniques in Food analysis, D. person
7) Nutrition & Dietetics 2ⁿᵈ edition , Shubhangini A. Joshi; Tata Mc Graw-Hill Publishing Company Limited.
8) Foods, facts & Principle 2 nd edition ;N. Shakuntala Manay ; New Age International .
9) Food Science 5ᵗʰ edition ;Norman N. Potter ;CBS
10) Fundamental of foods & Nutrition by R. Mudambi & M. V. Rajgopal
11) Outline of Dairy Technology by sukumar De- Oxfort university press.
12) Food Microbiology by Adams & Moss
13) Industrial Microbiology by Prescott & Dum

B.Sc. Final (Semester VI)

6S. Food Science

Food Processing : II

Unit-I   : Milk & milk products

Introduction; chemical composition, nutritional importance of milk and milk products. Fluid Milk: Testing quality, cooling, storage & transportation of liquid milk

Standardization and or processing (pasteurization, sterilization), Storage, packaging and distribution of liquids milks

Milk Products : composition, methods of preparation & production, quality or grading parameters, shelf-life of cream, butter & ghee, evaporated & condensed milk , skimmed, whole & instant milk powders

Ice- creams, fermented milk (curd, yogurt etc,) Milk products (cheeses, butter milk, lassie etc.) other milk products (khoa, casein, whey proteins) Milk and milks product based, sweetmeats (butfi, rasogolla, milk, cake, kalakand, etc.)

Unit-II : Fruits & vegetable processing:

Current status of production & processing of fruit and vegetables

Products : juices & pulp, beverages, concentrates & powders, squashes, beverages carbonated & its quality control. Fermented products (wine).

Jam, jelly, & marmalades; dried fruit, soup mixture; sauces & ketchups; puree & pastes; chutneys, & pickles.

Unit-III : Poultry, Meat & Fish processing:

Nutritional, safety/ health & hygienic considerations.

Egg; structure, composition , nutritional & functional characteristic of egg, grading spoilage, preservation of egg, solid products through drying & freezing.

Fish: types, care in handling processing of fish, freezing , canning, salting & drying of fish.

Unit-IV : Beverages ;

Introduction, Importance, Types of beverages, classification Example, composition, (coffee, cocoa,& chocolate, tea, its processing, composition, soft drinks, its ingredients, , different beverages, alcoholic beverage (wine , beer, etc.) , non alcoholic beverages, mineral water, carbonated, non beverages, and their processing methods.

Unit-V : Traditional and functional foods;

Fermentation ; basic concept of fermentation, dairy base fermented products, and its importance.

Production of bakers yeast, food yeas,t wine, beer, vinegar, organic acid (citric acid & lactic acid)

Oriented fermented products, soya sauce, pickles, fermented milk, cheeses.

Indian traditional sweet, papads, idli, dosa , dhokla etc.

Unit-VI : Spices:

Introduction , Method of classification , List of spices , sources , Medicinal importance , composition , properties

of spices (antioxidant)

Role of spices in cooking . preparation of different masalas & keeping quality

Practical :Semester VI
1)   Preservation of fruits and vegetables by pickling
2)   Preparation of squash
3)   Shelf life study of egg by using different preservation methods.
4)   Determination of quality of milk (Lactometer, pH & acidity, fat content, Specific gravity
5)   Preparation of certain dairy products (khoa, paneer, cream, shikhand etc.)
6)   Preparation of tomato ketchup & its preservation.
7)   Preparation of tomato purr & its preservation.
8)   Preparation of pickles.(lemon, mango, onion, amla).
9)   Preparation of jam & its preservation.
10) Preparation of Jelly & its preservation.
11) Preparation of squash & its preservation.
12) Preparation of different types of measles.

The distribution of marks in practical shall be as follows:
A)   Two short experiment   - 20 marks (10 Each)
B)   One long experiments   - 15 marks
C)   Viva voce   - 10 marks
D)   Practical records   - 05 marks
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                         Total   -   50 marks
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Book Recommended :
1)   Food Science 3ʳ edition , B. Srilakahmi,New Age International publication .
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4)   Outline of food Technology , Harry W. Volonesecke, Agrobios.
5)   A Hand book of Food & Nutrition , F. C. Blank; Agrobios.
6)   Laboratory Techniques in Food analysis, D. person
7)   Nutrition & Dietetics 2ⁿᵈ edition , Shubhangini A. Joshi; Tata

Mc Graw-Hill Publishing Company Limited.

8) Foods, facts & Principle 2 nd edition ;N. Shakuntala Manay ; New Age International .
9) Food Science 5th edition ;Norman N. Potter ;CBS
10) Fundamental of foods & Nutrition by R. Mudambi & M. V. Rajgopal
11) Outline of Dairy Technology by sukumar De- Oxfort university press.
12) Food Microbiology by Adams & Moss
13) Industrial Microbiology by Prescott & Dum

B.SC. FINAL SEMESTER-V
19 : INDUSTRIAL MICROBIOLOGY

The examination shall comprise of two theory papers, one in each semester and one practical in each semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-V (8 Marks).

5S. INDUSTRIAL MICROBIOLOGY
(Industrial Biotechnology)

UNIT I : TOOLS & TECHNIQUES OF GENETIC ENGINEERING:

a) Preparation of pure samples of DNA.
b) Enzymes in genetic engineering : Exo and endonucleases, restriction endonucleases, ligases, polymerases, DNA manipulating enzymes.
c) Analysis of DNA fragment size :Agarose gel electrophoresis.
d) Identification of DNA fragment : Southern Blotting
e) Cloning vehicles ó Plasmids, Cosmids & Bacteriophages.

UNIT II : GENE MANIPULATION AND EXPRESSION

a) Methods of gene transfer : Transformation, transduction, electroporation, microinjection.
b) DNA sequencing : Maxam and Gilbert technique, di-deoxynucleotide method, DNA chips.
c) Polymarase Chain Reaction.
d) Genomic DNA library, cDNA library.
e) Identification of clones : Colony hybridization.

UNIT III: GENETIC TECHNIQUES IN STRAIN IMPROVEMENT:

Mutation and selection of different types of mutants e.g. Auxotrophic, antibiotic resistant, analogue- resistant mutants. Mutants resistant to feedback effect and toxic compounds. Isolation of revertant mutants (Ames Test)

UNIT IV: HEALTH CARE INDUSTRIAL PRODUCTS

a) Production of hormones- Insulin
b) Production of interferon
c) Production of vaccines ó Recombinant Hepatitis vaccine.
d) Hybridoma technology & monoclonal antibodies.
e) Gene therapy.
f) SCP (Single Cell Protein)

UNIT V : INDUSTRIAL PRODUCTS FROM ACTINO MYCETES

a) Primary metabolides : Enzymes, vitamins, amino acids, siderophores.
b) Secondary metabolides : Antibacterial, antifungal, antiviral, insecticidal, anticancer, groth promoter herbicides, immunosupressive.
c) Bioconversion products
d) Recombinant products

UNIT VI: PROBIOTICS :

a) Introduction to prebiotics, probiotics and synbiotics.
b) Types of probiotics,
c) Beneficial characteristics of probiotic microbes

d) Probiotic organisms and its role in human health.

e) Probiotic products - (i) Yogurt, (ii) Koji, (iii) Tofu, (iv) Kefir, (v) Yakult, (vi) Miso.

Practicals:

1. Isolation of genomic DNA

2. Isolation of plasmid DNA.

3. Cultivation of yeasts and bacteria for single cell protein

4. Antibiotic sensitivity test

5. Isolation of antibiotic resistant mutants.

6. UV induced auxotrophic mutants production and isolation of mutants by replica plating technique.

7. Ames test for detecting potential carcinogenes.

8. Cultivation of actino mycetes.

9. Screening for antagonism

10. Preparation of Koji.

Distribution of marks for Industrial Microbiology Practical Examination:

1.	Major Experiment	- 15 marks
2.	Minor Experiment	- 10 Marks
3.	Viva Voce	- 10 marks
4.	Spotting	- 10 marks
5.	Laboratory Journal	- 05 Marks
	Total	**- 50 marks**

B.SC. FINAL (INDUSTRIAL MICROBIOLOGY) SEMESTER-VI

The examination shall comprise of two theory papers, one in each semester and one practical in each semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of semester-VI (8 Marks).

6S. INDUSTRIAL MICROBIOLOGY
(Tissue Culture and Industrial Waste Management)

UNIT I : ANIMAL TISSUE CULTURE

1) Introduction, Definition of terms ó Tissue culture, Cell culture, Organ culture. Primary, Secondary, Continuous & Established Cell lines.

2) Culture media for animal cells.

3) Primary Cell Culture Methods - Mechanical disintegration, Enzymatic disaggregation, primary explant technique.

4) Uses of Cell lines.

5) Cell culture products

UNIT II : PLANT TISSUE CULTURE

1) Introduction ó Terms used in plant tissue culture, types of tissue culture : callus, organ, cell, protoplast, suspension (batch and continuous).

2) Media used in Plant Tissue Culture, media constituents : Composition and preparation.

3) Callus Culture - Isolation & Culturing techniques.

4) Regeneration

   a) shoot regeneration

   b) somatic embryogenesis

5) Types of plant tissue culture

   a) Anther culture

   b) Ovary culture

   c) Meristem culture

   d) Embryo culture

UNIT III: PROTOPLAST CULTURE, SOMATIC HYBRIDIZATION & TRANSGENIC PLANTS

1) Protoplast isolation, culture & regeneration.

2) Somatic hybridization : Protoplast fusion, selection, identification and applications of hybrid cells.

3) Transgenic Plants :-

    a) Resistance to biotic stresses : Insect resistance, virus resistance, fungal and bacterial disease resistance.

    b) Resistance to abiotic stresses : Herbicide resistance (Glyphosate, Phophinothricin, sulphonyl urea).

4) Improvement of crop yield and quality, Commercial transgenic crop plants.

UNIT IV : WASTE MANAGEMENT

1) Composition of Sewage, Need for waste water treatment

2) Physical, Biological & Chemical methods for treatment of industrial effluents

3) Solid waste management (outline).

4) Biogas production.

5) Composting

UNIT V : BIOREMEDIATION

1) Bioremediation, biodegradation, xenobiotics, recalcitrant compounds.

2) Types of bioremediation : In situ and Ex situ with advantages and disadvantages.

3) Role of microbes in -

    a) Degradation of crude oil

    b) Bioleaching of metals

    c) Recovery of metals

    d) Biodegradation of pesticides and herbicides.

4) Genetically engineered microbes in bioremediation.

UNIT VI : ENTREPRENEURSHIP

Basic regulations of excise. Survey the demand for a given microbial product, feasibility of its production under the given constraints, project preparation for financial assistance, different funding agencies. Subsidies for various projects, patenting the product.

Practicals

1) Preparation of various media for Tissue culture.
2) Development of Callus Culture.
3) Plant Regeneration from Callus Culture.
4) Organogenesis from different types of Explants.
5) Isolation and culture of plant protoplast.
6) Estimation of DO of different industrial effluents.
7) Estimation of BOD of different industrial effluents.
8) Estimation of COD of different industrial effluents.
9) Visit to Industrial effluent treatment plant, Dairy; Food processing industry etc.
10) Study tour.

Distribution of marks for Industrial Microbiology Practical Examination:

1.	Major Experiment	- 15 marks
2.	Minor Experiment	- 10 Marks
3.	Viva Voce	- 10 marks
4.	Spotting	- 10 marks
5.	Laboratory Journal	- 05 Marks
	Total	**50 marks**

List of books recommended for 5S and 6S:

1) Old, S.B. Primrose. (1994) Principles of Gene Manipulations, Blackwell Scientific Publications.
2) Brown T.A. Gene Cloning- An Introduction, Chapman and Hall India.
3) Brown (1991) Essential Molecular Biology ó A practical Approach Vol I & II, Oxford University Press.
4) Freshney, R.I (ed), 1992, Animal cell culture: A practical approach (2 nd ed), Oxford University Press, New York.
5) Freshney, R.I 1987, Culture of animal cells: A Manual of basic techniques (2 nded), Alan R. Liss, New York.
6) Paul, J., 1975, Cell and Tissue culture (5thed) Livingstone, Edinburgh.
7) Bhojwani, S.S., (ed) 1990, Plant Tissue Culture: Application and Limitations, Elsevier, Amsterdam.
8) Street, H.E., 1977, Plant cell and Tissue Culture, Blackwell, London.
9) Davar R.S, Principles and Practice of Management.

10) Jain and Agarwal, Production Management and Industrial Organization.
11) Sherlekar, S.A., Marketing / Management.
12) Satyanarayan, Biotechnology.

B.Sc. Final (Semester - V)
20 : Biotechnology (Regular/Vocational)

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

The following syllabi are prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-V (8 marks).

5S : Biotechnology (Regular / Vocational)
ANIMAL CELL BIOTECHNOLOGY

UNIT I : Major types of tissues- Epithelial, Muscle, Connective, Nerve, Blood. Structure and organization of cells in various tissues, Origin and linage. Junctions between cells ó Tight junctions, Adherens junctions, Gap junctions, Desmosomes. Extracellular matrix ó structural proteins, specialized proteins and proteoglycans.

History of development of cell cultures ó Contributions of Ross Harrison, Alex Carrel, Charles Lindbergh, Ian Wilmut.

UNIT II : Design and Layout of the laboratory, Functioning of Equipments: Various incubators, biosafety cabinets, Sterilizers, Refrigerators and freezers, inverted microscope, Deionizers and water purification systems, CO2 incubators, Colony counters, Flow cytometer. Laboratory safety and Biohazards, ethics and good laboratory practices (GLP).

UNIT III: Introduction to the balanced salt solutions and simple growth medium, Chemical, physical and metabolic functions of different constituents of culture medium, Gas phase,

buffering and Osmolality of medium. Role of serum and supplements. Selection of medium and serum, Serum free medium.

UNIT IV : Type of tissue culture: Disaggregation of tissues for primary culture ó Primary explants technique, Enzymatic disaggregation, Mechanical disaggregation, Physical methods of cell separation.

Established cell line- Commonly used animal cell lines, Origin of cell culture, characteristics of cells in culture. Plating efficiency. Characterization of cell lines ó karyotyping, Isozyme analysis. Cryopreservation.

UNIT V : Applications of animal cell culture ó Production of viral vaccines, growth factors, Erythropoietin, Interleukins. Studies on gene ex-pression, Transfection of animal cells: selectable markers, antibiotic resistance, Somatic cell fusion- HAT selection, production of monoclonal antibodies.

UNIT VI: Specialized Techniques: Mass culture techniques ó Suspension culture, Continuous culture, Monolayer culture ó Roller culture, Spiral propagator, Micro-carriers, Establishment of Synchronous cultures, Culture of Amniocentesis.

Practical :
1. Preparation of balance salt solution.
2. Preparation of TPVG and filter sterilization.
3. Separation serum and filter sterilization.
4. Dissociation of cells from primary tissue.
5. Dissociation of cells from culture vessels.
6. Enumeration of cells using Hemocytometer.
7. Estimation of viability of cells by dye exclusion method.
8. Preparation of primary culture from chick embryo.
9. Maintenance and subculturing of cell lines.

Equipments :
1. Autoclave
2. Incubator
3. Laminar flow
4. Balance

5. Centrifuge
6. Inverted Microscope
7. Quartz Distillation unit
8. CO2 incubator
9. Magnetic stirrer
10. Water bath
11. Hot air oven

Books Recommended:
1. Freshney, R.J.: Culture of Animal Cells, Wiley-Lissz
2. Masters, J.R.W (ed.): Animal Cell Culture ó Practical Approach, Oxford Uni. Press
3. Sudha Gangal: Principle and practice of animal tissue culture, Universities Press, India
4. Freshney, R.J.: Animal cell culture- Practical Approach.
5. Gupta P.K.: Elements in Biotechnology.

Semester-V : Animal Cell Biotechnology
Distribution of Practical Marks :
1. Major Experiment   12 Marks
2. Minor Experiment   08 Marks
3. Spotting   05 Marks
4. Viva Voce   10 Marks
5. Practical Record   10 Marks
6. Study tour / visit   05 Marks
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Total   50 Marks
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B.SC. FINAL (SEMESTER-VI)
20 : BIOTECHNOLOGY (REGULAR / VOCATIONAL)

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

The following syllabi are prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in

every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-VI (8 marks).

6S : Biotechnology (Regular / Vocational)
PLANT BIOTECHNOLOGY

UNIT–I : Grwoth : Terminology and definitions, methods of measuring growth and differentiation. Growth curves and growth analysis, Geotropism, Phototropism, Apical dominance, Effect of environmental factors on growth: Photoperiod, Radiation energy, (Intensity, Wavelength), transpiration and nutrition.

UNIT–II: Plant Growth Substances: Hormone concept, Auxins, Gibberllins, Cytokinins, Ethylene, Abscisic acid. Physiological effect of hormones, Mechanism of action of plant growth substances, Use of plant growth substances in agriculture and horticulture.

UNIT–III: Plant Tissue Culture ó Introduction and history, Practical applications of tissue and organ cultures, Equipments and other requirements, Commercialization of tissue culture: Design of typical tissue culture laboratory and its management. Media preparation and composition.

UNIT-IV: In vitro techniques in tissue culture: Beginning of in vitro culture. Clonal multiplication of elite species (Micropropagation) from axillary bud, shoot tips, protocorms (Orchids), meristem culture. Hardening of tissue cultured plants.

Induction of callus, ovary and ovule culture. Embryo rescue, embryo culture and its applications. Somaclonal variation and its applications, Pollen and anther culture, Endosperm culture and triploids

UNIT–V : Single cell suspension cultures and their applications in selection of variants/mutants. Transport processes in plant cells and tissues, Protoplasmic membrane, General transport law, active and passive transport across the membrane. Protoplast isolation and regeneration,

UNIT –VI: Somatic hybridization - Markers for selection of hybrid cells, Hybrids, cybrids, application of somatic hybridization,

protoplast and tissue culture for genetic manipulation of plants, various methods of genetic manipulations (electroporation, gene gun, Agrobacterium mediated, etc.), practical applications of genetic transformation of plants.

Practical :
1. Bioassay of Indole acetic assay using coleoptiles.
2. Bioassay of Gibberllic acid using barley seeds.
3. Initiation and maintenance of callus culture of soybean.
4. Bioassay Cytokinin using soyabean callus.
5. Study of growth parameters in callus culture.
6. Initiation and growth study of suspension culture.
7. Initiation of shoots from apical or axillary bud
8. Induction of shoot initiation by modulating hormone balance.
9. Induction of root initiation by modulating hormone balance.
10. Single cell suspension culture from carrot.
11. Generation of somatic embryo from suspension culture of carrot.
12. Induction of Agrobacterium infection in any dicot leaf and maintenance of resultant callus.

Equipments :
1. Autoclave
2. Incubator with illumination and temperature control
3. Laminar flow
4. Balance
5. Centrifuge
6. Microscope
7. Quartz Distillation unit
8. Magnetic stirrer
9. Water bath
10. Hot air oven

Semester-VI : Plant Biotechnology
Distribution of Practical Marks :

1.	Major Experiment	12 Marks
2.	Minor Experiment	08 Marks
3.	Spotting	05 Marks
4.	Viva Voce	10 Marks
5.	Practical Record	10 Marks
6.	Study tour / visit	05 Marks

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Total   50 Marks
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Book Recommended :-
1) Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture : (Ed.) J.Reinert and Y.S.P. Bajaj
2) Plant Tissue Culture : Application and Limitations : S.S.Bhojwani
3) Plant Cell Culture : A Practical Approach (IRL Press) : R.A. Dixon and Geonzales
4) Introductory Plant Physiology : G.Ray Noggle and George J.Fritz (Prentice Hall of India Pvt.Ltd.)
5) Introduction to Plant Biotechnology : H.S.Chawla

B.SC. FINAL (SEMESTER-V)
21 : BIOINFORMATICS
5S : BIOINFORMATICS
Paper V (Methods in Bioinformatics)

UNIT-I : Introduction to Database :

Importance of Database, Types of Database, Data Models, Data Abstraction, Test Databases. Database Design (DBMS & RDBMS), Data Security, Data Warehousing, capture and Analysis, Data Management and Architecture.

Microarray Database, Enzyme Database, Biodiversity Database.

UNIT-II : Biology and Computer Science :

Structural Organization of genome. *In silico* analysis of primary structures of nucleic acid sequences. Representing sequence Data , a program to store a DNA sequence, DNA Fragments, Transcription : DNA to RNA Nucleic Acid Sequence databanks : GenBank, Genomic Databases. Repositories : EST and STS, Limitation of Computation Analysis.

UNIT-III: Mutations, Randomization and genetic code :

Random number generators. A program using randomization. A program to simulate DNA mutation generating random DNA analyzing DNA. The genetic code. Hashes data structures and algorithms for biology. Translating DNA into proteins. Reading DNA from files in

FASTA format reading frames. Database Similarity Searches : BLAST, FASTA, PSI-BLAST, BLAST-2

UNIT-IV: Restriction Maps and Regular Expression :

Regular expression restriction maps and restriction enzymes Perl operations GenBank, GenBank files, GenBank libraries, separating sequence and annotation, parsing annotations indexing GenBank with DBM. Biological Databanks : Introduction to Biological databanks, Protein Sequence databanks : PDB, SRS, SWISSPROT

UNIT-V : Protein Data Bank :

The Organization of proteins. *In silico* analysis of primary structures of proteins, Protein Tertiary structure prediction methods: Homology modeling, fold recognition, Abintio Method. Comparison between and tertiary structure. Files and Folders PDB files parsing PDB files controlling other programs.

UNIT-VI: HMM (Hidden Marcov Model) : Introduction to HMM, its application in sequence alignment and structure prediction, based Softwares (HMMER and HMMSTR) obtaining BLAST String Matching and Homology, BLAST output files, parsing BLAST output presenting data bioperl.

Practicals :

1. Downoading primary structure of nucleic acids and proteins.
2. Protein Sequence comparison and analysis
3. Properties of primary structure of proteins using online tools.
4. *In silico* analysis of nucleic acids and proteins tools.
5. Installing perl and command lines arguments.
6. Access to Gene and Protein data bank.
7. Prediction of secondary structure of proteins.
8. Visulazation of tertiar structure of proteins in Rasmol or Cn3d.
9. Accessing existing databases on www.
10. Homology search tools like BLAST.
11. Database Searches : NCBI, DDBI, EMBL, Uniprot.
12. Parremire sequence alignment ó BLAST.
13. Downloading and installing software/plugs in windows.

14. Spreadsheet Applications : (Database Management Sorting Records, finding, adding, deleting.)

Distribution of Practical Marks :-

(1)	To perform one major experiments :	15 Marks
(2)	To perform two minor experiments :	15 Marks
(3)	Viva-voce:	10 Marks
(4)	Practical Record:	10 Marks

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Total   50 Marks

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List of Equipments :-   **Quantity**

1)	Computer Terminals :- Pentium-IV with latest configuration	8 computers for batch of 16 students
2)	Printer CDMP : Configuration :- 24 pim, 132/80 columns	02 Nos.
3)	C++ Software (Compiler or Interpreter)	01
4)	Perl Language Compiler	01
5)	Broad Band Internet Connection	01

Recommended Books :-

(1) Baldi P. and Hatfield G.W. (2002), DNA Microarray and gene expression. Cambridge University Press, U.K.

(2) Bowtell D. and Smbrook J. (2003), DNA Microarray : A molecular cloning manual. Cold Spring Harbour Laboratory, New York.

(3) Hastie T. Tibshirani R. and Friedman J. (2001), Elements of statistical learning : Data mining, inference and prediction, Springer, New York.

(4) Johnson R.A. and Wichern D.W. (1998), Applied Multivariate statistical analysis, 4th Edition, Prentice Hall, New Jersey.

(5) Lentner M. and Bishop T. (1993), Experimental design and analysis, 2nd Ed., Valley Book Company, Verginia.

(6) Li W.H., (1997), Mocecular Evolution, Sinaur and Associates, New York.

(7) Smyth G.K., Throne N.P. and Wettenhall J. (2003) Limma : Linear Models of Microarray data userø guide. Walter and Eliza Hall Institute of Medical Research, Australia.

(8) Snedecor G. and Cocharan W. (1989), Statistical Methods. 8th Ed. Lowa State University Press lowa.

(9) Weller J.I. (2001), Quantitative trait loci analysis in animals, CABI Publishing, London.

(10) Myers E.W. (1997), Computational Methods in genomic research Plenum Press, New York.

(11) NCBI : National Centre for Biotechnology Information (1993), Manual for NCBI software development tool kit version, 1.8. National Library of medicine, National Institute of Health, Washington.

(12) Branden C. and Tooze J. (1991), Introduction to Protein Structure, Garland Publication, New York.

(13) Bushman F. (2002), Lateral DNA transfer : Mechanism and consequences. Cold Spring Harbur Laboratory Press, Cold Spring Harbur Laboratory, New York.

(14) Durbin R., Eddy S., Krogh A., and Mitchison G. (1998) Biological sequence analysis : Probalistic models of proteins and nucleic acid, Cambridge University Press, U.K.

(15) Li. W. and Graur D. (1991) Fundamentals of Molecular Evolution, Sinaur Asssociates, Sunderland, Massachusetts.

(16) Dayhoff M.O. (1978), Atlas of Protein sequence and structure, Volume 5, National Biomedical Foundation, Gergetown University, Washington.

(17) Waterman M.S. (1989), Sequence Alignment. In mathematical methods for DNA sequences. CRC Press, Boca Raton, Florida.

(18) Von Heijne G. (1987), Sequence Analysis in molecular Biology ó Treasure trove or trivial pursuit, Academic Press. San Diego.

(19) James Tisdall, 2001, õBeginning Perl for Bioinformaticsö, OøReilly & Associates (2001), Learning Perl, 3rd Edition.

(20) Bioinformatics and Functional Genomics ó Jonathan Persner (3) S.C.Rastogi, Namita Mendirata, Parag Rastogi, õBioinformatics concepts skills and application, CBS Publisher.

(21) D.Baxevanis and F.Oulette, (2002), õBioinformatics : A practical guide to the analysis of genes and proteinsö, Wiley.

(22) Arthur M. Lesk, (2002), õIntroduction to Bioinformaticsö, Oxford University.

Semester-VI
6S : BIOINFORMATICS

Paper VI (Advanced Bio-computing)

UNIT-I :   Object Oriented Programming using C++ :

Introduction to OOPS, features, structure, data types and user defined database, Constants, variables, operators, control statements, creating and writing functions, inline functions and function overloading.

UNIT-II: Classes & Objects :

Data abstraction, encapsulation, data hiding, defining class, member functions and data members, creating objects, accessing class members, constructors, destructors, array of objects, pointer to objects, operator overloading, inheritance and its types.

UNIT-III: RDBMS ORACLE 9i :

Architecture, Database models : Relational, Hierarchical, Networks; data dictionary, DMI operations, Domains and attribuetes, normalization process, Normal forms : 1NF, 2NF, 3NF, 4NF, BCNF. SQL : Components of SQL, data types and operators. DDL Commands : CREATE, ALTER, DROP, for tables and views. DML Commands : SELECT, INSERT, DELETE, UPDATE, BREAK & COMPUTE.

UNIT-IV: Functions

Number, Character, Concatenating functions, joins, unions, data integrity and constraints. PL/SQL : Features, Block structures, variables, constants, data types, control structures, cursor, concept, type, opening, declaring, classify and censor attributes. Transactions : Rollback, commit, save point, Rollback segment.

UNIT-V :   Features of SQL form of SQL report :

Users, Roles and Privileges : Concept, creating users, system and object previlage, GRANT privilege, REVOKE

privilege, passing on privileges, creating roles.

UNIT-VI: Perl and Programming :-

Low and long learning curve. Perlø benefits. Installing Perl on computer. Perl program peration text editors. Finding help. Individual approaches to programming Edit-Run-Revise (and Save) An environment of programs, programming strategies. The programming process using the Perl. documentation calculating the reverse complement in Perl Proteins, files and arrays reading proteins in files arrays scalar and list context. Subroutines scoping and subroutines command-line arguments and arrays. Passing data to subroutines modules and libraries of subroutines fixing bugs in code.

Practicals :-

Minimum 18 experiments based on theory paper Advanced Bio-computing covering all aspect of syllabus.

Distribution of Practical Marks :-

(5)	To perform one major experiments :	15 Marks
(6)	To perform two minor experiments :	15 Marks
(7)	Viva-voce:	10 Marks
(8)	Practical Record:	10 Marks

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Total   50 Marks

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List of Equipments :-   **Quantity**

1)	Computer Terminals :- Pentium-IV with latest configuration	8 computers for batch of 16 students
2)	Printer CDMP : Configuration :- 24 pim, 132/80 columns	02 Nos.
3)	C++ Software (Compiler or Interpreter)	01
4)	Perl Language Compiler	01
5)	Broad Band Internet Connection	01

Recommended Books :

1) Object Oriented Programming with C++ : E.Balaguruswamy
2) Programming with C++ : R.S. Nisar Ali
3) Mastering C++ : Venugopalan.

4) C++ Programming : Ravi Chandran
5) Understanding Oracle : Perry and Latic ó BPB
6) Essentials of oracle 8 : TOM Lewis.
7) An Introduction of Data Base Systems : C.J.Date ó Narosa
8) Programming with C++ : Robert Lafore
9) Oracle Press Introduction to oracle (TMH)
10) Oracle Unleashed (Sams)

B.SC. FINAL (SEMESTER-V)
22 : APICULTURE

5S : APICULTURE
Paper V (Cytogenetic & Bee breeding)

Unit-I : A. Cytology in General: Cell and its structure and function, Cell division, Cell membrane, mitochondria, endoplasmic reticulum, lysosome, Golgi apparatus, nucleus. Elementary principles of heredity, Applications of genetics to bee improvement.

B. Inbreeding and heterosis, mass selection of superior genotypes. Examination of matings among superior genotypes is isolated apiaries.

C. Progeny testing methods for bees. Elementary analysis. Scope and limitations of instrumental insemination for bees.

Unit–II : **A**. Bee breeding: General methods of breeding and selection, mitosis and miosis, applicability of individual methods for bees.

B. Organization of breeding apiaries: Acquisition of colonies from their natural nests. Their transference to movable frame of standard hives.

Location of different types of breeding apiaries duly related to their functions. Equipment and tools for bee breeding programme. Special apiary management problems for bee breeding programme.

Unit-III : Selection Criteria : General Criteria- Particular criteria to meet the demands of local habitats, Desirable and undesirable characters. Quantitative and qualitative characters.

Differential components subscribing to higher yield and better performance -Honey yield , Body size, Tongue reach , frequency of egg laying and hatching, percentage Temper, Steadiness , Discretion, Absconding, Swarming, Parsimonious habit , Hive sanitation , Disease resistance.

Unit-IV : A. Individual colony records: Pedigree records system adapted for maternal living age of bees. Periodicity for observation and recordings. Providing uniform conditions for valid comparison of pedigrees.

B. Evaluation of Individual colony records : Tabulation of individual colony records. Apiary averages for characters susceptible to environmental influences. Grouping of individual colonies.

Unit-V : Assigning of maternal pedigree number for selection: Rearing of pedigree queen bees. Migration for queen rearing programme. Distribution of individual groups to isolated apiaries for maximizing superior mating and minimizing inferior mating. Available resources. Advance provisioning for implementing the programme.

Unit-VI : Transport of sealed queen cells: Preparation of mating nuclei with sealed queen cells or virgin queens, Special management problems for organizing mating yards. Provision of adequate population or pedigree drones, single and multiple mating, mating signs. Re-migration of stocks, Progeny testing.

Equalization of colony strength through upgrading or downgrading for equal starts for pedigree and unselected controls.

Practical Course PR-5 :
1. DNA isolation from honey bee
2. Study of permanent stained slides (Meiosis)
3. Polytene Chromosome isolation and staining
4. Morphometric study of different species of honey bee.
5. Phylogenetic study of honey bee using sequences from NCBI
6. Mutation study using UV rays in honey bee larvae.
7. Estimation of tongue reach.
8. Demonstration of equalization of colonies.

9. General methods of bee breeding and selection.
10. Organization of breeding apiaries.
11. Study of mitosis in onion root tip.

Distribution of Marks : 4 Hrs.

1.	DNA isolation of Honey bee / Tounge reach estimation.	15 Marks
2.	Polytene Chromosome Isolation and staining / study of mitosis, stages in onion root tip	15 Marks
3.	Morphometric study of honey bees	05 Marks
4.	Practical Record	05 Marks
5.	Field Diary	05 Marks
6.	Viva-voce	05 Marks

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Total Marks 50 Marks

List of Equiments :

1. Centrifuge
2. Vernier caliper
3. Bee coloney hives
4. UV source
5. Equipments for tongue rich estimation
6. USB digital camera with dimensional software

B.SC. FINAL (SEMESTER-VI)
6S : APICULTURE
Paper VI (Management, Marketing & Extraction)

Unit-I : Apiary management

A. A. Apiary selection and establishment of bee colonies and bee management. Establishment of Apiary. Choice of apiary site, consideration of climatic conditions like wind, light, rain temperature .

B. How to handle colony. Recognition of easier of a colony. Capturing of a natural colony. Hiving of the colony and maintenance. Survey and location of colony. Collection of honey -hygienically.

C. Approach to colony, method of handling bees (periodic inspection). Reorganization of queen, her

age, health, egg laying, behavior of honeybees. Brood and food condition.

Unit-II : Special Management

A. Special Management for practice - Seasonal management, variation in management, pattern related to regional differences.

B. Method of recording humidity, Temperature and other meteorological data, use of thermometer, barometer, rain gauge, anemometer and other simple meteorological instruments.

C. Production of comb honey. Commercial beekeeping management. Maintenance of technical record. Laying worker causes and remedial measures. Topography evaluations of the place. Drainage of rain water. Availability of water. Observation on competition between crops, crops & weeds & insect pollinations.

D. Migratory Beekeeping: Survey, packing transporting, pollination service.

Unit-III : Queen Rearing : In nature, need and scope of artificial methods of queen rearing, various methods of preparing various mating nuclei and distribution of mating nuclei, packing bees, introduction of queens and packages, clipping and making queens.

A. Drone breeding, queen cells formation, laying workers. Feeding, uniting dividing, of colonies. Sanitation, cleaning, observation of colonies for diseases. Routine forage and other activities.

B. Swarming: Its purpose, period of growth, various methods of swarm control and prevention. Desertion: Its causes and methods of prevention

Unit-IV : Marketing of honey & bee wax

A. Quality control & purity standard.

B. Organization of marketing of honey & bee wax.

C. Production, consumption & promotion for domestic, industrial market. Problems of marketing of honey & bee wax. Scope of marketing indigenous market for

industrial & domestic purpose. Scope of marketing for export of honey. Future strategy.

D. Accounts and book keeping.

Unit-V :   Beekeeping laws and regulations

A. Import restrictions on bee colonies package bees, queens, etc. in various countries, quarantine laws governing bee disease notifications in major honey producing countries.

B. Regulations, protecting bee populations against indiscriminate spraying.

C. Rules regarding honey house, processing, bottling packing, adulterations.

D. Laws governing standards on beekeeping equipments.

E. Laws governing standards on beekeeping products. International law. Legislation affecting beekeeping in general in various countries.

Unit-VI : Extension of Honey Bee Keeping:

A. Principles of Extension work with reference to Indian conditions and economy place of beekeeping in rural economics, beekeeping as agro-industry, and economics of the Industry: a glance of beekeeping in India and abroad.

B. Commission's co-operative Organization, Model bye-laws, Role of co-operative movement in the propagation of Beekeeping in this country Registered Industries Commission.

Field study:

1. Market survey for honey bee products.
2. Study of different bee colonies (rock bees, florea & trigona species)

Practicals :-

1. To isolate and study pollen from freshly extracted honey
2. Extraction of wax from comb.
3. To study technique for mounting of wax foundation sheet to frame.
4. To monitor internal bee colony hive temperature and humidity.
5. To study properties of propolis.
6. To study physical properties of squeezed honey.

7. Protocol for packing of bee products.
8. Methods of colony handling
9. Bee recognition with respect to sex, age, and brood.
10. Determination of humidity temperature and other meteological factors,
11. Use of thermometers, rain guage, anemometer.
12. Queen rearing and drone breeding.
13. Market survey technique
14. Costing of apiary products, quotations
15. Storage and packing of apiary products
16. Use of Computer in maintenance of stock quotations, etc.

Distribution of practical marks : 6 Hrs.

1. Practical based on apiculture management
   A. Methods of Colony handling   05 Marks
   B. Determination of metereological factor 05 Marks
   C. Bee recognitions   05 Marks
2. Preparationa of order/Bill of apiary   15 Marks
   products. OR
   Processing of Assorted data by using
   computers
3. Spotters, based of Syllabus of the paper   10 Marks
4. Certified practical record   05 Marks
5. Viva-voce   05 Marks.

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    Total   50 Marks

List of Equipments-
1. Queen grafting kit.
2. Thermometers
3. Wax extraction unit.
4. Wax foundation sheet

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प्रस्तावना

विद्यापीठ अनुदान आयोगाची मार्गदर्शक तत्वे आणि बदलत्या काळाचे आव्हाने ध्यानात घेऊन बी.एस.सी. भाग १ मराठी (अनिवार्य) या वर्गासाठी अभ्यासमंडळाने संपादित केलेले 'ऋतुरंग' हे पाठ्यपुस्तक आपल्या स्वाधीन करतांना आनंद होतो आहे.

अध्ययन - अध्यापन प्रक्रियेचा केंद्रबिंदु असलेला विद्यार्थी, त्यांच्या सर्वांगीण विकास साधण्याच्या दृष्टीने, विद्यार्थ्यांची ज्ञानार्जन क्षमता आणि मूल्यमापन प्रक्रिया या दोहोची सांगड घालण्याचा प्रयत्न या पाठ्यपुस्तकात केला आहे.

Course Outcome (प्रमुख साध्य)

भाषेच्या आकलनाबरोबरच विद्यार्थ्यांमध्ये समाजातील उच्चकोटीची मानवी मूल्ये वृद्धींगत व्हावी, राष्ट्रीय एकात्मता, सामाजिक बांधिलकी, मानुषता, राष्ट्रप्रेम, राष्ट्रभक्ती, वैज्ञानिक दृष्टिकोन, पर्यावरण संरक्षण – संवर्धन, भूतदया इत्यादीची पेरणी व्हावी, विद्यार्थ्यांची मातृभाषा आणि वाङ्मयविषयक अभिरुची वाढीला लागावी, त्यांना दर्जेदार व व्यवसायभिमुख शिक्षण मिळावे याकरिता केंद्र सरकारच्या मानव संसाधन आयोगाने जी ध्येय धोरणे निश्चित केली आहेत त्या अनुषंगाने हा अभ्यासक्रम, नवीन शैक्षणिक धोरणाच्या परिप्रेक्ष्यात, निश्चित करण्याचे धोरण संत गाडगे बाबा अमरावती विद्यापीठाने अत्यंत विचारपूर्वक स्वीकारलेले आहे.

Course Specific Outcome (प्रामुख्याने साध्य)

मराठी भाषा हा केवळ शिकण्याचा आणि शिकविण्याचाच विषय नाही तर ते आत्मप्रकटीकरणाचे एक प्रभावी माध्यम आहे. तसा व्यक्तिमत्त्व घडविणारा तो संस्कारही आहे. बहुविध अंगाने तो व्हायला हवा. त्याबरोबरच भाषेच्या सर्वांगीण अभ्यासाची दिशा विद्यार्थ्यांना सूचित व्हावी, साहित्यसरितेतील विविध वाङ्मय प्रकाराची आणि प्रवाहाची ओळख व्हावी हा उद्देश प्रामुख्याने ठेवला आहे.

Employability Potential of the Course (रोजगार निर्मिती क्षमता)

विद्यार्थ्यांच्या भविष्याच्या संदर्भात सकारात्मक विचार करुन अभ्यासक्रम तयार करण्यात आला आहे. परिक्षेतील विविध प्रश्न व त्यांच्या परिणामाची तसेच मराठी साहित्याचा उगम आणि वाटचालीची जाण व्हावी यादृष्टीने प्राचीन - मध्ययुगीन आणि अर्वाचीन साहित्यातील निवडक वेचे या पाठ्यपुस्तकात समाविष्ट केले असून कथा, कविता, वैचारिक लेख, आत्मचरित्र, निबंध इत्यादी वाङ्मयप्रकारातील प्रातिनिधिक उतारे व दर्जेदार कविता निवडण्याचा प्रयत्न केला आहे.

विद्यार्थ्यांचा फायदा

      या अभ्यासक्रमामागची महत्वपूर्ण भूमिका म्हणजे विद्यार्थ्यांचे सशक्त भविष्य तसेच त्यांची आयुष्याकडे बघण्याची सकारात्मक भूमिका निर्माण व्हावी आणि विद्यार्थ्यांना त्यांचे ध्येय प्राप्त करता येऊन नोकरी, व्यवसाय यामध्ये तो भक्कमपणे उभा राहून आपल्या विकासाबरोबर समाजाचाही विकास होऊन त्याचाही फायदा व्हावा. त्याचबरोबर या अभ्यासक्रमातून त्यांच्यात सकारात्मकता निर्माण व्हावी, हाही उद्देश आहे.

