Faculty of Science

Syllabus

For

B. Sc.

(II Semester Course)

W.E.F. - Session 2023 - 2024

P.K.UNIVERSITY SHIVPURI (M.P.)

P.K.University
Shivpuri (M.P.)

B.Sc. 2nd Semester

S. No.	Subject	Subject Code	Paper Title	Paper Code
1.	English	EN	English Language	UENGLCP105
2.	Physics	PH	Thermodynamics & Statistical Physics	UTHERPH103
			Physics Lab II	UPHYSPH104
3.	Chemistry	CH	Analytical Chemistry	UANALCH103
			Chemistry Lab II	UCHEMCH104
4.	Mathematics	MA	Calculus and differential equations	UCALCMA102
5.	Computer Science	CS	Programming Methodologies & Data Structure	UPROGCS103
			Lab Course Computer II	UCOMPCS104
6.	Botany	BO	Basic Botany	UBASIBO103
			Botany Lab II	UBOTABO104
7.	Zoology	ZO	Cell Biology, Reproductive Biology and Development Biology	UCELLZO103
			Zoology Lab II	UZOOLZO104
8.	Biochemistry	BC	Chemistry of Biomolecules	UCHEMBC103
			Biochemistry Lab II	UBIOCBC104
9.	Microbiology	MB	Microbial Techniques	UMICRMB103
			Microbiology Lab II	UMICRMB104
10.	Biotechnology	BT	Microbiology and Immunology	UMICRBT103
			Biotechnology Lab II	UBIOTBT104
11.	Food Technology	FT	Fundamentals of Food processing	UFUNDFT103
			Food Technology Lab II	UFOODFT104

	B.Sc. 2nd Semester Course Structure – Faculty of Science
	Compulsory courses for B.Sc. 2nd 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**	ENGLISH/AECC/4	English Language	UENGLCP105	4	4	0	0	40	60	0	0	100
2.		PHYSICS/ Major/6	Thermodynamics & Statistical Physics	UTHERPH103	4	4	0	0	40	60	0	0	100
3.			Physics Lab II	UPHYSPH104	2	0	0	4	0	0	40	60	100
4.		MATHEMATICS/Minor/ 6	Calculus and differential equations	UCALCMA102	6	6	0	0	40	60	0	0	100
5.		CHEMISTRY/GE/4	Analytical Chemistry	UANALCH103	3	3	0	0	40	60	0	0	100
6.			Chemistry Lab II	UCHEMCH104	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**200**	**600**

1.	**MATHEMATICS**	ENGLISH/AECC/4	English Language	UENGLCP105	4	4	0	0	40	60	0	0	100
2.		MATHEMATICS/ Major/6	Calculus and differential equations	UCALCMA102	6	6	0	0	40	60	0	0	100
3.		PHYSICS/Minor/6	Thermodynamics & Statistical Physics	UTHERPH103	4	4	0	0	40	60	0	0	100
4.			Physics Lab II	UPHYSPH104	2	0	0	4	0	0	40	60	100
5.		CHEMISTRY/GE/4	Analytical Chemistry	UANALCH103	3	3	0	0	40	60	0	0	100
6.			Chemistry Lab II	UCHEMCH104	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**200**	**600**
1.	**COMPUTER SCIENCE**	ENGLISH/AECC/4	English Language	UENGLCP105	4	4	0	0	40	60	0	0	100
2.		COMPUTER SCIENCE / Major/6	Programming Methodologies & Data Structure	UPROGCS103	4	4	0	0	40	60	0	0	100
			Lab Course Computer II	UCOMPCS104	2	0	0	4	0	0	40	60	100
3.		PHYSICS/Minor/6	Thermodynamics & Statistical Physics	UTHERPH103	4	4	0	0	40	60	0	0	100
4			Physics Lab II	UPHYSPH104	2	0	0	4	0	0	40	60	100
5		MATHEMATICS /GE/4	Calculus and differential equations	UCALCMA102	4	4	0	0	40	60	0	0	100
	Total				**20**				**160**	**240**		**200**	**600**

1.	**Botany**	ENGLISH/AECC/4	English Language	UENGLCP105	4	4	0	0	40	60	0	0	100
2.		BOTANY /Major/6	Basic Botany	UBASIBO103	4	4	0	0	40	60	0	0	100
			Botany Lab II	UBOTABO104	2	0	0	4	0	0	40	60	100
3.		ZOOLOGY / Minor/6	Cell biology, Reproductive biology, Developmental biology	UCELLZO103	4	4	0	0	40	60	0	0	100
4			Zoology Lab II	UZOOLZO104	2	0	0	4	0	0	40	60	100
5		CHEMISTRY/GE/4	Analytical Chemistry	UANALCH103	3	3	0	0	40	60	0	0	100
6			Chemistry Lab II	UCHEMCH104	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**
1.	**ZOOLOGY**	ENGLISH/AECC/4	English Language	UENGLCP105	4	4	0	0	40	60	0	0	100
2.		ZOOLOGY / Major/6	Cell Biology, Reproductive Biology and Development Biology	UCELLZO103	4	4	0	0	40	60	0	0	100
			Zoology Lab II	UZOOLZO104	2	0	0	4	0	0	40	60	100
3.		BOTANY /Minor/6	Basic Botany	UBASIBO103	4	4	0	0	40	60	0	0	100

4			Botany Lab II	UBOTABO104	2	0	0	4	0	0	40	60	100
5		CHEMISTRY/GE/4	Analytical Chemistry	UANALCH103	3	3	0	0	40	60	0	0	100
6			Chemistry Lab II	UCHEMCH104	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**
1.	**CHEMISTRY**	ENGLISH/AECC/4	English Language	UENGLCP105	4	4	0	0	40	60	0	0	100
2.		CHEMISTRY / Major/6	Analytical Chemistry	UANALCH103	4	4	0	0	40	60	0	0	100
			Chemistry Lab II	UCHEMCH104	2	0	0	4	0	0	40	60	100
3.		BOTANY /Minor/6	Basic Botany	UBASIBO103	4	4	0	0	40	60	0	0	100
4			Botany Lab II	UBOTABO104	2	0	0	4	0	0	40	60	100
5		ZOOLOGY /GE/4	Cell Biology, Reproductive Biology and Development Biology	UCELLZO103	3	3	0	0	40	60	0	0	100
6			Zoology Lab II	UZOOLZO104	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**

