Faculty of Science

Syllabus

For

B. SC.

(I SEMESTER COURSE)

W.E.F. - Session 2025 - 2026

RADHA GOVIND UNIVERSITY
CHANDAUSI,SAMBHAL (U.P.)

B.Sc. 1st Semester

S. No.	Subject	Subject Code	Paper Title	Paper Code
1.	Hindi*	HI	Hindi Language	UHINDCP101
2.	Physics	PH	Mechanics and General Properties of Matter	UMECHPH101
			Physics Lab I	UPHYSPH102
3.	Chemistry	CH	Fundamental of Chemistry	UFUNDCH101
			Chemistry Lab I	UCHEMCH102
4.	Mathematics	MA	Algebra, Vector Analysis and Geometry	UALGEMA101
5.	Computer Science	CS	Computer System Architecture	UCOMPCS101
			Computer Lab I	UCOMPCS102
6.	Botany	BO	Applied Botany	UAPPLBO101
			Botany Lab I	UBOTABO102
7.	Zoology	ZO	Animal Diversity: Non-Chordata	UANIMZO101
			Zoology Lab I	UZOOLZO102
8.	Biochemistry	BC	Biochemical Techniques	UBIOCBC101
			Biochemistry Lab I	UBIOCBC102
9.	Microbiology	MB	General Microbiology & cell structure	UGENEMB101
			Microbiology Lab I	UMICRMB102
10.	Biotechnology	BT	Cell biology and Biochemistry	UCELLBT101
			Biotechnology Lab I	UBIOTBT102
11.	Food Technology	FT	Processing of fruits and vegetables	UPROCFT101
			Food technology Lab I	UFOODFT102

	B.Sc. 1st Semester Course Structure – Faculty of Science												
	Compulsory courses for B.Sc. 1st semester students (Level 5)												
S. No.	**Course**	**Subjects/Paper type/Total Credits**	**Paper Title**	**Paper Code**	**Credits**	**: Lecture T: Tutorial P: Practical**			**Distribution of Theory Marks**		**Distribution of Practical Marks**		**Total Marks (CCE+UE)**
						L	**T**	**P**	**CCE**	**UE**	**CCE**	**UE**	
1.	**PHYSICS**	HINDI/AECC/4	Hindi Language	UHINDCP101	4	4	0	0	40	60	0	0	100
2.		PHYSICS/ Major/6	Mechanics and General Properties of Matter	UMECHPH101	4	4	0	0	40	60	0	0	100
3.			Physics Lab I	UPHYSPH102	2	0	0	4	0	0	40	60	100
4.		MATHEMATICS/Minor /6	Algebra, Vector Analysis and Geometry	UALGEMA101	6	6	0	0	40	60	0	0	100
5.		CHEMISTRY/GE/4	Fundamental of Chemistry	UFUNDCH101	3	3	0	0	40	60	0	0	100
6.			Chemistry Lab I	UCHEMCH102	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**200**	**600**

1.	**MATHEMATICS**	HINDI/AECC/4	Hindi Language	UHINDCP101	4	4	0	0	40	60	0	0	100
2.		MATHEMATICS/ Major/6	Algebra, Vector Analysis and Geometry	UALGEMA101	6	6	0	0	40	60	0	0	100
3.		PHYSICS/Minor/6	Mechanics and General Properties of Matter	UMECHPH101	4	4	0	0	40	60	0	0	100
4.			Physics Lab I	UPHYSPH102	2	0	0	4	0	0	40	60	100
5.		CHEMISTRY/GE/4	Fundamental of Chemistry	UFUNDCH101	3	3	0	0	40	60	0	0	100
6.			Chemistry Lab I	UCHEMCH102	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**200**	**600**
1.	**COMPUTER SCIENCE**	HINDI/AECC/4	Hindi Language	UHINDCP101	4	4	0	0	40	60	0	0	100
2.		COMPUTER SCIENCE / Major/6	Computer System Architecture	UCOMPCS101	4	4	0	0	40	60	0	0	100
3.			Computer Lab I	UCOMPCS102	2	0	0	4	0	0	40	60	100
4.		PHYSICS/Minor/6	Mechanics and General Properties of Matter	UMECHPH101	4	4	0	0	40	60	0	0	100
5.			Physics Lab I	UPHYSPH102	2	0	0	4	0	0	40	60	100
6.		MATHEMATICS /GE/4	Algebra, Vector Analysis and Geometry	UALGEMA101	4	4	0	0	40	60	0	0	100
	Total				**20**				**160**	**240**		**200**	**600**

1.	**BOTANY**	HINDI/AECC/4	Hindi Language	UHINDCP101	4	4	0	0	40	60	0	0	100
2.		BOTANY / Major/6	Applied Botany	UAPPLBO101	4	4	0	0	40	60	0	0	100
3.			Botany Lab I	UBOTABO102	2	0	0	4	0	0	40	60	100
4.		ZOOLOGY /Minor/6	Animal Diversity: Non-Chordata	UANIMZO101	4	4	0	0	40	60	0	0	100
5.			Zoology Lab I	UZOOLZO102	2	0	0	4	0	0	40	60	100
6.		CHEMISTRY/GE/4	Fundamental of Chemistry	UFUNDCH101	3	3	0	0	40	60	0	0	100
7.			Chemistry Lab I	UCHEMCH102	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**
1.	**ZOOLOGY**	HINDI/AECC/4	Hindi Language	UHINDCP101	4	4	0	0	40	60	0	0	100
2.		ZOOLOGY / Major/6	Animal Diversity: Non-Chordata	UANIMZO101	4	4	0	0	40	60	0	0	100
3.			Zoology Lab I	UZOOLZO102	2	0	0	4	0	0	40	60	100
4.		BOTANY /Minor/6	Applied Botany	UAPPLBO101	4	4	0	0	40	60	0	0	100
5.			Botany Lab I	UBOTABO102	2	0	0	4	0	0	40	60	100
6.		CHEMISTRY/GE/4	Fundamental of Chemistry	UFUNDCH101	3	3	0	0	40	60	0	0	100
7.			Chemistry Lab I	UCHEMCH102	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**

1.	**CHEMISTRY**	HINDI/AECC/4	Hindi Language	UHINDCP101	4	4	0	0	40	60	0	0	100
2.		CHEMISTRY / Major/6	Fundamental of Chemistry	UFUNDCH101	4	4	0	0	40	60	0	0	100
3.			Chemistry Lab I	UCHEMCH102	2	0	0	4	0	0	40	60	100
4.		BOTANY /Minor/6	Applied Botany	UAPPLBO101	4	4	0	0	40	60	0	0	100
5.			Botany Lab I	UBOTABO102	2	0	0	4	0	0	40	60	100
6.		ZOOLOGY /GE/4	Animal Diversity: Non-Chordata	UANIMZO101	3	3	0	0	40	60	0	0	100
7.			Zoology Lab I	UZOOLZO102	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**
1.	**BIOTECHNOLOGY**	HINDI/AECC/4	Hindi Language	UHINDCP101	4	4	0	0	40	60	0	0	100
2.		BIOTECHNOLOGY / Major/6	Cell biology and Biochemistry	UCELLBT101	4	4	0	0	40	60	0	0	100
3.			Biotechnology Lab I	UBIOTBT102	2	0	0	4	0	0	40	60	100
4.		BIOCHEMISTRY /Minor/6	Biochemical Techniques	UBIOCBC101	4	4	0	0	40	60	0	0	100
5.			Bio Chemistry Lab I	UBIOCBC102	2	0	0	4	0	0	40	60	100
6.		FOOD TECHNOLOGY /GE/4	Processing of fruits and vegetables	UPROCFT101	3	3	0	0	40	60	0	0	100
7.			Food technology Lab I	UFOODFT102	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**

1.	**MICROBIOLOGY**	HINDI/AECC/4	Hindi Language	UHINDCP101	4	4	0	0	40	60	0	0	100
2.		MICROBIOLOGY / Major/6	General Microbiology & cell structure	UGENEMB101	4	4	0	0	40	60	0	0	100
3.			Microbiology Lab I	UMICRMB102	2	0	0	4	0	0	40	60	100
4.		BIOTECHNOLOGY /Minor/6	Cell biology and Biochemistry	UCELLBT101	4	4	0	0	40	60	0	0	100
5.			Biotechnology Lab I	UBIOTBT102	2	0	0	4	0	0	40	60	100
6.		FOOD TECHNOLOGY /GE/4	Processing of fruits and vegetables	UPROCFT101	3	3	0	0	40	60	0	0	100
7.			Food technology Lab I	UFOODFT102	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**
1.	**BIOCHEMISTRY**	HINDI/AECC/4	Hindi Language	UHINDCP101	4	4	0	0	40	60	0	0	100
2.		BIOCHEMISTRY / Major/6	Biochemical Techniques	UBIOCBC101	4	4	0	0	40	60	0	0	100
3.			Bio Chemistry Lab I	UBIOCBC102	2	0	0	4	0	0	40	60	100
4.		BIOTECHNOLOGY /Minor/6	Cell biology and Biochemistry	UCELLBT101	4	4	0	0	40	60	0	0	100
5.			Biotechnology Lab I	UBIOTBT102	2	0	0	4	0	0	40	60	100
6.		FOOD TECHNOLOGY /GE/4	Processing of fruits and vegetables	UPROCFT101	3	3	0	0	40	60	0	0	100
7.			Food technology Lab I	UFOODFT102	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**

1.	**FOOD TECHNOLOGY**	HINDI/AECC/4	Hindi Language	UHINDCP101	4	4	0	0	40	60	0	0	100
2.		FOOD TECHNOLOGY / Major/6	Processing of fruits and vegetables	UPROCFT101	4	4	0	0	40	60	0	0	100
3.			Food technology Lab I	UFOODFT102	2	0	0	4	0	0	40	60	100
4.		BIOTECHNOLOGY /Minor/6	Cell biology and Biochemistry	UCELLBT101	4	4	0	0	40	60	0	0	100
5.			Biotechnology Lab I	UBIOTBT102	2	0	0	4	0	0	40	60	100
6.		MICROBIOLOGY /GE/4	General Microbiology & cell structure	UGENEMB101	3	3	0	0	40	60	0	0	100
7.			Microbiology Lab I	UMICRMB102	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**

1. Lab Name should be clearly indicated as Chemistry Lab I and Chemistry Lab II etc.

2. *It was also decided that student should be counseled by teacher to consider Sanskrit as another option in place of Hindi. If students opt for Sanskrit than Sanskrit may be allotted in place of Hindi.