कौशल्य संवर्धन मॉड्युल (Skill Enhancement Module)

      विद्यार्थ्यांनी प्रसिध्द साहित्यीकांची प्रत्यक्ष मुलाखत घेऊन साहित्य निर्मितीच्या प्रेरणा जाणून घेणे. व त्याव्दारे साहित्यीकांच्या साहित्याचे विश्लेषण करणे. यावर आधारीत प्रकल्प तयार करून मुलाखत देणे.

बी.एस.सी. (भाग१)

विषय - मराठी अनिवार्य

सत्र १ ले

गद्य

१.	पाखाला बाळास पांगुरवाणे	- म्हाइंभट
२.	गाडगे बाबांनी शाळा दिली	- सीमा साखरे
३.	... आणि गहुली झाली माऊली	– प्रकाश राठोड
४.	रद्दी	– विलास अंभोरे
५.	नियतीच्या विक्राळ जबड्यात !	– सिंधुताई सपकाळ
६.	अन्वरशा फकीर	- मधुकर वाकोडे

पद्य

१.	संतवाणी	अ - संत ज्ञानेश्वरांचे अभंग	– घनु वाजे घुणघुणा
		ब - संत तुकारामाचे अभंग	– टिळा टोपी उंच दावी
२.	विद्यार्थ्याप्रत		– केशवसुत
३.	सुख		- बबन सराडकर
४.	विश्वशांती		– दिनेश काळे
५.	बाप		- प्रमोद गारोडे

व्यावहारिक मराठी

१. व्यावहारिक मराठी - स्वरूप आणि भूमिका
२. भाषिक संवाद व्यवहारांची मूलतत्त्वे

बी.एस.सी. (भाग१)

विषय - मराठी अनिवार्य

सत्र २ रे

गद्य

१. शिक्षण — जोतीराव फुले

२. डॉ. पंजाबराव देशमुख — वि.भि. कोलते

३. भारतीय संविधानाची विज्ञाननिष्ठा — यशवंत मनोहर

४. कृष्णविवर — जयंत नारळीकर

५. लापड - गणेश चव्हाण

६. ग्रामगीतेतील अस्पृश्यता निर्मूलन विचार - सिंधू मांडवकर

पद्य

१. संतवाणी   अ - संत मुक्ताबाई - मुंगी उडाली आकाशी

ब - संत रामदास — निश्चयाचा महामेरू

२. आजोबा — विनायक पवार

३. मलाला युसुफझाई — विष्णू सोळंके

४. हुंकार — अनिल काळबांडे

५. **विज्ञानयुग** - **आ.य.पवार**

व्यावहारिक मराठी

१. **मराठी भाषा आणि प्रसारमाध्यमे** - **डॉ.सर्जनादित्य मनोहर**

२. जाहिरातीची लेखन कौशल्ये - **प्रा. वैशाली कार्लेकर**

अभ्यासक्रम व गुण विभागणी

गद्य	— एकूण गुण १५
पद्य	— एकूण गुण १५
व्यावहारिक मराठी	— एकूण गुण १०

कौशल्य संवर्धन मॉड्युल (Skill Enhancement Module)

— व्यावहारिक मराठीच्या अभ्यासक्रमावर प्रकल्प तयार करणे   — एकूण गुण १०
       व त्यावर प्रत्यक्ष मुलाखत

गद्य व पद्य विभाग

प्रश्न १ ला : वस्तुनिष्ठ बहुपर्यायी प्रश्न (गद्य गुण ५ अ पद्य गुण ५)   — एकूण गुण १०
       सर्व प्रश्नांना समान गुण

गद्य विभाग

प्रश्न २ रा : लघुत्तरीप्रश्न — कोणतेही दोन प्रश्न सोडवा   — एकूण गुण १०

पद्य विभाग

प्रश्न ३ रा : लघुत्तरीप्रश्न — कोणतेही दोन प्रश्न सोडवा   — एकूण गुण १०

व्यावहारिक मराठी

प्रश्न ४ था : कोणतेही दोन प्रश्न सोडवा   — एकूण गुण १०

व्याखानांचे वितरण (Distribution of Lectures)

Unit		No of Lectures
१) गद्य	-	१६
२) पद्य	-	१४
३) व्यावहारिक मराठी (Skill Enhancement Module)	-	१०
४) कौशल्य संवर्धन मॉड्युल (Skill Enhancement Module)	-	10

Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology
Programme: B. Sc. (Biotechnology)

POs:

At the time of graduation, Students will be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:
Upon completion of the programme successfully, students would be able to
1. understand the structures and purposes of prokaryotic and eukaryotic cells.
2. understand the structures and purposes of basic components of cell.
3. understand the cellular components underlying mitotic cell division.
4. apply their knowledge of cell biology in cell function.

Employability Potential of the Programme:

The Biotechnology sector in India is extremely innovative and on the rise. Next few years are bound to see exponential growth in this sector. India is among the top 12 Biotechnology destinations in the world and ranks third in the Asia-Pacific region. The industry comprises around 5000 biotech companies, with 4,240 being start-ups and 760 being core biotech companies, with the number of startups expected to touch 10,000 by 2024.
India has 665 FDA-approved plants; 44% of the global abbreviated new drug applications (ANDA) and more than 1400 manufacturing plants, which are compliant with WHO's requirements. It is regarded as one of the most significant sectors in enhancing India's global economic profile. India has been blessed with a highly talented pool of students in biotechnology.

The National Biotechnology Development Strategy (2015 – 2020) and National Education Policy (2016) envision a quality education system to produce graduates equipped with the knowledge, skills, attitude, and values that are required to lead a productive life and participate in the country's development process. Improving employability in this sector is heavily dependent on the overall curriculum of the educational programs. Since the last curriculum revision exercise was undertaken long ago, it is necessary to update the current curriculum.

The curriculum updating exercise not only brings the course curricula at par with the current development in Biotechnology sector but also seeks to create manpower and human resource capable of high order thinking and skills.

The programme has been aligned with the National Biotechnology Development Strategy (2015-2020) put forth by Department of Biotechnology, Ministry of Science and Technology, Government of India, which provides a strategic roadmap for India's emergence as a global Biotechnology innovation and manufacturing hub, which also highlight importance of human resource development and need for nurturing tailor-made human capital for advanced strategic research and entrepreneurship.

Syllabus Prescribed for B. Sc. I Sem I Year UG Programme

Programme:
Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
1BTC-DSC-3	**Cell Biology**	**90 hrs**

COs
Upon completion of this course successfully, students would be able to

1. understand the Cell as a basic structural and functional unit of life
2. differentiate prokaryotic and eukaryotic Cell.
3. understand the structure and function of various cell organelles
4. understand the basics of Cell organization, Cell communication and Cell transport.
5. understand the cellular components underlying cell division and cell cycle.

Unit	Content
Unit I	**Introduction to cell** A. Origin of life: Miller experiment B. Discovery of cell and Cell theory. Exceptions to the cell theory C. Cell as a basic unit of living system D. Prokaryotic and eukaryotic cell: Similarities and differences E. Structure of prokaryotic (bacterial) cell F. Structure of eukaryotic (plant and animal) cell G. Similarities and differences between plant and animal cell **(15 periods)**
Unit II	**Cell organelles: Structure and Function** A. Nucleus B. Cell wall C. Plasma membrane D. Mitochondria E. Golgi complex F. Endoplasmic reticulum, G. Lysosomes and Vacuoles H. Chloroplast I. Ribosomes J. Peroxisomes **(15 periods)**
Unit III	**Cytoskeleton and cell locomotion** A. Structure and function of microtubules B. Structure and function of actin filament C. Structure and function of intermediate filaments D. Cell locomotion : Flagellar, ciliary and amoeboid locomotion E. Stem cells: Properties and applications **(15 periods)**
Unit IV	**Cell division and cell transport** A. Cell division, Mitosis and meiosis B. Overview and phases of cell cycle C. Cancer D. Programmed cell death E. Cell transport across membrane: Active, Passive, Diffusion, Osmosis, Transporters, Ion channels **(15 periods)**

Unit V	**Extracellular Matrix, Membrane function, Cell lysis** A. Extracellular Matrix: Composition, molecules that mediate cell adhesion. B. Cell junctions. C. Signal transduction (Basic steps) D. Types of receptors: Cell surface receptors and nuclear receptors. E. Cell lysis methods, Density gradient and Differential centrifugation **(15 periods)**
Unit VI	**Skill Enhancement Module: Basic Microscopic techniques** A. Light microscopy B. Dark field microscopy C. Phase contrast microscopy D. Immuno fluorescence microscopy E. Electron microscopy **(15 periods)**

Course Material/Learning Resources

Text books:

Reference Books:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition.Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Syllabus Prescribed for 2022 Year **UG**
ProgrammeProgramme: B. Sc. Biotechnology

Semester I Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
- Practical – I	Practical based on DSC I	06

CO:
Upon completion of this course successfully, students would be able to

1. Adapt basic knowledge on various techniques and areas of cell biology.

Practical-I :

1. Compound microscope
2. Study the effect of temperature and organic solvents on semi permeable membrane.
3. Demonstration of dialysis.
4. Study of plasmolysis and de-plasmolysis.
5. Demonstrate Cell fractionation and identification of cell fraction
6. Study of structure of any Prokaryotic and Eukaryotic cell.
7. Cell division in onion root tip.

Learning Outcome:

Student would be able to design and execute experimental procedures in cell biology.

Syllabus Prescribed for B. Sc. I Sem II Year   UG Programme

Programme: B. Sc. Bio Technology

Semester II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
DSC-3	Biomolecules	90 hrs

COs

Upon completion of this course successfully, students would be able to

1. describe the properties of some important biomolecules.
2. explain important functions of biomolecules in living systems.
3. perform tests to detect the presence of carbohydrates and proteins.
4. explain classification of carbohydrates, proteins, lipids, nucleic acids etc.

Unit	Content
Unit I	**Carbohydrates** – A. Importance, classification, physical and chemical properties of carbohydrates B. Structure, configuration and biochemical importance of monosaccharides (Glucose and Fructose) Oxidation, Reduction; Vitamins- classification, sources, functions and applications C. Reducing and non-reducing sugars- structure, configuration and biochemical importance of disachharides and glycosidic bond (Sucrose, Lactose, Maltose, Isomaltose) D. Structure and functions of polysaccharides (Starch, glycogen, chitin) **(15 periods)**
Unit II	**Lipids** – A. Importance and properties. B. Classification-- simple lipids, complex lipids, derived lipids, sterols, C. Fatty acids: saturated and unsaturated fatty acids with examples D. Triacylglycerols: Structure & properties E. Biological significance of fats, F. Structure & functions of Phospholipids and glycolipids: lecithins, cephalins, phosphoinositides & spingomyelins,glycolipids-cerebrosides, gangliosides G. Steroids: properties & functions of ergosterol, cholesterol, bile acids **(15 periods)**
Unit III	**Proteins** – F. Classification, structure, physical and chemical properties of amino acids G. Classification of proteins. H. Peptide bond and peptides: Characteristic properties and formation I. Peptide-hormones J. Structure of proteins: primary, secondary, tertiary and quaternary. K. Biological importance of proteins. **(15 periods)**
Unit IV	**Nucleic acids** – A. Structure and functions: Physical & chemical properties of Nucleic acids B. Purine & pyrimidine bases, C. Nucleosides & nucleotides, D. Biologically important nucleotides E. Structure and functions of DNA F. structure and forces responsible for A, B & Z – DNA G. denaturation and renaturation of DNA H. Structure and functions of RNA (mRNA , tRNA, rRNA) **(15 periods)**

Unit V	**Enzymes-** A. Terminology: Enzyme, substrate, prosthetic group, coenzyme, cofactor, active site, inductive enzymes, allosteric enzymes, Isozymes, metalloenzymes, ribozymes, abzymes B. Classification and nomenclature C. Effect of temperature, pH, substrate concentration and enzyme concentration on enzyme catalyzed reactions. D. Mechanism of enzyme action E. Michaelis Menton equation F. Enzyme inhibition (competitive and non-competitive), G. Role of co-enzymes.

Unit VI	**Skill Enhancement Module: Qualitative analysis of biomolecules**
	    a. Benedicts test for monosaccharides
	    b. Qualitative analysis of amino acids
	    c. Qualitative analysis of proteins
	    d. Test for nitrogen, sulphur, halogens and phosphorus
	
	                                                   (15 periods)

Course Material/Learning Resources

Text books:

1.Lehninger Principles of Biochemistry By: David L. Nelson and Cox

2.Biochemistry By: Rex Montgomery

3.Harper's Biochemistry By: Robert K. Myrray

4.Enzymes By:Trevor Palmer

5. Enzyme structure and mechanism By: AlanFersht

6.Principles of Biochemistry By: Donald J. Voet, Judith G.Voet, Charlotte W.Pratt

7.Analytical Biochemistry By Cooper

Reference Books:

Weblink to Equivalent MOOC on SWAYAM if relevant:

Weblink to Equivalent Virtual Lab if relevant:

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

Syllabus Prescribed for UG ProgrammeProgramme: B. Sc. Biotechnology

Semester II Code of theCourse/Subject	Title of the Course/Subject (Laboratory/Practical/practicu m/hands-on/Activity)	(No. of Periods/Week)
- Practical – II	Practical based on DSC II	06

CO:
Upon successful completion of this course, students would be able to
1. Adapt basic knowledge on various techniques and areas of biological chemistry.

Practical-II :

1. Demonstrate Qualitative tests of sugars, amino acids and lipids
2. Estimation of total sugars by Anthron method
3. Reducing sugars by DNS method
4. Estimation of proteins by Biuret method
5. Enzyme assay- catalase or invertase
6. Determination of acid value of fats
7. Amylase activity assay

Learning Outcome:

Student would be able to design and execute experimental procedures in biochemistry.

Sant Gadge Baba Amravati University Amravati

Scheme of teaching, learning &Examination leading to the Degree Bachelor of Science (Three Years ... Six Semesters Degree Course- C.B.C.S)

(B. Sc Part-I) (Semester- I) BIOTECHNOLOGY

Sr. No	Subjects	Subject Code	Teaching & Learning Scheme							Duration of Exams Hrs.	Examination & Evaluation Scheme						Minimum Passing	
			Teaching Period Per week				Credits				Maximum Marks							
							Theory	Practical	Total		Theory + M.C.Q External	Skill Enhancement Module Internal	Practical		Total Marks	Marks	Grade
			L	T	P	Total							Internal	External			
1	BTC 1(Theory)		6	-	-	6	4.5	-	4.5	3hrs.	80	20	-	-	100	40	p
2	BTC lab 1 (Practical)		-	-	6	6	-	2.25	2.25	3 hrs.	-	-	-	50	50	25	p
3																	
4																	
5	AEC (Theory)																
6	AEC (Practical)																
7	GOEC – 1									College Level Evaluation							
8	Induction Programme		30 Hrs. (One Week) at the beginning of semester – 1 only							Non exam credit, evaluation at college level							
	Total																

L: Lecture, T: Tutorial, P: Practical

Sant Gadge Baba Amravati University Amravati

Scheme of teaching, learning &Examination leading to the Degree Bachelor of Science (Three Years ... Six Semesters Degree Course- C.B.C.S)

(B.Sc Part-I) (Semester- II) BIOTECHNOLOGY

Sr. No	Subjects	Subject Code	Teaching Period Per week				Credits			Duration of Exams Hrs.	Maximum Marks				Total Marks	Minimum Passing	
											Theory + M.C.Q External	Skill Enhancement Module Internal	Practical			Marks	Grade
			L	T	P	Total	Theory/Tutorial	Practical	Total				Internal	External			
1	BTC 2(Theory)		6	-	-	6	4.5	-	4.5	3hrs.	80	20	-	-	100	40	p
2	BTC lab 2 (Practical)		-	-	6	6	-	2.25	2.25	3 hrs.	-	-	-	50	50	25	p
3																	
4	DSC-…….(Practical) if applicable																
5	AEC (Theory)																
6	AEC (Practical)																
7	GOEC – II									College Level Evaluation							
	Total																

L: Lecture, T: Tutorial, P: Practical
Note : Internship /Field Work / Work Experience will be conducted after IInd semester till Vth semester in vacations for 15/30 days (60 hrs.)

<div align="center">**Sant Gadge Baba Amravati University, Amravati**</div>

Faculty: Science and Technology

Programme: B.Sc. (Chemistry)

POs:

At the time of graduation, Students would be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:

Upon completion of the programme successfully, the learners would be able to-

1. Understand the scope, methodology and application of modem chemistry.

2. Apply theoretical and practical concepts of instruments that are commonly used-in most chemistry field.

3. Plan and conduct scientific experiments and record the results of such experiments.

4. Get acquainted with safety of chemicals, transfer, and measurements of chemicals, preparation of solutions, and using physical properties to identity compounds and chemical reactions.

5. Describe how chemistry is useful to solve social, economic and environmental problem and issues facing our society in energy, medicine, and health.

Employability Potential of the Programme:

A degree in Chemistry is an intelligent choice for future employability and earning potential for learners. Degree program with Chemistry offers the necessary knowledge, develop skills and nurture creativity to achieve success in virtually any field that's even distantly related in some way to chemistry. A degree in chemistry is recognized as a symbol of quality and commitment by employers both inside and outside the chemical industries. Chemistry provides jobs in cutting-edge technologies within science and research as well as in many fields of distant relations. Chemistry graduates apply their skills within the areas of environmental sciences, medical fields, scientific equipment sales, science communication, teaching or academic research, a few to mention. Thus, a degree in chemistry widens numerous prospects and opportunities for a wide

variety of careers in many different fields like science, research, business and health care, etc. Chemistry inculcates excellent analytical and mathematical skills, which lead to enhanced problem-solving abilities and critical thinking. This improves the likelihoods to secure job in other fields too. Some important skills and abilities honed by chemistry learners include:

- Cutting-edge scientific and numerical skills
- Curiosity to understand and solve
- Attention to collect and analyse details
- Patience and determination
- Research and development skills
- Analytical skills
- Use of ICT enabled techniques
- Written and oral communications skills

The thriving and widely recognized branches of chemistry like Organic, Inorganic, Physical, Analytical, etc. not only expand critical thinking and the ability to understand other scientific and engineering concepts more easily, but also open new horizons to pursue career in different fields. Organic chemistry offers research and development of organic materials, modify and study carbon-based materials to develop a product having a specific purpose for wider use. They also accomplish various scientific studies to identify or find applications for compounds for society. Many industries like pharmaceuticals, agriculture, paints, dyes, and many more prefer to employ organic chemists. Inorganic chemistry has a greater potential in the fields of metallurgy, synthesis of new materials from different elements, bioinorganic, etc. It focusses on solving the fundamental problems associated with structure of atoms, molecules and their properties. Analytical chemists find their role for toxicology examinations, quality control and assessment, analysis of pharmaceuticals, investigations for forensic analysis, development of equipment, etc. Analytical chemists work for a particular private or government laboratory or organization, and also develop particular specialties like food technology, forensics or toxicology, to name a few. Physical chemistry enhances critical ability and inculcates problem solving skills among the learners. All industries rely heavily on physical parameters for manufacturing and quality assurance of products.

Apart from the technical and specific skills, a chemistry graduate also acquires fundamental professional skills throughout the degree program to pursue careers not directly related to the field. These skills include:
- Effective listening and communication skills
- Presentation and interaction skills
- Data collection, analysis and reporting skills
- Modern ICT enabled skills
- Aptitude to work proficiently independently or in a team

Future scope for B.Sc. Chemistry graduates:
- Prestigious institutions like IIT, NIT, IISER, IISc, BARC, TIFR, a few to mention, offer higher studies such M.Sc. and Ph.D.
- Likewise, foreign Universities also accept chemistry graduates for higher studies.
- Chemistry student can become small or medium scale entrepreneur (own industry).
- Union and State Public service commissions like UPSC, MPSC, Bank Probationary officers, other competitive examinations, etc. offer a multitude of jobs and positions like Drug Inspector, Lab chemist, forensic analyst, etc. for chemistry graduates.
- Students can take teaching jobs at Kendriya Vidyalaya, Navodaya Vidyalaya, High Schools after completing B.Ed. or respective eligibility criteria.
- Laboratory technician in various Public Sector Units like ONGC, IOCL, NTPC, BARC, and Private sector industries.
- Students can become Content Developer for IT industries.
- Students can become Quality Control Chemists/ Food Inspector at Food Co-operation of India, Food Safety and Standards etc
- Laboratory technicians to look after sophisticated instruments like NMR, Mass Spectrometer, UV-Visible Spectrophotometer, Single crystal machines, XRD, SEM, AAS, TEM etc. in research laboratory of academic institutions as well as private sector companies

- Research Scientist/ Operations Manager/ Chemists / Quality Manager / Research Manager at various industries like Pharmaceuticals, Cement, Plastic, Drugs, Paint, Dyes, Agricultural sector, etc.
- Employee at Security Printing and Minting co-operation of India
- Employee at Office of Controller general of Patent design and trade work

Syllabus Prescribed for Three Year   UG/PG Programme

Programme:

Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
CHE(1S)T	**Chemistry 1S**	**84**

COs:

By the end of this course, the students would be able to:

1. Solve the conceptual questions using the knowledge gained by studying periodicity in atomic radii, ionic radii, ionization energy and electron affinity of elements.
2. Apply concepts of acids and bases as well as non-aqueous solvents and their industrial usage.
3. Compare different reaction intermediates, functional group chemistry through the study of methods of preparation, properties and chemical reactions with underlying mechanism.
4. Choose correct synthetic approach to prepare derivatives of industrially important molecules
5. Solve different numerical problem of varying difficulty associated with gaseous and liquid state.
6. Apply the concepts from advanced mathematics to solve the derivation of different chemical formulae.

Unit	Content
Unit I	**Periodicity of Elements:** s and p block elements: Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle. Shapes of s and p orbitals. Electronic configuration for s and p block elements. Detailed discussion of the following properties of the elements, with reference to s and p-block. (a) Nuclear charge and number of shell and its variations (b) Atomic and ionic radii and their variations (d) oxidation states (e) Ionization potential, Successive ionization potential and its variations. (f) Electron affinity and its trends. (g) Electronegativity and its variations. Effect of ionization energy and electronegativity on different properties of elements namely metallic and non-metallic character, relative reactivity, oxidizing and reducing properties. Diagonal relationships: Li with Mg, B with Al. Abnormal behavior of nitrogen. **Periods: 14**
Unit II	**A) Acids and Bases**- Arrhenius, Bronsted-Lowry, and Lewis's theory of acids and bases, Theory of solvent systems and Lux-Flood concept of acids and bases. Hard and soft acids and bases. Pearson's HSAB or SHAB principle with important applications. **B) Nonaqueous Solvents**-Requirements of a good solvent. Water as a universal solvent. Physical properties of solvents namely liquid range, dielectric constant, dipole moment, heat of vaporization and solubility behavior. Classification of solvents. Acid base, precipitation, redox, solvolysis and complexation reactions in liquid ammonia. Merits and demerits of liquid ammonia as a solvent. **Periods: 14**
Unit III	**Basics of Organic Chemistry:** **A) Electronic Displacement and Reactive Intermediates:** Inductive, Electromeric, Resonance, Mesomeric effects, Hyperconjugation and their applications, dipole moment, homolytic and heterolytic fission with suitable examples. Electrophiles and nucleophiles. Types, shape and their relative stability of carbocations, carbanions, free radicals and carbenes and nitrene.

	B) Aliphatic Hydrocarbons: Formation and reaction of alkanes, Formation of alkenes and alkynes by elimination reactions (with mechanism of E1, E2, E1cb), Saytzeff and Hofmann eliminations, Reactions of alkenes and alkynes, Diels-Alder reaction. **C) Structural isomers:** Definition, classification, and examples. **Periods: 14**
Unit IV	**Aromatic Compounds:** **A) Structural Properties:** Aromaticity and Huckel's rule (Benzenoid and Non-Benzenoid compounds), Kekule and Dewar structures, Molecular orbital diagram of benzene, Anti-aromatic and non-aromatic compounds. **B) Orientation effect:** Effect of substituent groups, Activating and deactivating group, Theory of reactivity and orientation on the basis of inductive and resonance effects. **C) Electrophilic aromatic substitution:** Halogenation, nitration, sulphonation and Friedal Craft's alkylation/acylation with their mechanism. **Periods: 14**
Unit V	**Gaseous State:** Postulates of kinetic theory of gases, Maxwell-Boltzmann distribution of velocities (only qualitative treatment), RMS velocity, Average velocity, Most probable velocity, Relationship between RMS velocity and Average velocity, RMS velocity and Most probable velocity, Mean free path, Collision diameter, Collision number or Collision frequency, Deviation of real gases from ideal behaviour, Explanation of deviations, Derivation of van der Waal's equation for real gases. Critical phenomenon, Andrew's experiment (isotherms of carbon dioxide) Critical constant Pc, Tc, Vc in terms of van der Waal's constant (a, b) Derivation of reduced equation of state, Law of corresponding state, Numerical. **Periods: 14**
Unit VI	**A) Liquid State:** Definition of surface tension, Its SI unit and effect of temperature on surface tension, Derivation of expression for relative surface tension by stalagmometer method. Applications of surface tension. Viscosity, definition of coefficient of viscosity, Its SI unit and effect of temperature on viscosity, Derivation of expression for relative viscosity by Ostwald's viscometer method, Applications of viscosity. **B) Physical Properties and Molecular Structure:** **I. Electrical Properties:** (i) Polar and non-polar molecules. Dipole moment. (ii) Induced polarization and orientation polarization. Clausius Mossotti equation (only qualitative treatment). (iii) Measurement of dipole moment by temperature and refractitivity methods. (iv) Applications of dipole moment for the determination of molecular structure. i.e. percentage ionic character of covalent bonding, molecular geometry, cis-trans isomers, ortho, meta and para isomers of a disubstituted benzene. **II. Magnetic Properties:** (i) Paramagnetic and diamagnetic substances, origin of paramagnetism, diamagnetism, ferromagnetism and antiferromagnetism. (ii) Volume, specific, mass and molar susceptibility. Relationship between molar magnetic susceptibility and magnetic moment. (iii) Relationship between magnetic moment and number of unpaired electrons. (iv) Gouy's balance method for determination of magnetic susceptibility. (v) Application of magnetic moment in the determination of molecular structure. (vi) Numerical **Periods: 14**

*SEM:

A) Create models for periodic table or periodic properties, or shape of orbitals, categorization of acids and bases on the basis of various theories, Compare applications of non-aqueous solvents.

B) Analyze the role of reaction intermediates in different organic reactions, classification of aromatic and non-aromatic compounds with justification.

C) Numerical associated with gaseous and liquid state, Applications of van der Waal's equation for other gaseous constants and parameters, Prediction of molecular structures using physical properties, Data collection and analysis for surface tension and viscosity coefficient of different liquids.

COs:	
By the end of this module, the students will be able to: 1. Create models associated with periodic table 2. Associate reaction intermediates and functional group chemistry with different types of reaction mechanisms. 3. Solve numerical problem associated with gaseous and liquid state.	
**Activities:	Model creation, Chart preparation, memory maps, Class tests, assignments, project, survey, group discussion, industrial visit, or any other innovative pedagogical method. Any two activities be conducted from above. Class tests are compulsory. Equal weightage for each activity.

Course Material/Learning Resources

Text books:

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- Vishal Publications, Delhi.

2. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
3. A Text Book of Chemistry for first Semester of B.Sc. by AUCTA Association and DnyanPath Publication, Amravati

Reference Books:

1. Inorganic Chemistry by A.K. De, Wiley East Ltd.
2. Inorganic Chemistry by Meisler and Tarr, 4th Edition, Pearson Pub.

3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan, S. Chand & Co.

4. Concise Inorganic Chemistry by J.D. Lee, ELBS.

5. Inorganic Chemistry by J.E. Huheey- and Kettle, Harper & Row.

6. Advanced Inorganic Chemistry, Vol-I, Satya Prakash, Madan, Tuli, Basu.

7. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.

8. Organic Chemistry by S.K. Ghosh.

9. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.

10. Stereochemistry and mechanism through solved problems by P.S. Kalsi.

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12. Organic chemistry by R. K. Bansal

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16. Principles of Physical Chemistry: Puri, Sharma, and Pathania.

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24. Practical Physical Chemistry: Khosla.

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Weblink to Equivalent MOOC on SWAYAM if relevant:

Weblink to Equivalent Virtual Lab if relevant:

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

Syllabus Prescribed for three Year UG/PG Programme

Programme: B.Sc. with Chemistry

Semester 1

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
CHE(1S)PR	Chemistry 1S	Total 26 per Semester

COs

At the end of Lab/Practical course, students would be able to

1. Synthesise different types of organic compounds.
2. Perform the process of filtration, crystallization, melting point, waste management.
3. Understand the effect of orientation effect of a group
4. Skilfully determine the surface tension, viscosity of liquid.
5. Predict the endothermic or exothermic process from heat of solution of a salt.

* List of Practical/Laboratory Experiments/Activities etc.

1	Preparation of Acetyl derivative of aromatic primary amine (aniline or toluidine).
2	Preparation of Benzanilide (Benzoylation).
3	Preparation of Benzoic acid from Benzamide (Hydrolysis).
4	Preparation of Benzoic acid from benzaldehyde (Oxidation).
5	Preparation of phenyl–azo–β–naphthol dye (Diazotisation)
6	Base catalysed Aldol Condensation (Synthesis of dibanzal propanone).
7	Preparation of p-nitroacetanilide from acetanilide.
8	Determination of surface tension of a given liquid using Stalagmometer
9	Determination of the parachor value of -CH_2- group (methylene) using Stalagmometer
10	Determination of coefficient of viscosity of aqueous solution of ethanol or polymer at room temperature
11	Determination of unknown percentage composition of given glycerol solution from standard 2%, 4%,6%,8% and 10% solutions of glycerol
12	Determination of the heat of solution of KNO_3 (5% solution)

Note:

a) Student should perform the single stage preparation with the help of given procedure.

b) Melting point and percentage yield should be reported.

c) The sample should be submitted.

d) Students should recrystalize the sample with suitable solvent.

e) Students should know the reaction and its mechanism of given single stage preparation.

Distribution of Marks for Practical Examination

Time: 4 hours (One Day Examination)   Marks: 50

Exercise-I ……….. 18

Exercise-II ………..18

Viva-Voce ……….07

Record ……………... 07

           Total: 50

Syllabus Prescribed for Three Year   UG/PG Programme
Programme: B.Sc. with Chemistry
Semester 2

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
CHE(2S)T	Chemistry 2S	84

COs
By the end of this course, the students would be able to:
1. apply the knowledge gained by studying types of bonding, solvation, hybridization and molecular geometries.
2. Draw the correct molecular structures, bond order and bond length.
3. synthesize commercially important compounds of varying carbon backbone.
4. Choose correct synthetic approach to prepare derivatives of industrially important molecules.
5. Solve numerical problems related to crystalline state.
6. Acquire skills to use chemical kinetics to develop mechanism of chemical reactions.

Unit	Content
Unit I	**A) Ionic bonding:** Definition of ionic bond. Factors affecting ionic bond formation (energetic of ionic bond formation ionization energy, electron affinity and lattice energy). Born-Haber's cycle to determine lattice energy. Solvation and solvation energy, factors affecting solvation energy. **B) Polarization:** Definition, polarizing power, polarizability, effect of polarization on nature of bond. Fajan's rules of polarization and its applications. **C) Valence bond theory:** Directional nature of covalent bond. Hybridization, types of hybridization to explain geometries of $BeCl_2$, BF_3, CH_4, PCl_5, SF_6 and IF_7 **Periods: 14**

Unit II	**A) VSEPR Theory:** Various rules under VSEPR theory to explain molecular geometry (following examples may be taken to explain various rules- $SnCl_2$, CH_4, NH_3, H_2O, SF_4, ClF_3, XeF_4, XeO_3, PCl_3. Limitations of VSEPR theory **B) Molecular Orbital Theory:** Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level diagram. Concept of bond order. MO structure of homonuclear diatomic molecules of namely He_2, H_2, N_2 and O_2. Stability sequence of species of O_2 i.e. O_2, O_2^+, O_2^{2+}, O_2^- and O_2^{2-}. Paramagnetic nature of O_2. MO structure of heteronuclear diatomic molecules viz. NO, HF and CO (Coulson's structure). Explanation of important properties of CO viz. – triple bond, almost nonpolar nature, electron donor and acceptor behavior. Comparison of VB and MO theories. **Periods: 14**
Unit III	**A) Haloalkanes:** Vinyl chloride - Synthesis from acetylene and ethylene dichloride, reactions with aqueous and alcoholic KOH, polymerization. Allyl chloride - Synthesis from propylene, reactions with aqueous and alcoholic KOH. Allyl bromide - Synthesis from propylene using NBS, reaction with HBr. Comparison of reactivity of vinyl and allyl chloride. **B) Haloarenes:** Chlorobenzene - Synthesis from phenol, reaction with acetonitrile. Bromobenzene - Synthesis from silver salt of benzoic acid (Hunsdiecker reaction), Wurtz-Fittig reaction. Iodobenzene - Synthesis from benzene diazonium chloride, Ullmann reaction. Benzyl chloride - Synthesis from toluene and benzene, reactions with Mg and NaCN. Comparison of reactivity of chlorobenzene and benzyl chloride, benzyne intermediate mechanism. **C) Polyhydric alcohols:** Ethylene glycol - Synthesis from ethylene and ethylene dibromide, reactions with PCl_5, CH_3COOH and acetone, dehydrations using conc. H_2SO_4, $ZnCl_2$ and phosphoric acid. Pinacol - Synthesis from acetone and α-diketone, Pinacol-Pinacolone rearrangement (mechanism). Glycerol - Synthesis from propylene and 3-chloropropylene, reactions with HNO_3, HCl and Na, dehydration using $KHSO_4$ **Periods: 14**
Unit IV	**A) Phenols:** Phenol - Synthesis from toluene, cumene and salicylic acid, Kolbe's carboxylation reaction, Fries rearrangement, Reimer-Tiemann reaction, bromination, acidity of phenol. **B) Ethers and epoxides:** Diethyl ether - Synthesis from ethanol, Williamson's synthesis, reactions with cold and hot HI and acetic anhydride. Crown ethers - Brief introduction to crown ethers and its applications. Ethylene oxide - Synthesis from ethylene, ring opening reactions with Grignard reagent, HCN and H_2S, reduction with $Zn + CH_3COOH$, dimerization to dioxane (mechanism). Styrene oxide - Synthesis from styrene, ring opening reactions with acid and alkali, reduction with $LiAlH_4$. **C) Thiols and thioethers:** Ethanethiol - Synthesis from ethyl iodide, oxidations with I_2 and H_2O_2. Diethyl sulphide - Synthesis from ethyl bromide, Williamson's synthesis, desulphurization with Raney Ni, decomposition with alkali. **Periods: 14**
Unit V	**Crystalline state:** Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles. Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and Miller indices of a lattice planes, calculation of interplanar distance d(h,k,l) from Miller indices in a cubic system. Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.). Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C. Ratio of interplanar distances for 100, 110 and 111 lattice planes in S.C.C., B.C.C. and F.C.C. (No geometrical derivation). Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer

	method for the determination of crystal structure of NaCl and KCl. Anomalous behavior of KCl towards X-ray. Numerical. **Periods: 14**
Unit VI	**Chemical Kinetics:** Explanation of terms like rate of reaction, order of a reaction and molecularity. Definition with one example of zero, first and second order reaction. Half-life period of a reaction. Derivation of rate equation for first and second order reaction with equal initial concentration and different initial concentration of a reactant. Characteristics of first and second order reaction. Examples of first and second order reaction and their kinetics study with modified rate equation viz. the reactions (i) decomposition of H_2O_2, (ii) reaction between $K_2S_2O_8$ and KI, (iii) hydrolysis of methyl acetate catalyzed by acid, (iv) saponification of ethyl acetate by NaOH and (v) inversion of cane sugar. Determination of order of a reaction by integration, graphical, equifractional change, vant Hoff's differential method and Ostwald's isolation method. Effect of temperature on reaction rates. Arrhenius equation, activation energy and its determination using Arrhenius equation. Numerical. **Periods: 14**

*SEM:

A) Classify molecules using hybridization, VSEPR theory to predict molecular geometries, sketch Molecular orbital diagram for different molecules.

B) Comparative reactivity of halobenzene and benzyl halide, determine industrial uses of phenol, diethyl ether and ethylene epoxide.

C) Numerical associated with crystalline state and chemical kinetics, Determination of crystal structure of NaCl and KCl, Determination of order of reactions, and reaction kinetics.

COs:
By the end of this module, the students will be able to:
1. Create models associated with molecular geometries, hybridization, MO diagrams.
2. Develop synthetic routes for halobenzenes and benzyl halides.
3. Solve numerical problems associated with crystalline state and chemical kinetics.

**Activities:	Model creation, Chart preparation, memory maps, Class tests, assignments, project, survey, group discussion, industrial visit, or any other innovative pedagogical method. Any two activities be conducted from above. Class tests are compulsory. Equal weightage for each activity.

Course Material/Learning Resources

Text books:

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2. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
3. A Text Book of Chemistry for first Semester of B.Sc. by AUCTA
   Association and DnyanPath Publication, Amravati

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Syllabus Prescribed for three Year UG/PG Programme

Programme: B.Sc. with Chemistry

Semester 2

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
CHE(2S)PR	Chemistry 2S	26 per Semester

COs

At the end of Lab/Practical course, students would be able to -

1. Analyse the given organic compound qualitatively by different tests.
2. Prepare the derivative of the provided substance.
3. Illustrate the practical skills in volumetric analysis.
4. Differentiate types of titrations e.g. acid-base, redox, etc.
5. Comprehend the kinetics of reactions and interpret the experimental data.
6. Calculate, communicate and analyse the result.

* List of Practical/Laboratory Experiments/Activities etc.

	Complete analysis of simple organic compounds (like urea, thiourea, benzoic acid, Salicylic acid, oxalic acid, glucose, naphthalene, para-toluidine, benzamide, etc.) containing one or two functional groups involving following steps. i) Preliminary examination ii) Detection of elements iii) Detection of functional groups iv) Determination of melting point v) Preparation of derivative and determination of its melting point vi) Performance of spot test, if any
1	Qualitative analysis of compound-1
2	Qualitative analysis of compound-2
3	Qualitative analysis of compound-3
4	Qualitative analysis of compound-4
5	Qualitative analysis of compound-5
6	To determine the strength of oxalic acid by titration with $KMnO_4$.

7	To determine strength of FAS by titration with $KMnO_4$ using internal indicator.
8	Determination of temporary hardness of water sample.
9	To determine the strength of oxalic acid by titration with $KMnO_4$.
10	To determine strength of FAS by titration with $KMnO_4$ using internal indicator.
11	Determination of order of reaction of hydrolysis of methyl acetate by an acid.
12	To study kinetics of saponification of ethyl acetate by NaOH.

Distribution of Marks for Practical Examination

Time: 4 hours (One Day Examination)   Marks: 50

Exercise-I ……….. 18

Exercise-II ………..18

Viva-Voce ……….07

Record …………... 07

            Total: 50

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Faculty: Science & Technology

Programme:- B.Sc.

Subject: Compulsory English

Preamble:

English language plays an essential role in our lives as it helps in better communication on personal, social, literary, interdisciplinary topics and also in business world. It is the main language for studying any subject all over the world. It shall help to build up general language proficiency through listening, speaking, reading and writing, and provide the more opportunity to acquire broader information and specialized knowledge of particular subject through the English language. It is important for science students to learn English as it broadens their minds, develops communication skills and improves the quality of life by providing better job opportunities. It will perfect their communicative credentials, gain confidence, lead to achieve the goal early, make their personality effective, make them the part of global community, and enhance the opportunity of multiple career prospects. Since English is a global language used in many spheres of human life today, it has gained significance in every field. Skills and expertise acquired in usage of the language makes the students present themselves effectively and skilfully for jobs/ employment/ profession in various fields.

Course Outcome :

1. To facilitate the learners in acquiring listening and speaking competence

2. To assist the learners in independent language comprehension and production

3. To make the students aware about the different communicative functions of English.

4. To improve skills and proficiency for being employed as teachers, state government employees, civil aviation, engineering and medico-related industry, defence, commerce and taxation sector.

5. To be able to speak, write, read and listen flawlessly in person and through the electronic mode in English.

6. To understand views of others, mediate contradictory views/ disagreements, reaching conclusion in groups / group discussions.

7. To understand and use basic skills of the English language for applying it in the job assigned / employment accepted / profession undertaken.