1.	**BIOTECHNOLOGY**	ENGLISH/AECC/4	English Language	UENGLCP105	4	4	0	0	40	60	0	0	100
2.		BIOTECHNOLOGY / Major/6	Microbiology and Immunology	UMICRBT103	4	4	0	0	40	60	0	0	100
			Biotechnology Lab II	UBIOTBT104	2	0	0	4	0	0	40	60	100
3.		BIOCHEMISTRY /Minor/6	Chemistry of Biomolecules	UCHEMBC103	4	4	0	0	40	60	0	0	100
4			Lab Course Biochemistry II	UBIOCBC104	2	0	0	4	0	0	40	60	100
5		FOOD TECHNOLOGY /GE/4	Fundamentals of Food processing	UFUNDFT103	3	3	0	0	40	60	0	0	100
6			Food Technology Lab II	UFOODFT104	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**
1.	**MICROBIOLOGY**	ENGLISH/AECC/4	English Language	UENGLCP105	4	4	0	0	40	60	0	0	100
2.		MICROBIOLOGY / Major/6	Microbial Techniques	UMICRMB103	4	4	0	0	40	60	0	0	100
			Lab Course Microbiology II	UMICRMB104	2	0	0	4	0	0	40	60	100
3.		BIOTECHNOLOGY /Minor/6	Microbiology and Immunology	UMICRBT103	4	4	0	0	40	60	0	0	100
4			Biotechnology Lab II	UBIOTBT104	2	0	0	4	0	0	40	60	100
5		FOOD TECHNOLOGY /GE/4	Fundamentals of Food processing	UFUNDFT103	3	3	0	0	40	60	0	0	100
6			Food Technology Lab II	UFOODFT104	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**

1.	**BIOCHEMISTRY**	ENGLISH/AECC/4	English Language	UENGLCP105	4	4	0	0	40	60	0	0	100
2.		BIOCHEMISTRY / Major/6	Chemistry of Biomolecules	UCHEMBC103	4	4	0	0	40	60	0	0	100
			Lab Course Biochemistry II	UBIOCBC104	2	0	0	4	0	0	40	60	100
3.		BIOTECHNOLOGY /Minor/6	Microbiology and Immunology	UMICRBT103	4	4	0	0	40	60	0	0	100
4			Biotechnology Lab II	UBIOTBT104	2	0	0	4	0	0	40	60	100
5		FOOD TECHNOLOGY /GE/4	Fundamentals of Food processing	UFUNDFT103	3	3	0	0	40	60	0	0	100
6			Food Technology Lab II	UFOODFT104	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**
1.	**FOOD TECHNOLOGY**	ENGLISH/AECC/4	English Language	UENGLCP105	4	4	0	0	40	60	0	0	100
2.		FOOD TECHNOLOGY / Major/6	Fundamentals of Food processing	UFUNDFT103	4	4	0	0	40	60	0	0	100
			Food Technology Lab II	UFOODFT104	2	0	0	4	0	0	40	60	100
3.		BIOTECHNOLOGY /Minor/6	Microbiology and Immunology	UMICRBT103	4	4	0	0	40	60	0	0	100
4			Biotechnology Lab II	UBIOTBT104	2	0	0	4	0	0	40	60	100
5		MICROBIOLOGY /GE/4	Microbial Techniques	UMICRMB103	3	3	0	0	40	60	0	0	100
6			Lab Course Microbiology II	UMICRMB104	1	0	0	2	0	0	0	100	100
	Total				**20**				**160**	**240**		**300**	**700**

B.Sc. 2nd Semester

Syllabus

Ability Enhancement Course (AEC)

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

Subject: English (Foundation Course)

Part A- Introduction

Course Code: UENGLCP105
Course Title: English Language & Indian Culture
Course Type: Foundation Course.
Credit Value: 4 credits.
Total Marks: 100; Min. Passing Marks: 33
Pre-requisite (if any): To study this course, a student should have basic knowledge of English language. This course will be suited for all the students of UG level under the Foundation Course Category.
Course Learning Outcomes (CLO): Through this course, the students will be able to:

1. Prepare for various competitive exams by developing their English language competence.
2. Promote their comprehension skills by being exposed to a variety of texts and their interpretations.
3. Build and enhance their vocabulary.
4. Develop their communication skills by strengthening grammar and usage.
5. Inculcate values, which make them aware of national heritage and environmental issues, making them responsible citizens.

Part B - Content of the Course

Unit I: Reading, Writing and Interpretation Skills (No. of lectures: 10)**:**

1. Where The Mind is Without Fear – Rabindranath Tagore [Key word: Patriotism].
2. National Education – M.K. Gandhi (Key word: Edification].
3. The Axe – R.K. Narayan [Key word: Environment].
4. The Wonder that Was India – A.L. Basham (an excerpt) [Key word: Indianess].
5. Preface to the Mahabharata – C. Rajagopalchari [Key word: Indian mythology].

Unit II: Comprehensive Skill (No. of lectures: 10)**:** Unseen passage followed by multiple choice questions

Unit III: Basic Language Skills (No. of lectures: 10)**:**

1. Vocabulary building: Suffix, prefix, synonyms, antonyms, homophones, homonyms, & one-word substitution.
2. Basic grammar: Noun, pronoun, adjective, verb, adverb, prepositions, articles, time, & tense.

Part C - Learning Resources

Text books:

1. Essential English Grammar – Raymond Murphy, Cambridge University Press.
2. Practical English Grammar Exercises 1 – A.J. Thomson & A.V. Martinet, Oxford India.
3. Practical English Usage – Michael Swan, Oxford.
4. English Grammar in Use – Raymond Murphy, Cambridge University Press.

Part D - Assessment & Evaluation: External Exam/University Exam (UE): 50 marks [Time: 2 hours; Pattern/type: Objective/true-false/descriptive type questions to be asked.]

Subject: Physics

Course Title: Thermodynamics and Statistical Physics

Part A - Introduction

Course Code: UTHERPH103
Course Title: Thermodynamics and Statistical Physics
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 in 12th class.
Course Learning Outcomes (CLO):

1. The course would enable the students to understand the basic Physics of heat & temperature in relation to energy, work, radiation, & matter.
2. The students are expected to learn that "how laws of thermodynamics are used in a heat engine to transform heat into work".
3. This course will also develop an understanding of the various concepts of statistics and the methods to apply them in thermodynamics.
4. Students will understand the importance of studying statistical mechanics with the behavior of particles under classical and quantum conditions.