B.Sc. 1st Semester

Syllabus

Ability Enhancement Course (AEC)

Type– 1: Ability Enhancement Compulsory Course (AECC) or Foundation Course

Subject: Hindi (Foundation Course)

Subject: Physics

Course Title: Mechanics and General Properties of Matter

Part A - Introduction

Course Code: UMECHPH101
Credit value: 4
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course, a student must have had the subject Physics Lab In 12th class

Course Learning Outcomes (CLO):

1. The course would empower the students to develop the idea about the behavior of physical bodies.
2. It will provide the basic concepts related to the motion of all the objects around us in daily life.
3. The students would be able to build foundation to various applied field in science and technology especially in the field of mechanical engineering.
4. The studies will acquire the knowledge of basic mathematical methods to solve the various problems in physics.
5. The students will be able to understand the relativistic effect and the relation between energy and mass.

Unit I: Historical background and Mathematical Physics (No. of Lectures: 12):

1. Historical background:
   1.1. A brief historical background of mathematics and mechanics in the context of India and Indian culture.

1.2. A brief biography of Varahmihira and Vikram Sarabhai with their major contribution to science and society.

2. Mathematical Physics:
   2.1. Scalar and vector fields, gradient of a scalar field and its physical significance.
   2.2. Vector integral: Line integral, surface integral, & volume integral, divergence of a vector field & its significance, Gauss divergence theorem.
   2.3. Curl of a vector field and its physical significance, Stokes and Gauss theorem, numerical problems based on the above topics.

Keywords/Tags: Scalar field, Vector field, Vector integral, Gradient, Divergence, Curl.

Unit II: Mechanics of Rigid and Deformable Bodies (No. of Lectures: 12):

1. Rigid body mechanics: System of particles and concept of rigid body, torque, center of mass (position of the center of mass, motion of the center of mass), conservation of linear & angular momentum with examples, single stage and multistage rocket.
2. Mechanic of deformable bodies:
   2.1. Hook's law, Young modulus, bulk modulus, modulus of rigidity, & Poisson ratio, relationship between various elastic moduli.
   2.2. Possible values of Poisson's ratio, finding Poisson's ratio of rubber in the laboratory, torsion of a cylinder, strain energy of twisted cylinder.
   2.3. Finding the modulus of rigidity of the material of a wire by Barton's method, torsional pendulum and Maxwell's needle, Searl's method to find Y, η, &σ of the material of a wire, bending of beam, beam supported at its ends and loaded in the middle.

Keywords/Tags: Rigid body, Center of mass, Moment of inertia, Poisson's ratio.

Unit III: Fluid mechanics (No. of Lectures: 12):

1. Surface tension:
   1.1. Inter-molecular forces and potential energy curve, force of cohesion & adhesion.
   1.2. Surface tension, explanation of surface tension on the basis of intermolecular forces, surface energy, effect of temperature and impurities on surface tension, daily life application of surface tension.
   1.3. Angle of contact, the pressure difference between the two sides of curved liquid surface, excess pressure inside a soap bubble, capillarity, determination of surface tension of liquid – capillary rise method, Jaeger's method.

2. Viscosity:
   2.1. Ideal and viscous fluid, streamline and turbulent flow, equation of continuity, rotational and irrotational flow, energy of a flowing fluid, Euler's equation of motion of a non-viscous fluid and its physical significance.
   2.2. Bernoulli's theorem and its applications (velocity of efflux, shapes of wings of airplanes, Magnus effect, filter pump, Bunsen's burner).
   2.3. Viscous flow of a fluid, flow of liquid through a capillary tube, derivation of Poiseuille's formula and limitations, Stokes formula, motion of a spherical body falling in a viscous fluid, air resistance/drag, motion of parachute through air.

Unit IV: Gravitational potential and central forces (No. of Lectures: 12):

1. **Gravitational potential:**
   - 1.1. Conservative & non-conservative force field, conservation of energy in motion under the conservative and non-conservative forces, potential energy.
   - 1.2. Conservative force, conservation of energy, gravitational potential and intensity of gravitational field due to a uniform spherical shell and a uniform solid sphere.
   - 1.3. Gravitational self-energy, gravitational self-energy of a uniform spherical shell and a uniform solid sphere.
2. **Central forces:**
   - 2.1. Motion under central forces, conservative characteristics of central forces.
   - 2.2. The motion of a two particle system in central force, concept of reduced mass, reduced mass of positronium and hydrogen.
   - 2.3. Motion of particles in an inverse-square central force, motion of celestial bodies and derivation of Kepler's laws.
   - 2.4. Elastic & inelastic scattering (elementary idea).

Keywords/Tags: Conservative force field, Gravitational potential, Gravitational self-energy, Central force, Reduced mass, Scattering.

Unit V: Relativistic Mechanics and Astrophysics (No. of Lectures: 12):

1. **Relativistic Mechanics:**
   - 1.1. Frame of references, Galilean transformation, Michelson-Morley experiment.
   - 1.2. Postulates of special theory of relativity, Lorentz transformation, simultaneity and order of events, length contraction, time dilation, relativistic transformation of velocities, variation of mass with velocity.
   - 1.3. Mass-energy equivalence and its experimental verification.
2. **Astrophysics:**
   - 2.1. Introduction to the Universe, properties of the Sun, concept of astronomical distance.
   - 2.2. Life cycle of a star, Chandrasekhar limit, H-R diagram, red giant star, white dwarf star, neutron star, black hole.
   - 2.3. Big bang theory (elementary idea).

Keywords/Tags: Transformation, Mass-energy equivalence, Astronomical distance, Chandrasekhar limit, Black hole.

Part C- Learning Resources

Text Books:

1. M.R. Spiegel, Vector Analysis: Schaum Outline Series, McGraw Hill Education, 2017.
2. D.S. Mathur Mechanics, S. Chand, 2012.
3. A.K.Ghatak, I.C. Goyal, and S.J. Chua, Mathematical Physics, Laxmi Publication Private Limited, 2017.
4. D.S. Mathur D.S., Properties of Matter, Shyamlal Charitable Trust, New Delhi.
5. Sears and Zeemansky, University Physics, Pearson Education.

Part D – Assessment and Evaluation

A. Internal Assessment/Continuous Comprehensive Evaluation (CCE): 40 marks [Class Interaction/Quiz – 15 marks; Attendance – 05 marks; Assignments (Charts/Model/Seminar/Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial visit) – 10 marks.]
B. External Assessment/University Exam (UE): 60 marks [Time: 03.00 hours; Viva-voce on Practical – 10 marks; Practical Record File – 10 marks; Table work/Experiments – 50 marks.]

Course Title: Physics Lab I

Part A - Introduction

Course Code: UPHYSPH102

Course Type: Major Core Course for Physics Major students/Minor Course for Mathematics Major & Generic Elective for Chemistry Major students (practical).

Credit value: 2

Total Marks: 40 + 60 = 100; Min. Passing Marks: 35

Pre-requisite (if any): To study this course, a student must have had the subject Physics Lab In 12^{th} class.

Course Learning Outcomes (CLO):

1. The students would acquire basic practical knowledge related to mechanics through the experiments.
2. Students will be familiar with various measurement devices by which they can measure various physical quantities with accuracy..
3. The students will develop the concept related to the mechanics and properties of matter.

Part B – Content of the Course [Total number of practical (in hours): 60]

List of experiments

1. Determination of Young's modulus, modulus of rigidity and Poisson's ratio of material of a wire using Searl's method.
2. Determination of Young's modulus of material of a metallic bar by bending of beam method.
3. Determination of acceleration due to gravity (g) by free fall method.
4. Determination of acceleration due to gravity (g) using bar pendulum/Kater's double pendulum.
5. Determination of modulus of rigidity of a rod with the help of Barton's apparatus.
6. Determination of coefficient of viscosity of liquid using Poiseuille's method.
7. Determination of the moment of inertia of a flywheel about its axis of rotation.
8. Determination of moment of inertia of a given body (irregular body) with the help of inertia table.
9. Verification of laws of the parallel/perpendicular axes of moment of inertia.
10. Determination of moment of inertia of a given body (irregular body) with the help of Maxwell's needle.