Course Specific Outcome :

After completion of this course successfully, students would be able to

1. Understand nature and nuances of English Language used in prose lessons and poetic passages.

2. Apply the knowledge of English to communicate with others on personal, social, literary and interdisciplinary topics.

3. Compare the structure of English language to use LSRW.

4. Formulate the sentences as per situational requirement.

5. Differentiate between acceptable and unacceptable sentences in English.

6. Create appropriate, grammatically correct and acceptable sentences in English.

7. Develop general language proficiency through listening, speaking, reading and writing

Employability Potential of the Course:

English being one of the subjects only for Semester one and two in B.Sc degree restrict the students to learn English further in subsequent semesters. It is found that Compulsory English subject is given less importance and consequently the students of rural area are mostly affected and poor in their communications of English. However students who pass the B.Sc programme with English as one of the subjects in Semester one and Semester two have good opportunities of employment in education, private, semi-government, government, and industry sectors. The pass outs could get a job as per the core subject offered by them. If they develop their skills of communications, they can get the good job in their respective field. English is important for students as it broadens their minds, develops communication skills, employability skills and improves the quality of life by providing job opportunities.

English is the language of technology, agriculture, medical, aviation, computers, diplomacy, business and tourism. It is the language of international communication, the media and the internet. Whether it is for professional or personal reasons, understanding the importance of English will help the students to reach their goals. Knowing English increases the chances of getting a good job in a national and multinational company within the home country or of finding work abroad. In addition, English is increasingly used day by day in education and as a working language in many reputed companies. English is used in films, literature, songs, sports, trade, products, science and technology, and through these areas many English words and expressions have found their way into our mother tongue also. First and foremost, studying English can help the students to pursue and obtain more job opportunities. No matter what career pathway the students decide for them proficiency in English facilitates to become a better and more sought after employee.

Syllabus Prescribed for B.Sc. I Sem I Year UG Programme

Programme: B.Sc

Semester 1

Course Learning Outcome /CO

At the end of the Course, student would be able to:

CO1 understand the paragraph, prose, poetry and communicative skills.

CO2. apply the four skills of language in his daily inter-personal communications.

CO3. formulate/ compose his own sentences and able to speak English Language.

CO4. converse with other students in English.

CO5. communicate their ideas, thoughts and concepts properly in English.

B. Sc. I Semester I Compulsory English

Course Title	**English**
Course Code	
Course Category:	
Type of Course:	Theory + Practical
No. of Credits:	Theory - 04 + Tutorial – 01(Each batch of 16 students)
No. of Lectures:	Theory - 60 + Tutorial -15
Course Assessment:	End Term: 40 Marks (University level exam) SEM (Internal): 10 Marks (College level evaluation) AEC (Internal) : 25 Marks (College level evaluation)
Course Objective:	To train and prepare the students to seek and find employment in various field. To develop communicative competence in students To impart knowledge, ideas and concepts in the technicalities of proper pronunciation, construction, appropriate use and style of the English language as well as the application in the areas of English Communication Skills. To expose the students to the employment opportunities, challenges and job roles.
Course Outcomes:	At end of the course students would be able to CO1 understand the paragraph, prose, poetry and communication skills CO2. apply the four skills of language in his daily routine. CO3. formulate/ compose his own sentences and able to speak English Language.

	CO4. collaborate with others students in English.
	CO5. communicate properly their ideas and concepts in English.

B.Sc. Part I Semester – I
Compulsory English

Text Book Prescribed : *Magnificence* **Edited by Board of Editors, Sant Gadge Baba Amravati University, Amravati**

Publisher : Orient BlackSwan Pvt Ltd

Code :   Lectures

Unit I : Prose   18

1) Appro JRD – Sudha Murthy
2) All about a Dog – A. G. Gardiner
3) The Power of Prayer – APJ Abdul Kalam
4) Model Millionaire – Oscar Wilde

Unit II : Poetry   18

1) Daffodils – William Wordsworth
2) Leisure – W. H. Davies
3) Stay Calm – Grenville Kleiser
4) The Mountain and the Squirrel - Ralph W. Emerson

Unit III : Writing Skills   12

1) Preparing a CV
2) Applying for a Job
3) Narrating an Experience
4) Creative Writing (Expansion of idea)

Unit IV: Communication Skills
   1. Non –Verbal Communication   12
   2. Preparing a Newspaper Report

Unit V: Skill Enhancement Module (SEM)   `   15

1) Spot Visit and preparing a report – Visit to Super Market, Bus Stand, Railway Station, Bank, Medical Shop, Bakery etc.
2) Interview of a dignitary and writing a report in dialogue form
   (Skill Enhancement module will be of 25 marks. This module will be internally assessed flexibly on the basis of Class tests, assignments, seminar, reading material, project, survey, group discussion, Study tour, MCQ, Open Book exam (OBE), etc.)

Internal Assessment:

1) Class Test   5 Marks
2) Viva-Voce   5 Marks

(For Skill Enhancement Module and internal assessment the subject teacher shall be the sole examiner.)

Pattern of Question paper and Distribution of Marks
Maximum Marks: 40   **Time: Two Hours**

Que. 1 A : Students shall have to answer 4 MCQ questions based on Prose of one mark each. 4x1=4
Que. 1 B. Students shall have to answer 2 long answer questions based on Prose out of four questions.
Each question carries four marks each. 4x2=8
Que.2 A: Students shall have to answer 4 MCQ questions based on Poetry of one mark each. 4x1=4
Que.2 B. Students shall have to answer 2 long answer questions based on Poetry out of four questions.
Each question carries four marks each. 4x2=8
Que. 3. Students shall have to answer two questions based on unit three, out of four questions from this
Unit. 4x2=8
Que. 4. Students shall have to answer two questions based on unit four, out of four questions from this
Unit. 4x2=8

B. Sc. I Semester II Compulsory English

Course Title	**English**
Course Code	
Course Category:	
Type of Course:	Theory + Practical
No. of Credits:	Theory - 04 + Tutorial – 01(Each batch of 16 students)
No. of Lectures:	Theory - 60 + Tutorial -15
Course Assessment:	End Term: 40 Marks (University level exam) SEM (Internal): 10 Marks (College level evaluation) AEC (Internal) : 25 Marks (College level evaluation)
Course Objective:	To train and prepare the students to seek and find employment in various field. To develop communicative competence in students To impart knowledge, ideas and concepts in the technicalities of proper pronunciation, structure, appropriate use and style of the English language as well as the application areas of English Communication. To expose the students to the employment opportunities, challenges and job roles.
Course Outcomes:	➢ At end of the course students would be able to CO1 understand the paragraph, prose, poetry and communication skills CO2. apply the four skills of language in his daily routine. CO3. formulate/ compose his own sentences and able to speak English Language. CO4. collaborate with others students in English. CO5. communicate properly their ideas, thoughts and concepts in English.

Semester II Compulsory English
Text Book Prescribed : *Magnificence* **Edited by Board of Editors, Sant Gadge Baba Amravati University, Amravati**

Publisher : Orient BlackSwan Pvt Ltd

Code :   Lectures

Unit I : Prose   18

1) The Last Leaf – O' Henry
2) Of Studies – Francis Bacon
3) Why is the Sea Blue? – G. Venkatraman
4) The Mute Companion - R. K. Narayan

Unit II : Poetry   18

1) Treasured Moments – Manjushree Sardeshpande
2) Ode on a Grecian Urn – John Keats
3) Leave this Chanting and Singing – Ravindranath Tagore
4) How do I love thee? – Elizabeth Barrett Browning

Unit III : Speaking Skills   12
1) Introducing Yourself
2) Introducing People to Others
3) Interviews
4) Describing Daily Routine

Unit IV: Communication Skills   12
1) Verbal Communication
2) Précis Writing

Unit V: Skill Enhancement Module   15

1) Blog Writing
2) Presentation on a topic from prescribed prose/poem
   (Skill Enhancement module will be of 25 marks. This module will be internally assessed flexibly on the basis of Class tests, assignments, seminar, reading material, project, survey, group discussion, Study tour, MCQ, Open Book exam (OBE), etc.)

Internal Assessment:

1) Class Test   5 Marks
2) Viva-Voce   5 Marks

   (For Skill Enhancement Module and internal assessment the subject teacher shall be the sole examiner.)

Pattern of Question paper and Distribution of Marks

Maximum Marks: 40   **Time: Two Hours**

Que. 1 A : Students shall have to answer 4 MCQ questions based on Prose of one mark each. 4x1=4

Que. 1 B : Students shall have to answer 2 long answer questions based on Prose out of four questions. Each question carries four marks each. 4x2=8

Que.2 A: Students shall have to answer 4 MCQ questions based on Poetry of one mark each. 4x1=4

Que.2 B: Students shall have to answer 2 long answer questions based on Poetry out of four questions. Each question carries four marks each. 4x2=8

Que. 3. Students shall have to answer two questions based on unit three, out of four questions from this Unit. 4x2=8

Que. 4. Students shall have to answer two questions based on unit four, out of four questions from this Unit. 4x2=8

Faculty: Science & Technology
Programme:-B.Sc.

Syllabus for B.Sc. Part-I
Subject: Compulsory English

Preamble:

Since English is a global language used in many spheres of human life, it has gained significance. Skills and expertise acquired in usage of the language makes the person present himself / herself for jobs/ employment/ profession in various fields.

After studying the programme the learner shall be able to understand basic skills of the English language for applying it in his / her chosen field to apply the knowledge acquired in the job assigned / employment accepted / profession undertaken.

General Course Outcome (COs) :

1. To facilitate the learners in acquiring listening and speaking competence

2. To assist the learners in independent language comprehension and production

3. To make the students aware of the different communicative functions of English.

4. To impact skills and proficiency for being employed as teachers, state government employees, civil aviation, engineering and medico-related industry, defence, commerce and taxation sector.

5. To be able to speak, write, read and listen flawlessly in person and through the electronic mode in English.

6. To understand views of others, mediate contradictory views/ disagreements, reaching conclusion in groups / group discussions.

Course Specific Outcome :

After completion of this course successfully, students would be able to

1. Understand nature and nuances of English Language used in prose lessons, poetic passages.

Course Learning Outcome

At the end of the Course, student would be able to:

1. Understand the paragraph, prose and poetry.

2. Apply the four skills of language in his daily inter-personal communications.

3. Formulate/ compose his own sentences and able to speak English Language.

4. Converse with other students in English.

5. Communicate their ideas and concepts properly in English.

Employability Potential:

Students who pass the B.Sc programme with English as one of the subjects in Semester one and two have good opportunities of employment in Education, industry, sectors pass outs could get a job as steno, receptionist, event manager etc. If he / She develops his/ her can play the role or a job as a translator.

Students, who learn English language and grammar are good at communicating effectively, write and speak in English. This makes them eligible to grab career opportunities, such as translator, professor, various posts in media, industry, ministry etc.

Examinations leading to the Degree of Bachelor of Science
(Three Years Six Semesters Degree Programme) (Choice Based Credit System)
Scheme of Teaching, Learning, Examination and Evaluation (B.Sc. Part-I) (Mathematics) (Semester-I)

APPENDIX - AI

Sr. No	Subject	Subject Code	Teaching & Learning Scheme							Duration of Exams Hrs.	Examination & Evaluation Scheme						
			Teaching Period Per week				Credits				Maximum Marks					Minimum Passing	
			L	T	P	Total	Theory/ Tutorial	Practical	Total		Theory +M.C.Q Ext.	Skill Enhancement Module (SEM) Int.	Practical		Total Marks	Marks	Grade
													Internal	External			
1	Compulsory English		4	-		4	3	-	3	3	40	10	-	-	50	20	P
2	Communication Skill in English (AEC)		-	1	-	1	0.75	-	0.75	1			25	-	25	10	P
3	Second Language		2	-	-	2	1.5	-	1.5	3	40	10	-	-	50	20	P
4	Communication Skill in Second Language (AEC)		1	-	-	1	0.75	-	0.75	1			25	-	25	10	P

B. Sc. I Semester I Compulsory English

Course Title	**English**
Course Code	
Course Category:	
Type of Course:	Theory + Practical
No. of Credits:	Theory - 04 + Tutorial – 01(Each batch of 16 students)
No. of Lectures:	Theory - 60 + Tutorial -15
Course Assessment:	End Term: 40 Marks (University level exam) SEM (Internal): 10 Marks (College level evaluation) AEC (Internal) : 25 Marks (College level evaluation)
Course Objective:	To train and prepare the students to seek and find employment in various field. To develop communicative competence in students To impart knowledge, ideas and concepts in the technicalities of proper pronunciation, structure, appropriate use and style of the English language as well as the application areas of English Communication. To expose the students to the employment opportunities, challenges and job roles.
Course Outcomes:	At end of the course students would be able to

	At the end of the Course, student would be able to:
	CO1 Understand the paragraph, prose, poetry
	CO2. Apply the four skills of language in his daily routine.
	CO3. Formulate/ compose his own sentences and able to speak English Language.
	CO4. Collaborate with others students in English.
	CO5. Communicate properly their ideas and concepts in English.

B.Sc. Part I
Compulsory English
Semester – I

Code :   Lectures

Unit I : Prose   18

1) Appro JRD – Sudha Murthy
2) All about a Dog – A.G.Gardiner
3) The Power of Prayer – APJ Abdul Kalam
4) Model Millionaire – Oscar Wilde

Unit II : Poetry   18

1) Daffodils – William Wordsworth
2) Night of the Scorpion – Nissim Ezekiel
3) Stay Calm – Grenville Kleiser
4) The Mountain and the Squirrel - Ralph W. Emerson

Unit III : Writing Skills   12

1) Preparing a CV
2) Applying for a Job
3) Narrating an Experience
4) Creative Writing (Expansion of idea)

Unit IV: Communication Skills
  1. Non –Verbal Communication   12
  2. Preparing a Newspaper Report

Unit V: Skill Enhancement Module   `   15

1) Spot Visit and preparing a report – Visit to Super Market, Bus Stand, Railway Station, Bank, Medical Shop, Bakery etc.
2) Interview of a dignitary and writing a report in dialogue form

(Skill Enhancement module will be of 25 marks. It will be evaluated at college level)

Internal Assessment:

1) Class Test   5 Marks
2) Viva-Voce   5 Marks

(For internal assessment the subject teacher shall be the sole examiner.)

B. Sc. I Semester II Compulsory English

Course Title	**English**
Course Code	
Course Category:	
Type of Course:	Theory + Practical
No. of Credits:	Theory - 04 + Tutorial – 01(Each batch of 16 students)
No. of Lectures:	Theory - 60 + Tutorial -15
Course Assessment:	End Term: 40 Marks (University level exam) SEM (Internal): 10 Marks (College level evaluation) AEC (Internal) : 25 Marks (College level evaluation)
Course Objective:	To train and prepare the students to seek and find employment in various field. To develop communicative competence in students To impart knowledge, ideas and concepts in the technicalities of proper pronunciation, structure, appropriate use and style of the English language as well as the application areas of English Communication. To expose the students to the employment opportunities, challenges and job roles.
Course Outcomes:	➢ At end of the course students would be able to At the end of the Course, student would be able to: CO1 Understand the paragraph, prose, poetry CO2. Apply the four skills of language in his daily routine. CO3. Formulate/ compose his own sentences and able to speak English Language. CO4. Collaborate with others students in English. CO5. Communicate properly their ideas and concepts in English.

Semester II Compulsory English

Code :   Lectures

Unit I : Prose   18

    1) The Last Leaf – O' Henry
    2) Of Studies – Francis Bacon
    3) Why is the Sea Blue? – G. Venkatraman
    4) The Mute Companion - R.K. Narayan

Unit II : Poetry   18

    1) Once Upon a Time – Gabriel Okara
    2) Ode on A Grecian Urn – John Keats
    3) Leave this Chanting and Singing – Ravindranath Tagore
    4) How do I love thee? – Elizabeth Barrett Browning

Unit III : Speaking Skills   12
    1) Introducing Yourself
    2) Introducing People to Others
    3) Interviews
    4) Describing Daily Routine

Unit IV: Communication Skills   12
    1) Verbal Communication
    2) Précis Writing

Unit V: Skill Enhancement Module   15

    1) Blog Writing
    2) Presentation on a topic from prescribed prose/poem
       (Skill Enhancement module will be of 25 marks. It will be evaluated at college level)

Internal Assessment:

    1) Class Test   5 Marks
    2) Viva-Voce   5 Marks

    (For internal assessment the subject teacher shall be the sole examiner.)

Pattern of Question paper and Distribution of Marks
Maximum Marks: 40   **Time: Two Hours**

Que. 1. A Students shall have to answer 4 MCQ questions based on prose of one mark each. 4x1=4

B. Students shall have to answer 2 long answer questions based on prose out of four questions. Each question carries four marks each. 4x2=8

Que.2 A. Students shall have to answer 4 MCQ questions based on poetry of one mark each. 4x1=4

B. Students shall have to answer 2 long answer questions based on poetry out of four questions. Each question carries four marks each. 4x2=8

Que. 3. Students shall have to answer two questions based on unit three out of four questions with intra-Unit choice. 4x2=8

Que. 4. Students shall have to answer two questions based on unit four out of four questions with intra-Unit choice. 4x2=8

Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B.Sc. with Computer Science/ Computer Application [Voc/Non Voc] / IT

POs:
After completion of graduation, students will be competent to:
PO1: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO2: Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
PO3: Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO4: Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO5: Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO6: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
PO7: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:

At the end of this program, the students would be able to:

PSO1: Understand the computer hardware and software.
PSO2: use the knowledge of software installation.
PSO3: Select modern computing tools and techniques for programming task.
PSO4: Identify, analyze, formulate and develop computer-based solutions to meet desired needs within realistic constraints.
PSO5: Develop databases and perform operations on them.
PSO6: Identify research and development areas in multiple disciplines.
PSO7: Design and develop the small web applications.

Employability Potential of the B.Sc. with Computer Science/Computer Application(Voc/Non-Voc)/Information Technology:
The BSc with Computer Science, Computer application and IT helps develop a widely applicable skill set in computing with strong programming and mathematics skills, as well as wide ranging skills in project management, effective presentations and teamwork. Graduate with a portfolio of work fit to present to potential employers. Depending on your chosen pathway, you can focus on particular areas of interest such as programming, web development, design of database design and video games. Graduate with the Computer Science will be able to apply for a range of computational and mathematical jobs in the creative industries, business, finance, education, medicine, engineering and science. Typical job titles include:
  ➤ Data analyst
  ➤ Assistant Programmer
  ➤ Web designer
  ➤ Web developer
  ➤ Applications developer
  ➤ UI Developer
  ➤ Cyber security analyst
  ➤ Game designer
  ➤ Games developer

> ➢ Mobile App Developer
> ➢ Software Developer

Graduates of BSc Computer Science can find jobs in a variety of sectors like IT departments, MNCs, colleges, etc. in both private and government companies.

Some of the common job sectors, where a fresher and experienced professional can find a relevant job after completing this course are:

IT dept., Consultancies, Technical Support, Cyber Security, Software Engineering, MNCs, Website Development, Mobile App Development, Website Designing, Data Analyzation, Computer Manufacturers, Government Agencies, etc.

Bachelor degree with Computer Science/ Computer Application/IT has become one of the most favoured undergraduate programs for students now a day. A **career in Computer field** has been proved rewarding since last decade. This field has the potential to boost the career. After completing B.Sc in Computer science/ Computer Application/IT, one can always go for higher studies for a better career prospects. They can join Master of Computer Application (MCA) of M.Sc in Computer science course. (MCA and M.Sc – Computer Science are equivalent degrees as recognized by UGC).

India is known to be a leader in software and the IT sector. The software and IT companies are the major employers of computer science graduates and offers the best packages to the young graduates which are unmatched with any other branches of science. Information Technology is a consistently growing field in respect of job opportunities. **Computer science professionals** or software professionals in recent scenario have a very bright career prospect. With growing of IT and software companies, a variety of job opportunities for trained computer professionals are being offered not only in India and abroad as well. IT sector is quite broad in terms of employment and job options, which gives fresher's new opportunities to make successful careers. Computer graduate can also get jobs in non-IT companies like universities, research, private and public industries, government departments, business organizations, commercial organizations and the manufacturing sector, etc.

Future scope for B.Sc. Computer Science/CA and IT graduates:

- Offer higher studies such M.Sc. and Ph.D. , MCA and MBA
- Likewise, foreign Universities also accept computer graduates for higher studies.
- Computer student can become small or medium scale entrepreneur.
- Union and State Public service commissions like UPSC, MPSC, Bank Probationary officers, other competitive examinations, etc. offer a multitude of jobs and positions like Data Entry operator, Assistant Programmer, etc.
- Students can become Content Developer for IT industries.
- Employee at Security Printing and Minting co-operation of India.

Sant Gadge Baba Amravati University, Amravati

Part B

Syllabus Prescribed for <u>03</u> Year <u>UG</u> Programme

Programme: B.Sc. Part I (Computer Science/ Computer Application [Voc/Non-Voc]/IT)

Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
1CS1	**Fundamentals of Computer and C Programming**	84

COs Upon completion of this course successfully, Students would be able to -
1. Understand the computer, I/O and peripheral devices.
2. Understand concept of Operating systems.
3. Apply the Programming concepts.
4. Learn C language.
5. Write Simple C Programs.

Unit	Content
Unit I	Introduction to Computer, Characteristics, Generations of Computers, Block diagram of Computer. **Memories**: Primary Memories : RAM, ROM, and its types, Cache Memory, Secondary Storage Devices : Hard Disk, SSD, Pen drives. **I/O Devices:** Keyboard, Mouse, Scanner, Touch Screen, Monitors: LCD & LED. Printers: Impact and non-impact. **(14 periods)**
Unit II	**Operating System**: Definition, Functions of Operating System, Types: Batch Mode, Multiprogramming, Time sharing , Online Real Time, Distributed O.S. Booting process. **Windows**: Introduction, Features and taskbars, Desktop, Customizing Desktop. (14 periods)
Unit III	Programming Concept: Algorithm, flowcharting, Types of programming languages, Programming process: Program design, Coding, Compilation & Execution, Testing & Debugging, Documentation. Structured Programming : History of C language, Advantages, Structure of C program, Character set, Identifiers, Keywords, Constants and Variables, Symbolic constants, Qualifiers, Type conversion. Operators and Expressions. **(14 periods)**
Unit IV	I/O Operations : Formatted I/O : scanf(), printf() **Unformatted I/O** : getch(), getchar(), gets(), putch(), putchar(), puts(). **Control structures**: Branching: if, if-else, Conditional operator(? :), nested if, switch. Looping: while, do-while, for statements, comma operator, goto, break, continue, nested loops. **(14 periods)**
Unit V	**Arrays** - Declaration and initialization of one and two dimensional array. **Structure** - Definition, declaration, initialization, array of structure, nested structure, union. **Pointers** - Declaration, initialization, pointers arithmetic **(11 periods)**
Unit VI	**Functions in C**: Introduction, definition of function, function prototype, categories of function, actual argument, formal argument, function calling: call by value, call by reference, function parameters, local and global variable, functions with array, function recursion. **String functions** - String functions : strlen(), strcpy(), strcmp() & strcat() **(14 periods)**
*SEM: Assignment, Class test, Study tour, Industrial visit, Group discussion or any other innovative practice/activity	

COs:	
	1. To draw flowchart, learn Algorithms and write simple programs.
	2. To assess the curricular skills acquired by students at college level through Assignments, Unit test, Internal Test, Group Discussion/Seminar/Mini Project, Study Tour
Activities	1. Assignment
	2. Group discussion
	3. Study tour/ Industrial visit **(4 periods)**

Course Material/Learning Resources

Text books:

1) Computer Fundamentals & Networking - P.K.Sinha

2) Programming in C: E Balagurusamy : TMH Publication.

Reference Books:

1) Fundamentals of Computer - V.Rajaraman

2) Computer Network-Andrew Tanenbaum

3) ABC of Internet - Christian Crumblish (BPB)

4) ANSI C- Dennis Ritche

5) Programming in C - V.Rajaraman

6) Programming with C: Venugopal K.R. TMH, Publication.

7) Programming with C: Byson Gottfried , Schaum Series Publication.

8) Fundamentals of IT and C programming by C H Sawarkar, A P Chendke, G P Gawali Dnyanpath Publication.

9) Web Technology and Advance Programming by Dr. P N Mulkalwar, M M Bhonde, A A Tayade. Dnyanpath Publication.

Weblink to Equivalent MOOC on SWAYAM if relevant:

- https://onlinecourses.swayam2.ac.in/cec19_cs06/preview
- https://onlinecourses.swayam2.ac.in/nou20_cs03/preview
- https://www.classcentral.com/course/swayam-computer-fundamentals-13950
- https://onlinecourses.nptel.ac.in/noc19_cs42/preview
- https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
- https://onlinecourses.swayam2.ac.in/cec20_cs02/preview
- https://www.classcentral.com/course/swayam-introduction-to-programming-in-c-2486
- https://swayamprabha.gov.in/asset/new_team/images/course_files/R12-Introduction%20to%20Programming%20in%20C%20.pdf

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

- https://www.youtube.com/watch?v=eEo_aacpwCw
- https://www.youtube.com/watch?v=OGM2BJ29Syg
- https://www.youtube.com/playlist?list=PLWPirh4EWFpF_2T13UeEgZWZHc8nHBuXp
- ☐

Syllabus Prescribed for –BSc-I Year UG Programme

Programme: **B.Sc. Part-I Sem-I** (Computer Science / Computer Application [Voc/Non-Voc]/IT)

Semester 1

Code of the Course/Subject	Title of the Course/Subject	(No. of Periods/Week)
1CSLAB1	Laboratory/Practical of Fundamentals of Computer and C Programming	**06 periods per Batch per Week**

* List of Practical/Laboratory Experiments/Activities etc.

Course Name: Fundamentals of Computer and C Programming

COs

Upon completion of this course successfully, Students would be able to demonstrate/perform/accomplish the following

1. Write word processing task.
2. Create worksheet and perform operations on it.
3. Design, compile and debug programs in C language.
4. Classify conditional expressions and looping statement to solve problems associated with conditions and repetitions.
5. Demonstrate the programs using arithmetic and relational operators.
6. Implement the concept of various string handling functions.
7. Classify programming components that efficiently solve computing problems in real-world.

List of Practical:

1. Practical on Word Processing.
2. Practical on Spread Sheets.
3. Practical on Design of Presentation.
4. Write a program in 'C' to demonstrate Arithmetic Operations.
5. Write a program in 'C' to demonstrate If -Else Statement.
6. Write a program in 'C' to demonstrate Nested If Statement.
7. Write a program in 'C' to demonstrate Else..If ladder Statement.
8. Write a program in C to demonstrate Switch-case Statement.
9. Write a program in 'C' to demonstrate For Loop Statement.
10. Write a program in 'C' to demonstrate Nested For Loop Statement.
11. Write a program in 'C' to demonstrate While Loop Statement.
12. Write a program in 'C' to demonstrate Nested While Loop Statement.
13. Write a program in 'C' demonstrate Do-While Loop Statement.
14. Write a program in 'C' demonstrate Nested Do-While Loop Statement.
15. Write a program in 'C' demonstrate One-Dimensional Array.
16. Write a program in 'C' demonstrate Two-Dimensional Array.
17. Write a program in 'C' demonstrate String Functions.
18. Write a program in 'C' demonstrate Pointers.
19. Write a program in 'C' demonstrate Function.
20. Write a program in 'C' demonstrate Function Recursion.

Weblink to Equivalent Virtual Lab if relevant:
- https://www.programiz.com/c-programming/online-compiler/
- https://www.onlinegdb.com/online_c_compiler
- https://www.tutorialspoint.com/compile_c_online.php

Distribution of Marks for Practical Examination

Time: 4 hours (One Day Examination)   Marks: 50
Exercise-I 15
Exercise-II.............. 15
Viva-Voce.............. 10
Record 10
**   Total: 50**

INSTRUCTIONAL GUIDELINES

Laboratory/practical/practicum/hands-on/activity-based learning is a learning that occurs in a space where students can observe, practice, do some activity, get hands-on, get practical training, gain programming knowledge and ideas either individually or in groups. This learning is not confined within a physical laboratory space, but can also occur in various forms of space such as the e-learning management system and computer-simulated virtual laboratories. Within the laboratory, learning may occur in many ways, often through observing a case or phenomena, performing hands-on practical trainings.

Sample Examples for COs of some Lab/Practical Courses are as follows, which may be used for Reference purpose only.

BOS should decide the COs for practical/lab courses/practicum/activities conscientiously.

By the end of the Lab/Practical Course, generally students should be able to:

1. Design Algorithm and flowchart, develop data base, procedure iteratively, reflectively, and responsively
2. Design and execute program, work independently, interpret results, and draw a reasonable, accurate conclusion.
3. Evaluate the process and outcomes of an experiment quantitatively and qualitatively,
4. Communicate the process and output of program and
5. Design Conduct an experiment collaboratively and ethically.

Part B

Syllabus Prescribed for 2022-23 Year UGProgramme

Programme: B.Sc. I Semester – II (Computer Science /

Computer Application [Voc/Non-Voc]/IT)

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
1CS2	**Data Structure and OOPS**	**84 Periods**

COs

Upon completion of this course successfully, Students would be able to -

1. Implement basic data structures such as arrays, stacks.
2. use linked list, trees and queues.
3. Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
4. Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects.
5. Perform programming on functions, inline functions, constructor and destructor.
6. Perform programming on the concept of function overloading, operator overloading, virtual functions and polymorphism.

Units	Content	
Unit I	**Data structure:** Introduction to data structure, Types of data structure: Primitive and Non-primitive, Linear and Non-linear data structure, Data structure operations. **Array:** Definition and concepts, Memory Representations, Operations: Traversing, Insertion, Deletion. **Stacks:** Definition and concepts, Memory Representations, Operations: Traversing, Insertion, Deletion.	**14 (Periods)**
Unit II	**Queue:** Definition and concepts, Memory Representations, Operations: Traversing, Insertion, Deletion. Types of Queue. **Linked List:** Definition and concepts, Memory Representations, Types of Linked List, and Operations: Traversing, Insertion, Deletion. **Tree:** Definition and Terminologies, Memory Representations of Trees, Types of Trees : Binary Trees, Complete Binary Trees, Binary Search Trees, Traversing : Preorder, Inorder, Postorder, Insertion, Deletion.	14 (Periods)
Unit III	**Searching and Sorting:** Definition and concept. **Searching Techniques:** Linear Search, Binary Search and Indexed Sequential Search. **Sorting Techniques:** Bubble Sort, Selection Sort, Insertion Sort, Radix Sort, Merge Sort and Quick Sort.	14 (Periods)
Unit IV	**Object Oriented Programming:** Features, Advantages and Applications of OOPS. Comparisons between POP and OOP, Introduction to C++, Program structure in C++. **Classes and Objects:** Classes and Objects Specifiers, Defining data member and member functions, Accessing members. **Managing Console I/O:** Formatted and Unformatted, Usage of manipulators: endl & setw, Scope Resolution Operator.	14 (Periods)
Unit V	**Functions in C++:** Passing objects to and returning objects from functions. Function Overloading and Default argument, Inline function, Friend function. Array of Objects, Pointer to objects, 'this' pointer. Constructor and Destructor: Types of constructor, Usage of Constructor.	14 (Periods)
Unit VI	**Operator Overloading:** Definition, Overloading Unary and Binary operators. **Inheritance:** Definition, Types of Inheritance, Visibility mode; Types of inheritance with example, Virtual base classes and Abstract base classes.	14 (Periods)

*SEM : Assignment, Class test, Study tour, Industrial visit, Group discussion or any other innovative practice/activity
COs: 1. Acquire skill to work with core components of data structure   2. Acquire object oriented programming skill.

**Activities	1. Assignment 2. Group discussion 3. Study tour/ Industrial visit

Course Material/Learning Resources

Text books:

1. Object Oriented Programming with C++ : E Balagurusamy TMH
2. Data Structures , Seymour Lipschutz , Schaum's Outlines Series, Tata McGraw-Hill.
3. Text Book of Computer Science (Data Structure and C++): S D Pachpande, R B Ghayalkar and Athar Iqbal, Dnyanpath Publication.

Reference Books:

1. Fundamentals of Data Structures in C, Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed. W. H. Freeman and Company.
2. Object-Oriented Programming in C++, Fourth Edition, Robert Lafore, SAMS Publication.
3. Data Structure and Algorithms :Aho, Hopcroft, Ulman
4. Introduction to Data Structure : Bhagat Singh, Thomas L Naps
5. Mastering in C++ by K. R. Venugopalan.
6. Data Structure and C++: P.S.Bodkhe, A.A.Tayade, S.B.Agarmore, Dnyanpath Publication.

Weblink to Equivalent MOOC on SWAYAM if relevant:

1. https://onlinecourses.swayam2.ac.in/cec22_cs19/
2. https://onlinecourses.nptel.ac.in/noc22_cs92/
3. https://onlinecourses.nptel.ac.in/noc22_cs70/

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

1. https://www.youtube.com/watch?v=RBSGKlAvoiM
2. https://www.youtube.com/watch?v=zg9ih6SVACc

Syllabus Prescribed for 2022-23 Year UG Programme

Programme: LAB 2 B.Sc. I Semester II (Computer Science /

Computer Application [Voc/Non-Voc]/IT)

Semester - II

Code of the Course/Subject	**Title of the Course/Subject**	**(Number of Periods/Week)**
1CSLAB2	**Data Structure and OOPs**	**06 Periods/Batch per week**

 Course name: Data Structure and OOPs lab
 COs

 Upon completion of this course successfully, Students would be able to   demonstrate/perform/accomplish the following

1. Perform various operations Data structure using CPP.
2. Develop the concept of dynamic memory allocation through linked list.
3. Design stack and queue with contiguous and non-contiguous data storage mechanism.
4. Perform the various operations on binary tree.
5. Implement sorting on 1-D array using different techniques.

Practical List of Data Structure

1. Write a Data Structure program in C to insert the element into the STACK using PUSH operation.
2. Write a Data Structure program in C to delete the element from the STACK using POP operation.
3. Write a Data Structure program in C to insert the element into the QUEUE.
4. Write a Data Structure program in C to delete the element from the QUEUE.
5. Write a Data Structure program in C to insert the node into the Linked List.
6. Write a Data Structure program in C to delete the node from the Linked List.
7. Write a Data Structure program in C to demonstrate the Linear Search.
8. Write a Data Structure program in C to demonstrate the Binary Search.
9. Write a Data Structure program in C to demonstrate the Bubble Sort.
10. Write a Data Structure program in C to demonstrate the Sorting Algorithms.

Practical List of Object Oriented Programming language

1. Write a program in C++ to demonstrate Class and Object.
2. Write a program in C++ to demonstrate constructor and destructor.
3. Write a program in C++ to demonstrate Inline function.
4. Write a program in C++ to demonstrate the use of friend function.
5. Write a program in C++ for default argument.
6. Write a program in C++ for unary operator overloading.
7. Write a program in C++ for Binary operator overloading.
8. Write a program in C++ for function overloading.
9. Write a program in C++ for virtual base class.
10. Write a program in C++ to implement the Inheritance.

Weblink to Equivalent Virtual Lab if relevant:

1. http://cse01-iiith.vlabs.ac.in/

Distribution of Marks for Practical Examination

> **Time: 4 hours (One Day Examination)   Marks: 50**
> **Exercise-I 15**
> **Exercise-II.............. 15**
> **Viva-Voce............... 10**
> **Record 10**
> **Total: 50**

By the end of the Lab/Practical Course, generally students should be able to:

1. Collect data and revise the experimental procedure iteratively, reflectively, and responsively
2. Design and execute an experimental procedure, work independently, interpret experimental results, and draw a reasonable, accurate conclusion.
3. Evaluate the process and outcomes of an experiment quantitatively and qualitatively,
4. Extend the scope of an investigation whether or not results come out as expected,
5. Communicate the process and outcomes of an experiment, and
6. Conduct an experiment collaboratively and ethically.

Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B.Sc. (Mathematics)

POs:

At the end of the programme, graduates would be able to

1. Enhance the knowledge of student in all basic sciences.
2. Identify ,formulate and develop solutions to computational challenges.
3. Develop scientific temper and think in a critical manner.
4. Build up progressive and successful career in academics, industry and society.
5. Develop students abilities and aptitudes to apply the mathematical ideas.

PSOs :
Upon completion of the programme successfully, students would be able to
1. Understand major concepts in all disciplines of Mathematics
2. Formulate and develop Mathematical arguments in a logical manner
3. Gain good knowledge and understanding in advanced Mathematics
4. Create an awareness of the impact of Mathematics on the environment, society and development outside the scientific community.
5. Create sensitivity towards environmental concerns and contribute in the development of nation

Employability Potential of the Programme:

Career options for B.Sc. Mathematics students is not just limited to solving complex equation. Apart from the traditional career route of academics and research, there are many career options offer for B.Sc. Mathematics students that can pick up banking, corporate, accounting and even teaching as their career option on completion of B.Sc. Mathematics, even a career in medicine and law is possible for Mathematics Honors student. Also, a degree with Mathematics is even financially supporting for students because they help in landing placement opportunities by giving an edge over students with B.Sc. physics or other major.

After completing B.Sc. Mathematics, a student can either decide to go for higher studies or apply for jobs. In the case of B.Sc. Mathematics Honors, both the options are very promising. After the B.Sc. Mathematics course, students can purse M.Sc. Mathematics and follow it up with an M. Phil or Ph.D. Students can become a mathematician doing research and also become a assistant professor. Also students can pursue a B. Ed. and become a school teacher. Moreover, student can work in related field which required mathematical skills (Machine learning, Data Science etc.). Thus, there exist innumerable B.Sc. Mathematics career options.

The best way to get a prestigious government job is through competitive exams. Exams like UPSC, Railways, and Commission etc. are some important competitive exams that one need to consider as portals for B.Sc. Mathematics career options.

Syllabus Prescribed for the year 2022-23, UG Programme

Programme : B.Sc.-I (Mathematics)

Semester- I

Code of the Course/Subject	**Title of the Course/Subject**	**(Total Number of Periods/week)**
DSC-I / Mathematics	Algebra and Trigonometry	**9+1**

Cos: After completing this course, students would be able to

1. find inverse and normal form of matrices .

2. evaluate the characteristic equation, eigen value and corresponding eigen vector of a given matrix

3. evaluate relation between the roots and coefficients of equations .

4. to study application of De Moivre's theorem .

5. compute summation of trigonometric series.

Unit	Content
Unit I	Various types of matrices, Square matrix, triangular matrix, Hermitian and skew-Hermitian matrix, orthogonal matrices, singular and non- singular matrices, adjoint and inverse of matrix. Elementary transformation of a matrix, inverse of elementary transformation of a matrix , normal form of a matrix. **(12 period)**
Unit II	Rank of a matrix, row rank, column rank, eigen values, eigen vectors and the characteristic equation of a matrix, Cayley-Hamilton theorem, inverse by Cayley-Hamilton theorem. **(12 period)**
Unit III	Theory of equations: Descarte's rule of signs, relations between the roots and coefficients, transformation of equations, cubic equations. **(12 period)**
Unit IV	De Moivre's theorem, roots of complex number, circular functions, hyperbolic function, inverse hyperbolic function, relation between circular functions and hyperbolic functions, separation of real and imaginary parts of circular and hyperbolic functions of complex variable. **(12 period)**
Unit V	Summation of trigonometric series, Gregory series, Euler's series, Machin's series, Rutherford's series, series based on $\sin x$, $\cos x$, $\sinh x$, $\cosh x$ and exponential series. **(13 period)**
***SEM**	
COs: 1.To enhance interest among the students about course. 2. To develop the learning and writing skills. 3. To create mental ability.	
****Activities**	1. Unit Test 2. Assignment/ open book test 3. Quiz/ Study Tour

Text books :

1] T. M. Karade, Maya S.Bendre, V. G. Mete, R. S. Wadbudhe, S. N. Bayaskar, P. P.Khade: Elements of Algebra and Trigonometry. Sonu-Nilu , Nagpur, 2022.

2] V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A. N. Rangari: A Text book of Algebra and Trigonometry, Dnyanpath Publication, Amravati, First Edition, 2022.

Reference Books:

1] K.B.Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd. New Delhi, 2000.
2] H.S.Hall and S.R.Knight, Higher Algebra, H.M.Publications, 1994.
3] S.L.Loney, Plane Trigonometry Part-II, MacMillan & Co., London.

4] Ayres Jr Frank : Matrices : Schaum's outline series, McGraw Hill   Book Company, Singapore, 1983.
5] Hohn Franz E : Elementary Matrix Algebra, Amerind Publishing Co., Pvt.Ltd. 1964.
6] Shanti Narayan : A Test Book of Matrices, S.Chand & Co. Delhi.

Programme: B.Sc.-I (Semester-I), Mathematics

Syllabus Prescribed for the Year 2022-23 , UG Programme

Programme : B.Sc.-I
Semester- I
Code of the Course/Subject   Title of the Course/Subject   (Total Number of Periods/week)
DSC-II / Mathematics   Differential and Integral Calculus   **9+1**

Cos: After completing this course, students would be able to

1.   define limit and study the basic properties .
2.   classify continuity and discontinuity of the functions.
3.   solve the differentiability and L'Hospital rule with their applications.
4.   describe the geometrical applications of mean value theorems.
5. evaluate the reduction formulae for integration.