Part B – Content of the Course

Unit I: Historical background & Laws of thermodynamics (No. of Lectures: 12):

1. **Historical background:** A brief historical background of thermodynamics and statistical physics in the context of India and Indian culture, contribution of S.N. Bose in statistical physics.
2. **Laws of thermodynamics:**
   2.1. Thermodynamical system &thermodynamical coordinates, thermal equilibrium, Zeroth law of thermodynamics, concept of path function and point function, work done by & on the system.
   2.2. First law of thermodynamics, internal energy as a state function, reversible & irreversible change, heat engine & its efficiency, Carnot's cycle, Carnot's engine & its efficiency, Carnot's theorem, Otto cycle, diesel engine.
   2.3. Second law of thermodynamics, statement of Kelvin-Planck &Clapeyron, absolute scale of temperature: zero of absolute scale, size of degree, identity of a perfect gas scale & absolute scale.

Keywords/Tags: Thermodynamics, Internal energy, Heat engine, Absolute scale.

Unit II: Entropy (No. of Lectures: 12):

1. Concept of entropy, Clausius theorem, entropy as a point function, change in entropy in reversible and irreversible processes.

2. Change of entropy of an ideal gas, change of entropy when two liquids at different temperatures are mixed (or two bodies at different temperatures are kept in contact).
3. Principle of increase of entropy, change in entropy of the universe in an irreversible process, disorder & heat death of universe.
4. Physical significance of entropy, Temperature-Entropy (T-S) diagram, third law of thermodynamics.

Keywords/Tags: Reversible process, Entropy, Ideal gas.

Unit III: Thermodynamic potential and kinetic theory of gases (No. of Lectures: 12):

1. **Thermodynamic potential and its application:**
   1.1. Thermodynamic potentials, thermal equilibrium, internal energy, Helmholtz free energy, Enthalpy & Gibbs free energy.
   1.2. Derivation of Maxwell's relations from thermodynamic potentials, Gibbs-Helmholtz equation, thermodynamic energy equation for ideal and van der Waal gas.
   1.3. TdS equation, derivation of expression for C_P-C_V and their specific cases for ideal and van der Waal gases, derivation of the expression C_P/C_V.
   1.4. Clausius-Clapeyron latent heat equation, temperature change in adiabatic process, principle of refrigeration, Joule-Thomson effect, cooling by adiabatic demagnetization, production & measurement of very low temperature.

2. **Kinetic theory of gases:**
   2.1. Behavior of a real gas and its deviation from an ideal gas, Virial equation, Andrew's experiment on CO_2 gas.
   2.2. Critical constant, continuity of the liquid and gaseous state, vapor and gas state, Boyle temperature, van der Waal's equation for real gas, values of critical constants, law of the corresponding state.

Keywords/Tags: Potential, Enthalpy, Adiabatic, Real gas, Critical constant

Unit IV: Classical Statistics(No. of Lectures: 12):

1. Probability, distribution of N particles in two identical boxes, probability of occurrence of either event, probability of composite events, weightage probability.
2. Probability distribution and its narrowing with the increase in number of particles, expression for average properties constraints, accessible and non-accessible microstates.
3. Ensemble theory (micro-canonical, canonical and grand-canonical), macro and micro states with examples, ensemble average & time average, principle of equal a priori probability, Ergodic hypothesis, concept of phase space, μ- and γ-space, degree of freedom, generalized coordinates.
4. Boltzmann canonical distribution law: Application: Average energy of one-dimensional harmonic oscillator.
5. Derivation of law of equipartition of energy from statistics, equilibrium between two system in thermal contact and β parameter, statistical interpretation of entropy and relation $S = k \log \Omega$.
6. Boltzmann partition function and derivation of expression for internal energy, Helmholtz free energy, enthalpy and Gibb's free energy.

Keywords/Tags: Probability, Microstate, Ensemble theory, Partition function.

Unit V: Quantum Statistics(No. of Lectures: 12):

1. Indistinguishability of particles and its consequences, Maxwell-Boltzmann statistics (classical statistics): Maxwell-Boltzmann distribution law of velocity and speed, Maxwell-Boltzmann statistics and its distribution law.
2. Quantum statistics: Bose-Einstein statistics and distribution law, derivation of Planck's law from B-E statistics, Rayleigh-Jeans law, Wien's displacement law, and Stefan's law.
3. Fermi-Dirac statistics and its distribution law, explanation of free electron theory,Fermi level and Fermi energy.
4. Comparison between Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics.

Keywords/Tags: Indistinguishability, Velocity distribution, Fermi level.

Part C - Learning Resources

Text books:

1. M.W. Zemansky&R. Dittman, Heat and Thermodynamics, Tata McGraw-Hill.
2. Sears & Salinger,Thermodynamics, Kinetic Theory, & Statistical Thermodynamics, Narosa.
3. S.C. Garg&C.K. Ghosh, Thermal Physics, Tata McGraw-Hill.
4. N. Subrahmanyam, BrijLal, P.S. Hemne, Heat, Thermodynamics, & Statistical Mechanics, S. Chand, 2012.

Part D – Assessment and Evaluation

A. Internal evaluation/Continuous Comprehensive Evaluation (CCE): 30 marks [Class Test – 20 marks; Assignment/Presentation – 10 marks.]

B. External/University Exam (UE): 70 marks [Time: 3 hours; Question pattern: As per Bloom's taxonomy.]

Course Title: Physics Lab II

Part A - Introduction

Course Code: UPHYSPH104

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 in 12^{th} class

Course Learning Outcomes (CLO):

1. The students would gain practical knowledge about heat and radiation by performing various experiments.
2. The students will acquire knowledge about the different forms of distribution of subatomic particle in the system using statistical methods.
3. The students will be able to use various thermodynamical instruments in daily life.

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

List of experiments

1. Determination of mechanical equivalent of heat by Callendar&Barne's method.
2. Determination of efficiency of electrical kettle with variable voltages.
3. Determination of temperature coefficient of a resistance using platinum resistance thermometer.
4. Determination of electromotive force of a thermocouple.
5. Determination of thermal conductivity of a bad conductor by Lee's disc method.
6. Verification of Newton's law of cooling.
7. Determination of the ratio of specific heat of air by Clement-Desome's method.
8. Determination of the specific heat of liquid with the help of Newton's law of cooling.
9. Determination of the coefficient of thermal conductivity of a metal by Searl's method.
10. Determination of thermal conductivity of the rubber using calorimeter.
11. Determination of mechanical equivalent of het (J) using Joule calorimeter.
12. Determination of Stefan's constant using thermocouple.
13. Study of statistical distribution and determination of standard deviation with the help of black and white dice.
14. Determination of the temperature coefficient of a resistance with the help of Carey-Foster bridge.
15. Determination of the critical constant of a gas/vapour.

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 – 10 marks; Practical Record File – 10 marks; Table work/Experiments – 50 marks.]