11. Determination of Young's modulus of material of a rod using cantilever method.
12. Determination of modulus of rigidity of material of a wire with the help of torsional pendulum.
13. Determination of force constant of a spring
14. Determination of Poisson's ratio of a rubber.
15. Determination of surface tension of a liquid by Jaeger's method.
16. Determination of static & dynamic friction.
17. Determination of elastic and inelastic collisions, momentum, and Newton's laws of motion.

Part C- Learning Resources

Text books:

1. I. Prakash& Ramakrishna, A Text Book of Practical Physics, KitabMahal, 2011, 11/e.
1. G.L. Squires, Practical Physics, Cambridge University Press, 2015, 4/e.
2. B.L. Flint and H.T. Worsnop, Advanced Practical Physics for Students, Asia Publishing House.
3. D. Chattopadhyay& P.C. Rakshit, An Advanced Course in Practical Physics, New Central Book Agency.

Part D – Assessment and Evaluation

A. Internal Assessment: Continuous Comprehensive Evaluation (CCE): 40 marks [Class Interaction/Quiz – 15 marks.; Attendance – 05 marks; Assignments (Charts/Model/Seminar/Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial visit) – 10 marks.]

B. External Assessment: University Exam (UE): 60 marks [Time: 03.00 hours; Viva-voce on Practical – 10marks; Practical Record File – 10 marks; Table work/Experiments – 50 marks.]

Subject: Mathematics

Course Title: Algebra, Vector Analysis and Geometry

Part A - Introduction

Course Code: UALGEMA101
Course Title: Algebra, Vector Analysis and Geometry
Credit value: 6
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course, a student must have had the subject Mathematics in class 12^{th}.
Course Learning Outcomes (CLO): The course will enable the students to:

1. Recognize consistent and inconsistent systems of linear equations by the row echelon form of augmented matrix, using the rank of matrix.
2. To find the Eigen values and corresponding Eigen vectors for a square matrix.
3. Using the knowledge of vector calculus in geometry.
4. Enhance the knowledge of three dimensional geometrical figures (e.g., cone and cylinder).

Part B - Content of the Course
Total No. of Lectures (in hours per week): 3 hours per week; Total Lectures: 90 hours.

Unit I: (No. of Lectures: 15):

1. Historical background:
   1.1. Development of Indian Mathematics: Later classical period (500 – 1250).
   1.2. A brief biography of Varahmihira and Aryabhatta.
2. Rank of a matrix.
3. Echelon and normal form of a matrix.
4. Characteristic equations of a matrix
   4.1. Eigen-values
   4.2. Eigen-vectors.

Unit II: (No. of Lectures: 18):

1. Cayley Hamilton theorem.
2. Application of Cayley Hamilton theorem to find the inverse of a matrix.
3. Application of matrix to solve a system of linear equations.
4. Theorems on consistency and inconsistency of a system of linear equations.
5. Solving linear equations up to three unknowns.

Unit III: (No. of Lectures: 18):

1. Scalar and vector products of three and four vectors.
2. Reciprocal vectors.
3. Vector differentiation:
   3.1. Rules of differentiation.
   3.2. Derivative of triple products.

4. Gradient, divergence, and curl.
5. Directional derivatives.
6. Vector identities.
7. Vector equations.

Unit IV: (No. of Lectures: 15):

1. Vector integration.
2. Gauss theorem (without proof) and problems based on it.
3. Green theorem (without proof) and problems based on it.
4. Stoke theorem (without proof) and problems based on it.

Unit V: (No. of Lectures: 24):

1. General equation of second degree.
2. Tracing of conics.
3. System of conics.
4. Cone
   - 4.1. Equation of cone with given base.
   - 4.2. Generators of cone.
   - 4.3. Condition for three mutually perpendicular generators.
5. Cylinder
   - 5.1. Equation of cylinder and its properties.
   - 5.2. Right circular cylinder.
   - 5.3. Enveloping cylinder.

Keywords: Indian mathematics, Rank of a matrix, Scalar and vector products, Vector differentiation, Vector identities, Vector integration, General equation of second degree, Tracing of conics, System of conics, Equation of cone, Equation of cylinder.

Part C- Learning Resources

Text books:

1. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of india Pvt. Ltd. New Delhi 2000.
2. Shanti Narayan,A Text Book of Vector Calculus, S. Chand 7 Co., New Delhi, 1987.
3. S.L. Loney, The Elements of Coordinate Geometry part – 1, New Age International (P) Ltd. Publishers, New Delhi, 1999.
4. P.K. Jain and Khalil Ahmad, A text book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd., 1999.
5. Gerard, G. Emch, R. Sridharan, M.D. Srinivas, Contributions to the History of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005.

Reference books:

1. Chandrika Prasad,A Text Book on Algebra and Theory of Equations, Pothisala Pvt. Ltd., Allahabad, 2017.
2. N. Jocobson, Basic Algebra, Vol. I and Vol. II, W.H. Freeman, 2009.
3. I.S. Luther and I.B.S. Passi, Algebra Vol.I and II, Narosa Publishing House, 1997.

4. N. Saran and S.N. Nigam, Introduction to Vector Analysis, Pothishala Pvt. Ltd. Allahabad, 1990.
5. M.R. Spiegel, Vector Analysis, Schaum Publishing Company, 2017.
6. Gorakh Prasad and H.C. Gupta, Text Book on Coordinate Geometry, Pothishala Pvt. Ltd. Allahabad, 2000.
7. P.K. Jain and Khalil Ahmad, A text book of Analytical Geometry of Two Dimensions, Macmillan Indian Ltd., 1994.
8. N. Saran and D.N. Gupta, Three Dimensional Coordinate Geometry, Pothishala Pvt. Ltd. Allahabad, 1994.
9. R.J.T. Bell, Elementary Treatise on coordinate Geometry of Three Dimensions, Macmillan India Ltd., 194.
10. BibhutibhusanDatta and Avadesh Narayan Singh, History of Hindu Mathematics, Asia Publishing house, 1962.

Part D – Assessment and Evaluation

A. Internal Assessment/Continuous Comprehensive Evaluation (CCE): 40 marks [Class Test – 20 marks; Assignment/Presentation – 10 marks.]
B. External Assessment/University Exam (UE): 60 marks [Time: 03.00 hours; Question: As per Bloom's taxonomy.]

Subject: Chemistry

Course Title: Fundamentals of Chemistry

Part A - Introduction

Course Code: UFUNDCH101
Course Title: Fundamentals of Chemistry
Credit value: 4
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course, a student must have had the subject Chemistry Lab In class 12^{th}.
Course Learning Outcomes (CLO): By the end of this course students will learn the following aspects of Chemistry:

1. Ancient Indian chemical techniques.
2. Various theories and principles applied to reveal atomic structure.
3. Significance of quantum numbers.
4. Concept of periodic properties of elements.
5. Theories related to chemical bonding.
6. Acid-base concept, pH, buffer.
7. Factors responsible for reactivity of organic molecules.
8. Basics and mechanism of chemical kinetics.
9. Properties of electrolytes.

Part B – Content of the course

Unit I: (No. of lectures:06):

1. **Chemical techniques in ancient India:** General introduction.
2. Contribution of ancient Indian scientists in chemistry, e.g., metallurgy, dyes, pigments, cosmetics, ayurveda, CharakSanhita.
3. **Atomic structure:**
   - 3.1. Review of Bohr's theory and its limitations, atomic spectrum of hydrogen, dual nature of particles and waves, de Broglie's equation, Heisenberg's uncertainty principle and its significance.
   - 3.2. Quantum numbers and their significance, rules for filling electrons in various orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations, variation of orbital energy with atomic number.
   - 3.3. Electronic configurations of the atoms, stability of half-filled and completely filled orbitals, concept of exchange energy, relative energies of atomic orbitals, anomalous electronic configurations.

Keywords/Tags: Metallurgy, Dyes, Cosmetics, CharakSamhita, Hydrogen spectrum, Hund's rule, Aufbau principle.

Unit II: (No. of lectures: 06):

1. Elementary idea of the following properties of the elements with reference to s and p-block elements in periodic table
    1.1. Effective nuclear number (EAN), shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.
    1.2. Atomic radii (van der Waals).
    1.3. Ionic and crystal radii.
    1.4. Covalent radii (octahedral and tetrahedral).
2. Detailed discussion of the following properties of the elements with reference to s and p-block elements in periodic table
    2.1. Ionization energy – successive ionization energy and factors affecting ionization energy, applications of ionization energy.
    2.2. Electronegativity – Pauling's/Mulliken's electronegativity scales, variation of electronegativity with bond order, partial charge, hybridization.

Keywords/Tags: EAN, Atomic radii, Ionic radii, Crystal radii, ionization energy.

Unit III: (No. of lectures: 20):

1. Chemical bonding:

1. Ionic bonding - general characteristics of ionic bonding.
2. Ionic bonding and energy – lattice & salvation energies and their importance in the context of stability and solubility of ionic compounds.
3. Statement of Born-Landé equation for calculation of lattice energy, Madelung constant, Born-haber cycle and its applications, covalent character in ionic compounds, polarizing power and polarizability, Fajan's rule.
4. Covalent bonding: Lewis structure, valence band theory (Heitler-London approach).
5. Hybridization: Concept, types (sp, sp^2, sp^3, dsp^2, d^2sp^3) with suitable examples of inorganic and organic molecules.
6. Ionic character in covalent compounds – dipole moment and percentage ionic character.
7. Valence shell electron pair repulsion theory (VSEPR) – assumptions, need of theory, application of theory to explain geometries or shapes of some inorganic molecules and ions on the basis of VSPER and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonalbipyramidal and octahedral arrangements such as NH_3, H_2O, SF_4, PCl_5, SF_6, ClF_5, XeF_4.