Unit	Content
Unit I	Limit of a function, ε-δ definition, basic properties of limits, some standard limits. **(12 period**)
Unit II	Continuous and discontinuous functions, types of discontinuity, properties of continuous functions, uniform continuous functions, properties of uniform continuous functions. **(12 period)**
Unit III	Differentiability, successive differentiation, Leibnitz theorem, indeterminate forms and L' Hospital rule. **(12 period)**
Unit IV	Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Maclaurin's and Taylor's series expansions. **(12 period)**
Unit V	Integration of the form $\int \dfrac{P_n(x)}{\sqrt{Q}}\,dx$, reduction formulae for $\int \sin^n x\,dx$, $\int \cos^n x\,dx$, $\int \tan^n x\,dx$, $\int \cot^n x\,dx$, $\int \sec^n x\,dx$, $\int \operatorname{cosec}^n x\,dx$, $\int \sin^n x.\cos^m x\,dx$ and Walli's formula. **(13 period)**

*SEM	
COs: 1.To enhance interest among the students about course. 2.To develop the learning and writing skills. 3.To create mental ability.	
**Activities	1. Unit Test 2. Assignment/ open book test 3. Quiz/ Study Tour

Text books :

1] T.M. Karade , Maya S. Bendre, V. P. Kadam, A.S.Nimkar,K.S.Wankhade,C.D.Wadale:
Elements of Calculus (Differential and Integral), Sonu- Nilu, Nagpur, 2022.

2] V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A. N. Rangari: A Text book of   Differential and Integral Calculus: Dnyanpath Publication, Amravati, First Edition, 2022.

Reference Books :

1] Ayres F Jr. : Differential equations, Schaum's outline series, McGraw Hill, 1981.
2] Ayres F.Jr. : Calculus, Schaum's Outline series, McGRaw Hill, 1981.
3] Edwards J : Differential Calculus for Beginners, MacMillan and Co.Ltd.,1963.
4] Greenspan D. : Introduction to Calculus, Harper and Row, 1968.
5] Gorakh Prassad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad, 1963
6] Gorakh Prassad: Integral Calculus, Pothishala Pvt. Ltd., Allahabad,1981
7] N.Piskunov : Differential and Integral Calculus, Peace Publishers, Moscow.
8] B. Choudhary and D. Somasundaram "Á first course in Mathematical analysis'',
Narosa Publication

Programme: B.Sc.- 1 (Semester- II), Mathematics

Syllabus Prescribed for the year 2022-23 , UG Programme

Programme : B.Sc.-I

Semester II

Code of the Course/Subject   Title of the Course/Subject   (Total Number of Periods/week)

DSC-III / Mathematics   Ordinary Differential Equations   **9+1**

COs: After completing this course, students would be able to

1.   Solve first order differential equations using different techniques..

2.   solve higher order differential equations and orthogonal trajectories.

3.   calculate complementary function and particular integral of the second order differential
Equation.

4.   Describe the different methods to solve second order differential equations.

5.   illustrate applications of differential equations **.**

Unit	Content
Unit I	Formation of ordinary differential equation**,** degree and order of a ordinary differential equation, homogeneous differential equations, linear differential equations, Bernoulli's equation, differential equations reducible to the linear form, exact differential equations. **(12 period)**
Unit II	Differential equations of first order and higher degree, differential equations solvable for p, x and y, Clairaut's equation, orthogonal trajectories (Cartesian and Polar form) **(12 period)**

Unit III	Linear differential equations with constant coefficients, complementary function of the differential equation, particular integral of the differential equation, homogeneous linear ordinary differential equations. **(12 period)**
Unit IV	Second order differential equation, Wronskian, method of change of dependent variable, normal form, method of change of independent variable, variation by parameters. **(12 period)**
Unit V	Applications of ODE: Electric circuit, steady state heat flow, radio active decay and carbon dating, Newton's law of cooling, compound interest. **(13 period)**

*SEM	

COs: 1.To enhance interest among the students about course. 2.To develop the learning and writing skills. 3.To create mental ability.	

**Activities	1. Unit Test 2. Assignment/ open book test 3. Quiz/ Study Tour

Text books :

1] T.M.Karade , V. G. Mete, V.S.Bawane , P.R. Agrawal , A.Y.Shaikh ,R.V.Kene: Differential
Equations (Ordinary and Partial), Sonu-Nilu, Nagpur, 2022.

2] V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A. N. Rangari: A Text book of ,
Ordinary Differential Equations, Dnyanpath Publication,Amravati, First Edition, 2022.

Reference Books :

1] Ayres F Jr.: Differential equations, Schaum's outline series, McGraw Hill, 1981.

2] Coddington: An Introduction to Ordinary Differential Equations, E.A.Prentice Hall of
India, 1998.

3] T.M.Karade, N.T.Karade: Ordinary Differential Equations, Sonu-Nilu. Nagpur, 2016.

4] Murray D.A.: Introductory course in Differential Equations, Orient Longman(India), 1967.

5] Piaggio HTS: Differential Equations, CBS Publishers &Distributors, Delhi, 1985.

6] Siminons G.F.: Differential Equations, Tata McGraw Hill, 1972.

7] A.R.Forsyth. A Treatise on Differential Equations. Macmillan and Co.Ltd.London.

8] H. K Dass, Advanced Engineering Mathematics, S. Chand Publication, 2010.

9] B.S.Grewal, Higher Engineering mathematics, Khanna Publisher, New Delhi, 2017.

Programme: B.Sc.- I (Semester-II), Mathematics

Part B

Syllabus Prescribed for the year 2022-23 , UG Programme

Programme : B.Sc.-I

Semester- II

Code of the Course/Subject	**Title of the Course/Subject**	**(Total Number of Periods/week)**
DSC –IV/ Mathematics	Vector Analysis and Geometry	**9+1**

COs: After completing this course, students would be able to

1. interpret the vectors, their products, differentiation and integration.

2. determine curvature and torsion .

3.apply the concepts of divergence, curls which are useful in physics.

4.. describe the different forms of sphere and properties.

5. discuss the equations of cone and cylinder.

Unit	Content
Unit I	Scalar and vector product of three vectors, product of four vectors, vector differentiation and vector integration. **(12 period)**
Unit II	Space curve, t, n, b vectors, fundamental planes, curvature, torsion, Frenet- Serret formulae. **(12 period)**
Unit III	Gradient, divergence and Curl, directional derivative, line integral and work done, circulation. **(12 period)**
Unit IV	Sphere: Different forms of sphere, section of a sphere by a plane, sphere through a given circle, intersection of spheres and a line, orthogonal spheres and condition of orthogonality. **(13 period)**
Unit V	Cone : The equation of a cone with a guiding curve, cone with vertex and origin, right circular cone. Cylinder: equation of right circular cylinder. **(12 period)**
*SEM	
COs: 1.to enhance interest among the students about course. 2.to develop the learning and writing skills. 3.to create mental ability.	
**Activities	1. Unit Test 2. Assignment/ open book test 3. Quiz/ Study Tour

Text books :

1] T.M.Karade, Maya S. Bendre, V. B Raut, R.S.Wadbudhe, S.B.Tadam, V.D.Elkar ,K.R.Muley:
   Vector Analysis and Geometry, Sonu Nilu , Nagpur,2022.

2] V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A. N. Rangari: A Text book of ,
   Vector Analysis and Geometry, Dnyanpath Publication,Amravati, First Edition, 2022.

Reference Books :

1] Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York,1981.
2] N.Saran and S.N.Nigam , Introduction to vector Analysis Pothishala Pvt.Ltd.Allahabad.
3] Shanti Narayan, A Text Book of Vector Calculus, S.Chand & Co. New   Delhi.
4] R.J.T.Bell, Elementary Treatise on Co-ordinate Geometry of Three Dimensions, Macmillan
   India Ltd., 1994.
5] P.K.Jain and Khalil Ahmad, A Text Book of Analytical Geometry of Three Dimensions,
   Wiley Eastern Ltd., 1999.
6] N.Saran and R.S.Gupta, Analytical Geometry of three dimensions, Pothishala Pvt.Ltd.
   Allahabad,2000.

Programme: B.Sc.- I (Semester-II), Mathematics

Part B

Syllabus Prescribed for the year 2022-23 , UG Programme

Programme : B.Sc.-I

Semester- II

Code of the Course/Subject   Title of the Course/Subject   (Total Number of Periods/week)

GIC/ Mathematics   Numerical Ability-I   ----

COs: After completing this course, students would be able to

1.   restate the ideas and concept of HCF & LCM of number and also find square root &
     cube roots.
 2.   illustrate the problem on numbers, ages, percentage, profit and loss.
3.   analyze ratio and proportion , time , work and distance.
4.   outline the problems on train, simple interest, compound interest, area measurement.
5.   create the Bar graphs, Pie charts and Line graphs.

Unit	Content
Unit I	HCF & LCM of number, Decimal fraction, Simplification, Square root & cube roots.
Unit II	Average, Problem on numbers, Problem on ages, Percentage, Profit & Loss.
Unit III	Ratio & Proportion, pipes and cisterns, Time and work, Time and Distance.
Unit IV	Problem on train, Simple Interest, Compound Interest, Area.
Unit V	Bar Graphs, Pie Charts, Line Graphs.

Reference:

 1) R. S. Agrawal, Quantitative aptitude for Competitive examination, S. Chand Publication
2) Arun Sharma, How to Prepare for quantitative Aptitude for CAT, Mac Grow Hill Publication

Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology
Programme: B Sc (Microbiology)

POs:

Students of undergraduate general degree programme at the time of graduation would be able to –

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, check out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest contexts socio-technological changes.

PSOs:

Upon completion of the programme successfully, The students would be able to

1. gain insight of Microbiology starting from history and fundamental knowledge about the microorganisms.

2. acquire the skill in the use and care of basic microbiological equipment and can perform basic laboratory procedures in microbiology.

3. be well-informative about the integral role of microorganisms and different branches of Microbiology.

4. Be acquainted with the basic concept of prokaryotes, their taxonomy, their differentiation from eukaryotes.

Employability Potential of the Programme:

Microbiology is a branch of science that deals with study of microorganisms. The microbiological study has wide range of scope ranging from basic sciences to applied sciences. Microbiological study is mainly focused on causative agents of various diseases, microorganisms of agricultural, environmental and industrial use. The production of antimicrobial drugs to cure various diseases is covered in this discipline. Here is an overview of job opportunities where our students has explored and would be helpful for upcoming students as well.

Medical microbiology refers to the use of microbiology in the healthcare industry. Microbiology firms are at the heart of the healthcare industry, whether they're developing diagnostic kits, vaccines, biologics, pharmaceuticals, or medical gear. Microbiology fields such as molecular biology, cell biology, recombinant technology, and immunotherapeutics benefited from the medical sector's evolution. For those interested in a career in Medical Microbiology, there are numerous career prospects in Research and Development, Pharmaceutical Companies, Hospitals, Diagnostic Centers, Manufacturing Sector of Microbiology, and Academic Sector. Many of our students have joined as Microbiologist at renowned pharmaceutical companies. Our students have also joined COVID-19 diagnostic laboratories across various districts, thus helping the society. Beside these students has also joined

vaccine manufacturing institutions.

Previously, this field only focused with the discovery and development of small molecules (drugs), but the industry has evolved throughout time. This industry's horizon has widened. Biopharmaceutics has added a new dimension to the industry. The use of microbiology in drug research and discovery has always been a component of the process, but the addition of biologics as therapeutic elements has resulted in a rise of biotech businesses in the pharmaceutical sector. To begin, consider cell-based treatments, monoclonal antibodies, vaccinations, and other medicines. In this regard our students has got jobs in various pharmaceutical industries.

Low crop yield, crop quality deterioration, weeds, loss of soil fertility, abiotic stress, and biotic stress are just a few of the issues that have plagued agriculture. Microorganisms are also helpful in enhancing the crop productivity. Our students are entrepreneur in this field. The biofertilizers are produced in bulk and are commercialized by few of our students. Incidentally biofertilizers are ecofriendly.

Food microbiology overcomes challenges in food production, processing, and preservation. The production of value-added food products are the greatest examples. Almost all food industries need pure water. The bacterial quality of water is tested by microbiologist. Food industry provides large scope for microbiologist. Our students have occupied jobs at different food industries. Microbiology always helps in introducing technology which aims to enhance the production, processing, packaging and preservation of food also.

Environment microbiology aims to restore the balance between nature, ecology and human interest. Bioremediation and biological intervention is only possible by the way of utilization of techniques of microbiology. All these issues are now being addressed by using biotech processes. Microbes like bacteria, fungi algae and plants are being used in the process of bioremediation.

Beside job opportunities in the sector of agriculture, pharmaceutical and food industries our students are working as research fellow at various National Institutes. Many students are working as Assistant Professor in colleges, Laboratory Technicians at Government and private pathological laboratories.

Syllabus Prescribed for 1ˢᵗ Year   UG Programme

Programme: B Sc

Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
MCB1	FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL PHYSIOLOGY	90

COs

Upon completion of this course successfully, students would be able to

1. get knowledge of historical aspects of microbes and their importance as well as application in day to day life.

2. differentiate the microbes on the basis of their characteristics and apply the classification scheme for identification.

3. demonstrate the structure of prokaryotic and eukaryotic cell.

4. illustrate different types of microscopes and staining techniques.

5. compare and design different nutritional media for microbial growth.

Unit	Content
Unit I A. **History of Microbiology** **B. Introduction and Scope of Microbiology**	**A. History of Microbiology:** a. Discovery of microscope- Contribution of Antony von Leeuwenhoek, Robert Hook. b. Controversy over Spontaneous generation: Contributions of Redi, Needham, Schulze and Schwan, Schroder & Van Dusch, Louis Pasteur c. Contribution of pioneers in development of microbiology : Louis Pasteur (fermentation & Vaccine) Alexander Fleming (Antibiotic) Joseph Lister (Antiseptic surgery), Edward Jenner (Small pox Vaccine) Robert Koch (Germ theory of diseases, Koch postulates & ure culture concept) **B. Introduction and Scope of Microbiology** **a.** Introduction of microorganisms and their distribution in nature b. Beneficial and harmful activities of microorganism c. Basic branches of Microbiology: Bacteriology, virology, mycology, phycology, parasitology.

	d Applied branches of Microbiology : Environmental Microbiology, Medical microbiology Industrial Microbiology, Food and Dairy Microbiology, Genetic engineering and Biotechnology. **(15 periods)**

Unit II **Microbial diversity & Classification:**	**A. Microbial Diversity:**
	General characteristics of :
	    i. Bacteria
	    ii. Viruses
	    iii. Rickettsia
	    iv. Actinomycetes
	    v. Archae
	    vi. Fungi (Including yeasts)
	    vii. Algae
	B. Bacterial Classification:
	i. Definition- Taxonomy, Classification, Taxonomic rank, Identification, Nomenclature
	ii. Bergey's manual of systematic Bacteriology, General characteristics enlisting all parts with major characters and examples (Vol.I to IV)
	iii. Methods of Classification: Numerical taxonomy, Genetic relatedness: r-DNA sequencing & phylogenetic tree
	
	(15 periods)

Unit III **Structural Organization of Bacteria:**	**Structural Organization of Bacteria:** a) Structure of prokaryotic and Eukaryotic cell, its Comparison and Differences. b) Typical Bacterial cell c) Shape, Size, and Arrangement of Bacteria d) Structure and functions of following i. Capsule and slime layer ii. Cell wall- Gram positive and Gram negative bacteria. iii. Cytoplasmic membrane- fluid mosaic model iv. Flagella- Arrangement, Mechanism of flagellar movement. v. Pili-Arrangement and function vi. Ribosomes- Prokaryotic and Eukaryotic vii. Plasmid- Definition, General characters, classes viii. Bacterial chromosome ix. Endospores- Structure and arrangements. **(15 periods)**
Unit IV **Microscopy and Staining**	**A. Microscopy:** a) Definition: Magnification, Resolving power, numerical aperture, focal length

	b) Principles, construction, ray diagram and applications**:** i) Compound Microscope ii) Dark field microscope iii) Electron Microscope. c. Introduction & application of Fluorescent and Phase contrast Microscope **B. Staining:** a) Dyes and Stains- auxochromes, chromophore, mordant b) Principles and Methods of the following techniques: i. Simple staining ii. Differential staining- Gram stain, Acid fast and Endospore staining **(15 periods)**
Unit V **Microbial Nutrition and Pure Culture Techniques**	**A. Microbial Nutrition:** i. Basic Nutritional Requirements: Sources of C, N, O, P, S, Energy, Macronutrients, Growth factors, water etc. ii. Media, Synthetic, Nonsynthetic , Liquid and Solid, Semisolid, Differential, Enriched, Selective media. Role of beef extract, yeast extract, peptone, agar in nutrient media. iii. Determination of nutritional requirements: Auxanographic technique, Replica plating technique. iv. Nutritional classification on the basis of source of carbon and energy **B. Pure Culture Techniques:** i. Definition- Pure and Mixed culture ii. Methods of Isolation of Pure culture- Streak plate, pour plate and Enrichment culture. iii. Methods of preservation of pure culture- Agar slants, Saline suspension, Overlaying with oil, glycerol stock, Freeze drying/ Lyophilization. iv) Introduction of Microbial cultural collection centre- ATCC, ITCC, MTCC and NCIM **(15 periods)**
Unit VI if applicable	**Not Applicable**
*SEM **Basic Skills of Microbiological Laboratory** A. Handling and caring of different instruments used in Microbiology laboratory: 1. Microscope 2. Autoclave 3. Hot air oven 4. Laminar air flow cabinet	

B. Preparation of Nutrient media:

i. Nutrient broth

ii. Nutrient agar

iii. PDA

C. Motility of bacteria

D. Isolation and maintenance of microorganism

- Isolation of fungi by slide culture technique
- Isolation and Maintenance of pure culture of bacteria by - Agar slants, Saline suspension, Glycerol stock, Overlaying with oil, Freeze drying.

COs: 1. Student will be able to get employment in different laboratories related with Microbiology work.

2 Student will be able to get employment in Microbial culture collection centers dealing with isolation, identification and maintenance of microorganism.

**Activities	1. Demonstration
	2 Assignment
	3 Project
	4. **Task**
	5. Field visit
	(15 periods)

Course Material/Learning Resources

1) General Microbiology : Stainer, Roger et. al.

2) General Virology : Luria, S.E.

3) Fundamentals Principles of : A.J. Salle. bacteriology

4) Microbiology : Pelczar, Chan, Krieg.(TMH)

5) Text Book of Microbiology : Dubey & Maheshwari (S.Chand, Publication)

6) Fundamental of Microbiology : Frobisher

7) General Microbiology Vol. I & II : Power & Daginawala. (Himalaya Publication)

8) Zinsser Microbiology : W.K. Joklik

9) General Microbiology : W.G. Walter

10) Elements of Microbiology : M.J. Pelozar & E.C.S. Chan

11) Essays in Microbiology : J.N. Norris & M.H. Richmond

12) Microbiology : L. Mckane & J. Kandel (Essentials & Applications)

13) Basic Microbiolgy : Volk

14) Chemical Microbiology : Rose

15) Elementary Microbiology : Modi (Akta Prakashan) Vol. I & II

16) Basic experimental : Ronald M., Atlas, & Alfred Microbiology Miller E.Brown, Kenneth W. Dobra, Lionas (1986) (Prentice Hall - 316 PP)

17) General Microbiology : Robert F.Boyd (1984) times mirror / mosby college, Pub. 22 PP

List of Books For PRACTICALS

1) Microbes in Action : Seely, Wander Mark Tarporewala, Bombay

2) A Mannual of Microbiology : A.J. Salle. Methods

3) Medical Microbiology Vol. II : R. Cruickshank

4) Microbiology Methods : Collins

5) Difco mannual

6) Bacteriological Techniques : F.J.Baker

7) Introduction to Microbial : Gunasekaran Techniques

8) Biochemical methods : Sadashivam & Manickam

9) Laboratory Fundamentals of : Alcamo, I.E., Jones and Microbiology Bartlett Publishers.

10) A textbook of Practical Microbiology (B Sc Sem 1 &2) : Dr. R. R. Pachori, P.S.Sadar, Dr. A. M. Pande, 2nd Edition

Weblink to Equivalent MOOC on SWAYAM if relevant:

Weblink to Equivalent Virtual Lab if relevant:

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

Sant Gadge Baba Amravati University, Amravati

Syllabus Prescribed for 1ˢᵗ Year UG Programme

Programme: B. Sc

Semester 1

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
MCB lab1	**FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL PHYSIOLOGY Lab 1**	**06/week/batch**

COs

Upon completion of this course successfully, students would be able to

1. acquire the skill in the use and care of basic Microbiological equipment.

2. perform basic laboratory procedures in microbiology; proper collection and forwarding of microbiological and parasitological specimens to the laboratory.

3. demonstrate different staining techniques.

4. acquire skill in bacterial motility.

* List of Practical/Laboratory Experiments/Activities etc.

1	1. Study and use of different instruments use in Microbiology Laboratory i. Autoclave ii. Hot air oven iii.Bacteriological Incubator iv. Laminar air flow
2	2. Demonstration of bacteria from; Soil, Water, Air, Milk, Skin
3	3. Microscopic Examination of bacteria i. Monochrome/ simple staining ii. Gram's staining iii. Negative staining iv. Endospore staining
4	4. Demonstration of bacterial motility by Hanging drop technique
5	5. Cultivation and Demonstration of i. Yeast- Saccharomyces cereviceae, Candida albicans. ii. Mold- Penicillium, Aspergillus
6	6. Demonstration of a) Protozoa-E.histolytica, Paramoecium b) Algae –Nostoc, Spirogyra
7	7. Isolation of bacterial Pure culture by i) Streak plate ii) Pour plate

Syllabus Prescribed for 1ˢᵗ Year   UG Programme

Programme: B.Sc

Semester II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
MCB 2	GENERAL AND APPLIED MICROBIOLOGY	90

COs

Upon completion of this course successfully, students would be able to

1. apply the knowledge of bacterial growth in industrial productions and determine the growth of bacteria.

2. demonstrate the nature, structure, general properties and replication of viruses as well as acquainted with the knowledge of interferon.

3. apply the concept of microbial control methods for prevention against infections.

4. formulate different microbial products using production strains of microorganisms.

5. evaluate microbe- host relationship in nature, humans and plants.

Unit	Content
Unit I **Reproduction and Growth of Bacteria:**	**Reproduction and Growth of Bacteria:** a) Reproduction: Binary fission, Budding, Fragmentation, Sporulation, b) Growth rate and generation time- Definition, mathematical expression. c) Bacterial growth curve d) Synchronous culture: Definition, methods of isolation (Helmstetter- Cummings Technique) and application. e) Continuous culture: Definition, method (chemostat, and Turbidostat Techniques) and Application. f) Measurement of Growth: i. Cell number measurement - Breed method and Colony count ii. Cell mass measurement- Turbidity measurement. g) Factors influencing bacterial Growth- Temperature, pH, Gaseous. **(15 periods)**
Unit II **VIRUSES:**	**VIRUSES** i) Discovery of viruses ii) Structure of viruses iii) Classification of viruses (LHT System) iv) Replication of viruses – Lytic cycle (T4), Lysogeny (Lambda phage) v) Cultivation of viruses – Embryo culture, Tissue culture method. vi) Interferon **(15 periods)**
Unit III **MICROBIAL CONTROL**	**MICROBIAL CONTROL** i) Definition and Terms- Sterilization, disinfection, Antiseptic, Sanitizer, Germicide, Microbiostatis, Antimicrobial agent. ii) Mechanism of cell Injury - Damage of cell

	wall, cell membrane, Inhibition of metabolic reactions. iii) Physical Control :- Temperature, osmotic pressure, Radiation, filtration. iv) Chemical Control – Chemistry and mode of action of halogens, heavy metals and their derivatives, Alcohols, Detergents and Gaseous Sterilization. v) Chemotherapeutic agents.- Definition and mode of action of penicillin , tetracycline, Norfloxacin **(15 periods)**
Unit IV **APPLIED ASPECTS OF MICROORGANISMS IN -**	**APPLIED ASPECTS OF MICROORGANISMS IN -** i) Agriculture – Biofertilizers & Biopesticides. ii) Medical – Antibiotics, Vaccines iii) Industrial- Outline of Industrial Microbiology and role of microorganisms in fermented food, beverages, probiotics, Single cell protein & Pharmaceutical products iv) Environmental – Bioremediation, Biodegradation **(15 periods)**
Unit V **Microbial Interaction**	**Microbial Interaction** **A.** Microbial Interaction with nature: positive, negative and neutral associations **B. a**) Microbial interaction with human- Normal flora of the human body- Skin, Nose & Nasopharanynx, Respiratory tract, Eye, Mouth, Stomach, External ear, Intestine, Genitourinary tract b) Types of infection **C.** Microbial interaction with plants. a) Rhizosphere, Phyllosphere and Rhizoplane b) Mycorrhizae, fungal and bacterial endophytes c) Symbiotic Nitrogen fixation – Rhizobium, Actinorhizae d) Common plant pathogens **(15 periods)**
Unit VI if applicable	**Not Applicable**

*SEM

Biofertilizer Preparation

       A.   Introduction, History and concept of biofertilizer

      Scope and importance of biofertilizer

      Use of microorganisms for biofertilizer production

      Classification and characters of biofertilizer

   B. Production technology: Strain selection, fermentation equipment, sterilization, mass production of career base and liquid biofertilizer

   C. Specification and quality control of bio fertilizer

      Application technology and Marketing of biofertilizer

COs: 1. Student can be able to start small scale unit of biofertilizer production and can work as entrepreneur. 2. Students will be able to create awareness among farmers for application of biofertilizer in farming which helps in increasing crop yield.	
**Activities	1. Demonstration 2 Assignment **3** Project **4** **Task** **3.** **Field visit** **(15 periods)**

Course Material/Learning Resources

1) General Microbiology : Stainer, Roger et. al.

2) General Virology : Luria, S.E.

3) Fundamentals Principles of : A.J. Salle. bacteriology

4) Microbiology : Pelczar, Chan, Krieg.(TMH)

5) Text Book of Microbiology : Dubey & Maheshwari (S.Chand, Publication)

6) Fundamental of Microbiology : Frobisher

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8) Zinsser Microbiology : W.K. Joklik

9) General Microbiology : W.G. Walter

10) Elements of Microbiology : M.J. Pelozar & E.C.S. Chan

11) Essays in Microbiology : J.N. Norris & M.H. Richmond

12) Microbiology : L. Mckane & J. Kandel (Essentials & Applications)

13) Basic Microbiolgy : Volk

14) Chemical Microbiology : Rose

15) Elementary Microbiology : Modi (Akta Prakashan) Vol. I & II

16) Basic experimental : Ronald M., Atlas, & Alfred Microbiology Miller E.Brown, Kenneth W. Dobra, Lionas (1986) (Prentice Hall - 316 PP)

17) General Microbiology : Robert F.Boyd (1984) times mirror / mosby college, Pub. 22 PP

18) Introduction to Soil Microbiology : Alexander Martin

19) Soil Microbiology : Subbaroa N.S.

List of Books For PRACTICALS

1) Microbes in Action : Seely, Wander Mark Tarporewala, Bombay

2) A Mannual of Microbiology : A.J. Salle. Methods

3) Medical Microbiology Vol. II : R. Cruickshank

4) Microbiology Methods : Collins

5) Difco mannual

6) Bacteriological Techniques : F.J.Baker

7) Introduction to Microbial : Gunasekaran Techniques

8) Biochemical methods : Sadashivam & Manickam

9) Laboratory Fundamentals of : Alcamo, I.E., Jones and Microbiology Bartlett Publishers.

10) A textbook of Practical Microbiology (B Sc Sem 1 &2) : Dr. R. R. Pachori, P.S.Sadar, Dr. A. M. Pande, 2nd Edition

Sant Gadge Baba Amravati University, Amravati

Syllabus Prescribed for 1st Year UG Programme

Programme: B Sc

Semester 2

Code of the Course/Subject	Title of the Course/Subject	(No. of Periods/Week)
	(Laboratory/Practical/practicum/hands-on/Activity)	
MCB Lab 2	**GENERAL AND APPLIED MICROBIOLOGY Lab 2**	06/week/batch

COs

Upon completion of this course successfully, students would be able to

1. acquire the skill in the use and care of basic Microbiological equipment.

2. get employment in diagnostic laboratories.

3. analyze the effect of different parameters on growth of bacteria.

4. determine the nutritional requirement of microorganisms.

* List of Practical/Laboratory Experiments/Activities etc.

1	1. Study of different Laboratory equipment's used in Microbiology i. pH meter ii. Centrifuge iii. Colorimeter/ spectrophotometer iv. Anaerobic Jar v. Bacteriological filters
2	2) Effect of salt, sugar concentration , pH & Temperature on bacterial growth
3	3) Demonstration of oligodynamic action (copper, silver)
4	4) Antibiotic sensitivity test of bacteria.
5	5) Anaerobic culture method – by Anaerobic Jar method / RCMM.
6	6) Demonstration of Replica plate technique / auxanography.

Sant Gadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B.Sc. (Physics)

POs:

At the time of graduation, Students will be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:

Upon completion of the Programme successfully, students would be able to

1. acquire a comprehensive knowledge and sound understanding of fundamentals of Physics
2. develop laboratory skills, enabling them to take measurement in a physic laboratory and analyze the measurements to draw valid conclusions.
3. be prepared to acquire a range of general skills, to solve problems, to evaluate information, to use computers productively, to communicate with society effectively and learn independently.
4. Develop good oral and written scientific communication skill.

<u>Employability Potential of the Programme:</u>

Physics programme develops the skills, particularly the ability to analyze and apply information, gives one a good head start, in any field, one wishes to get in. The skills are useful even in the management disciplines. This programme gives physics enthusiasts a chance to develop their mathematical, problem solving, communication skills and critical thinking, that helps to interpret rich scientific data and that is always a boon to scientific researchers.

After accomplishing M. Sc. in Physics, student can certainly increase his/her employability in this field. Students can easily avail of technical jobs, both in the private and public sector. Some of the common job positions or profiles for a physics enthusiast are Online tutor, College lecturer, Assistant Professor, Observation Scientist, Laboratory Technician, School Science Technician or Research Analyst, Assistant Scientist, Physics Training Manager, Software Engineer, Network Administrator, IT Consultant, Security Expert, Java Developer, Systems Support Administrator, Interface Engineer etc. They can apply for jobs in Aerospace and Defence, Automobile, IT and Software, Railways, Nuclear and Renewable energy, Oil and Gas, Electronics and Telecommunications and the Manufacturing sector.

Students can pursue an MTech/MS degree in a variety of engineering or technology disciplines such as aeronautical, automobile, instrumentation, electronics and communication, or computer sciences. But, make sure to crack the GATE (Graduate Aptitude Test in Engineering) exam first, before going down this road.

For a long career in the field of research, students are advisable to pursue MPhil or PhD in Physics, after completing MSc Physics and join any science/technology research center. Students can also apply in Government or private colleges and universities; polytechnic institutes, degree colleges, engineering

colleges, IITs, IISc etc for teaching job. The minimum requirement is MSc Physics and UGC-CSIR NET exam for lectureship and JRF. Moving on, an MSc Physics followed by a BEd can also land you a job in higher secondary schools and then, there is the option of physics tutor, at the convenience of one's homes. Some of the prominent national organizations, that student can try aim for, include Defence Research and Development Organisation (DRDO), Indian Space Research Organization (ISRO), BARC, SSPL, Space Application Centres, Indira Gandhi Centre for Atomic Research Centre, Variable Energy Cyclotron Centre, National Thermal Power Corporation (NTPC), Oil and Natural Gas Corporation (ONGC), Bharat Heavy Electricals Limited (BHEL) and National Atmospheric Research Laboratory of Department of Space.

The research institutes in India such as Physical Research Laboratory, Ahmedabad, Saha Institute of Nuclear Physics, Kolkata and Nuclear Science Centre, New Delhi, TIFR (Education); IISER also recruit MSc Physics graduates, for technical jobs. At the same time, student can also look out for the national laboratories and institutes like National Geographical Research Institute, Regional Research Laboratories, National Institute of Science Communication and Information Sources, NEERI (CSIR labs) etc. These are some of the leading names to be associated with the field of science. Moving further, student can try for public sector banking to the post of Probationary Officers.

MSc Physics graduates have ample of opportunities, be it, in healthcare, manufacturing and electronics companies in most foreign countries. Those with exceptional academic excellence can go a step further and apply in the best space research organizations such as National Aeronautics and Space Administration (NASA).

After completion of this programme, the students are placed as Scientists, Radiologist, Meteorologist, Analyzers in forensic labs, IAS, SDO, Dy Superintendent of Police in wireless stream, Assistant Professors, Lecturers, Teachers, Radiologist, Telecom officers (JTO).

Syllabus Prescribed for B.Sc. I Year   UG Programme

Programme:

Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
PHY/S1CS	**Mechanics, Properties of matters, Oscillations & Relativity**	72

COs

On successful completion of this course, the students would be able to
1. Discuss the basic concepts of rotational dynamics.
2. Examine the phenomenon of simple harmonic motion and distinction between undamped, damped and force oscillations and the concept of resonance.
3. Explain the superposition of simple harmonic motion and acquire the knowledge of Ultrasonic waves, their production, detection and applications in different field.
4. Determine the constants of elasticity and relate it with appropriate things
5. Interpret the postulates of special theory of relativity.
6. Know the concept of Global positioning system (GPS)

Unit	Content
Unit I	**Rotational Dynamics:** Rigid body, Torque, Rotation about fixed axis, Kinetic Energy of rotation, moment of inertia and its physical significance, Radius of gyration, Perpendicular and parallel axes theorem (Statement Only), Fly-wheel, Moment of inertia of different bodies (Rod, Disc, cylinder and sphere) about different axes, Rolling motion. Principle of Conservation of Angular momentum. Principle and working of Gyroscope. Numericals **12 (periods)**
Unit II	SHM and its solution, time period of simple pendulum, compound pendulum, kater's pendulum & Torsional pendulum; Bifilar pendulum (Qualitative). Damped Oscillations: Differential equation of damped harmonic oscillator and its solution, Energy equation of damped oscillations, Power dissipation and Quality factor. Forced Oscillations: Differential equation of forced oscillation (Qualitative), Resonance (Amplitude). Numericals **12 (periods)**
Unit III	**Superposition of S.H.Ms.:** Superposition of two SHM of same frequency along the same line, superposition of two mutually perpendicular SHM of same frequency, Lissajous figures. Velocity of longitudinal waves (Newton's formula), Laplace correction, velocity of transverse waves in stretched string, Standing waves, Organ Pipe, harmonics and overtones. Velocity of waves by Kundt's tube. Ultrasonic waves: Production (piezoelectric crystal and Magnetostriction) and detection of ultrasonic waves and its applications in medical and industrial field. Numericals **12 (periods)**
Unit IV	**Elasticity:** Different types of elasticity, Twisting couple on a cylindrical rod or wire, Determination of modulus of rigidity by Maxwell needle, Torsional pendulum, Torsional oscillations, Modulus of rigidity of a material of wire by torsional pendulum, Beam, Bending of beam, Bending moment, External and internal bending moments, Cantilever, Expression for depression of a beam (i) loaded at one end and (ii) loaded at the center. Numericals **12 (periods)**
Unit V	**Gravitation and Special Theory of Relativity:** Kepler's laws of planetary motion (Statements only), Newton's law of gravitation, Variation of "g" with altitude and depth, weightlessness, Satellite in circular orbit and applications, Geosynchronous orbit, basic idea of Global Positioning System(GPS). Frame of reference, Inertial and Non-inertial frame of reference, Galilean transformation, Postulates of special theory of relativity, Lorentz transformation, length contraction, Time dilation, Einstein's mass energy relation. Numericals **12 (periods)**
*SEM **Basics of Measurement Technique** Measurements: Significance of measurements, methods of measurements, Static and dynamic characteristics: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements: Types of errors: i) Gross errors ii) Systematic errors iii) Random errors and loading effects. Statistical evaluation of measurement data: Arithmetic mean & median, Average deviation: Measurement with Screw Gauge, Vernier Caliper, Travelling Microscope, Spectrometer. **(12 periods)**	
COs: After completion of this course students will able to 1. apply the principles of measurement and error analysis. **2.** Develop the skills to handle various instruments with precision.	

**Activities	1. Measurement of dimension of solid block, volume of cylindrical objects, diameter of thin wire.
	2. Measurement of length and diameter of capillary tubes.
	3. Comparison of diameter of a thin wire using screw gauge and travelling microscope.
	4. Measurement and estimation of errors in any one of the above activities.

Course Material/Learning Resources

Text books & Reference Books:
1. A Course in electrical &Electronic Measurements And Instrumentation by A. K. Sawhney, Dhanpatrai& Company (Pvt.) Ltd. Educational & Technical Publishers,
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper. PHI Learning Pvt. Ltd. New Delhi.
3. Measurement, Instrumentation And Experiment Design In Physics And Engineering By Michael Sayer, AbhaiMansingh, Phi Learning Private Ltd. New Delhi.
4. Electronic Instrumentation by H.S. Kalsi
5. Elements of Electronic Instrumentation and Measurement by Joseph J. Carr
6. A text book in Electrical Technology - B L Theraja - S Chand and Co.
7. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
8. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
9. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
10. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning
11. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
12. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
13. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
14. University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://nptel.ac.in

Weblink to Equivalent Virtual Lab if relevant:

https://vlab.amrita.edu/

https://www.vlab.co.in/

http://vlabs.iitb.ac.in/vlab/labsps.html

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtube.com/playlist?list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e

Syllabus Prescribed for B.Sc. I Year   UG Programme

Programme: Semester 1

Code of the Course/Subject	**Title of the Course/Subject** (Laboratory/Practical/practicum/hands-on/Activity)	**(No. of Periods/Week)**
PHY/S1	**Physics Lab-1**	**6**

COs

On successful completion of this practical course, the students would be able to
1. List out, identify and handle various equipment likes different types of pendulum.
2. Learn the procedures of operation of various oscillating objects.
3. Acquire skills in observing and measuring different types of errors.
4. Perform procedures and techniques related to experiments based on mechanics.
5. Conduct an experiments collaboratively and ethically.

* List of Practical/Laboratory Experiments/Activities etc.
It is necessary to perform **TEN** Experiments from the list given below.

1	To determine acceleration due to gravity by Bar pendulum.
2	To determine acceleration due to gravity by Kater's reversible pendulum.
3	To study oscillations in bifilar suspension arrangement
4	To determine Moment of Inertia of a body by a torsion pendulum.
5	To study the theorem of parallel axes of Moment of Inertia
6	To study the theorem of perpendicular of Moment of Inertia
7	To determine the Moment of Inertia of a body using bifilar suspension method (with parallel threads)
8	To determine the moment of inertia of a fly-wheel.
9	To determine the i) equivalent length, ii) radius of gyration, iii) moment of inertia of a compound pendulum by method of coincidences
10	To study the oscillations of a mass in combinations of two springs and hence determination of force constant.
11	To show that the frequency of a Helmholtz resonator varies inversely as the square root of its volume and to estimate the neck correction.
12	To determine Young's modulus of the material of a beam by method of vibration.
13	To determine Young's modulus of the material of a beam by method of bending.
14	To determine Young's modulus of the material of a beam by a cantilever.
15	To determine the Young's Modulus of a Wire by Optical Lever Method.
16	To determine modulus of rigidity of material of a given wire by Maxwell's needle.
17	To determine the modulus of rigidity of material of a given wire by using Torsional pendulum.
18	To determine coefficient of restitution for inelastic collision.
19	To determine the surface tension of mercury by Quinke's method

Text books & Reference Books:

15. *B.Sc. Practical Physics by Harnam Singh & Dr. P. S. Hemne , 2000, S. Chand and Company Limited.*
16. *A Textbook of Practical Physics by Indu Prakash, Ram Krishna & A. K. Jha, 2011, Kitab Mahal Publication.*
17. *B.Sc. Physics Practical by C. L. Arora, 2010, S. Chand and Company Limited.*

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://nptel.ac.in

Weblink to Equivalent Virtual Lab if relevant:

https://vlab.amrita.edu/

https://www.vlab.co.in/

http://vlabs.iitb.ac.in/v,,lab/labsps.html

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:
https://youtube.com/playlist?list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e

Faculty: Science and Technology
Programme: B.Sc.

Syllabus Prescribed for B.Sc. I Year UG Programme
Programme:
Semester 1I

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
PHY-S2/physics	**Electrostatics, Magneto-statics, Ultrasonic Waves and Acoustics,** **Network Theorems**	72

COs

After going through the course, the student would be able to

7. Discuss the concept of scalars & vectors and their properties.
8. Develop an understanding of Gauss law and its applications to obtain electric filed in different cases.
9. Formulate the relationship between electric displacement vector, electric polarization and dielectric constant.
10. Distinguish between the magnetic effect of electric current, electromagnetic induction and the related laws in appropriate circumstances.
11. Simplify electrical circuits by applying various network theorems.