Subject: Mathematics

Course Title: Calculus and Differential Equations

Part A - Introduction

Course Code: UCACL102
Course Title: Calculus and Differential Equations
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. Sketch curves in a plane using its Mathematical properties in the different coordinate systems of reference.
2. Using the derivatives in optimization, social sciences, physics and life sciences etc.
3. Formulate the differential equations for various Mathematical models.
4. Using techniques to solve and analyze various Mathematical models.

Part B: Content of the course [Total no. of lectures (in hours per week); 3 hours per week. Total lecture: 90 hours]

Unit I: (No. of lectures: 18):

1. **Historical background:**
   1.1. Development of Indian mathematics: Ancient and Early Classical Period (till 500 CE).
   1.2. A brief biography of Bhāskaracharya (with special reference to Lilavati) and Madhava.
2. **Successive differentiation**
   2.1. Leibnitz theorem.
   2.2. Maclaurin'sseries expansion.
   2.3. Taylor series expansion.
3. **Partial Differentiation**
   3.1. Partial derivatives of higher order.
   3.2. Euler theorem on homogeneous functions.
4. **Asymptotes**
   4.1. Asymptotes of algebraic curves.
   4.2. Condition for existence of asymptotes.
   4.3. Parallel asymptotes.
   4.4. Asymptotes of polar curves.

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

1. **Curvature**
   1.1.Formula for radius of Curvature.
   1.2.Curvature at origin.
   1.3.Center of Curvature.
2. **Concavity and Convexity**

2.1.Concavity and convexity of curves.
2.2.Point of inflection.
2.3.Singular point.
2.4.Multiple points.

3. **Tracing of Curves**
   3.1. Curves represented by Cartesian equation.
   3.2.Curves represented by Polar equation.

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

1. Integration of transcendental functions.
2. Introduction to double and triple integral.
3. Reduction formulae.
4. Quadrature
   4.1. For Cartesian coordinates.
   4.2. For Polar coordinates.

Unit IV: (No. of lectures: 18):

1. Linear differential equations.
   1.1. Linear equation.
   1.2. Equations reducible to the linear form.
   1.3. Change of variables.
2. Exact differential equations
3. First order and higher degree differential equations.
   3.1. Equations solvable for x, y, and p.
   3.2. Equations homogeneous in x and y.
   3.3. Clairaut's equation.
   3.4. Singular solutions.
   3.5. Geometrical meaning of differential equations.
   3.6. Orthogonal trajectories.

Unit V: (No. of lectures: 18):

1. Linear differential equations with constant coefficients.
2. Homogeneous linear ordinary differential equations.
3. Linear differential equations of second order.
4. Transformation of equations by changing the dependent/independent variable.
5. Method of variation of parameters.

Keywords/Tags: Indian mathematics, Successive differentiation, Partial differentiation, Asymptotes, Curvature, Tracing of curves, Quadrature, Rectification, Linear differential equations, Method of variation of parameters.

Part C- Learning Resources

Text books:

1. Gorakh Prasad: Differential Calculus, Pothishala Private Ltd., Allahabad, 2016.
2. Gorakh Prasad: Integral Calculus, Pothishala Private Ltd., Allahabad, 2015.

3. M.D. Raisinghania: Ordinary and Partial Differential Equations, S. Chand 7 Co. Ltd., 2017.
4. Gerard G. Emch, R. Sridharan and M.D. Srinivas: Conrtibutions to the Histroy of Indian Mathematics, Hindustan Book Agency, Vol. 3, 2005.

Reference books:

1. N. Piskunov, Differential and Integral Calculus, CBS Publishers, 1996.
2. G.F. Simmons, Differential Equations, Tata McGraw Hill, 1972.
3. E.A. Codington,An Introduction to ordinary differential Equations, Orient Longman (India),1961.
4. D.A. Murray, Introductory Course in Differential Equations and their Application, C.B.S. Publisher & Distributors, Delhi, 1985.
5. H.T.H. Piaggio, Elementary Treatise on Differentia Equations and their Application, C.B.S. Publisher & Distributors, Delhi, 1985.
6. Gorakh Prasad and H.C. Gupta, Text Book on Coordinate Geometry, Pothishala Pvt. Ltd.
7. 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: Analytical Chemistry

Part-A: Introduction

Course Code: UANALCH103
Course Title: Analytical Chemistry
Credit value: 4
Total Marks: 40 + 60 = 100; Min. Passing Marks: 35
Course Learning Outcomes (CLO): By the end of this course students will learn the following aspects of chemistry:

1. Basic concepts of mathematics for chemists.
2. Fundamentals of analytical chemistry and steps involved in analysis.
3. Basic knowledge of computer for chemists.
4. Basic concepts of chemical equilibrium.
5. Principles f chromatography and chromatographic techniques.
6. Various techniques of spectroscopic analysis.

Part B – Content of the course

Unit I: Mathematics for Chemists (No. of lectures: 10): Straight line equation. Logarithmic relations, curve sketching, linear graphs & calculation of slopes, differentiation, differentiation of functions like e^x, x^n, sinx, log x, maxima & minima, partial differentiation, integration of some useful relevant functions.

Keywords/Tags: Linear graphs, Logarithmic relation, Differentiation, Integration.

Unit II: Basic Analytical Chemistry (No of lectures: 10): Introduction to analytical chemistry and its interdisciplinary nature, concept of sampling, importance of accuracy, precision and sources of error in analytical measurements, presentation of experimental data and results, from the point of view of significant figures, statistical terms – mean, mean deviation, median, standard deviation, numerical problems.
Calculations used in Analytical Chemistry
Some Important units of measurements – SI units, distinction between mass and weight, mole, milli mole & numerical problems.
Solution and their concentrations – Empirical and molecular formulas, stoichiometric calculations, numerical problems.

Keywords/Tags: Accuracy, Precision, SI units, Units of concentration, Chemical stoichiometry.

Unit III: Computer for Chemists (No. of lectures: 10):Introduction to computer, introduction to operating systems like-DOS, Windows, Linux, and Ubuntu.
Use of computer programs – Running of standard programs & packages such as MW-word, MS-

excel, Power Point, Execution of linear regression, x-y plot, use of software for drawing structures and molecular formulae.

Keywords/Tags: Operating system, MS-Word, MS-Excel, Power Point.

Unit IV: Chemical Equilibrium (No. of lectures: 10): Equilibrium constant and free energy, concept of chemical potential, thermodynamic derivation of law of chemical equilibrium, temperature dependence of equilibrium constraint, Van't Hoff reaction isochore, Van't Hoff reaction isotherm, Le-Chatelier's principle and its applications.

Keywords/Tags: Chemical equilibrium, Equilibrium constant, Free energy, Chemical potential.