2. Molecular Orbital (MO) concept of bonding:

1. The approximation of the theory, linear combination of atomic orbitals (LCAO) (elementary pictorial approach).
2. Rules for the LCAO method, bonding and antibonding MOs, characteristics for s-s, s-p, and p-p combinations of atomic orbitals, nonbonding of orbitals.
3. MO diagrams of homonuclear diatomic molecules: H_2, Li_2, Be_2, C_2, N_2, O_2, F_2, and their ions.
4. Molecular orbitals of heterogeneous diatomic molecules: CO, NO, CN, HF.
5. Bond parameters: Definition and factors affecting – bond orders, bond lengths, bond angles.

Keywords/Tags: ionic bonding, Covalent bonding, Hybridization, VSEPR theory, LCAO, MO diagrams, bond parameters.

Unit IV: Acid base concept (No. of lectures: 4):

1. Arrhenius concept, Bronsted-Lowry's concept, conjugate acids and bases, relative strength of acids, Lewis concept, pH, buffer solutions, acid-base neutralization curves, Handerson equation.
2. Strength of organic acids and bases: Comparative study with emphasis on factor pH values.
3. Indicator, choice of indicator.

Keywords/Tags: Acid-base concept, Bronsted-Lowry concept, Conjugate acids and bases, pH, Buffer solution, indicator.

Unit V: (No. of lectures:12):

1. **Fundamentals of organic chemistry:** Structure, shape and reactivity of organic molecules, physical effects, electronic displacement, inductive effect, electrometric effect, resonance and hyperconjugation, cleavage of bonds – homolysis and heterolysis, reactive intermediates – carbocations, carboanions and free radicals, nucleophiles and electrophiles.

2. **Stereochemistry of organic compounds:**
   1. Geometrical isomerism – Determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.
   2. Optical isomerism – Elements of symmetry, molecular chirality, enantiomers & their properties, stereogeniccenter, optical activity of enantiomers, concept of chirality (up to two carbon atoms) – chiral and achiral molecules with two stereogeniccenters, diastereomers, threo and erythroisomers, mesoisomer, resolution of enantiomers, invesion, retention and racemization, relative and absolute configuration, sequence rules, D & L and R & S system of nomenclature.
   3. Conformations and Conformational Analysis: Conformationa of ethane, butane, and cyclohexane, interconversion of Wedge formula, Newman, Sawhorsw and Fischer representations.

Keywords/Tags: Electronic displacements, Nucleophiles, Electrophiles, Isomerism, Molecular Chirality, Enantiomers, Sequence rules, Conformation.

Unit VI (No. of lectures: 12):

1. **Chemical kinetics:** Rate of reaction, definition and difference of order and molecularity, derivation of rate constants for first, second, third, and zero order reactions and examples, derivation for half-life period, methods to determine the order of reactions, effect of temperature on rate reaction, Arrhenius equation, concept of activation energy.

2. **Ionic equlibria:** Strong, moderate, and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water, common effect, salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for

different salts, solubility and solubility product of sparingly soluble salts – applications of solubility product.

Keywords/Tags: Order of reaction, molecularity of reaction, Arrhenius equation, Activation energy, Electrolytes, Salt hydrolysis, Solubility product.

Part C- Learning Resources

Text books:

1. J.D. Lee, Concise Inorganic Chemistry, ELBS, 1991.
2. H.C. Khera, J.N. Gurtu, J. Singh, Chemistry of B.Sc. 1st Year, PragatiPrakashan.
3. A. Bariya& S. Goyal, B.Sc. Chemistry Combined (in Hindi), Krishna Educational Publishers, 2019.
4. B.R. Puri, M.S. Pathania, L.R. Sharma, Principles of Physical Chemistry, Vishal Publishing Co., 2020.
5. J.N. Gurtu and A. Gurtu, Advanced Physical Chemistry, PragatiPrakashan, Meerut, ISBN: 9789386633347, Edition IV, 2017.
6. M.C. day and J. Selbian, Theoretical Inorganic Chemistry, ACS Publications, 1962.
7. A. Bahl& B.S. Bahl, Advanced Organic Chemistry, S. Chand, 2010.
8. P.S. Kalsi, Stereochemistry Conformation and Mechanism, New Age International 2005.
9. I.L. Finar, Organic Chemistry (Vol. I & II), ELBS.
10. R.T. Morrison and R.N. Boyd, Organic Chemistry, Pearson, 2010.
11. J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, Oxford University Press, 2nd edition, 2012.
12. Atkin's Physical Chemistry, 10thedtion, Oxford University Press, 2014.

Reference books:

1. S. Prakash, Founders of Sciences in Ancient India, published by the Research Institute of Ancient ScientificStudies, New Delhi.
2. AcharyaPrafulla Chandra Ray – A Collection of Writing, Vol. IIIA: A History of Hindu Chemistry (Vol. 1), Editor- Prof. Anil Bhattacharyya.Publisher: University of Calcutta.
3. Chemistry Lab In India, in Tradition and Practices of India, Textbook for Class XI, module 2, Central Board of Secondary Education.
4. J.E.Huheey, E.A. Keiter, R.L. Keiter, & O.K. Medhi, Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
5. B.E. Douglas, D.H. McDaniel, & J.J. Alexander, Concepts and Models in Inorganic Chemistry, John Wiley & Sons, 1994.
6. T.W. Graham Solomom, C.B. Fryhle, & S.A. Dnyder, Organic Chemistry, John Wiley & Sons, 12th Edition, 2016.
7. J.E. McMurry, Fundamentals of Organic Chemistry, Cengage Learning India Edition, 2013.

Part D – Assessment and Evaluation

A. Internal Assessment/Continuous Comprehensive Evaluation (CCE): 40 marks) [Class Test – 20 marks; Assignment/Presentation – 10 marks.]
B. External Assessment/University Exam (UE): 60 marks) [Time: 03.00 hours; Question: As per Bloom's taxonomy.]

Course Title: Chemistry Lab I

Part-A: Introduction

Course Code: UCHEMCH102
Course Title: Chemistry Lab I
Credit value: 2
Total Marks: 40 + 60 = 100;Min. Passing Marks: 35
Pre-requisite (if any): To study this course, a student must have had the subject Chemistry Lab In class 12^{th}.
Course Learning Outcomes (CLO): By the end of this course students will learn the following aspects of Laboratory exercises in Chemistry:

1. Importance of chemical safety and lab safety while performing experiments in laboratory.
2. Qualitative inorganic analysis.
3. Elemental analysis of organic compounds (non-instrumental).
4. Qualitative identification of functional group of organic compounds.
5. Techniques of pH measurements.
6. Preparation of buffer solutions.

Part-B: Content of the course

Unit I: Qualitative inorganic analysis: Identification of simple inorganic mixture (5 radicals) with two/three acidic and two/three basic radicals (including typical combinations), special emphasis on learning theoretical concepts of strong, moderate, and weak electrolysis, ionic product, common ion effect, solubility and solubility product.

Unit II: Qualitative organic analysis:

1. Detection of hetero-elements (N,S, Cl, Br, I) in organic compounds.
2. Functional group tests for alcohol, aldehyde, carboxylic acid, carbohydrate, phenols, nitro, amine, and amide.

Quantitative analysis of acid, alkali, and buffer solutions
Ionic Equilibria

1. Measurement of pH of different solutions of acids and alkalies using pH-meter (may use aerated drinks, fruit juices, shampoos, and soaps).

Note – use dilute solutions of soaps and shampoos to prevent damage to the glass electrode.

2. Measurement of the pH of buffer solutions and comparison of the values with theoretical values.
3. Preparation of buffer solutions and determination of their pH and buffer capacity:
    a) Sodium acetate-acetic acid
    b) Ammonium chloride-ammonium hydroxide.

Part C- Learning Resources

Text Books:

1. A.K. Goswami, A. Mehta, O.R.S KhannaRehana, UGC Practical Chemistry, Vol. 1, PragatiPrakashan, 2015.
2. S. Goyal, B.Sc. Chemistry Practical, Krishna Publications, 2017.
3. J.Mendham, Vogel's Quantitative Inorganic Analysis, Pearson Education, 2012.

References:

1. B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, Practical Organic Chemistry, Pearson, 2012.
2. Prof. Robert H. Hill Jr., David C. Finster, laboratory Safety for Chemistry Students, Wiley, 2016.

Part D – Assessment and Evaluation

A. Internal Assessment: 40 marks

I. Class interaction:Chemical and lab Safety (15 marks)
    1. Toxicity of the compounds used in chemistry laboratory.
    2. Safety symbols on labels of pack of chemicals and its meaning.
    3. What is MSDS sheet? Find out MSDS sheets of some hazardous chemicals ($K_2Cr_2O_7$, benzene, cadmium nitrate, sodium metals, etc.)
    4. Precautions in handling and storage of hazardous substances like concentrated acids, ammonia, organic solvents, etc.

NOTE: Description to be written in practical record.

II. Attendance: 5 marks.

III. Assignments (Charts/Model seminar/rural service/technology dissemination/report of excursion/lab visits/survey/industrial visit): 10 marks

B. External Assessment: 60 marks[Time: 3 hours; Viva voce on practical: 10 marks; Practical Record File: 10 marks; Table work/Experiments: 50 marks.]