Unit	Content
Unit I	Vector Analysis: Scalar and Vector product, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors. Numericals **(12 Periods)**
Unit II	Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Relation between electric field and electric potential. Numericals **(12 Periods)**
Unit III	Capacitors: Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. Numericals **(12 Periods)**
Unit IV	Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. Numericals **(12 Periods)**
Unit V	Network Theorems : Series circuit, Series voltage dividers, Parallel circuits, Series Parallel circuits, Resistances in series and parallel, Kirchhoff's Current and Voltage laws, Wheatstone's Bridge, Ideal constant voltage source, Ideal constant current source, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Milliman's theorem, Numericals. **(12 Periods)**

*SEM
Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.
Introduction to electrical components:
Resistor-Types of Resistors, Color coding - Applications of a Resistor as a heating element in heaters and as a fuse element.
Capacitor- Types of Capacitor, Color coding, Applications of Capacitor in power supplies, motors (Fans) etc.
Inductor-Types of Inductors, EMF induced in an Inductor, Applications of Inductor in a fan, radio tuning

circuit and Series resonance circuit.

Energy audit: Unit of electricity, power of domestic appliances. **(12 periods)**

COs: After completion of this course students would be able to 3. Make use of Multimeter for the measurement of electrical parameters and get the knowledge of electronic components and their applications. 4. Estimate the power consumption of domestic appliances and carry out energy audit.	
**Activities	1. Use of Multimeter for the measurement of ac voltage & dc voltage in different domestic appliances. 2. Use of Multimeter for the measurement of Resistance, Capacitance. 3. Estimate the values of Resistor & capacitor by color code method. 4. Connect two or three resistors or capacitors or inductors and measure the Series, Parallel Combination values using a Multimeter. 5. Identification of electronic components in mobile charger and to estimate their values. 6. Estimate and compare the power consumptions of different domestic appliances. **7.** Energy audit of your home and compare it with monthly electric bill (for three months).

Course Material/Learning Resources

Text books & Reference Books:
1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
6. A Course in electrical &Electronic Measurements And Instrumentation by A. K. Sawhney, Dhanpatrai & Sons Educational & Technical Publishers, Delhi.
7. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper. PHI Learning Pvt. Ltd. New Delhi.
8. Physics for degree students (B.Sc.2nd year) by C. L. Arora & P.S. Hemne, S. Chand Publication.
9. Physics for degree students(B.Sc. 1st year)by C. L. Arora & P.S. Hemne, S. Chand Publication.
10. Basic Electronics by B. L. Theraja, S. Shand Publication.
11. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
12. Properties of Matter and Acoustics for B.Sc, Kiruthiga Sivaprasath & R Murugeshan, S. Chand & Co. New Delhi.

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://nptel.ac.in

Weblink to Equivalent Virtual Lab if relevant:

https://vlab.amrita.edu/

https://www.vlab.co.in/

http://vlabs.iitb.ac.in/vlab/labsps.html

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://www.youtube.com/watch?v=rtlJoXxlSFE&list=PLyQSN7X0ro2314mKyUiOILaOC2hk6Pc3j

Sant Gadge Baba Amravati University, Amravati

Syllabus Prescribed for B.Sc. I Year   UG Programme

Programme: Semester II

Code of the Course/Subject	**Title of the Course/Subject** (Laboratory/Practical/practicum/hands-on/Activity)	**(No. of Periods/Week)**
PHY/S2	Physics Lab-2	72

COs

On successful completion of this practical course, the students would be able to
6. Simplify various electrical circuits by using network theorems.
7. Learn the procedures of operation of electrical components like capacitor, resistor and inductor.
8. Acquire skills in measuring dielectric constants of different materials.
9. Perform procedures and techniques related to experiments based on electrical and electronic circuits.
10. Conduct an experiments collaboratively and ethically.

* List of Practical/Experiments/Activities etc.

It is necessary to perform **TEN** Experiments from the list given below.

1		Verification of Kirchhoff's Current Law
2		Verification of Kirchhoff's Voltage Law
3		To determine unknown resistance by using Wheatstone's bridge
4		Verification of Thevenin's theorem.
5		Verification of Norton's theorem.
6		Verification of Milliman's theorem.
7		To verify the Superposition theorem
8		To verify Maximum Power Transfer Theorem
9		To determine high resistance by leakage method
10		To study the charging & discharging of a condenser through resistor.
11		To compare capacitances using De Sauty's bridge.
12		To determine capacitance by phaser diagram method
13		To determine inductance by phaser diagram method
14		Study of Primary & Secondary coil of Transformer
15		To determine dielectric constant of a given material
16		Study of frequency response of series LCR circuit
17		Comparison of capacities by repeated charge decay method
18		Measurement of the low resistance by Potentiometer

Text books & Reference Books:
18. *B.Sc. Practical Physics by Harnam Singh & Dr. P. S. Hemne , 2000, S. Chand and Company Limited.*
19. *A Textbook of Practical Physics by Indu Prakash, Ram Krishna & A. K. Jha, 2011, Kitab Mahal Publication.*
20. *B.Sc. Physics Practical by C. L. Arora, 2010, S. Chand and Company Limited.*

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https://www.vlab.co.in/
http://vlabs.iitb.ac.in/vlab/labsps.html

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:
https://www.youtube.com/watch?v=rtlJoXxlSFE&list=PLyQSN7X0ro2314mKyUiOILaOC2hk6Pc3j

Sant Gadge Baba Amravati University Amravati

Syllabus Prescribed for 2022-23 UG Programme

B. Sc. Zoology

Faculty of Science and Technology

POs:

At the time of graduation, Students will be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs

By the end of the programme, Students would be able to

1. Develop a deeper sense with respect to phylum Protozoa to Echinodermata relation to taxonomy, classification, body organization and general characteristics this strengthens students' capability in basic zoology.
2. grasp various the Systematic positions from Protozoa to Echinodermata their pathogenicity and its epidemiology.
3. describe unique characters and recognize life functions of Protozoa, Porifera, Coelenterate, Helminthes, Arthropoda, Annelida, Mollusca and Echinodermata. Improve ability and apply Knowledge of Non-chordates for its execution in Agriculture especially with the phylum Arthropoda.
4. Implement an extensive idea about economic and ecological significance of various non-chordates phylum's in human life.

Employability Potential:

The B. Sc. Zoology is a walk for the Bachelor's entrant through the amazing diversity of living organism from simple to complex. BSc Zoology Programme scope is very rewarding owing to the relevancy of the course. B.Sc. Zoology employability can be found in both the private and public sectors.

The course makes a detail comparison of the systematic study of different taxa of Non-chordate. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to   their grouping into taxa and clades.

Zoology deals with the structure, embryology, evolution, classification, habits, and distribution of all animals, both living and extinct. If you are interested in making a career in Zoology then you need to deal with both the existing, dead and quite possible the extinct species of the animal kingdom.

A zoologist might even get to travel because the nature of his / her job. Channels like **National Geographic, Animal Planet, Discovery Channel** are in constant need of Zoologists for research and documentaries. Zoologists are also hired for zoos, wildlife services, botanical gardens, conservation organizations, national parks, nature reserves, universities, laboratories, aquariums, animal clinics, fisheries and aquaculture, museums, research, pharmaceutical Companies, veterinary hospitals, etc.

There are various sectors of employment in the field of Zoology. Here's the list of job profiles:

Jobs are available with a wide range of organisations in the public, private and not-for-profit sectors. Typical employers include:

- Zoos or wildlife parks and environmental protection agencies
- Government agencies and research institutions
- Medical research establishments and the National Health Service
- Environmental and animal charities
- Schools, colleges, science centres, libraries and museums
- Universities and research institutes
- Environmental consultancies
- Chemical, pharmaceutical and petroleum companies
- Aquaculture and animal nutrition companies.
- **Wildlife Biologist:** In the current scenario of global warming, mankind needs to pay attention to conserving the wildlife. Main concern of wildlife biologist are conservation and propagation of wildlife.
- **Community development organizations:** Ideal places to apply theoretical knowledge in real life settings. You can also join a number of organizations to pursue career in community development like:
    - Zoo Outreach Organization
    - Dr. Salim Ali School of Ecology
    - Indian Tiger Welfare Society
    - Wildlife Trust of India
    - Bombay Natural History Society (BNHS)
    - Protection Society of India
    - Ashoka Trust for Research in Ecology and the environment (ATREE) etc.
    - Central Zoo Authority (CZA)
    - Regional Resource Centers of Ministry of Environment and Forest Wildlife
    - Wildlife Information Liaison Development
    - Center for Science and Environment (CSE)
- **Indian Forest Services (IFoS):** A candidate can take IFoS exam conducted by Union Public Services Commission (UPSC). The upper age limit is relaxable up to 5 years for the candidates belonging to categories: Scheduled Caste/ Scheduled Tribe (SC /ST).

- **Research work:** If student is keen in research then he/she can apply for IISc., IISER, TIFR, NCBS, JNCASR, etc. for an Integrated MSc-PhD program or pursue advanced degree in wildlife biology or ecological sciences in various institutes.
- **Freelance consultant**: Student may also work as a freelance consultant in various research and development organizations.

This a great **career** interest for students, who are fascinated with nature and would not mind spending time understanding it. There are several specializations that the students pursuing the field can venture into.

Many research agencies recruit expert students for various research projects for environmental research, animal biodiversity research, conservation of wildlife, environmental management research and monitoring of ecosystems etc.

B.Sc. Zoology Student has ample opportunities as Zoology teacher, Lab Assistant, Conservationist, Wildlife biologist, Marine Biologist, Museum Curator, Taxonomist, forensic expert, Eco-toxicologist, Biomedical Scientist, Animal Care taker, Animal and wildlife Educator, Zoo Curator, Environmental Consultant, Zoo Educator, wildlife Rehabilitator, Medical Representative, Sustainability officer, etc.

Apart from the above, private business enterprise is also one of employability potential such as, Agro Business Industry (Fish, Farming, Sericulture, Apiculture, Prawn culture, pearl Culture, Lac Culture, etc.) Clinical Business Associate, Veterinary based small scale Industry (Goat farming, poultry), Nutrition specialist.

Some top organizations also employ B.Sc. Zoology students such as Wildlife Institute of India (NII), Zoological Survey of India (ZSI), National Institute of Oceanography (NIO),

State Forest Department, Centre Marine Fisheries Research Institute (CMFRI), Central Inland Fisheries Research Institute (CIFRI), Ministry of Environment and forest, Medical Laboratories, Agricultural firms Pharmaceutical Companies, etc.

Being Zoology is a basic Science, the demand of Zoology is increasing day by day. It provides a good career option to students. It provides wide horizon of knowledge with preview of employability potential. P.G. in Zoology provides services in various sectors like, Biological Medical, Agriculture as Zoologist, Assistant Professor, Ecologist, Entomologist, Herpetologist, Department of Fishery Zoo Keeper, Zoo Officer, Marine Scientist etc.

- The students can also work in forest department by qualifying Indian Forest Service examination. They can work in sample investigator for those derived from animals in different poaching and forest crime cases. They have opportunities like Wildlife Conservationist, Forest Ranger, Zoologist, Wildlife Educator, Naturalist, Field Officer, Biomedical Scientist, Toxicologist, Marine Scientist, Medical Coder etc.

They can opt to do research-based programs or study for competitive examinations like civil services besides doing a job in a zoology-related field. They can develop entrepreneurship in the different fields like Apiculture, Sericulture, Lac culture, Pisciculture, Aquaculture, Vermiculture, etc. They can contribute as a consultant in Environment impact assessment in different projects of Dam/Road/Rail track constructions etc.

Other than this, they can opt for post PG Studies M.Phil or Ph.D or can qualify competitive exam like NET/SET/GATE to join as an Assistant Professor or as a Researcher.

A Scholar Student can join services at Bhabha Atomic Research Centre (BARC), NCBS/TIFR, NIO/ZSI etc. as a scientist.

Programme : B.Sc : I- Zoology

Name of the programme: **B.Sc. I**   Class : **Part I S**

Semester :**I** ,DSC -1-01S   Subject Zoology

Name of the course (Paper): **Life and diversity of Animals (Non-chordata)**

Course Outcomes Code : COs-01

About the course

        The course is a walk for the Bachelor's entrant through the amazing diversity of living organism from simple to complex. The course makes a detail comparison of the systematic study of different taxa of Non-chordate. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to   their grouping into taxa and clades.

COs:

Upon completion of this course successfully, students would be able to

1. Develop a deeper sense with respect to phylum Protozoa to Echinodermata relation to taxonomy, classification, body organization and general characteristics this strengthens students' capability in basic zoology.
2. grasp various the Systematic positions from Protozoa to Echinodermata their pathogenicity and its epidemiology.
3. describe unique characters and recognize life functions of Protozoa, Porifera, Coelenterate, Helminthes, Arthropoda, Annelida, Mollusca and Echinodermata.
4. Improve ability and apply Knowledge of Non-chordates for its execution in Agriculture especially with the phylum Arthropoda.
5. Implement an extensive idea about economic and ecological significance of various non-chordates phylum's in human life.

Unit I

      12 L

1. Introduction and Classification to Non-Chordata
2. Phylum Protozoa: General characters
3. Type Study: Plasmodium vivax: structure, Life cycle
4. Parasitic Protozoan and human diseases: Malaria, Amoebiasis

Unit- II

      12 L

1. Phylum Porifera: General characters
2. Type study: Scypha: Habits, Habitat and Distribution, Cell types, Spicules and Structure and significance of canal system.
3. Phylum Coelenterates: General characters
4. Type study: Metridium: Habits and Habitat, External features, Gastrovascular cavity, Mesenteries, Corals and coral reefs.

Unit III:

12 L

1. Phylum Platyhelminthes: General characters
2. Type study Fasciola hepatica: Habits and Habitat, External features, Excretory, Reproductive system and life cycle, disease and control.
3. Phylum Aschelminths: General Characters
4. Type study: Ascaris lumbricoides: Habits and Habitat, External features, Digestive, Excretory, Reproductive system and life cycle.

Unit IV:

12 L

1. Phylum Annelida: General characters
2. Type study: Leech: External features, Digestive, Reproductive system.
3. Phylum Arthropoda: General characters.
4. Type study Cockroach: Habits and Habitat, Digestive, Excretory, Respiratory system, Reproductive system.

Unit – V:

12 L

1. Phylum -Mollusca: General characters
2. Type study: Pila globose: Habit and habitat. External Features (Shell and body) Digestive system, Respiratory system, Reproductive system,
3. Phylum: Echinodermata: General characters,
4. Type study: Asterias, Habits and habitat. External Feature, Water vascular system

Unit: VI:

12 L

1. Phylum: Hemichordata : General characters, Body organisation of Balanoglossus, Affinities of Balanoglossus with Non-Chordata and Chordata.
2. Parasitic adaptation in Helminthes, Morphological and Physiological
3. Larval forms and their significance
4. Amphiblastula, Planula, Trochophore, Bipinnaria, Brachiolaria.

Unit VII:

20 M

Skills Enhancement Module (SEM)

1) **Comparative study protozoan disease in the local area.**
   a) Procurement of resources such as reference books and data on protozoan disease in the local area.
   b) Visiting local public health Centre to fetch data on protozoan Diseases.
   c) Shortlisting most frequently occurring protozoan diseases in the area with the help of PHC authorities.
   d) Preparing data to represent the status and severity of the diseases.
   e) Submission of study report with proper inference and suggestion if available.

2) Study of hotspots regarding coral reefs from the Indian subcontinents
   a) Use of resources such as books and web to familiarise with corals, their various types and diversity and making writeup on it.
   b) Getting acquainted with the importance of coral reefs and their role in oceans.
   c) Making datasheet of few of the aquatic faunal species dependant to a large degree on coral reefs for their survival. Make an account on relationship of coral reefs with other faunal species with suitable example.
   d) Study of Economic importance of coral reefs to humans and current coral reef status throughout the Indian subcontinent.
   e) Submission of study report taking above mentioned points into consideration with the help of available resources.

3) Types of worm disease and control.
   a) Study of various worm diseases through Reference books and Internet and making list of frequently found worm diseases and getting acquainted with various modes of worm infections.
   b) Getting help from local Medical services such as Primary Health Centres and Practicing medicos to get an idea about status of worm diseases in the local area.
   c) Make a note on various treatments for worm infections, availability of treatments in the local area and methods to curb spreading of these infections.
   d) With the help of Public health Government authorities in your area make a report on their plan to prevent worm diseases and submit the study report covering all above mentioned points.

4) Diversity of Annelida in the local area.
   a) With the help of Internet and Books make list of locally occurring annelids. Procure pocket field guide to help identification of species.
   b) Getting familiarised with Procedure to Survey and study the diversity of annelids through various resources.
   c) Survey of Local area to select suitable spot to study and record various annelids.
   d) Take a record photo shot (if possible) and identify the species of annelid with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
   e) Make list of various species and their abundance in the area and submit study report taking above mentioned points into the consideration.

5) Collection of diversified Mollusc from the local water resources.
   a) Get acquainted with mollusc with the help of available material and procure primary equipment for its collection.
   b) In the suitable season survey the area to record and collect various molluscans from the nearby vicinity and make note of G.P.S location data, season, and type of habitat from where the mollusc is collected.
   c) With the help of identification guide, identify the samples and take photographs of the specimen for the report.
   d) Make list of various species and their abundance in the area and submit detailed study report taking above mentioned points into the consideration.

6) Economic importance of culture of Mollusca
   a) Use of resources such as books and web to familiarise with Molluscans, their various types and diversity.
   b) Get familiarised with the significance of molluscans and Economic importance them with reference to human context.
   c) Procure information about sites of aquaculture and species of molluscan that are commercially grown in plants in india.
   d) Mention current scenario and future of molluscan aquaculture by use of available resources.
   e) Submission of study report taking above mentioned points into consideration with the help of available resources.

7) Survey of Malarial infection from local region.
   a) With the help of available study resources get familiarised with causal animal of malaria, its vector and its life cycle. Make a list of commonly occurring parasite species in your local area.
   b) With the help of Primary Health Centre procure malarial infection incidences data.
   c) Tabulate and represent data of available years and derive inference if the severity and occurrences of malarial infections is increasing or decreasing.
   d) By contacting Public health governmental organisations procure information on various steps employed to restrict the spread of malarial infections.
   e) Submit study report taking all the above points into consideration and also include suggestions if any.

8) Survey the impact of amoebiasis infection in local population.
   a) With the help of various resources like Books and internet, understand and note down epidemiology of the disease and its status in your surrounding area.
   b) Procure information from PHC's about occurrences of the disease, its season wise frequency, commonly infected sex, age group, disease prone areas of local population.
   c) Inquire and enlist current plan of action of PHO's to contain the spread of infection.
   d) With the help of detailed data set and draw inference about its impact on public health and submit it in study report. Mention suggestions, if any.

9) Photographic collection of spiders web from the local area.
   a) With the help of Internet and Books make list of locally occurring spiders. Procure pocket field guide to help identification of species also get acquainted with webs of different spider species.
   b) Get familiarised with Procedure to Survey and study the diversity of Arachnida through various resources.
   c) Survey of Local area to select suitable spot to study and record various Arachnids.
   d) Take a record photo shot of spider and its web and identify the species of Spider with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
   e) Make list of various species and their abundance in the area and submit study report taking above mentioned points into the consideration.

10) Study of varieties of odonates surrounding area.
   a) With the help of Internet and Books make list of locally occurring Odonates. Procure pocket field guide to help identification of species.
   b) Get familiarised with Procedure to Survey and study the diversity of Odonata through various resources.
   c) Survey of Local area to select suitable spot to study and record various Odonates.
   d) Take a record photo shot and identify the species of with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
   e) Make list of various species and their abundance in the area and submit study report taking above mentioned points into the consideration.

11) Photographic collection of aquatic and terrestrial hemipterans.
   a) Make list of locally available hemipterans with the help of available resources.
   b) Familiarise with the life cycle and season of abundance hemipterans in the region.
   c) Take a record photo shot and identify the species of with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
   d) Submit recorded data and photographs accompanied with proper identification.

12) Photographic collection of colourful beetles and bugs from the local region.
   a) Make list of locally available Coleopterans with the help of available resources.
   b) Familiarise with the life cycle and season of abundance of coleopterans in the region.
   c) Take a record photo shot and identify the species of with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
   d) Submit recorded data and photographs accompanied with proper identification.

13) Types of honey bees and their culture.
a) Procurement of resources such as reference books and data on honey bees and their culture.
b) Visiting nearby apiculture plant Centre to fetch data about honey bees.
c) Listing various species of honey bees and their attributes in regard to honey production quality and quantity.
d) Preparing data to represent the survey and status of apiculture in your local area.
e) Submission of study report with proper inference and suggestion if available.

Practical : Life and diversity of Animals (Non-chordata)

Practical : Two practical per week and each of 03 periods duration> The examination shall be of 04 hours duration and of 50 marks

I-Life and diversity of Animals (Non-chordata)
COs:

Upon completion of this course successfully, students would be able to perform/demonstrate

1. Observation, classification upto classes and sketching of the following animals (Specimens and models)
   - Phylum : Protozoa: Plasmodium trophozoite, Euglena, Entamoeba histolytica
   - Phylum : Porifera : Sycon, bath sponge, Euplectela
   - Phylum :Coelenterata : Obelia, Aurelia, Tubipora,
   - Phylum : Helmenthis : Taenia, Ascaris (male and female)
   - Phylum Annelida : Neris, Earthworm, Leech,
   - Phylum :Arthropoda : Prawn, Aranea,scolopendra, julus, moth, mosquito
   - Phylum : Mollusca : Chiton, Pila, Dentalium, Unio, Octopus
   - Phylum : Echinodermata :Antodon, holothuria, seastar, Brittle star
   - Phylum : Hemichordata : Balonaglossus

2. **Study of permanent slides**
   L.S. of Sycon, nematocyst, Ascaris egg, T.S Ascaris through Testis and ovaries, T.S. Leech through Crop, Compound eye of Insect, Radula of Pila, Gill lamella, Osphradium of Pila, Scolex and gravid proglottid of Taenia

3. **Anatomical Study through computer aided techniques, Video clipping, models, photographs and other available resources**

   a. Leech/Earthworm: Alimentary canal, reproductive system, Nervous system,

   b. Grasshopper/ Cockroach; Digestive system, Nervous system, Reproductive system,

   c. Culture of Hydra and Volvox (to be given to all students)

4. **Mounting**
   a. Mosquito (culex and Anopheles) : Wings ,legs, mouthparts
   b. House fly; Mouth pars, legs, wings
   c. Paramecium and volvox

Distribution of Marks during Practical Examination: Time : 4 hrs.

i) Identification and comments on spots (1-8) 4 specimens, 4 slides   12 Marks
ii) Labelling of Anatomical diagrams provided (Two)   10 Marks
iii) Permanent stained micro preparation   08 Marks
iv) Study tour diary - …………   04 Marks
v) Permanent stained micro preparation Submitted by examinee ….. 04 Marks
vi) Certified class record - ………   05 Marks
vii) Check list of 20 locally available invertebrate fauna………   02 Marks
viii) Viva- voce ……………..   05 Marks
Total: - ….   50 Marks

Note:

   1) One or two short excursion/study tours are compulsory for observation of animals in their natural habitat. 2) Candidates shall be required to produce at the practical examination the following.
•   Practical record book duly signed by the teacher in charge and Certified by the Head   of the department as bona fide work of the Candidate.
•   Five permanent stained micro preparations.
•   Study tour report and field diary duly signed by the teacher.

Reference Books Recommended (All latest editions):

1) Hickman, C.P. Jr.F.M. Hickman and L.S.Roberts, Integrated principles of Zoology Mosby College publication St.Louis.
2) Ayyar, E.K. and T.N.Ananthakrishnan, Manual of Zoology Vol.I (Invertebrata), Part-I & II S. Viswanathan (Printers and Publishes) Pvt. Ltd. Madras.
3) Jordan, E.L. and P.S.Verma Invertebrate Zoology, S.Chand and Co., Ltd. Ram Nagar, New Delhi.
4) Parker and Haswell, Text book of Zoology, Vol. I (Invertebrata), A.Z.T.B.S. Publishers and Distributors, New Delhi –110051.
5) Waterman, Allyn J. etal., Chordate structure and Function, Mac Millan and Co Newyork.
6) S.N.Prasad : Text Book of Invertebrate Zoology.
7) Vishwanathan : Invertebrate Zoology.
8) Majpuria : Invertebrate Zoology
9) Dhami and Dhami : Non-chordate Zoology.
10) Baini Prasad: Indian Zoological memoir. Pila.
11) R.L.Kotpal : Modern Text Book of Invertebrate Zoology.
12) Malviya M.K. Invertebrate Zoology, by Rajdhool publications.
13) S.S.Lal, Practical Zoology, Invertebrate.
14) Bhamrah H.S.and Kavita Juneja A text book of Invertebrate Zoology, Anmol Publication Pvt. Ltd,. New Delhi.

15) Verma and Agarwal Practical Zoology, Invertebrate

16) - Barnes R.D. Invertebrate Zoology -(W.B. Saunders Co.)

17) P.G.Puranik and Thakur, Invertebrate Zoology.

Sant Gadge Baba Amravati University Amravati

Syllabus Prescribed for 2022-23 UG Programme

Programme : B.Sc-I : Zoology

There shall be the following paper and practical for B.Sc. Part-I and Semester II examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory sessions and 25 practical sessions during the complete semester). There shall be one compulsory theory paper of 3 hours duration, as stated below and a practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

Name of the programme: **B.Sc. I**
Class : **Part II S**

Semester :**II** ,DSC-2-02S
        Subject Zoology

Name of the course (Paper): **Life and diversity of Animals (Chordata) and concept of**

Evolution

Course Outcomes Code : COs-02

Max Marks : 80

About the course

        The course is a walk for the Bachelor's entrant through the amazing diversity of living organism from simple to complex. The course makes a details comparison of the systematic study of different taxa of Non-chordate. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and an anatomy which led to   their grouping into taxa and clades.

COs:
Upon completion of this course successfully, students would be able to

1. know what the chordates are.
2. Learn about the different phylum of chordates.
3. confidently explain the general characters and classification of Protochordates upto class Mammalia.
4. understand the level of organization in chordate.
5. explain the origin and evolutionary relationship in different subphylums of chordates.
6. describe specific features of Protochordates upto class Mammalia.
7. recognize and differentiate life functions of Protochordates upto class Mammalia.
8. understand Migration in fishes and birds , parental care in Amphibians and Poisonous and non-poisonous snakes.
9. explain the adaptations in Birds and Mammals.

Unit – I:

Phylum Chordata

12 L

1. Origin of Chordata
2. Protochordates: Type study: Amphioxus, Habits and habitat, External characters, Digestive system and feeding, Excretory organs, gonads, Affinities of Amphioxus. Affinities of Agnatha.
3. Series: Pisces: Type study: *Scoliodon sorrakawah* (Dog fish) Habits and habitat, External characters, Respiratory system, respiratory organ and mechanism of respiration, circulatory system, structure and working of heart, Lateral line receptors. Migration in fishes-types causes and significance.

Unit: II

12 L

1. **Class Amphibia**: Type study: *Rana tigrina:* Habits and habitat, Respiratory organ, Circulatory system, structure of heart, major arteries an vein, Urinogenital system. Parental care in Amphibia.
2. **Class Reptilia**: Type study: *Calotes versicolor*- Habits and habitat, Circulatory system, Structure of heart, major arteries and veins. Types of Snake venom and anti-venom.

Unit: III

12L

1. **Class Aves**: Type study: Pigeon -*Columba livia,* Habits and habitat, external characters, Respiratory system, Urinogenital system, flight adaptation, Migration in birds.
2. Class: Mammalia: Primitive mammals: Salient features of Prototheria and Metatheria, Aquatic mammals, Flying mammals. Adaptive radiation in Mammals.

Unit: IV

12L

1. Evolution meaning and scope
2. Indirect evidences of evolution: Evidences of organic evolution-morphological and anatomical, physiological and biochemical, embryological.
3. Direct evidences of evolution: Paleontological evidences: Fossil and fossilization: petrified fossils dead and preserve bodies and moulds, trails and foot prints, condition for fossilization. Radioactive carbon dating of fossils. Living fossil. Importance of fossil record. Evidences from connecting links – Peripatus and Archaeopteryx.

Unit: V

12 L

1.   Evolutionary Processes: Natural selection: Darwinism and Lamarckism
2.   Speciation- definition of speciation-Allopatric and Sympatric speciation.
3.   Modern concept of organic evolution -Neo-Darwinism. Population Genetic: Hardy - Weinberg equilibrium, Gens pool, Gene frequency, Genetic drift, Convergent, Divergent and parallel evolution, Coevolution.

Unit VI:

12L

1.   Evolution of Man-brief accounts of Parapithecus, Dryopithecus, Parapithecus, Australopithecus, Homoerectus, Neanderthal man, Cro-magnon man and modern man. Evolution of heart and aortic arches
2.   Animal adaptation: Desert, Aquatic and Terrestrial.

Unit VII:

Skill Enhancement Module—(SEM)   **20 M**

Upon completion of this course successfully, students would be able to perform/demonstrate

1. **Study on edible fishes from the local region.**
   - Select local spots.
   - Find various water reservoirs from selected areas.
   - Choke out a plan to visit.
   - Observed edible fishes and their photographic records.
   - Prepare the data in a scientific way and submit.

2. **Case study of diversity in frogs from surrounding areas.**
   - Select a different location from the surrounding area.
   - Search for varieties of frog by observing in the particular area.
   - Take photographic records and classify accordingly.
   - Comparative study of their occurrence in different locations.
   - Prapare a scientific data and submit.

3. **Survey of Photographic evidence of parental care in frogs in monsoon.**
   - Study is carried out during monsoon season only.
   - Focus selective location where the possibility of frog nesting occurs.
   - Multiple visits during June to September to get expected results.
   - Prepare data with photographic evidence and submit.

4. **Survey the diversity of snakes in the surrounding area.**

    * Visit a locally working snake rescue team.
    * Involved in their rescue operation in the surrounding area.
    * After a multiple visit, prepare data with snake photographs and classify accordingly.
    * Prepare Survey report and submit it.

5. **Survey of Migratory birds in the forest /Grassland/Field.**

 * Find out a list of migratory birds and visit the selected area from the books and other bird organizations
* Decide multiple visits to the selected area.
* Prepare a list of observation and Photographic records.
* Compare this list with actual records which are mentioned in books and other reservoirs.
* Submit a final report of the bird survey.

6. Case Study of migratory wetland birds from local reservoirs.

* Download a list or read a list of migratory wetland birds from IUCN red data list or renown books.
* Select reservoir for case study from the surrounding area.
* Visit during migration period i.e. September to may.
* Try to take a photograph of migratory bird species from the different reservoirs.
* Prepare the data with a basic classification and a few characters with photographs and submit.

7. Prepare a model on the evolution of man.

* Find out the latest information from the internet and recent books on evolution of man.
* Collect a photographic record and their history and related information.
* Prepare a model with photographic records and basic information like evidential proof,period of occurrence, characters etc.
* Submit this model.

REFERENCE BOOKS:
1. Integrated Principles of Zoology, 7th Edition, Hickman, C.P. Jr.,F.M.Hickman and L.S. Roberts, 1984. Times Mirror/Mosby College Publication. St. Louis. 1065 pp.
2. A life of Vertebrate – K.Z.Young, ELBS Oxford University Press.
3. A Text Book of Chordates – H.S.Bharmah and Kavita Juneja.
4. Modern Text Book of Zoology Vertebrate – R.L.Kotpal, Rastogi Publication Meerut.
5. A Text Book of Chordates – A .Thangamani, S, Prasannakumas, L.M.Narayanan and
6. Arunmugam Saras Publication, Nagercoil.
7. A Text Book of Chordate Zoology – R.C.Dalela –Jaiprakashnath Publication Meerut.
8. Chordate Zoology – E.L.Jordan and P.S.Verma, S.Chand and Company New Delhi.
9. A Text book of Practical Zoology Vertebrate – S.S.Lal, Rastogi. Publication, Meeru
10. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.
11. Chordate Zoology and Elements of Animal Physiology, Jordan, E.K.and P.S. Verma, 1995. 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
12. Zoology of Chordates, Nigam, H.C., 1983. Vishal Publications, Jalandhar - 144 008, 942.
13. The Phylum Chordata, Newman, H.H., 1981. Satish Book Enterprise,Agra - 282 003, 477 pp.
14. Text Book of Zoology, Vol. II (Chordata), Parker and Haswell, 1964.A.Z.T,B.S. Publishers and Distributors, New Delhi – 110 051, 952 pp
15. Chordate Structure and Function, Waterman, Allyn J. et al., 1971. Mac Millan & Co., New York, 587 pp.
16. Simpson, G.C. 1967 - The meaning of Evolution. Revised Edition – New Haven, Tale University Press.
17. Colbert, E.H. 1969 - Evolution of Vertebrates, Wiley, New York.
18. Mayr, Ernst, 1973 - Animal Species and Evolution. The Belknap Press of Harvard University, Cambridge.
19. Dobzansky, T. 1976 - Genetics and the Origin of Species. Oxford and TBH Publishing Co. New Delhi.
20. Savage, J.M. 1976 - Evolution. Amerind Publishing Co. Pvt. Ltd. New Delhi.
21. Elic. Minkoff, 1983 - Evolutionary Biology, Addison Wesley.
22. Life, Origin, Evolution and Adaption (2002) – Sanjib Chattopadhyay. Books and Allied (p) Ltd.
23. P.S.Verma & V.K.Agrawal.(2008) Cell Biology, Genetics, Molecular
Biology, Evolution & Ecology –S. Chand Publications.

24. Dhabade. D.S. I. A. Raja. R.A>Gulhane. A.P.Charjan. A.K.Patki., And P.S.Patil.,.A Text Book of Evolution: Sanket Publicatin. Washim
25. Zoology for Degree Students, Prof.Dr.V.K.Agrawal.

Practical:-
Two practical per week of 3 periods duration. Examination shall be of 5
Hrs duration and of 50 marks.

COs:

Upon completion of this course successfully, students would be able to demonstrate/perform/accomplish the following

1. General characters and classification of Phylum Chordata:
2. General characters and Classification up to orders of the following chordates or as per the availability in the laboratory from the major orders, (Specimens or Models):
Protochordata: Herdmania, Doliolum Salpa, Amphioxus.
Agnatha: Petromyzon, Myxine.
Pisces: Scoliodon, Torpedo, Acipenser, Exocoetus. Hippocampus
Amphibia: Ichthyophis, Salamander, Bufo, Hyla.
Reptilia: Varanus, Phrynosoma, Chameleon, Cobra, krait, Russell's viper, Typhlops, Hydrophis
Aves: Duck, Woodpecker, Kingfisher, Parrot.
Mammalia: Mongoose, Squirrel. Manis. Bat., monkey,
B) Dissections:
1. Dissection - afferent and efferent branchial vessels, cranial nerves, internal ear of scoliodon.
2. Dissection - Digestive system, Arterial system, venous system, reproductive system of rat.
3. Permanent micro-preparations .a. Fish scales. b. Ampullae of Lorenzini. c. Eyeball muscles.
4. Observations of air bladder in air breathing fishes.
C) Osteology. Rabbit, Varanus (excluding loose bones of skull).
D) Evolution:
1. Study of fossils, including living fossils.
2. Study of Evidences of evolution.
i) Analogous and Homologous organs.
4. Study of Mesozoic Reptiles (By Models/Charts).
5. Mimicry, coloration in animals.
6. Beak and Leg modifications with reference to: Parrot, Woodpecker, Kingfisher, Heron, Duck, Sparrow/Pigeon Hawk/Kite, Owl.

E) Histological Slides :- Amphioxus, Frog, Rat
Slides :
T.S, Oral hood, Pharynx, Tail
T.S. lung, Stomoch, Kidney, T.S. Intestine,
T.S. Liver, Pancrease, Ovary, Testies, Pituitary,
Thyroid, Adrenal

DISTRIBUTION OF MARKS FOR
PRACTICAL EXAMINATION.

1. Dissection: -	10
2. Permanent stained micro preparation.	05
3. Spotting. (Specimens, Slides, bones, fossil)	10
4. Practical on evolution -	10
5. Class record	05
6. Viva - Voce	05
7. Submission of study tour report.	05

Total Marks: 50

<u>**Course- Zoology**</u>
General Interest Course (GIC)

Title: Snake Identification their Rescue & Snake Bite Management

Course Duration :

15 hours

Email- profpraveenjoshi@gmail.com

Credit   :   01

Course Information:

              The importance of snakes in nature is extraordinary. They play an important role in the food chain. The snakes are found in all habitats like villages, towns, farms and forests but in villages and cities people are often bitten by snakes and die prematurely but these are due to poisonous snakes but among the diversity very few snakes are poisonous but people unaware of the facts. Most of the time non-venomous snakes bite and they do not cause death but lack of information creates fear and kills snakes. The snake maintains the balance of the environment by controlling the population of many species such as rodents, mice, small mammals, birds and reptiles. In this course students will be given complete information about the species of snakes commonly found in Vidarbha, their habitat, predators, behaviors, snake bites and its causes and remedies as well as beliefs about snakes and superstitions and their importance in nature. Students can effectively spread awareness about snakes in the society through this medium.

Course Outcome:

              Every student participating in the course will get to know about the different species of snakes in Vidarbha. The student can easily identify venomous and non-venomous snakes. It will be possible to differentiate between venomous and non-venomous snake bites. Participate in a rescue operation with volunteers from a snake rescue organization. Understand how to catch them. Students confidently told about the habitat of snakes, their role in nature and why it is important to save snakes. Visiting hospitals for people who have been bitten by snakes will help them to understand the difference between the bites of different venomous snakes. Awareness can be created by taking active part in future campaigns on the importance of snakes for the environment.

Facility provided by the Institution:

              First of all, cooperate with the local organization working on snakes. Make available books on snakes to the students through the college library. Provide information about snakes with the help of photos and videos with the help of projector. With the help of children working in the organization, go to different habitats and give information about catching snakes. Visit a snakebite victim at a local government hospital. Create awareness about snake bites in the future, how to prevent snake bite accidents.

Course Syllabus

Unit 1   10 L
- General information of world wide diversity of snakes.
- Diversity of snakes in India, Maharashtra and Vidarbha region.
- Identification of poisonous and non-poisonous snakes in Vidarbha.
- Participating in snake rescue operation and developing skill handling and capturing of snakes under the guidance of authorized snake catchers.
- Arrange field visits to know about different habitats of snakes.

Unit 2   10 L
- Role of snakes in the environment.
- Snakes are important creature in the food chain.
- Methods to avoid the snake bite.
- Identification of different poisonous snake bites and non-poisonous snake bite.
- Primary steps after snake bite.
- Volunteers in snake bite operation.

- Participating while arranging rallies, lectures and seminars in public places in creating an awareness of saving snakes and saving nature.

Evaluation Methods:

1. Submit Project based on Local diversity of snakes. -------------------------   10 marks

2. Deliver a seminar on any topic based on syllabus. -----------------------   10 marks

3. Participation certificate in a snake rescue team by the local snake organization.—5 Marks

4. Member of awareness program which will be run by the organization for saving snakes.- 5 Marks

Bibliography:-

1. Venomous Bites from Non Venomous snakes:A Critical Analysis of Risk By,D.A.Warrel,Daniel E.Keyler Julian White and Scott
2. Guideline for the management of snakes bites World Health Organization Regional Office South East Asia.
3. Snakes of the world-A catalogue of living and extinct species by Van Wallach,Kenneth L. Williams and Jeff Boundy-Google Book.Dec-1995.
4. Snakes of India-Romulus Whitakar and Ashok Captain
5. Common Indian Snakes- Romulus Whitakar
6. Snakes of Maharashtra- Neelamkumar Khaire
7. Reptiles and Amphibians of India: J. C. Daniel
8. Uncover a Cobra: Van Wallach.
9. Reptiles By: J.Z.Young
10. Vertebrates Zoology: P. S. Verma, S. Chand Pub. N. Delhi
11. Vertebrates Zoology: R. L. Kotpal, Rastogi Pub. N. Delhi

Course- Zoology

General Interest Course (GIC)

Title: Basic Course in Ornithology

Course Duration :   15 hours

Credit   :   01

Course Outcome:
The student who has taken admission in this course will get basic knowledge of bird species from all over the world as well as complete information about bird species found in Maharashtra and Vidarbha. Course students will get an in-depth knowledge of various bird species in nature, their functions, their major habitats, bird-specific habitat. Students may have the opportunity to work on various research projects run by international or national bird organizations. Students can set up their own bird tour company, organize small bird tours at famous bird sanctuaries in India, pursue their hobbies and earn money through the tour. Students can put up an exhibition of selected photographs of the birds they photograph while going birding each day. This will make people aware of the local bird diversity and at the same time help encourage other students who are interested in the field. Students can also earn money by selling selected photos displayed in the exhibition.