Unit V: Chromatography (No. of lectures:10): Introduction, principle and classification, mechanism of separation – adsorption, partition, and ion-exchange; development of chromatograms – frontal elution, and displacement methods; paper chromatography (ascending, descending, and circular), this layer chromatography (TLC) and Column Chromatography (CC), Gas Chromatography (GC) and High Pressure Liquid Chromatography (HSPLC), types of column and column selection, applications limitation; Principles and applications of flash chromatography, ion-exchange chromatography, and chiral chromatography.

Unit VI: Spectral techniques of analysis (No. of lectures: 10)**:**

1. **Basics of absorption spectroscopy:** Electromagnetic radiation, spectral range, absorbance, absorptivity, molar absorptivity, fundamental laws of absorption, Lambert-Beer law and its limitations, constitution and working of photometer, spectrometer, colorimeter.

2. **Ultraviolet (UV) absorption spectroscopy:** Presentation and analysis of UV spectra, types of electronic transitions, effects ofconjugation, concept of chromophore andauxochrome, bathochromic, hypsochromic, hyperchromic and hpochromic shifts, UV spectra of conjugate polyenes and enones.

3. **Infra-red (IR) absorption spectroscopy**: Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, finger point region, characteristics absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

Keywords/Tags: Hypsochromic, Hypochromic, Absorption, Spectrum

Part C- Learning Resources

Text books:

1. S. Gaur, Computer for Chemists, Neel Kamal Prakashan, 2017.
2. S.M. Khopkar, Basic Concepts of Analytical Chemistry, New Age International Publisher, 2009.

3. A. Bahl& B.S. Bahl, Advanced Organic Chemistry, S. Chand, 2010.
4. Y.R. Sharma, Elementary Organic Spectroscopy, S. Chand, 2013.

Reference Books:
1. G.M. Barrow, Physical Chemistry, Tata McGraw-Hill, 2007.
2. Banwell, Molecular Spectroscopy, 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: Chemistry Lab II

Part A - Introduction
Course Code: UANALCH104
Course Title: Chemistry Lab II
Credit value: 2
Total Marks: 40 + 60 = 100 Min. Passing Marks: 35
Course Learning Outcomes (CLO): By the end of this course students will learn the following aspects of Laboratory exercises in chemistry.
1. Concepts and analytical methods in chemistry.
2. Preparation of solutions of different concentrations.
3. Standardization of organic compounds by chromatographic techniques.
4. Analysis by spectral techniques.

Part B - Content of course
Experiments to be performed in laboratory
1. Basic analytical exercises:
   - Calibration of different weights and glass apparatus (measuring cylinder, burette, pipette, volumetric flasks.
     - Preparation of solutions of different molarity/normality by weighing and dilution.
2. Quantitative analysis: Titrimetric analysis
   - Standardization of NaOH with oxalic acid.
   - Determination of carbonate and hydroxide present in mixture.
   - Determination of carbonate and bicarbonate present in mixture.
   - Determination of free alkali present in different soaps/detergents.
3. Quantitative analysis by colorimetry:
   - Verification of Lambert-Beer law.

- Determination of concentration of colored compounds (e.g., $CuSO_4$, $KMnO_4$).

4. Quantitative analysis:
    - Systematic identification of organic compound by qualitative analysis.
    - Chromatography: Identification of the R_f values of the given organic/inorganic compounds by paper/thin layer chromatography.

Keywords/Tags: Analytical, Authentication, Molarity/Normality, Standardization, Colorimetry, Qualitative analysis.

Part C- Learning Resources

Text books:

1. D.A. Skoog& J.J. Leary, Instrumental Methods of Analysis, Saunders College Publication, New York, 1992.
2. Vogel's textbook of quantitative chemical analysis.
3. SudhaGoyal, B.Sc. Chemistry Practical, Krishna Publication, 2017.

Part D – Assessment and Evaluation

A. Internal Assessment: 40 marks

I. Class interaction on: 15 marks.
   i. Common glassware and lab wares for solution preparation & analysis.
   ii. Numerical problems related to solution preparation.
   iii. Any other discussion.

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: 15 marks; Practical Record File: 15 marks; Table work/Experiments: 50 marks.]

Subject: Computer Science

Course Title: Programming Methodologies & Data Structure

Part A - Introduction

Course Code: UPROGCS103
Course Title: Programming Methodologies & Data 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 Physics in 12th class.
Course Learning Outcomes (CLO):

5. The course would enable the students to understand the basic Physics of heat & temperature in relation to energy, work, radiation, & matter.
6. The students are expected to learn that "how laws of thermodynamics are used in a heat engine to transform heat into work".
7. This course will also develop an understanding of the various concepts of statistics and the methods to apply them in thermodynamics.
8. Students will understand the importance of studying statistical mechanics with the behavior of particles under classical and quantum conditions.

Part B – Content of the Course

Unit – 1
Introduction to Programming;- Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies
Introduction to C++ Programming:- Basic Program Structure In C++, Data Types, Variables, Constants, Operators and Basic I/O.
Variables - Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise). Using Comments in programs, Character I/O (gete, getchar, pute, putchar etc.). Formatted and Console I/O (printf(), scanf(), cin, cout). Using Basic Header Files (stdio.h. iostream.h. conio.h etc.)
Simple Expressions in C++ (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions
Conditional Statements if construct, switch-case construct.

Unit – 2
Iterative Statements while, do-while, and for loops, Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative)
Functions Top-Down Design, Pre-defined Functions, Programmer- defined Functions, Local Variables and Global variables, Functions with Default Arguments, Call-By-Value and Call-By-

Reference arameters, Recursion.
Introduction to Arrays - Declaration and Referring Arrays, Arrays in Memory, Initializing Arrays. Arrays in Functions, Multi-Dimensional Arrays.

Unit – 3
Structures - Member Accessing. Pointers to Structures, Structures and Functions, Arrays of Structures.
Unions - Declaration and Initialization.
Strings - Reading and Writing Strings. Arrays of Strings. String and Function, Strings and Structure, Standard String Library Functions.
Searching Algorithms - Linear Search, Binary Search.
File Handling - Use of files for data input and output, merging and copying files.

Unit- 4
Data Structure - Basic concepts, Linear and Non-Linear data structures
Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis.
Linked List - Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations.
Array-Representation of single, two dimensional arrays, sparse matrices-array and linked representations.
Stack- Operations, Array and Linked Implementations, Applications- Infix to Postfix Conversion, Postfix Expression Evaluation. Recursion

Unit - 5
Queue - Definition, Operations, Array and Linked Implementations. Xon Implementation. Circular Queue-Insertion and Deletion Operations, Dequeue (Double Ended Queue), Priority Queue- Implementation.
Trees - Representation of Trees, Binary tree. Properties of Binary Trees, Binary Tree Representations- Array and Linked Representations, Binary Tree Traversals. Threaded Binary Trees.
Heap- Definition, Insertion, Deletion.