Subject: Computer Science

Course Title: Computer System Architecture

Part A - Introduction

Course Code: UCOMPCS101
Course Title: Computer System Architecture
Credit value: 4
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course a student must have had the subject Biology in the 12^{th} class.

Part B – Content of the Course

Unit - I
Fundamentals of Digital Electronics: Data Types, Complements, Fixed-Point Representation, Floating- Point Representation, Binary and other Codes, Error Detection Codes.
Logic Gates, Boolean Algebra, Map Simplification. Combinational Circuits, Sequential Circuits, simple combinational circuit design problems.
Circuits- Adder- Subtractor, Multiplexer, Demultiplexer. Decoders, Encoders Flip-Flops, Registers, Counters.

Unit - II
Basic Computer Organization: Instruction codes, Computer Registers, Computer Lab Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction. Input-Output & Interrupts, Complete Computer Description & Design of Basic Computer.

Unit - III
Instructions - Instruction formats, Addressing modes, Instruction codes, Machine language, Assembly language. **Register Transfer and Micro operations -** Register Transfer language, Register Transfer, Bus & Memory Transfer, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations.

Unit - IV
Processor and Control Unit - Hardwired vs. Micro programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, Introductory Format, Data Transfer & Manipulation, Program Control, Introductory concept of RISC, CISC, advantages and disadvantages of both.
Pipelining - concept of pipelining, introduction to pipelined data path and control - Handling Data hazards & Control hazards.

Unit - V
Memory and I/O System - Peripheral Devices, I/O Interface.,
Data Transfer Schemes- Program control, Interrupt, DMA Transfer. I/O Processor.
Memory Hierarchy, Processor vs. Memory Speed, High-Speed Memories, Main memory, Auxiliary memory, Cache Memory, Associative Memory, Interleaving, Virtual Memory, Memory Management.

Unit - VI

Parallelism - meaning, types of parallelism, introduction to Instruction- level-parallelism, Parallel processing challenges, Applications.

Flynn's classification - Introduction to SISD, SIMD, MISD, MIMD

Hardware multithreading - Introduction, types, advantages and applications.

Multicore processors - Introduction, advantages, difference from Multiprocessor.

Unit - VII

Indian contribution to the field - Contributions of reputed scientists of Indian origin - like - Dr. Vinod Dham - Father of Intel Pentium Processor, Dr. Ajay Bhat - Co-Inventor of USB Technology, Dr. Vinod Khosla- co-founder of Sun Microsystems, Dr. Vijay P Bhatkar - architect of India's national initiative in supercomputing, and many others.

Parallel Computing projects of India - PARAM, ANUPAM, FLOSOLVER, CHIPPS etc. Other relevant contributors and contributions.

Course Title: Computer Lab I

Part-A: Introduction

Course Code: UCOMPCS102

Course Title: Computer Lab I

Credit value: 2

Total Marks: 40 + 60 = 100;Min. Passing Marks: 35

Pre-requisite (if any): To study this course, a student must have had the subject Chemistry Lab In class 12^{th}.

Part-B: Content of the course

Suggestive list of Practicals

1. To study basic gates (AND, OR. NOT) and verify their truth tables.
2. To convert a given binary number to Gray code using IC 7486.
3. To study and verify NAND as Universal gate using IC 7400.
4. To study half adder using basic gates and verify its truth table.
5. To study Full Adder using basic gates and verify its truth table.
6. To realize basic gates (AND, OR, NOT) from Universal gates (NAND and NOR).
7. To verify truth table of 4-bit adder using IC 7483.
8. To design and construct RS flip Flop using gates and verify the truth
9. To design and construct JK flip Flop using gates and verify the truth
10. To verify DeMorgan's Theorem.

Subject: Zoology

Course Title: Animal Diversity: Non-Chordata

Part A - Introduction

Course Code: UANIMZO101
Course Title: Animal Diversity: Non-Chordata
Credit value: 4
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course a student must have had the subject Biology in the 12^{th} class.
Course Learning Outcomes (CLO): Upon completion of the course students should be able to

1. Learn about the importance of systemic, taxonomy and phylogeny to get a concrete idea of evolution of non-chordata phyla.
2. Understand the various morphological, anatomical structures and functions of animal of different phyla.
3. Get the knowledge about economic, ecological and medical significance of various animal in human welfare.
4. Understand the important parasites and their control measures.

Part B – Content of the Course

Unit I: Taxonomy, Phylogeny and Protozoa (No. of lectures: 11):

1. **Taxonomy:**
   1.1. Elementary knowledge of Zoological Nomenclature and International Code.
   1.2. Classification of Animal Kingdom upto Phylum of acoelomate and coelomate non-chordates according to Parker and Haswell 7^{th} edition.
2. **Phylogeny:** Definitions and examples.
3. **Protozoa:**
   3.1. Phylum Protozoa: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples.
   3.2. Structure, life history and pathogenicity of malarial parasite (*Plasmodium vivax*).
   3.3. Protozoa and disease.

Keywords/Tags: ICZN, Classification, Protozoa, *Plasmodium*.

Unit II: Porifera, Coelenterata(No. of lectures: 11):

1. **Porifera**
   1.1. Phylum Porifera: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples.
   1.2. Type study of *Sycon*.

1.3. Canal system of Sponges.

2. **Coelenterata**
   2.1. Phylum Coelenterata: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples.
   2.2. ype study of *Obelia*.
   2.3. Coral and Coral reef formation.

Keywords/Tags: Classification, Porifera, *Sycon*, Coelentearata, *Obelia*, Coral reefs.

Unit III: Platyhelminthes, Nemathelminthes, Annelida(No. of lectures: 14):

1. Platyhelminthes
   1.1. Phylum Platyhelminthes: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples.
   1.2. External morphology and life history of Liver fluke.

2. Nemathelminthes
   2.1. Phylum Nemathelminthes: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples.
   2.2. Pathogenic symptoms of Nematodes and diseases.

3. Annelida
   3.1. Phylum Annelida: General charaters of the phylum and outline classification up to classes with distinctive characters and suitable examples.
   3.2. Type study of Earthworm (*Pheretima*).
   3.3. Structure and significance of Trochophore larva.

Keywords/Tags: Classification, Platyhelminthes, Liver fluke, Nematode disease, Annelida, *Pheretima*, Trochophore.

Unit IV: Arthropoda, Mollusca (No. of lectures: 12):

1. **Arthropoda**
   1.1. Phylum Arthropoda: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples.
   1.2. Type study of Prawn.
   1.3. Larval forms of crustacean.
   1.4. Insects as a vector of human disease.

2. **Mollusca**
   2.1. Phylum Mollusca: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples.
   2.2. Type study of *Pila*.
   2.3. Structure and Significance of Glochidium larva.

Keywords/Tags: Classification, Arthropoda, Prawn, Crustacea larva, Insects, Mollusca, *Pila*,.

Unit V: Echinodermata,Hemichordata(No. of lectures: 12):

1. **Echinodermata**
   - 1.1. Phylum Echinodermata: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples.
   - 1.2. External features and water vascular system of Starfish (*Asterias*)
   - 1.3. Larval forms of Echinodermata.
2. **Hemichordata**
   - 2.1. Phylum Hemichordata: General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples.
   - 2.2. Balanoglossus – External morphology.
   - 2.3. Structure and significance of Tornaria larva.

Keywords/Tags: Classification, Echinodermata, *Asterias*, Echinodermata larvae, Hemichordata, Balanoglossus, Tornaria.

Part C- Learning Resources

Text books:

1. J. Parker and W.A. Haswell, A Text Book of Zoology, 7th edition, Vol.I & II, Low Price Publications, Delhi, 1990.
2. R.D. Barnes, Invertebrate Zoology, 7th edition, Cengage learning, India, 2006.
3. J.A. Pechenik, Biology of the Invertebrates, McGraw-Hill Education, 7th edition, 2015.
4. Dhami&Dhami, Invertebrate Zoology, R. Chand & Co., India, 2009.
5. Jordan &Verma, Invertebrate Zoology, S. Chand & Co., India, 2013.
6. V.K. Agarwal, Zoology for Degree Students: Non-Chordata, S. Chand & Co., 2017.

Part D – Assessment and Evaluation

A. Internal Assessment/Continuous Comprehensive Evaluation (CCE): 40 marks) [Class Test – 20 marks; Assignment/Presentation – 10 marks.]
B. External Assessment/University Exam (UE): 60 marks[Time: 03.00 hours; Question: As per Bloom's taxonomy.]

Course Title: Zoology Lab I

Part A - Introduction

Course Code: UZOOLZO102
Course Title: Zoology Lab I

Credit value: 2
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course a student must have had the subject Biology in the 12th class.

Course Learning Outcomes (CLO): Upon completion of the course students should be able to understand

1. Identify invertebrate animals of different phyla and their histology through study of museum specimens and slides.
2. Learn their different systems through dissections.
3. Enhance collaborative learning and communication skills through practical sessions, team work, group discussions, assignments and projects.

Part B – Content of the Course

Unit 1: Study of museum specimens and slides relevant to the invertebrates (No. of lectures: 25).
Unit 2: Dissection (Demonstration only – through You Tube video or Models or Charts) (No. of lectures: 25).

a) Earthworm – Digestive system, nervous system, reproductive system.
b) Prawn – nervous system and appendages.
c) Cockroach-Digestive system, nervous system (Easily available animal in residential areas which can be used for dissection and mounting)

Unit 3: Mounting (No. of lectures: 5).

a) Locally available small non-chordates, their larvae.
b) Moth part of insects.