Course Information:

This course is mainly based on Birds which is an indicator of a healthy environment, an important component of the food chain, attracting everyone with its appearance and sound. This is made especially for people who love birds and nature. The main objective of this course is to give the students an in-depth knowledge of the bird world of Vidarbha as well as to introduce the bird diversity of the world and the bird world of Maharashtra. Students need to be informed that birds play an important role in the environment. It is important to show how the extinction of bird species will adversely affect nature. It is important to explain the potential threats to habitat and the steps that need to be taken to address the rapidly declining number of bird species and the extinction of many species. Students will be informed about the number of migratory birds that come to Vidarbha from all over the world. Students will be given full information about the category they fall under as per IUCN. The benefits of bird watching for the environment, physical and mental health will be explained. It will be informed that many job opportunities are available due to this course. Students will also learn about the close relationship between birds and tourism so that we can start our own business in this field.

Facility provided by the Institution:

The Institute will make available the required books for this course in the Library. Provide an up-to-date classroom with projectors, computer systems and important study materials. In addition to regular teachers, guest lectures will be provided by expert teachers of related subjects. Programs such as workshops, seminars, group discussion field visits of experienced people who have been working in this field for many years will always be conducted. A study tour of the relevant subject will be organized by the college during the course. Students who have taken admission in the course will be given an opportunity to participate in their various activities by collaborating with an organization working in the field of birds.

Course Syllabus

Unit 1   10 L
- To introduce Bird diversity of the Indian subcontinent.
- Basic information about Bird Diversity of India, Maharashtra and Vidarbha region.
- Species based categorization (Prey birds, Passerine and waders).
- Diversity of residential birds of Vidarbha.
- Migratory birds visited the Vidarbha region.
- Rare birds are recorded as per IUCN in the Vidarbha region.

Unit 2   10 L
- Important bird watching tips and materials needed for bird watching.
- Benefits of Bird watching.
- Role of birds in the environment.
- Identification and census methods of birds.
- Reason for decline in population of birds in Vidarbha region.
- Steps involved in their habitat management and conservation.
- Birds and Tourism.

Evaluation Methods:

1. Visit local birding spots and submit a diversity survey report.   --------- 10 M
2. Deliver a seminar on any one of the topics from the syllabus.   ---------- 05 M
3. An exhibition of photographs of various species of birds taken during the Bird Survey should be displayed in the college.   ----------- 10 M
4. Volunteer for a few days with an organization working in the various issues like field of bird species diversity, destroy habitat and needs of conservation and submit its certificate.—05 M

Bibliography:-

Abdulali,H.(1972), Checklist of Birds of Maharashtra. Bombay Natural History society, Mumbai.

Ali, S. The book of Indian birds. (13th Edition). Bombay Natural History Society. 2012; 239 Oxford University Press.

Bibby C.J., N.D. Burgess & D.A. Hill (1992). Bird Census Techniques. Academic Press, London, 67–84 pp.

Daniels, R.J.R. (1997). A Field Guide to the Birds of South-Western India. New Delhi: Oxford University Press, 217pp.

Grimmett, R., C. Inskipp & T. Inskipp, Birds of the Indian Subcontinent. Oxford University Press, New Delhi. 2012; 528pp.

IUCN - ENVIS Center, IUCN Red List of Threatened Species.2018; IUCN category. Kazmierczak, K. (2000). A Field Guide to the Birds of the Indian Subcontinent. A & C Black Publishers Ltd., Pica press, 352pp.

Kazmierczak, K. A Field Guide to the Birds of the Indian Subcontinent. A & C Black Publishers Ltd., Pica press. 2012; 352pp.

Kumar, A., J.P. Sati, P.C. Tak & J.R.B. Alfred . Handbook on Indian Wetland Birds and their Conservation.

Zoological Survey of India. 2005; 218pp.

Grewal B., Harvey B. and Pfister O.Birds of India. Periplus Editions (HK) Ltd. 2011; 512 pp

Steward R.E. Jr., (1999). Technical aspects of wetlands: Wetlands as bird habitat. United States Geologic Water Supply Paper, pp. 24-25

Course- Zoology
General Interest Course (GIC)

TITLE - ENVIRONMENTAL ISSUES AND ITS AWARENESS

Course Duration – 15 Hours

Total Credits – 1

Course Information:

This credit course benefits students to perceive how their decisions and actions affect the environment. It augments their knowledge and skills necessary to address complex environmental issues. Also, it helps to chalk out strategies to keep our environment healthy and sustainable for the future.

This course empowers students to make connections and apply their learning in the real world. It helps pupils to see the interconnectedness of social, ecological, economic, cultural, and political issues. This course encourages students to investigate multiple facets of environmental issues to comprehend the situation as a whole. It promotes tolerance of different points of view and different cultures.

By exposing students to nature and allowing them to learn outside, this course nurtures sensitivity, appreciation, and respect for the environment.

Course outcomes:

- Students will understand current environmental scenario with clearer concepts in mind.
- Students will have Ability to demonstrate understanding of the environmental processes and will possess knowledge of the changing climate.
- Students will have Ability to comprehend to structure and functions of ecosystem.

- Students will know how to identify and quantify the magnitude and intensity of Environmental pollution problems.
- Student will have Ability to demonstrate understanding Environmental Laws and policies in India.
- Student will appreciate the ecosystem responses to climate change and how environmental crisis will greatly impact both current and future generations of humans and all other species.

Facility provided by the Institution:

- Institute will provide necessary equipment's for practical sessions.
- Institute will arrange guest lectures of eminent personnel in the field, so as to give better depth and understanding of the subject.
- Institute will arrange field visits to various Industries to show and assess their commitment to save environment.
- Institute will provide various e-learning resources for better understanding of the subject.
- Library facility and reference books will be made available to the students enrolling for the course.

Course Syllabus

UNIT I -Introduction to environmental studies.   10 L
- Definition, scope and importance.
- Need for public awareness.
- Environmental ethics: Issues and possible solutions.
- From Unsustainable to Sustainable development
- Water conservation, rain water harvesting, watershed management
- Climate change, global warming, acid rain, ozone layer depletion.

UNIT II - Natural resources   10 L
- Natural resources and associated problems. Types of resources.
- Forest resources: Use and over exploitation, deforestation.
- Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
- Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act.
- Wildlife Protection Act. Forest Conservation Act.

Evaluation Methods

- Presentation on any one suitable topic from syllabus at the end of course.   10 M
- Submission of Dissertation on topic which includes at least one Case Study.   10 M
- Submission of Excursion tour Report / Submission of Report on Industrial Visit.05 M
- Certificate from any Environment Cause related NGO / GO / NSS Unit (From College) for Spending Not less than 10 Hrs for any Environmental Cause.   05 M

Bibliography

1. Climatology by Devendra Singh.
2. Fundamentals of Ecology by EP Odum.
3. A Text Book of Ecology and Environment by P. C. Joshi and Namita Joshi, Himalaya.
4. Environmental Science, Danial Botkin and Edward Keller. New York: John Wiley & Sons (1997).
5. Environmental Biology by Verma and Agrawal.
6. Ecology and Environment- P. D. Sharma, Rastogi Publ.
7. Environmental Science. Van Cunninghnn, Tata McGraw Hill Pub.
8. Environmental Pollution Control Engineering – C.S. Rao. New Age International Publication.
9. Waste Water Treatment, M. N. Rao, and A. K. Datta (1987), Oxford and IBH Publ. Co". Pvt. Ltd. 345 p. Townsend C., Harper J., and Michael Begon,
10. Environmental Studies., Dr. Deshpande A.P., Dr. Chudiwale A.D., Dr. Joshi P.P. and Dr. Lad A.B. Nagpur:, Pimpalapure & Company Publishing.
11. Handbook of Environmental Laws, Rules. R. K. Trivedi, [Guidelines]. Compliances and Standards, Vol. I and II. Enviro Media.
12. Introduction to Air Pollution, R. K. Trivedi, and P. K. Goel, Techno-Science Publications.
13. Pollution Control in Process Industries – S.P.Mahajan. New Delhi: Tata McGraw Hill Publishing.
14. Air Quality Management by Stern, A.C. (Ed) (1974).
15. The Biological Diversity Act. 2002 and Biological Diversity Rules. National Biodiversity Authority India (2004): 475, 9th South cross street. Neelangarai Kalpalocwar Nagar, Chennai – 600041.
16. Environmental law and policy in India., Cases Materials, Statutes., Shyam Diwan and Armin Rosencranz. Oxford University Press.

Sant Gadge Baba Amravati University, Amravati

Part B

Syllabus Prescribed for the Year 2023-24

UG Programme: B.Sc.-Part II [Computer Science/Computer Application (Voc/ Non-Voc)/IT]

Semester III

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
2CS1	**Networking and Web Technology**	**72**

COs: On completion of course, the students will be able to

1. Understand Internet and Networking
2. Understand the fundamentals of data communication,networking, internet and their importance.
3. Understand different networking topologies
4. Describe the seven layer OSI model with data transmission media
5. Understanding Switching and Multiplexing techniques

Unit	Content
Unit I	**Introduction to Networking:** Introduction, Need of computer communication network, Communication protocol, Types of network. **Topology**: Ring, Bus, Star & Mesh. LAN, MAN, WAN and Internet. Connection v/s Connectionless protocol. **(12 periods)**
Unit II	**OSI Reference Model:** Introduction, OSI Model, Functions of seven layers of OSI. **Data Transmission Media:** Guided Media and Wireless media. **Switching**: Circuit, Message, Packet. **Multiplexing**: Frequency Division, Time Division. **(12 periods)**
Unit III	**Internet:** History, Applications of Internet, Types of Internet Connection: wired and wireless. Internet Protocols: TCP/IP, FTP, HTTP, URL, e-mail address, WWW, Web browsers,Search Engines. **(12 periods)**
Unit IV	**HTML :**History of Markup Languages, Introduction to HTML, Structure of HTML Document,Tags: <HTML>, <HEAD>, <TITLE>, <BODY>, Heading tags, <P>, ,,<HR>,<B>,<I>,<U>.<EM>,<PRE>,<BIG>,<SMALL>,<STRONG>,<STRIKE>, <SUB>,<SUP>,<A>, <LINK>, <IMG>, <MARQUEE>, <BLOCKQUOTE>, Table tags and its attributes, List tags and its Attributes ,<FONT> tags. **(12 periods)**
Unit V	**XML:** Features of XML, Simple XML document, Elements, Attributes, **Components of XML docume**nt: document prolog and document instance. **DTD(Document Type Definition):** Introduction, Need of DTD, declaring elements, element content model, declaring attributes, attribute types, Internal and External DTD**.** **(10 periods)**
Unit VI	**Style Sheet :** Introduction,Advantages and applications of style sheet, **CSS**: Introduction, syntax of CSS with example, Type of style sheet(Embedded, External, Inline and Class), Units, Classes and Id attributes, **Properties**: Text, Font, Color, Background, Border, Height, Margin, width. CSS with HTML and XML. **(10 periods)**
*SEM: III	
**Activities	1. Assignment 2. Group discussion 3. Study tour/ Industrial visit**(4 periods)**

Course Material/Learning Resources

Text books:
1. Computer Networks (Fourth Edition) - Andrew S. Tanenbaum (PHI)
2. Mastering XML: Ann Navaro, Chuck White, Linda Burman, BPB Publication.
3. HTML Complete :BPB Publication

Reference Books:
1. Business Data Communication & Networking (fifth edition) - Fitzerland & Dennis.
2. Data and Computer Communication – William Stallings (Pearson)

3. Data Communication and Networking – Behrouz A. Forouzan
   (McGraw Hill)
4. Computer Network & Internet - Douglas E. Comer (Pearson)
5. The Complete reference-Web Design, Second Edition By Thomas A. Powell, TMH.
6. Inside XML : BPB Publication.

Weblink to Equivalent MOOC on SWAYAM if relevant:

Weblink to Equivalent Virtual Lab if relevant:

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

IMPORTANT NOTES:

Note: Please use Times New Roman 10 point font

(After filling the Table, *select the Table—Table Properties- Borders and Shading—None***, so that all Border Lines will get vanished)**

*SEM needs to be designed only for Courses in all UG Programmes

**Activities/Assignments/tasks/projects (individual/group)

Some Tips to extract and mine skill components from the Course (for ready reference)

What do you expect Students to LEARN or EXPERIENCE in the SEM/SEC?

Identify Employability Skills for SEM/SEC		
Interpersonal Skills	☐ Information Use	☐ Technology Use
Personal Qualities	☐Communication Skills	☐ Applied Academic Skills
Resource Management	☐Systems Thinking	☐Critical Thinking Skills

Employability Skills Categories

Effective Relationships	Interpersonal Skills
	Personal Qualities

Workplace Skills	Resource Management
	Information Use
	Communication Skills
	Systems Thinking
	Technology Use

Applied Knowledge	Applied Academic Skills
	Critical Thinking Skills

Sant Gadge Baba Amravati University, Amravati
Part B
Syllabus Prescribed for the Year 2023-24
UG Programme: **B.Sc-Part-II** [Computer Science/Computer Application (Voc/ Non-Voc)/IT]
Semester-IV

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
2CS2	**RDBMS and Core Java**	**72**

Course Outcomes: 1. Understanding basics concepts of DBMS
2. Demonstrating SQL commands
3. Demonstrating PL/SQL concepts
4.Writing basic java programs using basics features of Java
   programming language/
5. Demonstrating concepts of OOP's using classes, Inheritance, Interfaces etc.

Unit	Content	No of Periods
Unit I	**Fundamentals of DBMS:** Traditional Vs DBMS File approach,DBMS Architecture, Data Models, Relational Model, Relations, Domain and Attributes, Keys, E-R diagram, reducing ER diagram to table, Functional Dependency, Normalization: 1NF, 2NF, 3NF, 4NF, BCNF	**10**
Unit II	**Introduction to SQL**: Components of SQL, data types, operators **DDL Commands**: CREATE, ALTER, DROP, RENAME, **DML Commands:** SELECT, INSERT, DELETE & UPDATE; **Clauses:** ORDER BY, GROUP BY and HAVING; **Joins and Unions:** Self, Equi and Outer Join, Unions and Intersection. Functions: aggregate functions, string functions.	**12**
Unit III	**PL/SQL:** Features and block structure, variables and constant, data types, Identifiers, Operators and expression, Conditional statement, iterative statement. **Cursor** : Concepts of cursor, types of cursor, declaring, opening, using cursors, fetching data, closing a cursor, cursor attributes, Handling Exceptions, Creating Procedures, Creating Function, **Triggers**: Create Triggers, Types of Triggers, Creating BEFORE and AFTER Triggers, INSTEAD-OF triggers, Inserting, Updating and Deleting Triggers.	**12**
Unit IV	**Introduction to JAVA:** History and evolution, Feature, JRE, JDK, JVM, Tokens of Java, Data types and Literals, Operators, Structure of Java Program, Access controls, modifiers, type conversion and casting,**Control of Flow:** Selection Statements, Iteration Statements. Command Line Argument, Arrays.	**12**
Unit V	**Classes & OOPs:** Class, Object, Method, **Constructor**: types, this Keyword, **Polymorphism**: Overloading & Overriding, **Inheritance**: types of inheritance, Super, **Abstract class**, **Interfaces**: Interface concept, Defining, and Implementing of Interface., Using Final (variables , methods and classes).Garbage Collection.	**12**
Unit VI	**String & Packages: String:** String operation, String comparison, Searching and modifying string, StringBuffer. Wrapper classes, **Packages**: Package concept, Defining Package, organizing classes and interfaces in packages, making jar files for library packages, Java In-built Package.	**10**
*SEM		

**Activities	1. Assignments 2. Quizzes 3.Seminars 4. Internal Assessments	4

Course Material/Learning Resources

Text books:

1. Introduction to Database Management Systems by Muzumdar TMH

2. Database System Using Oracle: A simplified Guide to SQL & PL/SQL : Nilesh Shah, PHI Publication

3. Herbert Schiedt "Java the Complete Reference", TMH

4. Teach Yourself 'Java' in 2 Hrs : By Sams.

5. Java for You : By P. Koparkar

Reference Books:

1. Fundamentals of Database Systems (4th Ed) By: Elmasri and Navathe

2. Database System Concepts (4th Ed) By: Korth, Sudarshan, Silberschatz

3. Patricks Naughton, "Java Handbook",Osborne McGraw Hill

4. Programming with JAVA - A Primer : By E.Balguruswamy (Tata McGraw)

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Sant Gadge Baba Amravati University, Amravati

Faculty   : Science and Technology

Programme : B.Sc. (Microbiology)

**Course   **: B.Sc II Semester III

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Upon completion of the program me successfully, The students would be able to

> ➤ **PSO 1** Gain insight of Microbiology starting from history and fundamental knowledge about themicroorganisms.
>
> ➤ **PSO 2** Acquire the skill in the use and care of basic microbiological equipment and can perform basiclaboratory procedures in microbiology.
>
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>
> ➤ **PSO 4** Be acquainted with the basic concept of prokaryotes, their taxonomy, their differentiation from eukaryotes.

> ➤ **<u>Employability Potential of the Programme:</u>**

Microbiology is a branch of science that deals with study of microorganisms. The microbiological study has wide range of scope ranging from basic sciences to applied sciences. Microbiological study is mainly focused on causative agents of various diseases, microorganisms of agricultural, environmental and industrial use. The production of antimicrobial drugs to cure various diseases is covered in this discipline. Here is an overview of job opportunities where our students has explored and would be helpful for upcoming students as well.

Medical Microbiology refers to the use of Microbiology in the Healthcare Industry. Microbiology firms are at the heart of the Healthcare Industry, whether they're developing diagnostic kits, vaccines, biologics, pharmaceuticals, or medical gear. Microbiology fields such as Molecular Biology, Cell Biology, Recombinant Technology, and immune therapeutics benefited from the medical sector's evolution. For those interested in a career in Medical Microbiology, there are numerous career prospects in Research and Development, Pharmaceutical Companies, Hospitals, Diagnostic Centers, Manufacturing Sector of Microbiology, and Academic Sector. Many of our students have joined as Microbiologist at renowned pharmaceutical companies. Our students have also joined COVID-19 diagnostic laboratories across various districts, thus helping the society. Beside these students has also joined vaccine manufacturing institutions.

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Low crop yield, crop quality deterioration, weeds, loss of soil fertility, abiotic stress, and biotic stress are just a few of the issues that have plagued agriculture. Microorganisms are also helpful in enhancing the crop productivity. Our students are entrepreneur in this field. The biofertilizers are produced in bulk and are commercialized by few of our students. Incidentally biofertilizers are ecofriendly.

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Beside job opportunities in the sector of agriculture, pharmaceutical and food industries our students are working as research fellow at various National Institutes. Many students are working as Assistant Professor in colleges, Laboratory Technicians at Government and private pathological laboratories.

> **Transferable Skills:**

During the course student will develop skills other than laboratory skills that are transferable across the number of career areas. These are:

- Analytical skill
- Report writing skill
- Presentation skill
- Time management
- Creative thinking
- Problem solving
- Planning
- Observational skill

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> **Private Sector:** Biochemist can work in quality control, quality assurance and R & D divisions of companies like- Biotech companies, pharmaceutical companies, Chemical manufacturing companies, Food and Drink (includes brewing), Health and Beauty Care, Medical Instrument companies, Agricultural companies, Research Companies and Laboratories etc.

> **Public Sectors:** Blood Service, Cancer research institutes, Environmental Pollution Control, Forensic Science, Hospitals, National Blood Services, Overseas Development, Public Health Entities, Public Health Laboratories, Agriculture and fisheries etc.

> **Government Sector** : Syllabus has been design keeping in view that students can apply for various government post filled by Maharashtra Public Service Commission (MPSC), Union Public Service Commission (UPSC), Food Corporation of India, Forensic department, Health department and Food and Drug Administration. These departments recruit successful candidates for the post of Food safety officers in food and drug

administration, Assistant Chemical Analyzers in forensic laboratories of Maharashtra and other states all over India, Laboratory Technicians in Clinical pathology laboratories Health department and Food Corporation of India, Sanitary Inspectors for schools etc.

➢ **Job profiles:** Biochemist, Biologist, Biomedical Scientist, Biotechnologist, Chemical Examiners, Chemist, Clinical Scientist, Food Scientist, Forensic Scientist, Laboratory Technician, Microbiologist, Research Associates, Research Officers, and Research Scientist etc.

Thus syllabus has been prepared anticipating the requirements of B.Sc. Microbiology students under CBCS Program. The contents have been drawn to accommodate the widening horizons of the Microbiology discipline and reflect the changing needs of the students.

Hence, Board of Studies in Biochemistry (Including Microbiology and Food Science) in its meeting held on 10 / 07 /2023   resolved to accept the revised syllabus for B. Sc. II Sem. III and IV (Microbiology) based on Choice Based Credit System (CBCS) as per UGC guidelines. The detailed syllabus for each paper is appended with a list of suggested readings.

Sant Gadge Baba Amravati University Amravati
Scheme of teaching, learning &Examination leading to the Degree Bachelors of Science (Choice Based Credit System)C (Three Years Six Semesters Degree Programme- C.B.C.S)

(B.Sc. Part-II) (Semester-III) MICROBIOLOGY

S N	Subjects	Subject Code	Teaching & Learning Scheme							Duration of Exam Hrs.	Examination and Evaluation Scheme						
			Teaching Period Per week				Credits				Maximum Marks						Minimum Passing
			L	T	P	Total	Theory	Practical	Total		Theory + MCQ External	Skill Enhancement module Internal	Practical		Total Marks	Marks	Grade
													Internal	External			
1	MCB (3S) Medical Microbiology (Theory)	MCB (3S)T	6			6	4.5		4.5	3 hours	80	20	Internal	External	100	40	p
2	MCB (3S) Practical	MCB (3S) Pr.			6	6		2.25	2.25	3 Hours			25	25	50	25	p
3	Total		6		6	12	4.5	2.25	6.75	6 hours	80	20	25	25	150	65	P

Syllabus Prescribed for 2023-2024
UG Programme

Programme   : UG in Microbiology

Semester-III

Code of the Course /Subject	Title of the Course/Subject	Total Number of Periods
MCB-(3S) T	Medical Microbiology	90

Cos

Upon completion of course successfully, students would be able to

- **CO 1** Evaluate the prevalent communicable diseases of National importance and of the newer emerging pathogens.

- **CO 2** Understand the concept of Immunity, Antigen, Antibody and Immune system.

- **CO 3** Differentiate the   structure and Classes of Immunoglobulins and their diversity.

- **CO 4** Understand the principles of immunology and its application in the diagnosis and prevention of infectious diseases.

- **CO 5** Apply the diagnostic techniques of Serology

- **CO 6** Determine the mode of entry and transmission of pathogen, symptoms, Laboratory diagnosis, and treatment for infectious diseases.

- **CO 7** Evaluate the antibiotic susceptibility of bacterial pathogens

COURSE MODULE	UNIT	CONTENT
DSC	**Unit-I** **Principles of Epidemiology**	a) Definition, Scope & Application of epidemiology. b) Incidence & prevalence rates, Mortality & Morbidity rates c) Infection- Types of infection Epidemiology of infectious diseases:

		1) Sources & reservoir of infection 2) modes of transmission **d)** Measures for prevention of epidemics with Global health consideration **e)** Epidemiological aspects of AIDS & COVID 19 **f)** Outline of Infection process - pathogenicity and virulence, Microbial virulence factors: toxins, enzymes **(15 Periods)**
	Unit-II **Immunology**	**a)** Organs and cells of immune system **b)** Outline of Specific and Nonspecific factors in defense mechanism **c)** Immunity- Definition and classification **d)** Immune response: Antibody Mediated & Cell mediated Immune Response, Primary & Secondary Immune response **e)** Autoimmunity & auto-immune diseases (Ex. Rheumatoid Arthritis and Myasthenia Gravis) **(15 Periods)**
	Unit-III **Serology**	**a)** Antigens- Definition, types and factors determining antigenicity, Bacterial antigens. **b)** Antibodies (Immunoglobulins)- Definition, Structure, classification, Properties and differences **c)** Monoclonal antibodies definition and applications **d)** Antigen Antibody reactions- Agglutination-Blood grouping and WIDAL test, Precipitation - VDRL Test, Types of Immunodiffusion, Complement Fixation Test, ELISA and RIA. **(15 Periods)**

	Unit-IV
	Pathogenic
	Microorganisms
		A) Bacteria : Study of following bacteria with respect to their morphology, cultural and biochemical properties, pathogenesis, laboratory diagnosis and prophylaxis
		    a. *Staphylococcus aureus.*
		    b. *Clostridium tetani.*
		    c. *Salmonella typhi.*
		    d. *Mycobacterium tuberculosis.*
		B) Viruses-
		    a) Rabies.
		    b) Dengue

		c) Corona **C) Fungi-** a) *C. albicans* **(15 Periods)**
	Unit-V **Antimicrobial** **chemotherapy**	**a)** Ideal characters of chemotherapeutic agents **b)** Major antimicrobial agents and its clinical uses: **i)Antibacterial agents**: Rifampicin, Chloramphenicol, Streptomycin and Ciprofloxacin **ii) Antiviral agents**: Azidothymidine, Amantadine. **iii) Antifungal agents**: Griseofulvin, Amphotericin B, Imidazole. **c)** Basic mechanism of antibiotic action **d)** Antimicrobial susceptibility testing: Introduction to CLSI (NCCLS), MIC. Disc diffusion, agar dilution, broth dilution (macro and micro). **e)** Introduction to antibiotic Resistance (**15 Periods)**
SEM	**Techniques of Diagnostic Microbiology Laboratory**	1. Collection, Transportation and Cultural examination of Urine, Blood, Sputum, Stool, Pus, CSF. 2. Sample collection techniques for diagnosis of Mycotic infections – Skin scrapping, Nails Clipping, Sputum, Hair plucking 3. To detect the fungi by direct microscopic method 4. Detection of fungal elements – a) KOH preparation, b) Iodine. c) India Ink, d) Lactophenol Cotton Blue Staining

		5. Disposal of clinical samples **6.** Antimicrobial susceptibility testing and determination of MIC and MBC, Kirby- Bauer Disc diffusion Technique, Agar dilution, Broth dilution (Macro and Micro). **7.** Antifungal susceptibility testing by Automation techniques in Diagnostic Microbiology (**15 Periods)**

COs

The student would be able to understand

- ➤ **CO 1** proper methods of collection, storage & transport of clinical material for Microbiological investigations.
- ➤ **CO 2** methods of disinfection and sterilization and their application to control and prevent hospital and community acquired infections including universal biosafety precautions and waste disposal.
- ➤ **CO 3** Get Employment in Microbiological & Pathological Laboratories

**Activities for SEM: 1 Class test   (10 Marks)

                2. Assignments   (5Marks)

                3. Project/Field visit /Study Tour / Innovative activity (5 Marks)

Syllabus Prescribed for 2023-2024

UG Programme

Programme   : UG in Microbiology

Semester-III

Code of the Course /Subject	Title of the Course/Subject	Total Number of Periods
MCB-(3S)Pr	MCB-(3S) Practical	06 / per week /per batch

COs

Upon completion of the course, the student would be able to:

➢ **CO 1** Isolate and identify the bacteria

➢ **CO 2** Analyse the Antibiotic Resistance

➢ **CO 3** Perform the different serological Tests

Practical: 3S Microbiology

 List of Practical/Laboratory Experiments/Activities etc.

1. Studies of microbial enzymes

a) Urease   **b)** Coagulase   **c)** Oxidase

1   Study of Sugar Fermentation Test

2. Study of Indole Test

3. Study of Methyl Red Test

4. Study of Voges Proskauer Test

5. Study of Citrate Test

6. Isolation and Identification of *Staphylococcus aureus* and its Antibiotic sensitivity.

7. Isolation and Identification of *E. coli* and its Antibiotic sensitivity.

8. To perform Widal Test

9. To perform RPR Test

10. To perform Blood Grouping Test

11. Study of human   pathogenic Fungi using permeant slides

The distribution of marks for the practical examination shall be as follows:

External Examination		Internal Examination	
Performance of any two experiments	20 marks	Attendance & students performance	10 Marks
Viva-voce	05 marks	Practical Record book	10 Marks
		MCQ/ Spotting	05 Marks
Total	25 Marks	**Total**	25 Marks

Course Material/Learning Resources

1.Medical Bacteriology : Dey N.C. & Day T.K.

2. Medical Microbiology Vol. I & II : Cruickshank K.R.

3. Text Book of Microbiology : Ananthanarayan R. & C.E. Panikar

4. Medical Parasitology : Dey N.C. & Dey T.K.

5. Dorland's Pocket Medical Dictionary

6. Microbiology : Zinsser W.

7. Preventive & Social Medicine : Park & Park

8. General Microbiology & Immunity : S.G.Wilson. Vol. I & II

9. Medical Microbiology : R. Anantnarayan

10. Fundamental Priciples of Bacteriology : A.J.Salle.

11. Microbes & Diseases of Man : W.C.Deb. (Helminthology)

12. Microbiology : B.D.Davis, R.Dulbecoco, H.N.Eisen, H.S.Ginsburg.

13. Parasitology : K.D.Chatterjee

14.Text Book of Medical Microbiology: H.L.Chopra.

PRACTICALS :

1. Microbes in Action : Saley, Wandermark, Tarporewala, Bombay.

2. Medical Microbiology Vol.II : R.Cruickshank.

3. A manual of Microbiological Methods. : A.J.Salle

4. Microbiological Methods : Collins

5. Difco mannual

6. A Textbook of Practical Microbiology (Ist Edition) B. Sc. Part II :Dnyanpath Publication R. R. Pachori, P.S. Sadar, A.M. Pande Edited by: N.S. Kulkarni

7. A Textbook of Practical Microbiology (IInd Edition) B. Sc. Part II :Dnyanpath Publication P.S. Sadar, A.M. Pande Edited by: R. R. Pachori

Sant Gadge Baba Amravati University, Amravati

Faculty **:** Science and Technology

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Course : B.Sc II Semester IV

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➢ **Public Sectors:** Blood Service, Cancer research institutes, Environmental Pollution Control, Forensic Science, Hospitals, National Blood Services, Overseas Development, Public Health Entities, Public Health Laboratories, Agriculture and fisheries etc.

➢ **Government Sector** : Syllabus has been design keeping in view that students can apply for various government post filled by Maharashtra Public Service Commission (MPSC), Union Public Service Commission (UPSC), Food Corporation of India, Forensic department, Health department and Food and Drug Administration. These departments recruit successful candidates for the post of Food safety officers in food and drug

administration, Assistant Chemical Analyzers in forensic laboratories of Maharashtra and other states all over India, Laboratory Technicians in Clinical pathology laboratories Health department and Food Corporation of India, Sanitary inspectors for schools etc.

➢ **Job profiles:** Biochemist, Biologist, Biomedical Scientist, Biotechnologist, Chemical Examiners, Chemist, Clinical Scientist, Food Scientist, Forensic Scientist, Laboratory Technician, Microbiologist, Research Associates, Research Officers, and Research Scientist etc.

Thus syllabus has been prepared anticipating the requirements of B.Sc. Microbiology students under CBCS Program. The contents have been drawn to accommodate the widening horizons of the Microbiology discipline and reflect the changing needs of the students.

Hence, Board of Studies in Biochemistry (Including Microbiology and Food Science) in its meeting held on 10 /07 /2023 resolved to accept the revised syllabus for B. Sc. II Sem. III and IV (Microbiology) based on Choice Based Credit System (CBCS) as per UGC guidelines. The detailed syllabus for each paper is appended with a list of suggested readings.

Sant Gadge Baba Amravati University Amravati
Scheme of teaching, learning &Examination leading to the Degree Bachelors of Science (Choice Based Credit System) (Three Years Six Semesters Degree Programme- C.B.C.S)

(B.Sc. Part-II) (Semester-IV) MICROBIOLOGY

S N	Subjects	Subject Code	Teaching & Learning Scheme							Duration of Exam Hrs.	Examination and Evaluation Scheme						Minimum Passing	
			Teaching Period Per week				Credits				Maximum Marks							
			L	T	P	Total	Theory	Practical	Total		Theory + MCQ External	Skill Enhancement module Internal	Practical		Total Marks	Marks	Grade
													Internal	External			
1	MCB (4S) Biochemistry and Molecular Biology (Theory)	MCB (4S)T	6			6	4.5		4.5	3 hours	80	20	Internal	External	100	40	p
2	MCB (4S) Practical	MCB (4S) Pr.			6	6		2.25	2.25	3 Hours			25	25	50	25	p
3	Total		6		6	12	4.5	2.25	6.75	6 hours	80	20	25	25	150	65	P

Syllabus Prescribed for 2023-2024 UG Programme

Programme   : UG in Microbiology

Semester-IV

Code of the Course /Subject	Title of the Course/Subject	Total Number of Periods
MCB-(4S) T	**Biochemistry and Molecular Biology**	**90**

COs

After the completion of this course, the student will have knowledge about

- ➢ **CO 1** structure and function of biomolecules
- ➢ **CO 2** the classes of enzymes
- ➢ **CO 3** concepts and terminologies of enzymes
- ➢ **CO 4** importance and applications of various enzymes in the processes viz.
- ➢ **CO 5** Replication transcription and translations etc
- ➢ **CO 6** mutation, its types, and related effects.
- ➢ **CO 7** recombination- transduction, conjugation and transformation
- ➢ **CO 8** techniques used for DNA transformation in host cells, design of various vectors used for plants, animals and microorganisms and their modification strategies.
- ➢ **CO 9** different types of Vectors and enzymes used in r DNA technology

COURSE MODULE	UNIT	CONTENT

DSC	**Unit-I**
	
	 Biomolecules
		A) Structure and function of biomolecules
		    a. Carbohydrates
		    b. Proteins
		    c. Nucleic acid (DNA & RNA)
		    d. Lipids
		 B) Biosynthesis of DNA and RNA
		    a) Replication of DNA- Mechanism of replication with enzymes involved, models of replication: Knife and fork,

		rolling circle.
		b) Transcription (RNA synthesis) (**15 Periods)**
	Unit-II **Gene expression and regulation**	**a)** Concept of gene – Definition of Gene, gene within gene, split gene. **b)** Concept of Genetic code **c)** Outline of Translation (Protein synthesis) **d)** Gene regulation Mechanisms - *lac* operon ,Trp operon **(15 Periods)**
	Unit-III **Gene mutation and bacterial Recombination**	**A.** Mutation- Definition & types of mutations – Base pair substitution, frame-shift, point, missense, nonsense & silent mutations, Effect of Mutation on Phenotype (Sickle cell anemia **B.** Molecular basis of spontaneous and induced mutations - Spontaneous mutation (Tautomerism), Induced Mutation (Chemical Mutagens) e.g. Base analogues, Nitrous Oxide, Hydroxylamine, Acridine dyes, Physical mutagens e.g. X-rays, Gamma rays, U.V. light. **Mechanism of recombination :** Breakage and reunion **Transfer of genetic material in prokaryotes:** **a)** Transformation : Experiment of Griffith. Avery, MacLeod and McCarty experiment to prove Genetic Transformation. Mechanism of Transformation. **b)** Transduction: Experiment of Zinder and Lederberg. General mechanism of Transduction. Types of Transduction: Generalized and Restricted, **c)** Conjugation: Experiment of Lederberg and Tatum, Experiment of Davis, Nature and function of F Plasmid. Hfr formation. Various Mating types. Mechanism of conjugation: i) F+ x F ii) Hfr X F – . **(15 Periods)**

	Unit-IV Introduction and tools of genetic engineering	a) Introduction to basic technique of genetic engineering. b) Enzymes for splicing: Restriction endonucleases. c) Range of DNA manipulating enzymes: Nucleases, Ligases, Polymerases, DNA modifying enzymes, Topoisomerases. d) Vectors: Ideal characters and types: Plasmid (pBR$_{322}$, pUC19), Cosmid, Phagemid (p Bluescript) and Bacteriophage (M13, and Lambda gt 10,11), expression vectors. e) Host Microorganisms for Genetic Engineering (*E. coli, S. cerevisiae*) (**15 Periods**)
	Unit-V Enzymology and Metabolism	**A) Enzymology** a) Nature and Definition. b) Classification and nomenclature of enzymes. c) Terminologies used in enzymology - Enzyme, active site, substrate, co-enzyme , cofactors, prosthetic group, polo enzyme, apoenzyme, activation energy, isoenzyme, allosteric enzyme, inhibitors, immobilized enzymes. **B) Metabolism :** a) General strategies of metabolism. b) EMP pathway, TCA cycle. c) Oxidative phosphorylation and Electron transport chain. (**15 Periods**)
SEM	Skills for Molecular Biology and Genetic Engineering	**Characterization techniques of biomolecules** a) Electrophoresis (Agarose, Polyacrylamide) b) Chromatography and its types c) Isolation of Genomic DNA from bacteria d) Isolation of Plasmid DNA. e) Introducing DNA into host cell, competent cells, transformation of competent cells and identification of transformed cell (e.g., Antibiotic resistance gene, blue white selection) Selection

		of clones: Direct (colony hybridization) and Indirect method (southern blotting).
		
		  f) Definition, method and applications of DNA sequencing (by microarray) and PCR.
		
		  g) Construction of gene library (genomic and cDNA
		(15 Periods)

	COs:
	
	 By the end of this module, the students will have knowledge about
	
	  ➢ **CO 1** Basic rDNA Technology and its applications
	  ➢ **CO 2** DNA Sequencing and PCR
	  ➢ **CO 3** construction of cDNA Libraries	

	**Activities 1. Class test (10M)
	              2. Assignment (5M)
	              3. Educational Visit /Group discussion /Seminars and projects
	               /Any innovative activity (5M).	

Syllabus Prescribed for 2023-2024 UG Programme

Programme: UG in Microbiology

Semester-IV

Code of the Course /Subject	Title of the Course/Subject	Total Number of Periods
MCB- (4S) Pr	**MCB-(4S) Practical**	**6 periods /per week/per batch**

COs:

By the end of this module, the students would be able to:

➢ **CO 1** acquire knowledge in the qualitative and quantitative estimation of biomolecules
➢ **CO 2** study the various analytical techniques that are routinely used for separation of biomolecules
➢ **CO 3** Demonstrate Enzyme activity and enzyme immobilization
➢ **CO 4** Isolate Genomic DNA from bacterial culture

Practical: 4S Microbiology

List of Practical/Laboratory Experiments.

1. To perform the Qualitative test for Carbohydrate

2. To perform the Qualitative test for Lipids

3. To perform the Qualitative test for Proteins

4. To perform the Estimation of Proteins

5. To perform the Estimation of DNA

6. To perform the Estimation of RNA

7. To perform the Paper Chromatography of amino acids

8. Demonstrate the activity of Enzyme Amylase

9. To study the Immobilization of enzymes

10. To perform the Bacterial Genomic DNA isolation

11. To perform the Agarose gel electrophoresis of DNA

The distribution of marks for the practical examination shall be as follows:

External Examination		Internal Examination	
Performance of any two experiments	20 marks	Attendance & students performance	10 Marks
Viva-voce	05 marks	Practical Record book	10 Marks
		MCQ/ Spotting	05 Marks
Total	25 Marks	**Total**	25 Marks

Course Material/Learning Resources

1. Text Book of Biochemistry by Dr. O. P. Agrawal.

2. Essentials of Biochemistry by Dr. M. C. Pant.

3. Text book of Biochemistry by West and Todd.

4. Essentials of Food and Nutrition, Volume I & II by Swaminathan.

5. Text book of Biochemistry by Sucheta Dandekar.

6. Text book of Biochemistry by U. Satyanarayana

7. Fundamentals of Biochemistry by J. L. Jain

8. Lehninger, A I., (1982), Principles of Biochemistry, Butterworth Publishers, New York.

9. Palmer T., (1985). Understanding Enzymes. 2nd Ed., Ellis Horwood Ltd., Chichester

10. Price, N. C, Stevens, L, (1989), Fundamentals of Enzymology, 2"d Ed.,Oxford Sci. Publ., Oxford

11. Fundamentals of Biochemistry (1999) by Donald Voet, Judith Voet, Charlotte Pratt, John Wiley & Sons, N.Y. 145 146

12. Biochemistry 3rd edition (1994) by Lubert Stryer WH Freeman and Co. San Francisco.

13. General Enzymology by M.S. Deshpande and N. S. Kulkarni (Himalaya publication)

14. Molecular Biology of Cell : J.D. Watson, D.Bray

15. Genetic Engineering and its applications : Joshi P.

16. Cell Biology : C.B. Pawar

17. Genetics Vol. I &II : C.B. Pawar

PRACTICALS :

1. Practical Manual in Biochemistry by Jairaman

2. An Introduction to Practical Biochemistry by David T Plummer

3. A Textbook of Practical Microbiology (Ist Edition) B. Sc. Part II :Dnyanpath Publication R. R. Pachori, P.S. Sadar, A.M. Pande Edited by: N.S. Kulkarni

4. A Textbook of Practical Microbiology (IInd Edition) B. Sc. Part II :Dnyanpath Publication P.S. Sadar, A.M. Pande Edited by: R. R. Pachori

Syllabus Prescribed for B. Sc. II (Sem. III) Year UG Programme

Title of the Subject:

Essential Mathematics, Statistics, Bioinformatics and Biophysical Methods

Programme**: B.Sc. Biotechnology**

Cos:

Upon completion of this course successfully, students would be able to

1. Describe several areas of mathematics beyond calculus.

2. Apply laws of probability to concrete problems.

3. Know the various genes and proteins databases

4. Understand concepts in thermodynamics.

5. Understand concepts in radioactivity and chemical nature of solutions.

Unit	Content
Unit I	**Essential Mathematics:** **A.** Sets: Definition, Subset. Union, Intersection, Venn Diagrams, Complement of a Set, Universal Set. Use of Logarithms in simple problems. Binomial theorem (Without proof) – Simple Examples. **B.** Limits of a function: Concept of limit, Limit of function at a point, Simple algebraic limits. **C.** Derivative/ Differentiation: Derivative of simple algebraic functions; Derivatives of standard Trigometric & Logarithmic functions; Derivative of Addition and Subtraction of function; Product rule of differentiation. **D.** Integration: Integration as antidifferentiation, Problems involving simple polynomial functions.
Unit II	**Introduction to Statistics:** **A.** Sampling: Types of Sampling; Purposive sampling; Random sampling; Simple sampling & Stratified sampling. **B.** Probability: Random Experiment; Sample space; Event; Probability of an Event; Axioms of probability. **C.** Mean: Calculation of Mean of ungrouped & grouped data; Mode & Median of ungrouped data. **D.** Test of significance; ANOVA.
Unit III	**Bioinformatics:** **A.** Introduction; Historical overview and definition; Goal, Scope, Applications and Limitations of Bioinformatics. **B.** Major databases in bioinformatics; Information retrieval from databases. **C.** Tools for web search. **D.** Primary, Secondary, Composite databases and Structural databases.