Unit -6
Graphs - Graph ADT. Graph Representations, Graph Traversals, Searching
Hashing- Introduction, Hash tables, Hash functions, Overflow Handling.
Sorting Methods- Comparison of Sorting Methods,
Search Trees – Binary Search Trees, AVL Trees- Definition and Examples.

Unit – 7
Indian Contribution to the field : Innovations in India, origin of Julia Programming Language, Indian Engineers who designed new programming languages, open source languages. Dr. Sartaj Sahni computer scientist - pioneer of data structures. Other relevant contributors and contributions.

Course Title: Lab Course Computer II

Part A - Introduction

Course Code: UCOMPCS104
Course Title: Lab Course Computer II
Credit value: 2
Total Marks: 40 + 60 = 100 Min. Passing Marks: 35
Course Learning Outcomes (CLO): By the end of this course students will learn the following aspects of Laboratory exercises in chemistry.

5. Concepts and analytical methods in chemistry.
6. Preparation of solutions of different concentrations.
7. Standardization of organic compounds by chromatographic techniques.
8. Analysis by spectral techniques.

Part B - Content of course

1. Office Tools

a. Using a Text Editor Tool
1. Create a document and apply different Editing options.
2. Create Banner for your college.
3. Design a Greeting Card using Word Art for different festivals.
4. Design your Bio data and use page borders and shading.
5. Create a document and insert header and footer, page title, date, time, apply various page formatting
features etc.
6. Implement Mail Merge.
7. Insert a table into a document and try different formatting options for the table.

b. Using a Spreadsheet Tool

1. Design your class Time Table.
2. Prepare a Mark Sheet of your class result.
3. Prepare a Salary Slip of an employee of an organization.
4. Prepare a bar chart & pie chart for analysis of Election Results.
5. Prepare a generic Bill of a Super Market.
6. Work on the following exercises on a Workbook:
a. Copy an existing Sheet
b. Rename the old Sheet
c. Insert a new Sheet into an existing Workbook
d. Delete the renamed Sheet.
7. Prepare an Attendance sheet of 10 students for any 6 subjects of your syllabus. Calculate their total attendance, total percentage of attendance of each student & average of attendance.
8. Create a worksheet of Students list of any 4 faculties and perform following database functions on it.
a. Sort data by Name
b. Filter data by Class
c. Subtotal of no. of students by Class.

c. Using a Presentation Tool

1. Design a presentation of your institute using auto content wizard, design template and blank presentation.
2. Design a presentation illustrating insertion of pictures, Word Art and ClipArt.
3. Design a presentation, learn how to save it in different formats, copying and opening an existing presentation.
4. Design a presentation illustrating insertion of movie, animation and sound. 5. Illustrate use of custom animation and slide transition (using different effects).
6. Design a presentation using charts and tables of the marks obtained in class.

II. Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code in C++, execute and test it. Students should be given assignments on following:

1. a. To learn elementary techniques involving arithmetic operators and mathematical expressions,
appropriate use of selection (if, switch, conditional operators) and control structures
b. Learn how to use functions and parameter passing in functions, writing recursive programs.
2. Write a program to swap the contents of two variables.
3. Write a program for finding the roots of a Quadratic Equation.
4. Write a program to find area of a circle, rectangle, square using
5. Write a program to check whether a given number is even or switch case odd.
6. Write a program to print table of any number.
7. Write a program to print Fibonacci series.
8. Write a program to find factorial of a given number.
9. Write a program to convert decimal (integer) number into equivalent binary number.
10. Write a program to check given string is palindrome or not.
11. Write a program to perform multiplications of two matrices.
12. Write a program to print digits of entered number in reverse order.
13. Write a program to print sum of two matrices.
14. Write a program to print multiplication of two matrices.
15. Write a program to generate even/odd series from to 100.
16. Write a program whether a given number is prime or not.
17. Write a program for call by value and call by reference.
18. Write a program to generate a series 1+1/11+2/2+3/3!+--+n/n!
19. Write a program to create a pyramid structure
20. Write a program to create a pyramid structure
21. Write a program to check entered number is Armstrong or not.
22. Write a program for traversing an Array.
23. Write a program to input N numbers, add them and find average.
24. Write a program to find largest element from an array.
25. Write a program for Linear search.
26. Write a program for Binary search.
27. Write a program for Bubble sort.
28. Write a program for Selection sort.

Subject: Zoology

Course Title: Cell Biology, Reproductive Biology and Development Biology

Part A - Introduction

Course Code: UCELLZO103
Course Title: Cell Biology, Reproductive Biology and Development Biology
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. Develop deeper understanding of what life is and how it functions at cellular level.
2. Understand the nature and basic concepts of cell biology, reproductive and developmental biology..
3. Understand structure and functions of cell membrane and cellular organelles.
4. Understand the importance of latest reproductive trends, reproductive techniques to be applied for human welfare.
5. Understand the general patters and sequential development stages during embryogenesis; and understand how the developmental processes lead to establishment of body plans of multi-cellular organisms.
6. Understand about the evolutionary development of various animals.

Part B – Content of the Course

Unit I: Cell Biology (No. of lectures: 13):

1. Concept of Prokaryotic and Eukaryotic Cells, difference between Prokaryotic and Eukaryotic Cells.
2. Structure and functions of Plasma membrane.
3. Structure and functions of Golgi body, Mitochondria, Endoplasmic reticulum, Ribosome and Lysosome.
4. Structure and functions of Nucleus.
5. Structure and functions of Chromosome and special type of chromosomes – Lampbrush and Polytene chromosome.
6. Cell cycle, Mitotic and Meiotic cell division and their significance.

Keywords/Tags: Prokaryote, Eukaryote, Cell organalles, Chromosomes, Cell Cycle.

Unit II: Reproductive Biology (No. of lectures: 13):

1. Structure of male reproductive system of Lepus.

2. Structure of female reproductive system of Lepus.
3. Histology of Testis and Ovary of Lepus.
4. Gametogenesis – Spermatogenesis and oogensis, difference between spermatogenesis and oogenesis.
5. Types of eggs-based on amount and distribution of yolk with examples.

Keywords/Tags: Reproductive system, Gametogenesis, Sperms, Eggs.