Unit 4: Examination of pond water for study of different kinds of microscopic non-chordate organisms (No. of lectures: 8).
Unit 5: Economic importance of any to insects (No. of lectures: 5).
Unit 6: Parasitic adaptation of any one parasite (No. of lectures: 5).

Keywords/Tags: Museum specimens, Slides, Dissection, Mounting, Benefited isects, Parasitic adaptation.

Part C- Learning resources

Text books:

1. N. Arumuam, N.C. Nair, S. Leelavathy, N.S. Pandian, T. Murugan, Practical Zoology – Invetebrata, Vol.-1, Saras Publication, 2013.
2. P.S. Verma, A Manual of Practical Zoology – Invertebrates, S. Chand & Co., 2013.

Part D- Assessment and Evaluation

A. Internal Assessment: 40 marks [Class Interaction/Quiz: 15 marks; Attendance: 05 marks; Assignments (Charts/Model Seminar/Rural Service/Technology Dissemination/Report of Excursion/Lab. Visits/Industrial Visit): 10 marks.]

B. External Assessments: 60 marks

a) Viva voce on Practical: 10 marks.
b) Practical Record File: 10 marks.
c) Table work/Experiments: 50 marks.

i. Spotting: 16 marks.
ii. Dissection: 08 marks.
iii. Mounting: 04 marks.
iv. Examination of pond Water: 10 marks.
v. Economic Importance of Insects: 06 marks.
vi. Parasitic Adaptation: 06 marks.

Subject: Botany

Course Title: Applied Botany

Part A – Introduction

Course Code: UAPPLBO101
Course Title: Applied Botany
Credit value: 4
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course, a student must have had the subject Biology/Life Sciences/Agriculture in class 12^{th}.
Course Learning Outcomes (CLO): By the end of this course the student should have:

1. Understood the significance and role of botany.
2. Learnt the basic aspects of applied botany.
3. Gained knowledge about employment opportunities in field of botany.
4. Learnt about opportunities of social services.
5. Gained knowledge about best health practices.

Part B – Content of the Course

Unit I:(No. of lectures: 12):

1. Introduction, objectives, and importance of applied botany.
2. History and evolution of botany.
3. Relation of plants to man and relation with other services.
4. Various disciplines of botany and their applications to human welfare.

Unit II:(No. of lectures: 12):

1. Definition and types of pollution and pollutants.
2. Phytoremediation: Air, water, soil, noise, and thermal pollutants (any plants with botanical name, family) and their role in pollution control.
3. Bioremediation: Definition and types.

Unit III:(No. of lectures: 12):

1. Ancient agricultural practices.
2. Modern agriculture practices: Polyhouse, drip irrigation, hydroponics, computer based agriculture, terrace farming.
3. Organic farming: Introduction, objective and brief technique.
4. Horticulture: Definition and role in human welfare.
5. Forestry: Definition, branches, and role in human welfare.
6. Silviculture: Definition and management practices.

Unit IV:(No. of lectures: 12):

1. Role of Botany Lab In rural development.
2. Ethnobotany: Introduction and importance.
3. Ethnomedicine: Definition and examples (local name, botanical name, family and importance of NeemAloe, Clove, Ginger, Tulsi, Turmeric, Giloy, Emblica, Ashwagandha, Arandi).
4. Ethno-fibres: Definition and examples (local name, botanical name, family and importance of Ankara, Coconut, elephant, grass, cotton).
5. Ethno-food crops: Definition and examples (local name, botanical name, family and importance of Garadu, Singada, Kutaki, Sama, Kodo, Bathua, Sehjan, Jowar, Makka, Bajra, Jau).

Unit V:(No. of lectures: 12):

1. Plant tissue culture: Definition, types and importance.
2. DNA recombinant technique: Introduction, tools and importance.
3. Role of recombination in present era.
4. Bioinformatics: Definition, concept and tools.
5. Introduction to bioinformatics software: Basic idea of BLAST and FASTA, importance of bioinformatics.

Keywords/Tags: Applied botany, history of botany, Evolution of botany, Botany Lab In human welfare, Pollution, Pollutants, Phytoremediation, Bioremediation, hydroponics, Polyhouse, Terrace farming, Organic farming, Horticulture, Silviculture, Ethnobotany, Ethnomedicine, Ethno-fibres, Ethno-food crops, Bioinformatics, BLAST, FASTA, Recombinant DNA, Plant tissue culture.

Part C- Learning Resources

Text books:

1. E. Levetin and K. Mcmahon, Plants &Society, McGraw Hill Education, 2007.
2. R. Maiti, H.G. Rodriguez, & A.S. Thakur, Applied Botany, American Academic Press, 2017.
3. R.P. Agrahari, Environmental Ecology, Biodiversity, Climate Change, & Disaster Management, McGraw Hill Education, 2020.
4. Jin Xiong, Essential Bioinformatics, Cambridge University Press, 2006.
5. Kevin J. Gaston & John I. Spicer, Biodiversity – an introduction, Blackwell, 2004.

Part D – Assessment and Evaluation

A. Internal Assessment/Continuous Comprehensive Evaluation (CCE): 40 marks) [Class Test – 20 marks; Assignment/Presentation – 10 marks.]
B. External Assessment/University Exam (UE): 60 marks [Time: 03.00 hours; Question: As per Bloom's taxonomy.]

Course Title: Botany Lab I

Part A – Introduction

Course Code: UBOTABO102

Course Title: Botany Lab I
Credit value: 2
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Credits:2 credits.
Total Marks: 30 + 70, Min. Passing Marks: 35
Pre-requisite (if any): To study this course, a student must have had the subject Botany Lab In class 12^{th}.
Course Learning Outcomes (CLO): By the end of this course, the student should have knowledge of practical skill related with ethnobotany, tissue culture, application of bioinformatics software, and tool of recombinant DNA technology.

Part B – Content of the Course

1. Identification of ethnobotanical plants.
2. Preparation of soil health card of any agricultural field.
3. Study of vermicompost and composting of kitchen waste.
4. Use of BLAST & FASTA.
5. Prepare the list of important air, water, & soil pollutants of local areas.
6. Plant tissue culture technique: Sterilization, inoculation, culture media, acclimatization, & hardening.
7. Preparation of list of ethnomedicinal, food, fibre plant locally available.
8. Tools of recombinant DNA technology: Restriction, enzymes, plasmid vectors, other enzymes.
9. Study of global warming, acid rain, & water.

Part C – Learning Resources

Text books:

1. E. Levetin& K. Memahon, Plants & Society, McGraw Hill Education, 2007.
2. R. Maiti, H.G. Rodriguez, & A.S. Thakur, Applied Botany, American Academic Press, 2017.
3. R.P. Agrahari, Environmental Ecology, Biodiversity, Climate Change & Disaster Management, McGraw Hill Education, 2020.
4. D.K. Sharma, Biodiversity Conservation: Current Status & Future Strategies, Write & Print Publication, 2017.
5. J. Singh, Biodiversity Environment & Sustainability, M.D. Publications Pvt. Ltd., 2008.
6. P.K. Gupta, Molecular Biology & Genetic Engineering, Rastogi Publications, 2005.

Part D – Assessment and Evaluation

A. Internal Assessment: 40 marks. [Class Interaction/Quiz: 15 marks; Attendance: 5 marks, Assignments (Charts/Model seminar/Rural service/Technology dissemination/Report of excursion/Lab. visit/Survey/Industrial visit): 10 marks]
B. External Assessment: 60 marks. [Viva voce on Practical: 10 marks; Practical Record File: 10 marks, Table work/Experiment: 50 marks.]

Subject: Biotechnology

Course Title: Cell Biology and Biochemistry

Part A - Introduction

Course Code: UCELLBT101
Course Title: Cell Biology and Biochemistry
Credit value: 4
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course, a student must have had the subject Biology in 12th class.

Course Learning Outcomes (CLO): The main objective of the course will be to build the basic foundation for studying biotechnology. The Demand for trained work force in Biotechnology Lab Is ever-growing in fundamental research and industry sector. Academic and research sectors also require interdisciplinary trained manpower to foster the biotechnology revolution. The restructured syllabus combines basic principles of chemical and biological sciences in light of advancements in technology .T he curriculum aims to impart basic knowledge with emphasis on its applications to make the students ready for industries and research work in concerned field .At the end of the paper student should be able to –

1. Understand basics of cell biology.
2. Appreciate the importance of bonding and spatial arrangement of molecules for proper functioning and stability.
3. Understand both the physical as well as chemical properties of biomolecules.
4. The student could pursue a career in biochemical testing .The decrease of increase in the amount of some of the biomolecules can have clinical significance .
5. Students can also go in for medical laboratory technique courses, opening opportunities in hospital and pathological laboratories.

Part B – Content of the Course
Unit I: Cell as a Basic Unit(No. of Lectures: 12):
1. Historical background of the Cell
1.1 History of Cell Biology.
1.2 Cell Structure.
1.3 Cell Theory.
2. Prokaryotic Cell and Cell Organells:
2.1 Ultrastructure of Prokaryotic Cell.
2.2. Structure and function of cell organelles:Flagella, Pili. Cell wall,Cytoplasmic membrane, Nuclear region, Ribosomes, Vacuoles, Metachromatic granules, Spores and Cysts, Microtubules, Microfilaments, Centriole.
2.3 Difference between Prokaryotic and Eukaryotic cells.