Unit IV	**General Biophysical Methods:**
	A. Acids and Bases; Ionization of strong acids and bases; pH and pOH.
	B. Buffers; pH changes in buffers; Buffer capacity; Blood buffers; Henderson – Hasselbalch Equation.
	C. Radioactivity – Nuclear properties; Nuclear forces; Nuclear models (liquid drop and shell model); Radioactive nucleus; Nuclear radiations and their properties - alpha, beta and gamma.
	D. Physical and Biological Half-life; Role of Radioactivity in Biology.
Unit V	**Thermodynamics:**
	A. Thermodynamics as applied to biological systems; Laws of thermodynamics.
	B. Enthalpy, Entropy, Free energy, Gibb's free energy (G), Helmholtz free energy (A).
	C. Chemical potential; Half-cell potential; Redox potential.
	D. General idea about structure and bioenergetics of Mitochondria and Chloroplast.
Unit VI	**Skill Enhancement Module:**
	A. Sequence retrieval and alignment with bioinformatics tool.
	B. Structure prediction of Protein.
	C. Structure prediction of Gene.
	D. pH measurement of various solutions.
	E. Calculation of Mean, Mode and Median using data.

Course Material/Learning Resources

Text books:
1. Fundamentals of Mathematical Statistics-S.C. Gupta and V.K. Kapoor. S. Chand & Co.
2. Discrete Mathematics - B.S. Verma, Vishwa Prakashan.
3. Statistics for Biologists- Campbell R.C. Cambridge University Press, Cambridge.
4. Practical Statistics for Experimental Biologists- Ward Law A.C.
5. Statistical Methods in Biology- Baily N.T.J, English University Press.
6. An Introduction to Biostatistics- P.S.S. Sunderrao & J. Richards, Prentice Hall Pvt. Ltd. India.
7. Biophysics - Cotrell (Eastern Economy Edition)
8. Clinical Biophysics –Principles and Techniques- P. Narayanan (Bhalani Pub. Mumbai)
9. Biophysics – Pattabhi and Gautham (Narosa Publishing House)
10. Instrumentation measurements and analysis – Nakara, Choudhari (Tata McGraw Hill)
11. Handbook of analytical instruments – R.S. Khandpur (Tata Mc Graw Hill)
12. Biophysical Chemistry- Upadhyay, Upadhyay and Nath – (Himalaya Pub. House, Delhi).
13. Methods in Biostatistics- B K Mahajan. Jaypee Brothers, New Delhi.

14. Basic Biostatistics and its application- A K Datta. New Central Book Agency (P) Ltd, Kolkata.
15 Elements of Biostatistics – S Prasad. Rastogi Publications, Meerut.
16. Biophysics- G R Chatwal. Himalaya Publishing House.
17. Biophysics – Mohan P Arora. Himalaya Publishing House.
18. Bioinformatics A Beginner's Guide WILEY INDIA PVT LTD
19. Bioinformatics Basics: Applications in Biological Science and Medicine, Second Edition. Robert R. Ruffolo. TAYLOR & FRANCIS GROUP
20. Biochemical Calculations. I H Segel. John Wiley & Sons

Practicals:

1. Determination of action spectra of Chlorophyll.
2. Practical based on Chi-square and t- test.
3. Demonstration of Hill's reaction.
4. Retrieval of information from NCBI
5. Retrieval of information from EBI
6. Retrieval of structure file from PDB
7. Preparation of buffers using pH meter
8. Preparation of buffer using Henderson – Hasselbalch equation.

Learning Outcome: Student would be able to design and execute experimental procedures.

Syllabus Prescribed for B. Sc. II (Sem. IV) Year UG Programme

Title of the Subject:

Molecular Biology, Genetic Engineering and Microbial Biotechnology

Programme**: B.Sc. Biotechnology**

Cos:

Upon completion of this course successfully, students would be able to

1. Understand principal molecular events occur inside prokaryotic and eukaryotic cell.

2. Understand an application of genetic engineering techniques in experimental biology.

3. Understand the role of biotechnology in Medicine, Environment and Industries.

4. Understand principal, working and applications of various laboratory equipment.

5. Understand laboratory scale production of alcohol, amylase, organic acid and antibiotics.

Unit	Content
Unit I	**Molecular Basis of Life:** Structure of DNA. Replication of DNA in prokaryotes and eukaryotes DNA damage and repair mechanisms. Homologous (Holiday model) and non-homologous (site specific) recombination (transposons) Genetic code
Unit II	**Central theme of Protein Synthesis:** Transcription and Translation process in prokaryotes and eukaryotes. RNA processing in eukaryotes. Post- translational modification of proteins. Regulation of gene expression in prokaryotes (lac operon) and eukaryotes
Unit III	**Gene Cloning:** Isolation of genomic and plasmid DNA. DNA manipulating enzymes. Cloning vectors: - Plasmids, bacteriophages, cosmids and phagemids Southern blotting and colony hybridization. Gene library (cDNA and Genomic DNA library) Polymerase Chain Reaction
Unit IV	**Microbial Biotechnology (Medicine and Industry):** Interferon. Insulin, Dextran Recombinant vaccines Recombinant products (Growth hormone, erythropoietin) Types of bioreactors (CSTR, Fluidized bed reactor, UASB) Batch and continuous fermentation Alcohol fermentation Citric acid fermentation

Unit V	**Microbial Biotechnology (Environment):**
	Energy from Biomass (Biogas and Biodiesel)
	Microbial Pesticides and Biofertilizers
	Microbial Bioremediation
	Bioleaching
	Biodegradation of xenobiotic compounds
	Water Treatment – Aerobic and Anaerobic
Unit VI	**Skill Enhancement Module:**
	Preparation of Biofertilizers (PSB, Azotobacter)
	Preparation of microbial pesticides (Bt)
	Agarose gel electrophoresis for Nucleic Acid
	Laboratory scale production of Penicillin
	Laboratory scale production amylase

Course Material/Learning Resources

Text books:

1. Recombinant DNA: -James. D. Watson, John. Tooze, David.Kutz
2. Introduction to Genetic Engineering: - Nicholas
3. General Microbiology. Vol 1& II.: - Powar & Daginawala
4. Molecular Biology of the Cell: - J. D. Watson, D. Bray
5. The DNA Story: - J. D. Watson
6. Genetic Engineering and its Applications -Joshi P.
7. Gene Transfer and Expression a Laboratory Manual: - Michael Kriegler
8. Concept in Biotechnology: - D. Balasubramanium
9. Molecular Cloning. - A Laboratory Manual, J. Sambrook, E.F Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York
10. Introduction to Practical Molecular Biology, P.D. Dabre, John Wiley & Sons Ltd., New York, 1988
11. Molecular Biology Lab Fax, TA. Brown (Ed.), Bios Scientific Publishers Ltd., Oxford, 1991
12. Molecular Cell Biology (5th Edition) J. Darnell, H. Lodish and D. Baltimore, Scientific American Books, Inc., USA,
13. Gene VI (Xth Edition) Benjamin Lewin, Oxford University Press, U.K
14. Molecular Biology and Biotechnology. A comprehensive desk reference, R.A. Meyers (Ed.) VCH Publishers, Inc., New York, 1995
15. Genomes, TS. Brown
16. Environmental Biotechnology. S. V. S. Rana, Rastogi Publications Meerut.
17. Industrial Microbiology by A. H. Patel
18. Industrial Microbiology by Casida.
19. Biotechnology by U. Satyanarayana.
20. Genes: - Pramod Kumar

Practicals:

1. Isolation of Genomic DNA
2. To check purity of DNA
3. Plasmid isolation – Mini preparation
4. DNA ligation
5. Competent cell preparation
6. Transformation
7. Restriction digestion of plasmid DNA
8. Laboratory scale production and estimation of ethyl alcohol
9. Isolation of Azotobacter
10. Isolation of Phosphate solubilizing bacteria
11. Determination of Chemical oxygen demand (COD)
12. Determination of Biological oxygen demand (BOD)

Learning Outcome: Student would be able to design and execute experimental procedures in Genetic engineering and Microbial Biotechnology.

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
Faculty of Science and Technology
B.Sc. Part-II (PHYSICS) Semester III
Syllabus

3S Physics
Thermal Physics, Statistical Mechanics & Solid State Devices-I

Course outcomes

On successful completion of this course, the student will be able to:

1. Gain knowledge of the fundamental laws of thermodynamics, concept of enthalpy, develop critical understanding of concept of thermodynamic potentials and formulation of Maxwell's thermodynamic relations with its applications.
2. Understand the basic aspects of kinetic theory of gases, Maxwell's distribution law of velocities, Mean free path of molecular collisions and transport phenomena in ideal gases.
3. Examine the nature of black body radiations and understand Stefan-Boltzmann's Law, Rayleigh-Jeans Law and Wien's displacement Law with their significance.
4. Understand the properties of macroscopic systems using the knowledge of individual particles by different theories and comparison of Maxwell's-Boltzmann, Fermi-Dirac and Bose-Einstein statistics.
5. Explain the fundamental understanding of static and dynamic behaviour of P-N junction diode, Zener diode, light emitting diode and Transistor.
6. Understand concept of rectification, Ripple Factor and Filter Circuits and gain a knowledge of construction of Regulated Power supply.
7. Explain the structure and the operations of transistor and recognize the different types of transistor and their applications.

Thermal Physics, Statistical Mechanics & Solid State Devices-I

Unit-I

Introduction of laws of thermodynamics: Zeroth law, first law, second law, third law of thermodynamics and concept of entropy.

Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and internal energy functions, Maxwell's relations & applications, Joule-Thomson effect, Clausius- Clapeyron equation, Expression for ($C_P - C_V$), C_P/C_V, TdS equations, Numerical. (12 Lectures)

Unit-II

Kinetic Theory of Gases: Mean free path, **Transport phenomena:** viscosity, conduction and diffusion.

Theory of radiation: Blackbody radiation, spectral distribution, concept of energy density, Wien's distribution law, Rayleigh-Jeans Law, Planck's quantum hypothesis, derivation of Planck's law, deduction of Wien's distribution law, Rayleigh- Jeans law, Stefan Boltzmann law and Wien's displacement law from Planck's law, Numerical. (12 Lectures)

Unit-III

Statistical Mechanics: Phase space, unit cell, macrostate and microstate, entropy and thermodynamic probability, Maxwell-Boltzmann law, distribution of velocity, Quantum statistics: Fermi-Dirac distribution law, electron gas, Bose-Einstein distribution law, photon gas, comparison of three statistics, Numerical (12 Lectures)

Unit-IV

Semiconductor Devices: P-N junction diode, Zener diode and light emitting diode (construction, biasing, characteristics and applications)

Rectifiers: Half wave rectifier, full-wave rectifier, bridge rectifier, ripple factor, rectification efficiency (Qualitative only) comparison of rectifiers. **Filter circuits** (Qualitative only): capacitor filter, inductor filter, L-section and π- section filter.

Power Supply: Ordinary power supply, line and load regulation, regulated power supply, Zener diode as voltage regulator, Numerical. (12 Lectures)

Unit-V

Transistor: construction and working of PNP and NPN transistor, different modes, characteristics of transistor in CB and CE mode, current gain in CB and CE mode and relation between them, CE transistor amplifier, active, cut-off and saturation regions, dc load line, operating point. **Junction Field Effect Transistor (JFET):** Types, construction, working and characteristics, parameters of JFET and their relation, difference between JFET and BJT, Numerical. (12 Lectures)

Unit-VI Skill Enhancement Module (SEM)

Introduction to soldering Technique: Introduction, Types of solder, Solder flux, Soldering Irons and types, Contamination and cleaning of soldering iron, Desoldering techniques, Hazards involved in soldering.
Breadboard: Introduction, basics and its connections.

Regulated Power Supply: Definition, Block Diagram, Characteristics (Load and line regulation), its Application,

List of Activities: (any one)
1. Construction of Regulated power supply by using Bread board
2. Construction of Regulated power supply by using soldering technique.
3. Checking and repairing of old power supply.
4. Construction of Adjustable regulated power supply by using IC LM317 on PCB.

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3S Physics Practical

Practical for Thermal Physics, Statistical Mechanics & Solid State Devices-I

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Course outcomes

On successful completion of this Practical course, the students would be able to:

1. Understand basic concept of heat transfer and analyze process of heat transfer (conduction, convection and radiation)
2. Demonstrate an understanding of concepts involved in semiconductor devices operation and their characteristics.
3. Identify and handle different types of semiconductor devices like diodes & Transistors.
4. Acquire skills in observing and measuring different type of errors.
5. Perform procedures and techniques related to experiments based on Thermal and Semiconductor Physics.
6. Learn best practices for handling, cleaning and maintaining the instruments.

List of Experiments

1. To determine Mechanical Equivalent of Heat by Callender and Barn's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine C_p/C_v by Clement and Desorm's method.
4. To verify Stefan's law.

5. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
6. To determine the temperature co-efficient of resistance by Platinum Resistance Thermometer.
7. To study the variation of thermo-emf across two junctions of a thermocouple with temperature.
8. To verify MB/FD/BE distribution law using dice/ coins.
9. To study characteristics of P-N Junction diode.
10. To study characteristics of Zener diode.
11. To study characteristics of Light emitting diode (LED).
12. To determine energy gap of a semiconductor using PN junction diode in reverse bias mode
13. To study characteristics of CB transistor
14. To study characteristics of CE transistor
15. To study Half Wave Rectifier with filters
16. To study Half Wave Rectifier without filters
17. To study Full Wave Rectifier with filters
18. To study Full Wave Rectifier without filters
19. To study Bridge Wave Rectifier with filters
20. To study Zener regulated power supply
21. To study Transistor series regulated power supply
22. To study variation of gain of CE amplifier with load at fixed frequency.
23. To study variation of gain of CE amplifier with frequency at fixed load.
24. To Study FET characteristics
25. To study FET as a voltmeter

References Books

1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
2. Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. Narosa.
3. Physics for degree students (B.Sc.2nd year) by C. L. Arora & P.S. Hemne, S. Chand Publication.
4. Physics for degree students (B.Sc. 1st year)by C. L. Arora & P.S. Hemne, S. Chand Publication.
5. Heat Thermodynamics and Statistical Physics, Brijlal, N. Subrahmanyam, P.S. Hemane, S.Chand Publication, 2007
6. Elementary Statistical Mechanics , Gupta and Kumar, (Pragati Prakashan), 2005
7. Element of Statistical Mechanics , Kamal Singh & S P Singh, S.Chand Publication, 1984
8. Basic Electronics by B. L. Theraja, S. Chand Publication.
9. Principles of Electronics by V. K. Mehta, S. Chand Publications
10. Electronics Devices & Circuits, Sanjeev Gupta, Dhanpat Rai Publication (2010)
11. Electronics Devices & Circuits-I & II – Godse & Bakshi (Tech. Pub. , Pune) (2010)

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SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
Faculty of Science and Technology
B.Sc. Part-II (PHYSICS) Semester IV
Syllabus

4S Physics

Physical Optics, Fluid Dynamics & Solid State Devices-II

Course outcomes:
On successful completion of this course, the student will be able to:
1. Understand the phenomenon of Interference of light and its formation in thin films, Newton's rings and Michelson interferometer (division of amplitude.)
2. Distinguish between Fresnel and Fraunhoffer diffraction and observe the diffraction patterns in case of double slit and diffraction grating.
3. Describe the construction and working of zone plate and compare the zone plate with convex lens.
4. Explain various methods of production of plane, circularly and elliptically polarized light and their detection.
5. Comprehend the basic principle of LASER, the working of He-Ne laser and Ruby laser and their applications in various fields.
6. Understand the parameters of fiber-optics and explore their applications.
7. Understand the kinematics of moving fluid by different theorems and Laws.
8. Gain Knowledge about different applications of transistor by operational amplifier and oscillator circuits.

Physical Optics, Fluid Dynamics & Solid State Devices-II

Unit I
Interference of Light : Introduction, conditions for steady interference, Interference in thin film due to reflected and transmitted light, variable thickness (wedge shaped) film, Newton's rings (formation, theory and applications such as determination of wavelength and refractive index), Michelson Interferometer (principle, construction & working), Numerical.

Unit II
Diffraction of Light : Rectilinear propagation of light, half period zones, zone plate (construction and theory), difference between zone plate and convex lens, Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction at double slit, theory of plane transmission grating, determination of wavelength of light by diffraction grating.
Polarization: Transverse nature of light waves, plane polarized light, half and quarter wave plate, circular and elliptical polarization (production and analysis). Numerical.

Unit III
LASER: Introduction, properties of Laser, stimulated absorption, spontaneous and stimulated emission, metastable state and population inversion. Components of Laser (active medium, pumping, optical resonant cavity), three level and four level laser system, construction and working of Ruby laser and Helium Neon (He-Ne) laser. Applications of laser in medical and industrial field.
Fibre Optics: Introduction, structure, types, total internal reflection, propagation of light wave through an optical fibre, acceptance angle and acceptance cone, numerical aperture. Numerical.

Unit IV
Kinematics of Moving Fluids: viscosity, streamline and turbulent flow, critical velocity, equation of continuity, energy of the liquid, Bernoulli's theorem and its applications (Venturimeter, Atomizer), derivation of Poiseuille's equation for flow of liquid through a capillary tube, Reynold's number and its physical significance, terminal velocity, Stokes' law and its deduction. Numerical.

Unit V

Operational amplifier: Differential Amplifiers, OP-AMP Block Diagram, Parameters of OP-AMP, Characteristics of Ideal OP-AMP, Inverting and Non-inverting amplifiers, Adder, Subtractor, Differentiator, Integrator.

Sinusoidal Oscillators: Feedback in amplifier, Barkhausen Criterion, Phase Shift Oscillator (Construction and working), Oscillatory Circuit (Tank Circuit), Colpitt's and Hartley Oscillator (Construction and working). Numerical.

Unit VI   Skill Enhancement Module (SEM)

Design and Handling of Microscopes and Telescopes

Contents:
1. Optical Components in Microscopes and Telescopes
   - Objective lenses and eyepieces
   - Mirrors and prisms
   - Filters and diaphragms
   - Optical coatings and materials
2. Microscope Design and Operation
   - Compound and stereo microscope systems
   - Illumination techniques
   - Magnification and resolving power
   - Image formation and focusing mechanisms
3. Telescope Design and Operation
   - Refracting and reflecting telescope systems
   - Aperture and focal length considerations
   - Mounts and tracking mechanisms
   - Observing techniques and celestial objects
4. Alignment and Calibration Techniques
   - Aligning optical components in microscopes and telescopes
   - Collimation of telescopes
   - Testing and verification of alignment
   - Calibration of magnification and measurements
5. Handling and Maintenance of Microscopes and Telescopes
   - Proper handling techniques to avoid damage
   - Cleaning procedures for optical components
   - Environmental considerations for these instruments
   - Maintenance and troubleshooting common issues

Activities:
1. Lunar Observation: Organize a night-time session for students to observe the Moon using a telescope. Teach them about lunar features, such as craters, maria, and mountains, and guide them to locate and identify these features on the Moon's surface.
2. Planetary Viewing: Choose a clear night to observe planets visible to the naked eye, such as Jupiter or Saturn. Use a telescope to show students the planet's details, including its moons, rings, and cloud bands. Discuss planetary characteristics and encourage questions and discussions.
3. Microscopic Measurement: Introduce the concept of using a microscope for measurement. Provide a micrometer scale slide and guide students on how to calibrate and use it for measuring microscopic objects.
4. Microscopic Crystal Analysis: Collect various crystals like salt, sugar, or Epsom salt. Dissolve them in water and allow the solution to evaporate on a slide. Examine the resulting crystals under the microscope to observe their unique shapes and patterns.

Practical for Physical Optics, Fluid Dynamics & Solid State Devices-II

Course outcomes:
On successful completion of this Practical course, the students would be able to:

1. Understand the different optical phenomena like Interference, Diffraction and Polarization.
2. Determine the wavelength of light by different phenomena like Interference and diffraction.
3. Demonstrate an understanding of the key concepts of LASER & Fiber Optics
4. List out, identify and handle different types of passive and active devices (resistors, capacitors, inductors, diodes & Transistors.
5. Acquire skills in observing and measuring different types of errors.
6. Perform procedures and techniques related to experiments based on Optics and Semiconductor Physics.
7. Learn best practices for handling, cleaning and maintaining the equipment, components & devices

List of Experiments
1. To determine the Refractive Index of the Material of a given Prism using Sodium Light
2. To determine the value of Cauchy's Constants of a material of a prism.
3. To determine wavelength of Sodium light using Fresnel Biprism.
4. To determine wavelength of Sodium light using Newton's Rings.
5. To determine wavelength of Sodium light using plane diffraction Grating.
6. To determine the Resolving Power of a Plane Diffraction Grating.
7. To determine the wavelength of laser light by plane diffraction grating.
8. To find the number of lines per centimeter of the given diffraction grating.
9. To determine the resolving power of telescope.
10. To verify Malu's law.
11. To verify Brewester's law.
12. Study of elliptically polarized light using photodetector.
13. To determine specific rotation of sugar solution by half shade polarimeter.
14. To study the divergence of a LASER beam.
15. To determine the focal length of a given convex lens using LASER.
16. To determine Numerical Aperture of Optical Fiber.
17. To verify Stokes' law and hence to determine the viscosity of a liquid (glycerin).
18. To determine coefficient viscosity of water by Poiseuille's flow method.
19. To study Phase Shift oscillator.
20. To study Wien Bridge oscillator.
21. To study Hartley oscillator.
22. To study Colpitts oscillator.
23. Study of OP AMP as an Inverting amplifier.
24. Study of OP AMP as Non-inverting amplifier.
25. Study of OP AMP as an adder.
26. Study of OP AMP as subtractor.
27. Study of OP AMP as differentiator.
28. Study of OP AMP as an integrator.

References Books
1. A text book of Optics, N. Subrahmanyam, Brijlal, M. N Avadhanulu, S. Chand Publication
2. Physics for degree students (B.Sc.1st year), C. L. Arora and P.S. Hemne, S. Chand Publication
3. Fundamentals of Optics, Devraj Singh, PHI Learning Pvt. Ltd
4. Optics by Ajoy Ghatak, McGraw Hill Education (India) Private Limited.
5. Optics by N. B. L. Mathur, Anmol Publications Pvt.Ltd.
6. Optics and Spectroscopy, P. K. Mittal, S. Chand & Company LtdMechanics & Properties of Matter, J. C. Upadhyaya, Ram Prasad Publications
7. A Textbook of Optics, N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, S. Chand Publications.

8. Optics, Ajoy Ghatak, 4th Edition, McGraw Hill Publication.
9. Lasers, Theory and Application, Thaygrajan and Ajay Ghatak, Macmillan India Ltd
10. Laser and Nonlinear Optics, B. B. Laud (2nd Ed.), New Age International.
11. Fibre Optics – Kaiser, McGraw Hill.
12. Fiber Optic Communication, D. C. Agarwal, Wheeler Publishing
13. Optoelectronics & Fiber Optics Communication, C.K Sarkar, D.C. Sarkar, New Age International.
14. An introduction to Fiber Optics – R. Allen Shotwell, Prentice Hall
15. Properties of Matter , D. S. Mathur, S.Chand & Company Ltd
16. Properties of Matter, Brijlal and N. Subrahmanyam, S.Chand & Company Ltd
17. Basic Electronics Solid State ,B. L. Theraja, S. Chand & Co. Publications
18. Solid State Electronics Devices , B. G. Streetman, PHI Learning Pvt. Ltd
19. Electronics devices & Circuits, A. Mottershead, PHI Learning Pvt. Ltd
20. Solid State Devices & Electronics , Kamal Singh & S. P. Singh, S. Chand & Co. Publication
21. Electronic Devices and Circuits , Sanjeev Gupta, Dhanpat Rai Publication
22. Physics for Degree Students B.Sc. Second Year, C. L. Arora and P.S. Hemane, S-Chand Publication Reprint, 2015
23. Integrated Electronics , J. Millman and C. C. Halkias (Mc Graw Hill), 2001
24. Electronic Fundamentals and Applications, D. Chattopadhyay and P. C. Rakshit, New Age International

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SANT GADGE BABA AMRVATI UNIVERSITY AMRAVATI

Sr. no.	Course category	Subject code no.	Subject/Course	Credit	Teaching and Learning Scheme			Hours/ Week	Examination and Evaluation Scheme							
									Maximum Marks					MinimumPassing		
					Lectures	Tutorial	Practical		Theory		Practical		Total Marks	Marks	Grade	
									Theory + MCQ (EXT)	SEM (Int)	Internal	External				
		Semester -III														
1.	B.Sc.	DSC-3-03S	Zoology	4.5	06	---	----	06	80	20	--	--	100	40	p	
		Practical for DSC-3	Zoology	2.25	---	-----	06	04	----	----	25	25	50	25	P	
		Semester -IV														
2.	B.Sc.	DSC-4-04S	Zoology	4.5	06	---	----	06	80	20	--	--	100	40	p	
		Practical for DSC-4	Zoology	2.25	---	-----	06	04	----	----	25	25	50	25	P	

Curriculum Scheme for Second year B. Sc II. Sem III & Sem IV (Zoology)

Name of the Programme: B.Sc. II   **Class: Part 3S**

Semester: III DSC-3-03S   **Subject: Zoology**

Name of the course (Paper): Cell Biology and Developmental Biology

Course Outcomes Code: COs-03

About the course

The course is a walk for the Bachelor's degree through the amazing diversity of living organisms from simple to complex. The course makes a detailed knowledge of cell structure and functions. It explains the types, mechanism and significance of cell division. It also deals with the development of organism and how organism developed from single cell to multicellular organism.

COs:

Upon completion of this course successfully, students would be able to

1. Describe the structure and function of cellular organelles.
2. Describe various mode of cellular transport.
3. Compare active transport with passive transport.
4. Describe structure of chromosomes.
5. Differentiate between various types of chromosomes.
6. Define the basic concept of developmental biology, cell division, embryogenesis and emergence of adult organisms.
7. Describe zygote formation and different stages of embryonic development in frog and chick.

UNIT-I:

1. Plasma membrane: Sandwich model, Unit Membrane Model and Fluid-mosaic Model.
2. Functions of Plasma membrane: Transport across membranes, active transport, passive transport, facilitated transport.
3. Exocytosis, Endocytosis, Phagocytosis and Pinocytosis.
4. Structure of Nucleus and nucleolus.
5. Chromatin: Euchromatin and Heterochromatin.

UNIT-II:

1. General organization of Eukaryotic chromosomes.
2. Nucleosome; Solenoid model.
3. Types of Chromosomes based on position of centromere.
4. Giant chromosomes- Polytene and Lampbrush Chromosome.
5. Functions of Chromosomes.

UNIT-III:

1. Endoplasmic reticulum: Ultrastructure, Types and Functions.
2. Golgi complex: Ultrastructure and Functions.

3. Ribosome: Types (70S and 80S), Ultrastructure (Stoffler and Wittmann's model only); functions.
4. Lysosomes: Polymorphism, Ultrastructure, and functions.
5. Mitochondria: Ultrastructure and functions.

UNIT-IV:

1. Mitosis and its significance.
2. Meiosis and its significance.
3. Gametogenesis: Spermatogenesis and oogenesis
4. Fertilization: Types of fertilization.
5. Mechanism of fertilization.

UNIT V:

1. Cleavage, blastulation and gastrulation up to the formation of three germ layers in Frog.
2. Fate map in frog.
3. Cleavage, blastulation and gastrulation up to the formation of three germ layers in chick.
4. Development of Extra embryonic membranes in chick.
5. Significance of Extra embryonic membranes in chick.

UNIT-VI:

1. Placentation in mammals; Types and Functions of Placenta.
2. Parthenogenesis: Types and Significance.
3. Regeneration in invertebrates.
4. Regeneration in vertebrates.
5. Elementary idea, sources, types and use of Stem cells.

LIST OF PRACTICAL BASED ON CELL AND DEVELOPMENTAL BIOLOGY

I) Cell Biology:

1. Use, care and maintenance of microscope.

2. Study of different cell types by permanent slides/ICT Tools/Charts

    (Endothelium, Neuronal, Epithelia, Connective Tissue)

3. Demonstration of mitochondria by using vital staining.

4. Preparation of Polytene chromosome in *Chironomus* or *Drosophila* larva.

5. Preparation of various stages of mitosis.

6. Preparation of various stages of meiosis from suitable material.

II) Developmental Biology:

1. Study of stages of gametogenesis in rat/frog, (Permanent Stained Slides).

2. Study of different of types of animal eggs.

3. Study of developmental stages (Life Cycle) of Cockroach, Housefly, Mosquito, Butterfly, Moth, Frog (Any Four).

4. Study of developmental stages of *Lymnaea*.

5. Developmental stages of frog: Cleavage, blastula, gastrula, neurula, and tadpoles through available resources.

6. Study of chick embryo at different hours of incubation by permanent slides.

7. Study of different types of placenta with suitable histological slides or visual diagrams.

DISTRIBUTION OF MARKS DURING PRACTICAL EXAMINATION

EXTERNAL MARKS

1. Identification and comments on spots 1-4:   08 Marks
   (2 from Cytology, 2 from Developmental Biology)
2. Cytological Preparation: 08 Marks
3. Comment on given life cycle: 04 Marks
4. Viva-voce: 05 Marks

                                                            Total = 25

INTERNAL MARKS

1. Attendance: 05 Marks
2. Performance: 05 Marks
3. Certified Class record: 05 Marks
4. Study Tour Report: 05 Marks
5. Submission of Charts/Photograph/models on the basis of syllabus: 05 Marks

                                                            Total =25

SKILL ENHANCEMENT MODULE (SEM)

1. **Study of Different Types of Microscopes**
   - Search for literature on internet for different types of microscopes
   - Collect photographs of different types of microscopes.
   - Prepare a list of different types of microscopes available in your college/locality (in PHC/Pathology Laboratory).
   - Prepare a report on working of each microscope and its uses.
   - Submit a report with photographs.

2. **Comparative study of cleavages in different animals.**
   - Select animals with different patterns of cleavage.
   - Search for literature on internet regarding mechanism of each type of cleavage.
   - Collection of photographs of different stages of cleavage.
   - Submit a report.

3. **Study of different types of animal eggs like fish, frog, reptile, birds**
   - Make photographic collection of eggs from above-mentioned groups.
   - Study morphological features of eggs.
   - Study the egg-laying pattern based on data collected/ from internet.
   - Study the developmental stages from photographs.

4. **Study of developmental stages of (life cycle) insects not included in syllabus**
   - Search for information on internet.
   - Study the life cycle of a holometabolous and a hemimetabolous insect.
   - Photographic collection of life cycle stages.
   - Prepare a chart of life cycles.
   - Prepare report and submit.

5. **Comparative study prokaryotic and eukaryotic cell.**
   - Procure resources such as reference books and internet data on cell biology.
   - Describe the structure of a prokaryotic and a eukaryotic cell.
   - Describe the structure and function of various cellular organelles.
   - Describe the differences between prokaryotic and eukaryotic cells.
   - Prepare a model of prokaryotic and eukaryotic cell.

6. **Study of giant chromosomes.**
   - Collect available *Chironomus* larvae/Prepare a culture of Drosophila.
   - Prepare a slide of polytene chromosome.
   - Perform photomicrography.

7. **To study all aspects of plasma membrane.**
   - Search for different models of plasma membranes by using the latest resources.
   - To make a chart / model showing the functions of the plasma membrane.
   - Create a chart / model of how exchange of various substances takes place in and out of the plasma membrane.

8. **Studying eukaryotic chromosomes with the help of models or charts**
   - Model-assisted replication of eukaryotic chromosomes.
   - Creating a chart or model showing the types of chromosomes.
   - Constructing a model/chart showing the function of chromosomes.

9. **Study of Cell Division**
   - Prepare slides showing different types of stages of mitosis and observe under microscope.
   - Take photographs using a mobile phone and submit.
   - Prepare a slide of meiotic stages, focus under a microscope.
   - Take photographs using a mobile phone and submit.

10. **Study of Regeneration in Vertebrates and Invertebrates**
   - Survey your college campus, surrounding area and near forest.
   - Prepare a list of vertebrates and invertebrates showing regenerative capacity with photographs, and submit.

B. Sc. Zoology Semester IV

Name of the Programme: B.Sc. II   **Class: Part 3S**

Semester: IV DSC-4-04S   **Subject: Zoology**

Name of the course (Paper): Genetics and Ecology

Course Outcomes Code: COs-04

About the course

The course is a walk for the Bachelor's degree through the amazing diversity of living organisms from simple to complex. The course makes a detailed knowledge of genetics and ecology. It explains the inheritance of traits in animals, mechanism of linkage, crossing over and different genetic disorders. It also deals with effect of abiotic and biotic factors on organisms and structure and functioning of ecosystems.

COs:

Upon completion of this course successfully, students would be able to

1. Describe Mendel's Laws of Inheritance.
2. Differentiate between a monohybrid and a dihybrid cross.
3. Deduce the type of gene interaction from ratio of offspring.
4. Describe linkage and crossing over.
5. Describe various modes of sex determination.
6. Identify the type of syndrome from karyotype.
7. Describe various prenatal diagnostic techniques.
8. Describe effects of water, temperature and light as ecological factors.
9. Identify the type of biotic interaction from given example.
10. Describe components of ecosystem and structure of terrestrial and marine ecosystem.

UNIT I:

1. Law of dominance.
2. Law of segregation.
3. Law of independent assortment.
4. Interactions of genes: Supplementary factor, complementary factor, duplicate factor.
5. Inhibitory factors and lethal factors – dominant and recessive.

UNIT II:

1. Types of linkage, arrangement of linked genes and significance of linkage.
2. Crossing over –Mechanism of crossing over, theories of crossing over (Darlington's theory, breakage and exchange theory and copy choice theory).
3. Types of crossing over – Single, double and multiple crossing overs.
4. Factors affecting crossing over, Significance of crossing over.

5. Multiple alleles in relation to Blood group in man.

UNIT III:

1. Sex determination: Autosomes and sex chromosomes, Sex determination in animals, Chromosomal Theory, Genic Balance Theory. Environmental and hormonal control of sex determination, Gynandromorphs.
2. Human karyotype.
3. Non-disjunction and Disorders: Turner's syndrome, Klinefelter's syndrome, Down's syndrome, Edward's Syndrome,
4. Autosomal recessive disorders: Cystic fibrosis, Albinism, Phenylketonuria, Alkaptonuria,
5. Sex linked genetic disorders and their inheritance in man: Hemophilia and color blindness.

UNIT IV:

1. Genetic Screening and prenatal diagnosis: CVS (Chorionic Villus Sampling), Amniocentesis.
2. Human Heredity: - Inheritance of eye color, Skin color.
3. Recessive genes and consanguineous marriages.
4. Pedigree Analysis, Symbols used in pedigree analysis.
5. Kinds of twins: Identical, Fraternal, Siamese twins, Significance of twin study.

UNIT V:

1. Water as an abiotic ecological factor.
2. Temperature: Temperature tolerance, Effects of temperature on animals. Homeotherms, poikilotherms. hibernation, aestivation.
3. Light: Biological effects of light on aquatic and terrestrial animals: Reproduction, Metamorphosis, pigmentation, vision, photokinesis, phototropism, photoperiodism,
4. Biotic factors: Intraspecific and interspecific associations: Predation, parasitism, Antagonism, commensalism, mutualism, competition (Gauze's Principle).

UNIT VI:

1. Autotrophs and heterotrophs.
2. Food chain, food web, ecological pyramids (number, energy and biomass).
3. Terrestrial ecosystem: Characteristics, types of Biomes.
4. Aquatic ecosystem: Characteristics, Fresh water ecosystems (Lentic and Lotic) and Marine Ecosystem.
5. Ecotone and Edge Effect.

LIST OF PRACTICAL BASED ON GENETICS AND ECOLOGY

A) Genetics Experiments:

1. Recording of Mendelian traits in man.

2. Detection of monohybrid cross with the help of plastic beads.

3. Detection of dihybrid cross with the help of plastic beads.

4. Culturing *Drosophila* using standard methods.

5. *Drosophila* – male and female identification, Mutant forms of *Drosophila* (from pictures)

6. Demonstration of Barr body from buccal epithelium or leucocyte.

7. Preparation of human karyotypes with the help of ICT/suitable tools.

8. Study of syndromes with the help of ICT tools/Photo slides- Turner's syndrome, Klinefelter's syndrome, Down's syndrome

9. Detection of syndrome from karyotype (Turner's syndrome, Klinefelter's syndrome, Down's syndrome).

10. Study of human genetic traits and application of Hardy-Weinberg Principle to them – Baldness, length of index and ring Finger, attached and free earlobes, rolling of tongue, Widow's peak.

B) Ecology-

1. Estimation of pH in water.

2. Estimation of Dissolved oxygen, salinity, free CO_2, total hardness in water sample.

3. Adaptations of aquatic and terrestrial animals based on study of museum specimens such as rocky, sandy, muddy-shore, flying and burrowing animals.

4. Preparation of checklist of producers and consumers of local ecosystems and construction of a food web diagram based on field visit.

5. Mounting and identification of zooplankton.

General:-

Study of a natural ecosystem and field report of the visit.

DISTRIBUTION OF MARKS DURING PRACTICAL EXAMINATION

EXTERNAL MARKS

1. Genetics Experiment: 08 Marks
2. Ecological Estimation/Analysis: 04 Marks
3. Spotting: 08 Marks
   (2 spots each from section A and B of two marks each)
4. Viva-voce: 05 Marks

Total:- 25 Marks

INTERNAL MARKS

1. Attendance: 05 Marks
2. Performance: 05 Marks
3. Certified class record: 05 Marks
4. Field visit report   05 Marks
5. Submission of photographic collection
   as per syllabus: 05 Marks

Total:- 25 marks

SKILL ENHANCEMENT MODULE (SEM)

1. **Study of a Natural Aquatic Ecosystem**
   - Select of local natural aquatic ecosystem
   - Study various abiotic factors of the ecosystem and collect data on their annual variation.
   - Study various biotic components of the ecosystem and their interrelationships.
   - Submit a report.

2. **Study of a Natural Terrestrial Ecosystem**
   - Select of local natural aquatic ecosystem
   - Study various abiotic factors of the ecosystem and collect data on their annual variation.
   - Study various biotic components of the ecosystem and their interrelationships.
   - Submit a report.

3. **Study of Adaptations in Local Aquatic Animals**
   - Select aquatic animals showing different adaptations
   - Study the behaviour of selected animals / birds/ insects
   - Prepare a report on morphological and anatomical adaptations in these animals

4. **Studying the laws of Mendel's in a new and effective way**
   - Working Model/ Colorful charts / Slides Shows any effective way can be used to study and demonstrate the Mendelian laws.
   - Comparative study can be done by using any effective method.
   - Try to collect plant material to prove Mendel's principle.