Unit III: Recent Assisted Reproductive Techniques (ART) (No. of lectures: 13):
1. Stem cell – types and their uses.
2. Gene bank, sperm bank, superovulation, cryopreservation.
3. In Vitro Fertilization (IVF) and Embryo Transfer (ET), Zygote Intra Fallopian Transfer (ZIFT), Intracytoplasmic Sperm Injection (ICSI).
4. Placement - types, examples, and functions.
5. Placenta Banking – placenta preservation benefits.

Keywords/Tags: Gene bank, Sperm bank, Superovulation, IVF, ET, ZIFT, ICSI, Placenta banking.

Unit IV: Developmental Biology(No. of lectures: 11):
1. Fertilization.
2. Embryonic development of frog up to the formation of three germinal layers.
3. Fate map construction in frog.
4. Metamorphosis of Tadpole Larva.
5. Parthenogenesis.

Keywords/Tags: Fertilization, Frog embryology, Tadpole metamorphosis, Parthenogenesis.

Unit V: Embryonic Development of Chick (No. of lectures: 11):
1. Structure of hen's egg.
2. Embryonic development of chick embryo up to the formation of primitive streak.
3. Fate map construction in chick.
4. Extra embryonic membranes of chick: Formation and functions.

Keywords/Tags: Hen's egg, Chick embryology, fate map, Chick embryo membranes.

Part C- Learning Resources

Text Books:
1. B.I. Balinsky, An Introduction to Embryology, Cengage Learning, 2012.

2. S.R. Bolsover, J.S. Hyams, E.A. Shephard, H.A. White, & C.G. Wiedemann, Cell Biology – A Short Course, Wiley, 2004.
3. T.W. Sadler, Langman's Medical Embryology, 12th edition, Lippincott Williams & Wilkins, 2012.
4. W. Kuehnel, Color Atlas of Cytology, Histology, and Microscopic Anatomy, Thieme, 1992.
5. Verma and Agarwal, A Text Book of Cytology, S. Chand & Co., 1999.
6. Verma and Agarwal, Chordate Embryology, S. Chand & Co., 2000.

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 II

Part A - Introduction

Course Code: UZOOLZO104
Course Title: Zoology Lab II
Credit value: 2
Total Marks: 30 + 70 = 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. The different stages of mitotic and meiotic cell division and special types of chromosomes.
2. Different stages of embryology
3. Through squash preparation understand the stages of cell division and structure of polytene chromosomes.
4. Enhance collaborative learning and communication skills through practical sessions, team work, group discussions, assignments and projects.

Part B – Content of the Course

Unit 1: Spotting related to the cytology (No. of lectures - 13):

a) Prokaryote and Eukaryote cell
b) Stages of Mitotic cell division.

c) Stages of Meiotic cell division.
d) Lamp brush chromosome.

Unit 2: Spotting related to Reproductive biology and Embryology(No. of lectures - 13):
a) T.S. Testis of Mammal.
b) T.S. Ovary of Mammal.
c) Developmental stages of Frog embryology.
d) Developmental stages of Chick embryology.

Unit 3: Squash preparation of onion root tip to understand the stages of Mitosis (No. of lectures 8).

Unit 4: Squash preparation of grasshopper testis to understand the stages of Mitosis (No. of lectures 9).

Unit 5: Squash preparation of salivary gland chromosome from Chironomus larva/Drosophila (No. of lectures 9).

Keywords/Tags: Stages of cell division, Stage of Embryonic development, Squash preparation.

Part C- Learning Resources

Text Books:

1. M.M. Beffa and J. Knight, Experiments in Practical Development Biology, Cambridge University Press, 2011.
2. K.V. Chaitanya, Cell and Molecular Biology: A Lab. Manual, PHI, 2013.
3. L.R. Keller, J.H. Evans, T.C.S. Keller, Experimental Developmental Biology, Academic Press, 1998.

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 [Viva voce on Practical: 10 marks; Practical Record File: 10 marks; Table work/Experiments: 50 marks.]

Subject: Botany

Course Title: Basic Botany

Part A – Introduction
Course Code: UBASIBO103
Course Title: Basic 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 botany in class 12^{th}.
Course Learning Outcomes (CLO):

1. The course will help the student to understand the diversity of plants and evolutionary process in plant kingdoms.
2. It gives an account of plant adaptation from aquatic condition to colonize terrestrial habitat.
3. The changes in morphological, anatomical and reproductive structures that propel plant evolution can be investigated.
4. The economic importance and significance of plants in nature will be understood.
5. They will be acquainted with locally prevalent microbial disease of plants and humans.

Part B – Content of the Course
Unit I:(No. of lectures: 12):

1. History of botany and Indian contributions.
2. Morphological characteristics of lower and higher plants (Angiosperms).
3. Types of leaves, inflorescence, flowers, and fruits.
4. Structure of plant cell and cell organelles, prokaryotic and eukaryotic cells, types of cell division.
5. Microscope structure and function of light microscope (magnification and resolving power)
6. Various types of microscopes: Bright field, phase contrast, SEM & TEM

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

1. Algae
   1.1. General characteristics.
   1.2. Range of thallus organization, reproduction.
   1.3. Types of life-cycles in algae.
   1.4. Role of algae in nature and its economic importance.
2. Bryophytes
   2.1. General characteristics, ecology.
   2.2. Range of thallus organization, morphology, anatomy (internal and external features), & reproduction of any one Bryophyte.
   2.3. Economic importance of Bryophytes.

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

1. Pteridophytes

1.1. General characteristics and morphology.
1.2. Stelar organization and reproduction.
1.3. Heterospory and seed habit.
1.4. Economical importance

2. Gymnosperms
   2.1. General description and their distribution
   2.2. Economical importance of gymnosperms.
3. Paleonotany
   3.1. Indian contribution to paleobotany.
   3.2. Brief knowledge of fossils and geological time scale.

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

1. Fungi
   1.1.General characteristics and cell wall compostion.
   1.2.Mode of nutrition.
   1.3.Types of reproduction.
   1.4.Economic importance.
   1.5.Parasexuality and Mycorrhiza.
2. Lichens: Brief knowledge and their significance.

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

1. Brief outline of various types of microbes.
2. Archaebacteria, Eubacteria, Cyanobacteria, Mycoplasma, Actinomycetes, & Virus.
3. Beneficial & harmful roles.

Keywords/Tags: History of botany, Palebotany, Prokaryotes, Eukaryotes, Algae, Bryophyta, Pteridophyta, Gymnosperms, Fungi, Mycorrhiza, Lichens, Bacteria, Virus.