Key Words: - Cell theory, Prokaryotic Cell

Unit II:Cell Organelles and Cell Cycle(No. of Lectures: 12):

1. Eukaryotic Cell and Cell Organells:

1.1 Ultrastructure of Eukaryotic cell (Plant and Animal cells).

1.2 Structure and function of cell organelles: Cell membrane, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi bodies,Lysosomes, Peroxisomes, Nucleus.

2. Cell Cycle:

2.1 Cell cycle and Cell division.

2.2 Apoptosis or Cell death.

Keywords: Eukaryotic cell.Cell organelles, Cell cycle. Apoptosis

Unit III: Molecular Structure of Water (No. of Lectures: 12):

1. Water structure and Buffer:

1.1 Properties of Water.

1.2 Interaction of Water.

1.3 Role of Water in Bio molecular Structure.

1.4 Acid and Bases, Buffer solutions.

2. Chemical Bonds:

2.1 Chemical Bonds (Ionic Bond, Covalent Bond, Coordinate Bond, Non Covalent Bonds, Hydrogen Bond)

Keywords: Water, Buffer, Chemical bonds.

Unit IV: Biomolecules:(No. of Lectures: 12)

Sources. Nomenclature, Classification, Structures, Characteristics andFunctions:

1. Carbohydrates,
2. Lipids.
3. Proteins and Nucleic Acids.

Keywords: - Carbohydrates, Proteins, Lipids, Nucleic Acids.

Unit V: Tools and Techniques: (No. of Lectures: 12)

1.1 Principle and Applications of Light Microscopy, Centrifugation, Chromatography (Paper, Thin layer and Column), Colorimeter and Spectrophotometer.

Keywords: - Microscope, Chromatography, Spectrophotometer.

Part C - Learning Resources

Text books:

1. Industrial Biotechnology-B.D. Singh
2. Textbook of Biochemistry - S.P. Singh
3. Cell and Molecular Biology-P.K. Gupta
4. Cell Biology-P.S. Verma and Agrawal
5. Cell and Molecular Biology - S.C.Rastogy
6. Cell Biology - P.S. Verma and Agrawal

Part D – Assessment and Evaluation

A. Internal evaluation/Continuous Comprehensive Evaluation (CCE): 40 marks [Class Test – 20 marks; Assignment/Presentation – 10 marks.]
B. External/University Exam (UE): 60 marks[Time: 3 hours]

Course Title: Biotechnology Lab I

Part A - Introduction

Course Code: UBIOTBT102
Course Title: Biotechnology Lab I

Credit value: 2
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course, a student must have had the subject Biology in 12th class

Course Learning Outcomes (CLO): The Main Objective of the course will be to give hands-on practical knowledge in Biotechnology. The Demand for Trainedworkforce in Biotechnology Lab Is ever growing in Fundamental Research and Industry Sector. Academic and Research Sectors Require Interdisciplinary trained manpower to foster the Biotechnology Revolution. The curriculum aims to impart basic knowledge with emphasis on its applications to make the students ready for industries andresearch work in concerned field. At the endof the paper, a student will be able to:

1. Understand basic techniques of cell biology.
2. Know the physical as well as chemical properties of biomolecules.
3. Pursue a career in biochemical testing. The decrease of increase in the amount of some of the biomolecules can have clinical significance.
4. Take medical Laboratory Technique Courses, opening opportunities inhospitals and pathological laboratories.

Part B – Content of the Course [Total number of practical (in hours) - 30]:

List of experiments -

1. To study the plant cell structure using various plant materials.
2. To study the animal cell structure using cheek cells.
3. To Prepare Onion root tip for the stages of Mitosis.
4. To Prepare and study the different stages of Mitosis and Meiosis.
5. To analyze Carbohydrates Quantitatively.
6. To analyze proteins Quantitatively .
7. To analyze lipids Quantitatively .
8. To Prepare Buffers.
9. To Separate plant pigments by Paper Chromatography.
10. To Separate amino acids by TLC.

Part D – Assessment and Evaluation

A. Internal Assessment: 40 marks [Class Interaction/Quiz: 15 marks; Attendance: 5 marks; Assignments (Charts/Model seminar/Rural service/Technology dissemination/Report of excursion/Lab. visit/Survey/Industrial visit): 10 marks]

B. External Assessment: 60 marks [Viva voce on Practical: 10 marks; Practical Record File: 10 marks, Table work/Experiment: 50 marks.]

Subject: Microbiology

Course Title: General Microbiology & cell structure

Part A - Introduction

Course Code: UGENEMBT101
Course Title: General Microbiology & cell structure
Credit value: 4
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course, a student must have had the subject Biology in 12th class.

Part B – Content of the Course

Unit - I

1. The Microbial World
1.1 Indian traditional knowledge and global historical background of Microbiology.
1.2 Theory of Biogenesis, Germ theory of disease, Fermentation.
1.3 Significance of microbiology-
(a) Branches of microbiology
(b) Thrust area of microbiology- Genetic engineering and Biotechnology.
1.4 Contribution of following scientists in the field of microbiology - Louis Pasteur, Robert Koch, Edward Jenner, Alexander Fleming, Joseph Lister, Serge N. Winogradsky, Martinus Willem Beijerink, Dmitrii Ivanowsky, Wendell M. Stanley and Hans Christian Gram.

Unit - II
Acellular and Prokaryotic Microorganisms
2.1 Virus - General characters of following viruses - Bacteriophage (T4 and λ phage), Plant viruses (TMV), Prions and Viroids.
2.2 Whittaker's System of Five Kingdom Classification: Monera, Protista, Fungi, Plantae and Animalia.
2.3 Carl Woese's Three Domain System of Classification: Archaea, Eubacteria, and Eukaryotes.
2.4 Bacteria - Study of Spirochete, Rickettsia, Chlamydia, Mycoplasma and Actinomycetes.
2.5 Cyanobacteria - Study of Anabaena and Spirulina.

Unit - III
Eukaryotic Microorganisms
3.1 Basic knowledge of Eukaryotic organisms and their evolutionary pattern.
3.2 Fungi -Study of Saccharomyces cerevisiae, Mucor, Aspergillus, Rhizopus and Penicillium.
3.3 Protozoa - Study of Euglena, Trypanosoma, Leishmania, Amoeba, Entamoeba and Plasmodium.

Unit - IV

Introduction to Microbial Cell Structure

4.1 Study of Bacteria - Size, shape and arrangement of bacterial cells.

4.2 **Structures External to Plasma Membrane-**Glycocalyx (capsule, slime layer), flagella, fimbrae, stalk, prostheca and cell wall of Gram +ve and Gram-ve bacteria.

4.3 Structures Internal to Cell wall-Cell membrane, cytoplasm, cytoplasmic inclusions, genome, spores and cysts.

4.4 Reproduction in Bacteria-Binary fission, budding and fragmentation.

Course Title: Microbiology Lab I

Part A - Introduction

Course Code: UMICRMB102

Course Title: Microbiology Lab I

Credit value: 2

Total Marks: 40 + 60 = 100; Min. Passing Marks: 35

Pre-requisite (if any): To study this course, a student must have had the subject Biology in 12th class

Part B – Content of the Course [Total number of practical (in hours) - 30]:

List of experiments -

1. Isolation of autotrophic bacteria and Cyanobacteria, Rhizobia from root nodules
2. Isolation of lactobacillus from curd.
3. Isolation of yeast from ripened fruits.
4. Preparation of temporary wet mount and microscopic examination of Mucor, Aspergillus, Rhizopus and Penicillium.
5. Preparation of smear and microscopic examination of Staphylococcus, Lactobacillus Escherichia Vibrio and Leptospira.
6. Preparation of temporary wet mount and microscopic examination of Amoeba, Euglena, Paramaecium and Chlamydomonas.
7. Study of the structure of important animal viruses (rhabdo, influenza, paramyxo, hepatitis B and retroviruses) using electron micrographs.
8. Study of the structure of important plant viruses (caulimo, Gemini, tobacco ring spot, cucumber mosaic and alpha-alpha mosaic viruses) using electron micrographs.
9. Study of the structure of important bacterial viruses (6X174, T4, A phage) using electron micrograph.
10. Any other experiment may be designed on the basis of theoretical aspects.

Subject: Biochemistry

Course Title: Biochemical Techniques

Part A– Introduction

Course Code: UBIOCBC101
Course Title: Biochemical Techniques
Credit value: 4
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisition: To study this course a student must have had the subject Biology in class12th

Part B — Content of the Course [Total No. of Lectures- 60]

Unit 1 pH AND ITS MEASUREMENT
Concept of acids, bases, pH and buffers: Definitions, Ionization of weak acids and bases, Henderson-Hasselbalch equation, Biochemical buffers and their actions.
Titration curve for amino acids and the pK values, Physiological buffers and their role.
Preparation of common solutions based on molarity, normality and percent. Preparation of buffers.
Measurement of pH: Glass and reference electrodes, types of electrodes, complications of pH measurement (dependence of pH on ionic strength, electrode contamination and sodium error).