5. **Survey of Mendelian traits in local population**
   - Conduct a survey of about 100 people among the local population.
   - Note down the occurrence of different traits (dominant/recessive).
   - Apply Hardy-Weinberg principle to the data

6. **Counting of twins at local level through survey**
   - Collect the data of the percentage of twins.
   - Comparative analysis of kinds of twins.

7. **Study the food chain found in the around your town/village**
   - Prepare a flow chart with photographs (Mobile or camera click) of food chains in terrestrial, aquatic ecosystems.
   - Prepare a flow chart with photographs (Mobile or camera click) of food chains in terrestrial , aquatic ecosystems.
   - During local visits you can observe food web in the area and collect photographic evidence.

Sant Gadge Baba Amravati University Amravati   **Appendix- A-3**
Scheme of teaching, learning &Examination leading to the Degree Bachelor of Science (Three Years (Six Semesters) Degree Programme - C.B.C.S)
B.Sc. II Mathematics Semester-III

Sr. No	Subjects	Subject Code	Teaching & Learning Scheme							Duration of Exams Hrs.	Examination & Evaluation Scheme					Minimum Passing	
			Teaching Period Per week				Credits				Maximum Marks						
							Theory/ Tutorial	Practical	Total		Theory + M.C.Q External	Skill Enhancement Module Internal	Practical		Total Marks	Marks	Grade
			L	T	P	Total							Internal	External			
1	Mathematics DSC-V (Theory)				--			--		3	60	15	--	--	75	30	P
2	Mathematics DSC-VI (Theory)		9	1*		10	7.5		7.5	3	60	15	--	--	75	30	P
	Total														150	60	

L: Lecture, T: Tutorial, P: Practical

Note : * indicate that for the subject Mathematics, the strength of a batch of tutorials for UG classes shall be 16 (Sixteen) with an addition of 10 percent with the permission of Honorable Vice Chancellor (As amended by Executive council dated 27/28-4-1979)

Scheme of teaching, learning &Examination leading to the Degree Bachelor of Science (Three Years (Six Semesters) Degree Programme - C.B.C.S)

B.Sc.II Mathematics Semester-IV

Sr. No	Subjects	Subject Code	Teaching & Learning Scheme							Duration of Exams Hrs.	Examination & Evaluation Scheme							
			Teaching Period Per week				Credits				Maximum Marks						Minimum Passing	
			L	T	P	Total	Theory/ Tutorial	Practical	Total		Theory + M.C.Q External	Skill Enhancement Module Internal	Practical		Total Marks		Marks	Grade
													Internal	External				
1	Mathematics DSC-VII (Theory)				--			--		3	60	15	--	--	75		30	P
2	Mathematics DSC-VIII (Theory)		9	1*		10	7.5		7.5	3	60	15	--	--	75		30	P
	Total														150		60	

L: Lecture, T: Tutorial, P: Practical

     Note : * indicate that for the subject Mathematics, the strength of a batch of tutorials for UG classes shall be 16 (Sixteen) with an addition of 10 percent with the permission of Honorable Vice Chancellor (As amended by Executive council dated 27/28-4-1979)

Faculty: Science and Technology Program: B.Sc. (Mathematics)

POs:

At the end of the program, graduates would be able to

1. enhance the knowledge of student in all basic sciences.
2. identify, formulate and develop solutions to computational challenges.
3. develop scientific temper and think in a critical manner.
4. build up progressive and successful career in academics, industry and society.
5. develop student's abilities and aptitudes to apply the mathematical ideas.

PSOs :
Upon completion of the program successfully, students would be able to
1. understand major concepts in all disciplines of Mathematics
2. formulate and develop Mathematical arguments in a logical manner
3. gain good knowledge and understanding in advanced Mathematics
4. create an awareness of the impact of Mathematics on the environment, society and development outside the scientific community.
5. create sensitivity towards environmental concerns and contribute in the development of nation.

<u>Employability Potential of the Program:</u>

Career options for B.Sc. Mathematics students is not just limited to solving complex equation. Apart from the traditional career route of academics and research, there are many careers options offer for B.Sc. Mathematics students that can pick up banking, corporate, accounting and even teaching as their career option on completion of B.Sc. Mathematics, even a career in medicine and law is possible for Mathematics Honors student. Also, a degree with Mathematics is even financially supporting for students because they help in landing placement opportunities by giving an edge over students with B.Sc. physics or other major.

After completing B.Sc. Mathematics, a student can either decide to go for higher studies or apply for jobs. In the case of B.Sc. Mathematics Honors, both the options are very promising. After the B.Sc. Mathematics course, students can purse M.Sc. Mathematics and follow it up with an M. Phil or Ph.D. students can become a mathematician doing research and also become a assistant professor. Also students can pursue a B. Ed. and become a school teacher. Moreover, student can work in related field which required mathematical skills (Machine learning, Data Science etc.). Thus, there exist innumerable B.Sc. Mathematics career options.

The best way to get a prestigious government job is through competitive exams. Examinations like UPSC, Railways, banking and Commission etc. are some important competitive examinations as that one needs to consider as portals for B.Sc. Mathematics career options.

Program: B.Sc. II (Mathematics)

Semester- III

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC-V / Mathematics	Advanced Calculus	9+1* (Including both the papers of Sem-III)

Cos: After completing this course, students would be able to

1. get knowledge of basic principles of limit and continuity, Taylor's theorem.

2. understand Lagrange's multipliers method and Jacobian.

3. understand the concept of improper integral and Beta-Gamma function.
4. learn the definition of sequence and series and Sandwich theorem.

5. learn various tests for convergence and divergence of series.

Unit	Content
Unit I	**Limit and Continuity**: Limit and Continuity of functions of two variables, Algebra of Limit and Continuity, Taylor's theorem of function of two variables. **(12 period)**
Unit II	Maxima and Minima of two variables, Lagrange's multipliers method, Jacobian. **(12 period)**
Unit III	Improper Integral (Definition only), Beta and Gamma functions, Properties of Beta and Gamma functions, Relation between Beta and Gamma functions. **(12 period)**
Unit IV	**Sequence:-** Definition of Sequence, Uniqueness of limit of sequence, Algebra of limit of a sequence, Positivity theorem, Sandwich theorem, Monotonic and Bounded sequence (Definition only), Cauchy Sequence. **(12 period)**
Unit V	**Series:** Series of non-negative terms, Convergence of geometric series, P-Series, Comparison test, Cauchy's integral test, Ratio test, Root test **(12 period)**
***SEM**	
COs:	1. To enhance interest among the students about course. 2. To develop the learning and writing skills. 3. To create mental ability.
**Activities	1. Unit Test 2. Seminar/Group Discussion 3. Quiz/ Study Tour/Project/Assignments/Open Book Test

* For the subject Mathematics, the strength of a batch of tutorials for UG classes shall be 16 (Sixteen) with an addition of 10 percent with the permission of Honorable Vice Chancellor (As amended by Executive Council dated 27/28-4-1979)

Text book :
⬇   V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A. N. Rangari ,Y. S. Solanke: A Text Book of Advanced Calculus, Dnyanpath publication, Amravati, First edition 2023.

Reference Books:
1]T .M. Karade, J. N. Salunke, Maya S. Bendre, D .T. Solanke, C .S. Khodre, S. P. Gaikwad, N.B.Nawale: Advanced Calculus, SONU-NILU, Nagpur, 2023
2] Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
3] Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
4] Murray R. Spiegel: Theory and Problems of Advanced Calculus, Schaum Outline Series.
5] S. C. Malik and Arora: Mathematical Analysis, Wiley Estern Ltd., New Delhi.
6] O. E. Stanaitis : An Introduction to Sequences, Series and improper Integrals, Holden-Dey , Inc. San Francisco, California.
7] Earl D. Rainville : Infinite series, The Macmillan Co., New York.
8] N. Piskunov : Differential a nd Integral Calculus, Peace publishers, Noscow.
9] Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.
10] D. Somasundaram and B. Choudhary: A First course in Mathematical Analysis, Narosa Publ. House.

Program: B.Sc.-II (Semester-III), Mathematics

Syllabus Prescribed for the Year 2023-24, UG Program

Program: B.Sc.-II

Semester- III

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC-VI / Mathematics	Partial Differential Equations	9+1*(Including both the papers of Sem-III)

Cos: After completing this course, students would be able to

1. study partial derivatives, differential equation, real valued functions of two variables and solve the system of homogeneous functions.
2. learn to evaluate partial differential equations, solution of some special type of equations
3. learn to solve methods of partial differential equation of second and higher order.
4. students will be familiar with techniques of Calculus of variations.
5. recognize various methods of separation of variables.

Unit	Content
Unit I	Partial Derivatives and Differentiations of real valued functions of two variables, Homogeneous function, Euler's theorems on homogeneous function. **(12 period)**
Unit II	Formation of PDE, Partial Differential equation of the first order, Total Differential equation (Pfaffian), Lagrange's method, Some special type of equations. **(12 period)**
Unit III	Compatible Differential equation, Charpit's general method of solutions, Partial Differential equation of second and higher order, Homogeneous and non-homogenous equation with constant coefficients. **(12 period)**
Unit IV	Calculus of Variation: Functional, Continuity of functional, variational problems with fixed boundaries, Extremum of a functional. **(12 period)**
Unit V	Method of Separation of variables, Method of separation of variables for wave equations and heat equations in one dimension. **(13 period)**

*SEM	
COs: 1.To enhances interest among the students about course. 2. To develop the learning and writing skills. 3. 3. To create mental ability.	
**Activities	1. Unit Test 2. Seminar/Group Discussion 3. Quiz/ Study Tour/Project/Assignments/Open Book Test

* For the subject Mathematics, the strength of a batch of tutorials for UG classes shall be 16 (Sixteen) with an addition of 10 percent with the permission of Honorable Vice Chancellor (As amended by Executive Council dated 27/28-4-1979)

Text Books:
*   V. A. Sharma, S. R. Bhoyar, V. R. Patil, G. U. Khapekar, S. R. Kumbhare, T. D. Nakade, Salim H. Shaikh: A Text Book of Partial Differential Equation, Dnyanpath publication, Amravati, First edition 2023.

Reference Books:
1] T. M. Karade , J. N. Salunke, Smita V. Nahatkar, S. N. Bayaskar, I. D. Pawade, S. A. Salve, A. F. Gotharkar : Partial Differential Equations , SONU-NILU, Nagpur, 2023
2] Murray D.A.: Introductory course in Differential Equations, Orient Longman (India), 1967.
3] Erwin, Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 1999.
4] Piaggio HTS: Differential Equations, CBS Publishers &Distributors, Delhi, 1985.
5] Siminons G.F. : Differential Equations, Tata McGraw Hill, 1972.
6] A.R. Forsyth. A Treatise on Differential Equations. Macmillan and Co. Ltd. London.
7] Ian N., Sneddon, Elements of Partial Differential Equations. McGraw-Hill Book Company, 1988.
8] Jane Cronin. Differential equations, Marcel Dekker, 1994.
9] Frnak Ayres. Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
10] Richard Bronson, Theory and Problems of Differential Equations, McGraw Hill Inc, 1973.
11] A. S. Gupta: Calculus of Variations with Applications, Prentice-Hall of India, 1997.
12] I. M. Gelfand and S. V. Fomin: Calculus of Variations, Prentice-Hill Englewood Cliffs (New Jersey), 1963.
13] A. S. Gupta: Calculus of Variations with Applications, Prentice-Hall of India, 1997.
14] I. M. Gelfand and S. V. Fomin: Calculus of Variations, Prentice-Hill Englewood Cliffs (New Jersey), 1963.

Program: B.Sc.- II (Semester- IV), Mathematics

Syllabus Prescribed for the year 2023-24, UG Program

Program: B.Sc.-II

Semester IV

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC-VII / Mathematics	Elements of Algebra	9+1* (Including both the papers of Sem-IV)

COs: After completing this course, students would be able to
1 . learn the concept of Group, Subgroup and Cosets.
2. explain the significance of the notations of Cosets, Normal subgroups and Quotient group.
3. learn the concept of Homomorphism & Isomorphism and its Theorem.
4. study the properties of Ring and Ideals and Integral domain.
5.familiar with Fundamental concepts of Number theory.

Unit	Content
Unit I	Group: Definition of a group with examples, Properties of group, Subgroup, Cyclic group, Order of a generator of a cyclic group, Permutation groups, Even and Odd permutations. **(12 period)**
Unit II	Cosets and Normal subgroups: Cosets, Lagrange's theorem, Normal subgroups, Different Characterization of normal subgroups, Quotient group. **(12 period)**
Unit III	Homomorphism and Isomorphism: Homomorphism, Homomorphic image, Kernal of Homomorphism, Isomorphism of a group, Fundamental theorem on homomorphism of a group, second isomorphism theorem, third Isomorphism theorem. **(12 period)**
Unit IV	Ring: Definition, Examples and Properties of a ring (Commutative ring, ring with unity, zero divisor, without zero divisor), Subring, Characterization of ring, Integral domain, field, subfield, prime field(Definition Only). **(14 period)**
Unit V	Fundamental Concept of Number theory: Well ordering Principle, Principle of Mathematical induction, Division Algorithm, Greatest common divisor, Least common multiple, Euclidean Algorithm, Prime, fundamental theorem of arithmetic, Congruence and its properties, **(15 period)**
*SEM	
COs: 1.To enhances interest among the students about course. 2. To develop the learning and writing skills. 3. To create mental ability.	
**Activities	1.Unit Test 2. Seminar/Group Discussion 3. Quiz/ Study Tour/Project/Assignments/Open Book Test

* For the subject Mathematics, the strength of a batch of tutorials for UG classes shall be 16 (Sixteen) with an addition of 10 percent with the permission of Honorable Vice Chancellor (As amended by Executive Council dated 27/28-4-1979)

Text book :

✦ V. A. Sharma , S. R. Bhoyar, V. R. Patil, G. U. Khapekar , A. N. Rangari, N. S. Bayaskar, R. V. Kene, P. B. Deshmukh, M. C. Dhabe: A Text Book of Elements Algebra, Dnyanpath publication, Amravati, First edition 2023

Reference Books:
1] T .M. Karade, J. N. Salunke , Smita V.Nahatkar, Rekha Rani, Vidya N.Mahalle, K.M.Patil, V.D.Bokey, S.M.Munde: Elements of Algebra, SONU-NILU, Nagpur, 2023
2] I.N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
3] N. Jocobson : Basic Algebra ,Vol. I and II W.H.Freeman,1980(Hindustan Publishing Co.
4] Shanti Narayan :A Text Book Of Modern Abstract Algebra, S. Chand and Co. ,New Delhi
5] K.B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd.New Delhi,2000
6] P.B.Bhattacharya, S.K.Jain and S.R.Nagpal : Basic Abstract Algebra (IInd Edition) Cambridge University Press Indian Edition, 1997
7] K.Hoffman and R.Kunze :Linear Algebra ,II nd Edition Prentice Hall, Englewood Cliffs, New Jersey,1971.
8] S.K.Jain, A Gunawardhana and P.B.Bhattacharya : Basic Linear algebra with MATLAB, Key College Publishing (Springer-Verlag)2001
9] S. Kumaresan : Linear Algebra, A Geometric Approach, P Prentice Hall of India Pvt. Ltd. New Delhi,2000
10] Vivek Sahai and Vikas Bisht: Algebra, Narosa Publishing House, 1997.
11] D.S.Malik,J.N.Mordeson and M.K.Sen: Fundamentals of Abstract Algebra, McGraw Hill International Edition 1997
12] D. M. Burton: Elementary Number Theory, Universal Book Stall, New Delhi, Second Edition 2003.
13] C.Y. Hsiung: Elementary Theory of Numbers, Allied Publishers Ltd.1992.
14] I. Niven, H. S. Zuckerman and H. L. Montgomery: An introduction to the Theory of Numbers, Wiley Student Edition, Fifth edition 2004.
15] K. H. Rosen: Elementary Number Theory and its Applications, Addison-Wesley, 1986.
16] T. M. Karade, J. N. Salunke, K. D. Thengane, M. S. Bendre: Lectures on Elementary Number Theory, Sonu-Nilu publication 2005.
17] K. Irland and M. Rosen: A Classical Introduction to Modern Number Theory, GTM Volume 84, Springer-Verlag 1972
18] G. A. Jones and I. M. Jones: Elementary Number Theory, Springer, 1998

Program: B.Sc.- II (Semester-IV), Mathematics

Syllabus Prescribed for the year 2023-24 , UG Program

Program: B.Sc.-II Semester- IV

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC –VIII / Mathematics	Classical Mechanics	9+1* **(Including both the papers of Sem-IV)**

COs:

After completing this course, students would be able to

1. learn radial and transverse component of velocities and acceleration.

2. learn to explain Degree of freedom, Generalized co-ordinates and constraints.

3. learn to expressing the central force motion and areal velocity.

4. explain the significance of coplanar forces, triangle law of forces, parallel forces and equilibrium forces.

5. learn to find work and energy, virtual work and uniform catenary.

Unit	content
Unit I	Velocities and Acceleration along the co-ordinate axes, Radial and Transverse directions, Tangential and Normal directions, Projectiles. **(12 period**)
Unit II	Degree of freedom, Constraints, Generalized Co-ordinates, D'Alembert Principles and Lagrange's equations of motions. **(12 period)**
Unit III	Central force motion, Areal velocity, Equivalent one body problem, Central orbit, Virial theorem, Kepler's laws of motion (statement only). **(12 period)**
Unit IV	Coplanar forces, forces acting at a point, triangle law of forces, Parallel forces, Equilibrium Forces, Lami's Theorem, Analytical condition of equilibrium of Coplanar forces. **(13 period)**
Unit V	Work and Energy, virtual work, Uniform Catenary. **(12 period)**
*SEM	
COs: 1.To enhances interest among the students about course. 2. To develop the learning and writing skills 3. To create mental ability.	
**Activities	1. Unit Test 2.Seminar/Group Discussion 3.Quiz/ Study Tour/Project/Assignments/Open Book Test

* For the subject Mathematics, the strength of a batch of tutorials for UG classes shall be 16 (Sixteen) with an addition of 10 percent with the permission of Honorable Vice Chancellor (As amended by Executive Council dated 27/28-4-1979)

Text book:
✚   V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A.P.Wasnik, P. R. Langade, Y. D. Naner A. M. Bagde, N. B. Nawale, M. D. Netnaskar: A Text Book of Classical Mechanics, Dnyanpath publication, Amravati, First edition 2023.

Reference Books:
1] T.M.Karade, J.N.Salunke, Smita V. Nahatkar, Y.D.Patil, Minakshi T. Sarode, S.B. Khobragade, A.M.Bagade: Elements of Classical Mechanics, SONU-NILU, Nagpur, 2023.

2] H. Goldstein: Classical Mechanics (2nd edition) Narosa publishing house, New Delhi, 1998.

3] D. A. Wells: Lagrangian Dynamics, McGraw Hill, 1967.

4] J. L. Synge, B.A. Griffith: Principles of Mechanics, McGraw Hill, 1959.

5] M. R. Spiegel: Theoretical Mechanics, McGraw Hill, 1983.

6] L.D. Landau, E. M. Lifschitz: Mechanics, Pergamon Press, 1976.

7] B. R. Gossick: Hamilton's Principle and Physical Systems, Academic Press, 1967.

8] S. L. Loney : An Elementary Treatise on the Dynamics of a particle and of rigid bodies, Cambridge University Press, 1956.

9] P. K. Mittal: Mathematics for Degree Students, S. Chand & Co Ltd, New Delhi, 2011.

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Part B

Syllabus Prescribed for Three Year   UG Programme (CBCS)

Programme: B.Sc. with Chemistry

Semester 3

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
CHE(3S)T	**Chemistry 3S**	**84**

COs:

By the end of this course, the students will be able to:

1. apply concepts of volumetric and gravimetric analysis
2. use commercial method for extraction of elements and acquaintance of transition series elements
3. compare functional group chemistry through the study of methods of preparation, properties and chemical reactions with underlying mechanism.
4. select correct synthetic approach to prepare derivatives of industrially important molecules
5. solve different numerical problem of varying difficulty associated with thermodynamics, phase equilibrium and colligative properties.
6. apply the concepts from advanced mathematics to solve the derivation of different chemical formulae.

Unit	Content
Unit I	**A) Volumetric Analysis:** (a) Introduction: -Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance. Requirements of primary standard substance. Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. (Simple numerical expected). (b) Acid-Base titrations: - Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Modern theory (Quinoniod theory) of acid base indicators. Choice of suitable indicators for different acid base titrations. (c) Redox Titrations: -General principles involved in redox titrations (redox reactions, redox potentials, oxidant, reductant, oxidation number). Brief idea about use of $KMnO_4$, $K_2Cr_2O_7$ as oxidants in acidic medium in redox titrations. Use of I_2 in iodometry and iodimetry. Redox indicators-external and internal indicators. Use of starch as an indicator. Iodometric estimation of Cu (II). **B) Gravimetric Analysis:** Definition. Theoretical principles underlying various steps involved in gravimetric analysis with reference to estimation of barium as barium sulphate. Coprecipitation and post precipitation. (Definition, types and factors affecting). **Periods: 14**
Unit II	**A) P-Block Elements-**Comparative study of 16th and 17th group elements with reference to electronic configuration, ionization energy and oxidation states. Oxidising properties of halogens with reference to oxidation potential. Interhalogen compounds, structure and bondings. Introduction to fluorocarbons. **B) Chemistry of elements of transition series:** Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration (ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour. Study of 4d and 5d series elements-Electronic configuration. Comparison of 3d series elements with 4d and 5d series elements with respect to size, oxidation states, magnetic properties and color. **Periods: 14**
Unit III	**A) Aldehydes and Ketones:** Introduction, Structure of carbonyl group, acidity of α hydrogen in carbonyl compounds. Preparation of aldehydes and ketones from appropriate alcohol, dihalide, alkyne.

		Preparation of benzaldehyde from benzene (Gatterman-Koch synthesis/reaction) and toluene. Preparation of acetophenone from benzene and ethyl benzene. **Chemical Reactions:** Reaction with HCN, ROH, $NaHSO_3$, NH_2^- groups derivatives. Iodoform test, Reactions of aldehydes & /or ketones: Aldol condensations Reformatsky, Mannich, Perkin, Cannizaro's, Benzoin reaction with mechanism, Knoevenagel, Stobbe, Wittig reaction only. Clemmensen, Wolff-Kishner, MPV and $LiAlH_4$ reductions. **B) Carboxylic acids:** Structure and reactivity of carboxylic groups. Acidity of carboxylic acids, effects of substituents on acids strength. **Oxalic acid**: Preparation from ethylene glycol and cyanogen. Reactions: Reaction with ethyl alcohol, ammonia, glycerol and action of heat. **Lactic acid**: Preparation from acetaldehyde and pyruvic acid. Reactions: Reaction with ethanol, PCl_5, action of heat, oxidation and reduction. **Benzoic acid:** Preparation from toluene, benzyl alcohol, phenyl cyanide and benzamide. Reactions: Reaction with ethanol, PCl_5 and ammonia. **Salicylic acid**: Preparation by Reimer-Tiemann reaction. Reactions: Reaction with CH_3COCl, CH_3OH and C_6H_5OH. Hell- Vohlard -Zelinsky Reaction. **Periods: 14**
Unit IV	**Stereochemistry:** **A) Optical isomerism:** Isomerism, Types of isomerism, Stereoisomerism, Optical isomerism, assymetric carbon atom, Element of symmetry, chirality (up to two carbon atoms), enantiomers, diastereoisomers, meso compounds, configuration, relative and absolute configurations, DL and RS nomenclature (for up to 2 chiral carbon atoms), racemisation and resolution (by chemical method). optical isomerism in allenes and biphenyls. **B) Geometrical isomerism:** Cis-trans & E-Z nomenclature (for up to two C=C systems) with examples and applications. **C) Conformational isomerism:** Conformational isomers, Newman & Sawhorse projection formulae, conformations of ethane, n-butane and cyclohexane, their energy level diagrams. conformation of cyclic systems mono-substituted cyclohexanes. **Periods: 14**	
Unit V	**A) Colligative Properties of Dilute Solutions:** Definition and examples of colligative properties. Importance and applications of colligative properties. Elevation of boiling point. Thermodynamic derivation of the relationship between elevation of boiling point and the molar mass of non-volatile solute. Cottrell's method for the determination of elevation of boiling point and hence the molar mass of solute. Depression of freezing point. Thermodynamic derivation of the relationship between depression of freezing point and the molar mass of non-volatile solute. Rast's method for the determination of molar mass of solute. Abnormal behaviour of solution. Van't Hoff's factor 'i'. Determination of degrees of association and degree of dissociation from Van't Hoff's factor. Numerical. **B) Phase rule:** Statement of Phase rule. Explanation of Phase, number of components and degrees of freedom. Application of phase rule to water and sulphur systems. Numerical. **Periods: 14**	
Unit VI	**A) Thermodynamics:** First law of Thermodynamics and its limitations, Need of Second law. Carnot's heat engine, derivation of expression for the work done and efficiency of Carnot's engine. Statements of Second law of thermodynamics. Concept of Entropy, Physical significance of Entropy, Derivation of expression for the Entropy change for an ideal gas in terms of pressure, temperature and volume. Entropy change for an ideal gas for isothermal, isoberic and isochoric processes, Entropy of fusion, sublimation, vapourization, transition and its calculations. Entropy change for reversible and irreversible processes. Entropy change as a criteria for spontaneity. Numerical. **(B) Phase Equilibrium:** Raoult's Law and it's limitations. Ideal and non-ideal solution. Classification of binary solutions of completely miscible liquids (I, II and III) on the basis of Raoult's Law. Phase diagrams of Phenol-Water, Triethylamine-Water and Nicotine-Water system. Nernst distribution law and its applications to association and dissociation of solute in one of the immiscible solvents. Process of extraction. Derivation of the formula for the amounts of the solute left unextracted after nth extraction. Numerical. **Periods: 14**	
*SEM: A) Appropriate use of chemicals and glassware for determination of concentration, Applications of p-block and transition series elements		

B) Preparation of charts for organic reactions of aldehydes, ketones, and carboxylic acids, Model creation and drawings for different stereoisomers. C) Numerical associated with colligative properties and thermodynamics, Applications of laws of thermodynamics and phase equilibrium,	
COs: By the end of this module, the students will be able to: 1. Create models associated with stereochemistry 2. Use aldehydes, ketones and carboxylic acids as starting material for different commercially important molecules 3. Solve numerical problem associated with thermodynamics and colligative properties.	
**Activities:	Model creation, poster, chart preparation, memory maps, class tests, assignments, project, survey, group discussion, industrial visit, or any other innovative pedagogical method. Any two activities be conducted from above. Class tests are compulsory. Equal weightage for each activity.

Course Material/Learning Resources

Text books:

1. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
2. A Text Book of Chemistry for third Semester of B.Sc. by AUCTA Association and DnyanPath Publication

Reference Books:

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.

2. Inorganic Chemistry by A.K. De, Wiley East Ltd.

3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan, S. Chand & Co.

4. Concise Inorganic Chemistry by J.D. Lee, ELBS.

5. Inorganic Chemistry by J.E. Huheey- and Kettle, Harper & Row.

6. Advanced Inorganic Chemistry, Vol-I, Satya Prakash, Madan, Tuli, Basu.

7. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.

8. Organic Chemistry by S.K. Ghosh.

9. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.

10. Stereochemistry and mechanism through solved problems by P.S. Kalsi.

11. Organic Chemistry by TWG Solomons, 8th edition, John Wiley

12. Organic chemistry by R. K. Bansal

13. Physical Chemistry: Walter, J. Moore, 5th edn., New Delhi.

14. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.

15. Principles of Physical Chemistry: Maron and Prutton.

16. Principles of Physical Chemistry: Puri, Sharma, and Pathania.

17. Physical Chemistry: P.W. Atkins, 6th Edn.

18. Physical Chemistry: Levine

19. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.

20. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.

21. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.

22. Practical Physical Chemistry: Palit and De.

23. Practical Physical Chemistry: Yadao.

24. Practical Physical Chemistry: Khosla.

25. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Pulishing House, Meerut.

Weblink to Equivalent MOOC on SWAYAM if relevant:

Weblink to Equivalent Virtual Lab if relevant:

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

Sant Gadge Baba Amravati University, Amravati

Syllabus Prescribed for three Year UG/PG Programme

Programme: B.Sc. with Chemistry

Semester 3

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
CHE(3S)PR	**Chemistry 3S**	**Total 26 per Semester**

COs: At the end of Lab/Practical course, students will be able to -
1. estimate different metals using a variety of methods.
2. skilfully prepare solution of different concentrations.
3. determine molecular weight of an organic molecule.
4. determine thermodynamic parameters associated with a physical phenomenon and state.
5. use methods of determination of partition coefficient.

* List of Practical/Laboratory Experiments/Activities etc.

	Exercise-1 Inorganic
1	Estimation of Ba^{2+} as $BaSO_4$.
2	Estimation of Fe^{3+} as Fe_2O_3 using china and silica crucible.
3	Estimation of Ni^{2+} as Ni-DMG using sintered glass crucible.
4	Estimation of copper (II) in commercial copper sulphate sample by iodometric titration.
5	To determine the percentage of calcium carbonate in precipitated chalk.
6	To determine volumetrically the amounts of sodium carbonate and sodium hydroxide present together in the given solution
7	Preparation of standard solution of an acid (oxalic acid) & a base (sodium bicarbonate) by weighing and calculation of concentrations in terms of strength, normality, molarity, molality, formality, % by weight, % by volume , ppm, ppb and mole fraction.
8	Preparation of standard solution of hydrochloric acid by dilution and calculation of concentrations in terms of strength, normality, molarity, molality, formality, % by weight, % by volume , ppm, ppb and mole fraction.

	Exercise II: Physical Chemistry Experiments
9	Determination of molecular weight of solute by Rast's method
10	To determine activation energy of a reaction between $K_2S_2O_8$ and KI.
11	Determination of thermodynamic values ($\Delta S°$, $\Delta H°$, and $\Delta G°$) from the dissociation of a weak acid.
12	To determine transition temperature of $MnCl_2.4H_2O$.
13	To study critical solution temperature (CST) of phenol water system.
14	To determine the partition coefficient of CH_3COOH between H_2O and CCl_4
15	To determine the partition coefficient of Benzoic acid between H_2O and toluene.

Note:

Distribution of Marks for Practical Examination

Time : 04 hours (One Day Examination)

Total Practical Marks 50, Duration of Exam 04 Hours	
Internal Practical Exam (25 Marks)	**External Practical Exam* (25 Marks)**
Attendance, Students Performance, Activity, Practical Record Book / Laboratory Manual/Journal Report : 20 Internal Viva/Assignment/Quiz/Test : 05	Experiment 1 Performance / Demonstration : 10 Experiment 2 Performance / Demonstration : 10 External Viva (by External and Internal Examiner: 05
Total : 25	**Total : 25**

*Note: One practical from respective exercise

Syllabus Prescribed for Three Year   UG/PG Programme

Programme: B.Sc. with Chemistry

Semester 4

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
CHE(4S)T	**Chemistry 4S**	**84**

COs: By the end of this course, the students will be able to:

1. Application of methods of synthesis of soaps and detergents
2. Commercial method for extraction of elements and acquaintance of transition series elements
3. Compare functional group chemistry through the study of methods of preparation, properties and chemical reactions with underlying mechanism.
4. Choose correct synthetic approach to prepare derivatives of industrially important molecules
5. Solve different numerical problem of varying difficulty associated with electrochemistry and photochemistry.
6. Apply the concepts of UV and IR spectroscopy for structure elucidation.

Unit	Content
Unit I	**A) Noble Gases-**Inertness of noble gases. Compounds of noble gases-only structure and bonding in XeF_2, XeF_4, XeF_6, XeO_3, and XeO. **B) Polarisation-**Definition, polarising power, polarizability, effect of polarization on nature of bond. Fajan's rules of polarisation and its applications. **B) General Principles of Metallurgy:** Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froth floatation and electromagnetic separation. Calcination, roasting, smelting and refining of metals. Meaning of terms hydrometallurgy and pyrometallurgy. **Periods: 14**
Unit II	**A) Inner transition elements:** Definition, Lanthanides and Actinides. Comparative study of Lanthanides with respect to following properties:(i) Electronic configuration (ii) Atomic and ionic radii lanthanide contraction-definition, cause and effect of lanthanide contraction (iii) Oxidation states (iv) Magnetic properties (v) Colour of salts (vi) Complex formation behaviour. Occurrence of lanthanides. Isolation of lanthanides by ion exchange method. Actinides- Electronic configuration and oxidation states. Comparison of lanthanides and actinides. **B) Extraction of elements:** Principles involved in extraction of elements. Major methods of extraction of elements. Factors affecting choice of extraction method. Thermodynamics of reduction processes-Ellingham diagrams for oxides and importance of this diagram (only preliminary ideas). **Periods: 14**
Unit III	**A) Soaps and Detergents** **Soaps: -**Introduction, Manufacture of soaps by i)Kettles process, ii) Hydrolyser process, Cleansing action of soap. **Synthetic Detergents: -**Introduction, Synthetic detergent classification, i)Anionic detergent, ii) Cationic detergents, iii) Non-ionic detergents. Synthetic detergent versus soaps, Soft versus Hard detergents. **B) Reactive methylene compounds:** Malonic Ester: Synthesis from acetic acid, Synthetic applications-Synthesis of acetic acid, succinic acid, glutaric acid, crotonic acid and malonyl urea. Acetoacetic ester: Synthesis from ethyl acetate, Synthetic applications- Synthesis of acetic acid, propionic acid, isobutyric acid, succinic acid, glutaric acid, crotonic acid, acetyl acetone and 4-methyl uracil. **C) Carbohydrates:** Constitution of glucose, cyclic structure, Pyranose and Furanose structure, Epimerization, conversion of glucose to fructose and vice-versa, Introduction to fructose, ribose, 2-deoxyribose, maltose, sucrose. (their structures only- determination not needed).

		Periods: 14
Unit IV	**A) Aromatic nitro compounds:** Nitrobenzene: Synthesis from benzene, Reduction of nitrobenzene in acidic, neutral and alkaline medium. **B) Amino Compounds:** Basicity and effect of substituents. Methods of preparation of aniline from nitrobenzene, Reactions: with acetyl and benzoyl chlorides, Br_2 (aq) and $Br_2(CS_2)$, Carbylamine reaction, alkylation, Hoffmann's exhaustive methylation and its mechanism. **C) Diazonium Salts:** Preparation benzene diazonium chloride, Synthetic applications- Preparation of benzene, phenol, halobenzene, nitrobenzene, benzonitrile, coupling with phenol and aniline. **D) Amino acids and Proteins:** Classification, Strecker and Gabriel phthalimide synthesis, Zwitterion structure, Isoelectric point, peptide synthesis, Structure determination of polypeptides by end group analysis.	
		Periods: 14
Unit V	**A) Electrochemistry -I:** Conductance of electrolyte solution. Specific, equivalent and molar conductance. Determination of conductance of electrolyte solution, variation of specific and equivalent conductance with dilution for strong electrolyte. Conductometric titrations. Applications of conductometric titration. Migration of ions under the influence of electric field. Transport number of ions. Determination of transport number by Hottorf's method and Moving boundary method. Kohlrausch's law of independent migration of ions. Determination of l¥ and degree of dissociation a of a weak electrolyte. Determination of dissociation constant of weak electrolyte. Numerical. **B) Electrochemistry-II** pH of a solution and pH scale. Determination of pH of solution using Hydrogen, Quinhydrone and Glass electrodes. Advantages and Disadvantages of these electrodes. pH metric titrations. Determination of pKa of a weak acid by pH metric titration. Potentiometric titration. Advantages of Potentiometric titrations. Study of following potentiometric titrations- (a) Acid-Base (b) Redox (c) Precipitation. Numerical.	
		Periods: 14
Unit VI	**Photochemistry:** Photochemical and thermal reactions. Lambert's law (Statement and derivation). Beer's law (Statement and derivation). Reasons for deviations from Beer's law. Laws of photochemistry- Grotthus-Draper law, Stark-Einstein law. Quantum yield of photochemical reaction. Reasons for high and low quantum yields. Experimental determination of quantum yield. Photosensitized reactions. Kinetics of photochemical decomposition of HI. Fluorescence and Phosphorescence. Selection rule for electronic transitions. Internal conversion and Intersystem crossing. Explanation of Fluorescence and Phosphorescence on the basis of Joblonski Diagram. Chemiluminescence and Bioluminescence (with examples). Numerical.	
		Periods: 14

*SEM: A) Extraction of metals, synthesis of soaps and detergents. B) Applications of nitrogen-based compounds and groups as starting materials for commercial compounds C) Numerical associated with electrochemistry and photochemistry.	
COs: By the end of this module, the students will be able to: 1. Create charts and posters for nitrogen-based compounds and groups 2. Use of carbonyl compounds for starting material for different commercially important molecules 3. Solve numerical problem associated with thermodynamics and colligative properties.	
**Activities:	Model creation, poster, chart preparation, memory maps, Class tests, assignments, project, survey, group discussion, industrial visit, or any other innovative pedagogical method. Any two activities be conducted from above. Class tests are compulsory. Equal weightage for each activity.

Course Material/Learning Resources

Text books:

1. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
2. A Text Book of Chemistry for first Semester of B.Sc. by AUCTA Association and DnyanPath Publication

Reference Books:

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.
2. Inorganic Chemistry by A.K. De, Wiley East Ltd.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan, S. Chand & Co.
4. Concise Inorganic Chemistry by J.D. Lee, ELBS.
5. Inorganic Chemistry by J.E. Huheey- and Kettle, Harper & Row.
6. Advanced Inorganic Chemistry, Vol-I, Satya Prakash, Madan, Tuli, Basu.
7. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.
8. Organic Chemistry by S.K. Ghosh.
9. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
10. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
11. Organic Chemistry by TWG Solomons, 8th edition, John Wiley
12. Organic chemistry by R. K. Bansal
13. Physical Chemistry: Walter, J. Moore, 5th edn., New Delhi.
14. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.
15. Principles of Physical Chemistry: Maron and Prutton.
16. Principles of Physical Chemistry: Puri, Sharma, and Pathania.
17. Physical Chemistry: P.W. Atkins, 6th Edn.
18. Physical Chemistry: Levine
19. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
20. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
21. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
22. Practical Physical Chemistry: Palit and De.
23. Practical Physical Chemistry: Yadao.
24. Practical Physical Chemistry: Khosla.
25. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Pulishing House, Meerut.

Weblink to Equivalent MOOC on SWAYAM if relevant:

Weblink to Equivalent Virtual Lab if relevant:

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

Sant Gadge Baba Amravati University, Amravati

Syllabus Prescribed for three Year UG/PG Programme

Programme: B.Sc. with Chemistry

Semester 4

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
CHE(4S)PR	Chemistry 4S	Total 26 per Semester

COs: At the end of Lab/Practical course, students will be able to -

1. prepare soap from available oil or fat and determine its different parameters.
2. extract different constituents of milk.
3. prepare glucose from cane sugar
4. use advanced instruments like pH-meter, potentiometer, conductometer, etc.
5. determine electrode potential of a metal.
6. determine pH of given soil sample.

* List of Practical/Laboratory Experiments/Activities etc.

	Exercise-1 organic
1	To prepare glucose from cane sugar.
2	To determine the iodine value of the given Oil or Fat.
3	Determination of equivalent weight of an organic acid.
4	Determination of equivalent weight of an ester by saponification.
5	Preparation of soap from oil or fat.
6	Determination of properties of soaps (at least two samples) with respect to pH, Foam, interaction with oil, and hard water test.
7	Isolation of casein from milk.
8	Isolation of lactose from milk.
	Exercise II: Physical Chemistry Experiments
9	Determination of standard electrode potential of Cu/Cu^{+2} or Zn/Zn^{+2} electrodes potentiometrically.
10	To determine dissociation constant of weak acid by conductometry.
11	To determine dissociation constant of weak acid by potentiometry.
12	To determine dissociation constant of dibasic acid by pH-metry.
13	To determine solubility and solubility product of sparingly soluble salts conductometrically.
14	To study strong acid and strong base titration by pH-metry.
15	To determine pH of a soil sample by pH-meter.
16	To verify Beer's Lambart's law using $KMnO_4/K_2Cr_2O_7$.
17	To determine solubility of benzoic acid at different temperature and heat of solution.

Note:

Distribution of Marks for Practical Examination

Time : 04 hours (One Day Examination)

Total Practical Marks 50, Duration of Exam 04 Hours	
Internal Practical Exam (25 Marks)	**External Practical Exam* (25 Marks)**

Attendance, Students' Performance, Activity, Practical Record Book / Laboratory Manual/Journal Report : 20	Experiment 1 Performance / Demonstration : 10
	Experiment 2 Performance / Demonstration : 10
Internal Viva/Assignment/Quiz/Test : 05	External Viva (by External and Internal Examiner: 05
Total : **25**	**Total :** **25**

*Note: One practical from respective exercise