Unit 2 CHROMATOGRAPHY
General principle of chromatographic separation. Technical details of Column adsorption and column partition chromatography, Paper chromatography, Thin-layer Chromatography, Gas chromatography.
Principle, Technique and applications of Ion-exchange chromatography, Molecular-sieve chromatography, Affinity chromatography, Hydrophobic ligand chromatography and HPLC

Unit 3 ELECTROPHORESIS AND CENTRIFUGATION
Introduction, Principle and Types of Electrophoresis. Factors affecting the rate of electrophoresis, Free and Zonal electrophoresis, Paper electrophoresis.
Gel electrophoresis: Technique and uses of agarose electrophoresis, PAGE and SDS-PAGE, Two-dimensional electrophoresis, its importance and uses.
Isoelectric focusing. Principle of Centrifugation, RCF and Factors affecting it, Ultracentrifugation and its applications, Types of ultracentrifuges - Preparative and Analytical, Sedimentation coefficient and sedimentation velocity, Density gradient centrifugation.

Unit 4 SPECTROSCOPY
Principle of Spectroscopy, Lambert-Beer's Law and its limitations, Interaction of light with molecules, Light absorption and transmission, Extinction coefficient.
Basic design of photoelectric colorimeter and spectrophotometer, Applications of uv-visible spectroscopic techniques. Infrared Spectroscopy, Flame Photometry, Atomic absorption spectrophotometry.

Unit 5 RADIOACTIVITY

Types of Isotopes, Synthesis of labeled compounds, units of radioactivity, Measurement of radioactivity - Methods based upon Gas ionization, Ionization chamber, Proportional counters, Geiger Muller counter; Methods based upon excitation - Liquid Scintillation Counter. Autoradiography. Isotopes commonly used in biochemical studies — ^{32}P, ^{35}S, ^{4}C and ^{3}H, Isotopic labelling of Biomolecules. Applications of radioisotopes.

Biological hazards of radiation and safety measures in handling radioisotopes.

Part C – Learning Resources

Suggested Readings

1. Boyer, R.F. Biochemistry Laboratory: Modern Theory and Techniques.
2. Wilson K. an d Walker J. "Principles and Techniques of Biochemistry and Molecular Biology".
3. Voet, D and Voet, J. C. "Biochemistry".
4. Robyt, J. F. and White, B. J. "Biochemical Techniques".
5. Holme, D. J. and Peck, H. "Analytical Biochemistry".

Course Title: BioChemistry Lab I

Part A - Introduction

Course Code: UBIOCBC102

Course Title: Bio Chemistry Lab I

Credit value: 2

Total Marks: 40 + 60 = 100; Min. Passing Marks: 35

Pre-requisite (if any): To study this course, a student must have had the subject Biology in 12th class

Part B – Content of the Course [Total number of practical (in hours) - 30]:

List of experiments -

1. Preparation of common reagents, acids and alkali of different strengths/ Concentrations.
2. Titration curves for amino acids and determination of pK value
3. Preparation of biochemical buffers of different ionic strengths.
4. Separation and quantification of amino acids by paper chromatography.
5. Separation of plant pigments by column chromatography using Silica gel-G.
6. Separation of lipids by TLC.
7. Two dimentional chromatography of amino acids.
8. Blectroporetic separations.

9. Demonstration of Polyacrylamide gel electrophoresis and SDS-PAGE of proteins.
10. Differential Centrifugation for organelle separation.
11. Verification of Lambert-Beer's Law.

Keyword: pk, chromatography, electrophoresis, Lambert Beer's Law, Colorimetric estimation.

Part C – Learning Resources

Text Books, Reference Books, Other Resources
Suggested Reading:
1. Boyer, R.F., "Biochemistry Laboratory: Modern Theory and Techniques", Boston, Mass: Prentice Hall, 2012, 6th ed., ISBN-13: 978-0-13-604302-7.
2. Plummer D. T., "An Introduction to Practical Biochemistry", Tata McGraw Hill Education Pvt. Ltd. (New Delhi), 1998, 3rd ed., ISBN: 13: 9780070994874 / ISBN:10: 0070994870.
3. Wilson K. and Walker J., "Principles and Techniques of Biochemistry and Molecular Biology", Cambridge University Press, 2010, 7th ed., ISBN 9780521516358.
4. Voet, D and Voet, J.C. "Biochemistry", John Wiley and Sons, Inc, 2010, 4th Edition, ISBN: 978-0-470-57095-1.
5. Robyt, J.F.and White, B.J." Biochemical Techniques — Theory and Practice", Brooks and Cole Publishing Co., ISBN: 0-534-07944-X.
6. Holme, D.J. and Peck, H. "Analytical Biochemistry", Longman Scientific and Technical ISBN: 0- 562-06694-8.
Suggested Reading:
1. Plummer D. T., "An Introduction to Practical Biochemistry", Tata McGraw Hill Education Pvt. Ltd. (New Delhi), 1998, 3rd ed., ISBN: 13: 9780070994874 / ISBN:10: 0070994870.
2. Jayaraman, J., "Laboratory manual in Biochemistry", New Age International Publisher.
Assignments (Chart/ Model Table work/ Experiments/ Seminar/ Rural Service.

Subject: Food Technology

Course Title: Processing of fruits and vegetables

Part A– Introduction

Course Code: UPROCFT101
Course Title: Processing of fruits and vegetables
Credit value: 4
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisition: To study this course a student must have had the subject Biology in class12th
.

Part B — Content of the Course [Total No. of Lectures- 60]

Unit-I Introduction of processing in Fruits and Vegetables
Introduction definition, importance and status of post harvest technology.
Selection of raw fruits and vegetables products.
Methods involved in processing of fruits and vegetables.
Basic Physiological and Biochemical changes during post harvest period.
Principles involved in Processing of fruits and vegetables

Unit-II Processing and principals involved for Fruits beverages
Principles involved in preparation of squashes, cordials, nectars, syrup and sharbat.
Introduction to Jam: Constituents, selection of fruits, processing and technology, defects.
Preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation).

Unit-III Processing of fruits and vegetable products: jellies, marmalades and pickles
Tomato products: Selection of tomatoes, pulping and processing of tomato juice, tomato puree, paste, ketchup, sauce and soup.
Jelly: Essential constituents (Role of pectin, ratio), Theory of formation, Processing and technology, defects in jelly.
Marmalade: Types, processing and technology, defects.
Processing of different varieties of pickles and Causes of spoilage in pickles Shelf life study and role of preservatives in pickling.

Unit-IV Canning of fruits and vegetables
Introduction and principle of canning
Cans &containers for packing, lacquering, syrups and brines of canning.
Spoilage in canned foods, problems in the storage of canned food and changes during canning in fruits and vegetables.

Unit-V Equipments and Preparation of Dehydrated products
Principles involved in various equipment employed in Fruits and vegetable processing
Dehydrated Products Preparation and packing.

Part C – Learning Resources
Suggested Readings:
1. Preservation of rutaVedelables Girdharilal, Siddappaa, G.S and Tandon, G.L., Preserv ICAR, 1967 New Delhi.
2. Commercial Uniland Vegetable Products ;Crusess, W. B , Pub: Agro bios India, W.V. Special Indian Edition.
3. Food:Facts and Principles; Manay, S. and Shadakshara swami, M., New Age Publishers.
4. Handbook of Analysis and Quality Control for fruits and vegetable products; Rangana, S, Tata McGraw Hill publishing co, Itd.1986 II Ed.
5 Fruits and Vegetable Preservation : Principles and Practices, Srivastava, R P and Kumar .S. International Brol Distributing Co.2006.
6. Preservation of Fruits and Vegetables. Khader V
7. Handbook of Fruits and Vegetable products. Ashraf S.M. a
8. Fruits and Vegetables: Preservation Technology, Narang R K.

Suggested Equivalent Online Courses / Weblinks-
1. Fruit and vegetable processing http://www.udyogwardhini.com
2. Fruit and vegetable processing and training http:/Awww.akademijaoxford.com
: 3. Post harvest management of fruits and vegetables http://www.classcentral.com

Course Title: Food technology Lab I

Part A - Introduction

Course Code: UFOODFT102
Course Title: Food technology Lab I

Credit value: 2
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Pre-requisite (if any): To study this course, a student must have had the subject Biology in 12th class

Part B – Content of the Course [Total number of practical (in hours) - 30]:

List of experiments -

1. Estimation of total soluble solids (TSS) in fruits products.
2. Assessment of pH and acidity of different food products.
3. Preparation jam, jelly and marmalade.
4. Estimation of brix: acidity ratio
5. Preparation od Dehydrated fruits and vegetables products.

6. Preparation of tomato products (juice, paste, puree, ketchup and soup)
7. Preparation of different types of squash.
8. Preparation of different types of juice.
9. Preparation of different varieties of pickles.
10. Visit to fruits and vegetables processing unit.

Text Books, Reference Books, Other resources
: Suggested Readings:

1. Handbook of Fruits and Fruit processing (http://ubblab.weebly.com). |
2. Fruits and vegetable canning technician : Practical guide (http://ficsi.in).
3. Technology of Handling, Packaging, Processing and Preservation of fruits and vegetables by V K Joshi (http://www.nipabooks.com).
4. The complete book on Fruits, Vegetable and Food processing (http://www.etrepreneurindia.co).

Suggested equivalent online courses:

1. Free online food processing course/food preservation/Alison > SS
http://alison.com
2. Food preservation technology course-Swayam e CR
http://onlinecoursses.swayam2.ac.in
3. Online course : Canning and preserving 101 certificate .
http://www.universalclass.com