Part C – Learning Resources

Text books:

1. O. Oladele, Microbial Diversity: Form & Function in Prokaryotes, Wiley Blackwell, 2008.
2. L. Presscort, J. Harley, & D. Klein, Microbiology, Tata McGraw-Hill Co., New Delhi, 2005.
3. P.C. Vasishtha, Botany for Degree students: Gymnosperms, revised edition, S. Chand & Comp. Ltd., New Delhi, 2018.
4. O.P. Sharma &Shivani Dixit, Gymnosperms, PragatiPrakashan, Meerut, 2015.
5. M.J. Pelezar et al., Microbiology, Tata McGraw-Hill Co., New Delhi, 2001.
6. S.P. Bhatnagar&AlokMoitra, Gymnosperms, New Age International (P.) Ltd., New Delhi, 2000.

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: 60 marks. Time: 3 hours. Question pattern: Bloom's taxonomy.

Course Title: Botany Lab II

Part A – Introduction

Course Code: UBOTABO104
Course Title: Botany Lab II
Pre-requisite (if any): To study this course, a student must have had the subject botany in class 12^{th}.
Course Learning Outcomes (CLO):
1. Students will learn to carry out practical work in the laboratory.
2. Interpreting plant morphology & anatomy of various groups of lower & higher plants.
3. Students will be able to identify the major groups of microorganisms.

Credits:2 credits.
Total Marks: 30 + 70 = 100, Min. Passing Marks: 35

Part B – Content of the Course

1. Study of various types of leaves, inflorescence, flowers & fruits.
2. Understanding various parts of Microscope (simple & compound microscope).
3. Study of plant cells (e.g., onion etc.).
4. Study of Electron Micrographs of Cell and organelles from internt, youtube.
5. Identification of various algae from speciments, slides & temporary mounts of water from nearby areas like *Nostoc*, *Oscillatoria*, *Volvox*, *Spirogyra*, *Oedogonium*, *Chara*, and specimens and pictographs of marine algae like *Ectocarpus, Sargasssum, Polysiphonia*.
6. Study & identification of some Bryophytes like *Riccia, Marchantia, Anthoceros, Funaria*& field visit.
7. Study of some fossils (specimens & slides).
8. Study of some Pteridophytes like *Lycopodium*.*Sellaginella*, *Equisetum* and *Marselia*.
9. Section cutting of Pteridophytes& Gymnosperms: Stem, root, & leaves.
10. Specimen study of Pteridophytes& Gymnosperms cones.
11. Study of fugal structures & preparation of temporary mounts of *Mucor, Rhizopus, Asperigillus, Yeast, Pencillium, Alternaria, Albugo, Helimenthosporium*.
12. Permanent slides of Puccinia on host.
13. Study of various fungal plant diseases.
14. Observation of symptoms of virus & bacteria on plant.
15. Gram staining techniques.

Key works/Tags: Microscope, Algae, Bryophyta, Pteridophyta, Gymnosperms, Fungi.

Part C – Learning Resources

Text books:

1. A. Bendre& A. Kumar, A Textbook of Practical Botany, Vol. I, Rastogi Pub., Meerut, 1984.
2. B.P. Pandey, Modern Practical Botany, Vol. 1, S. Chands & Co. Ltd., N. Delhi, 1999.
3. M.P. Singh, S.B. Chaudhary, & H. Sahu, Textbook of Practical Botany, Daya Pub. House, N. Delhi, 2005.
4. E. Margaret & G. Angela, Practical Manual of Botany, Vol. 1, New Age, 2007.

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: Microbiology and Immunology

Part A - Introduction

Course Code: UMICRBT103

Course Title: Microbiology and Immunology

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): To create general understanding about microbiology and immunology.

1. The students will be able to understand microbial diversityand Nutrition.
2. The students will be able to understand immune system.Immune responses and Vaccination.
3. The students will be able to describe role of immune system in both maintaining health and contributing to disease.
4. The students will be able to understand immunologicaltechniques.

At the end of the course studentwill familiar with -

1. Microbial diversity and nutrition.
2. Immune system, its properties and types.
3. Immunoglobulin structure, types and functions and can applythe concept of hypersensitivity and vaccination for different diseases.
4. Perform various immunological techniques.

Part B – Content of the Course

Total lectures – 60 hours

Unit I: History, Basic concepts of Microbiology and Culture Media preparation (No. of lectures: 12):

1. History, Basic concepts of Microbiology:

1.1 Fundamental, History and evolution of microbiology. Development of microbiology, Application of microbiology inhuman welfare.

1.2 Classification, General characteristic and structure of Bacteria.Fungi and Viruses.

2. Media Preparation:

2.1 Methods and Types Culture, Minimal, Selective, differential, Transport media.

2.2 Synchronous, Batch and Continuous culture.

Keywords: Classification of Microorganisms.Media Preparation.

Unit II: Microbial Growth and Growth measurement:(No. of lectures: 14):

1. Microbial Growth:

1.1. Definition of growth, Mathematical expression of growth, Growth Curve, Generation time, Growth yield. Effect of nutrients on growth.
1.2. Factor affecting growth: Nutrient, Temperature, Oxygen, pH, Osmotic pressure.

2. Growth measurement:
2.1 Measurement of Growth (Direct and Indirect methods): cellnumber, Cell Mass and Cell Activity.

2.2. Cell Count: Turbidometric method, Plate count method.Membrane count method, Dry weight and Wet method by measurement of cellular activity.

Keywords/Tags: Growth.Measurement.

Unit III:Basics of Immunology(No. of lectures: 10):
1. Basics of Immunology:
1.1. Concept of Innate and Acquired immunity, Phygocytosis complement and inflammatory responses.
1.2. Immune cells and organs: Structure, Function and Propertiesof immune cells -Stem cell.T-cell, B-cell. NK-cell .Macrophagus, Neutrophil, Eosinophil , Basophil, Mast cell, dentric cell.
1.3 Immune organ: Bone marrow, Thymus, Lymph Node, Spleen, Lymphatic system.

Keywords/Tags: Immunity, Immune cells.

Unit IV: Immunoglobulins and Immune response (No. of lectures: 15):
1. Immunoglobulins
1.1. Antigens: Characteristics of an antigen: Foreignness, Molecular size, Chemical composition and Heterogeneity. Antigen Adjuvants, Epitopes, Haptens.
1.2. Antibodies: Structure, Types, Functions and Properties of antibodies Antigenic determinant on antibodies (Isotypic, Allotypic, Idiotypic).Monoclonal, Polyclonal and Chimericantibody.
2. Immune response:
2.1. Generation of immune response: Primary and Secondary immune response, generation of Humoral response (Plasma and Generation of cell mediated immune response (self MHCMemory cell),restriction, T-cell activation, Co-stimulatory signals), Killing Mechanisms by CTL and NK cells, Introduction to tolerance.

Keywords/Tags: Antigens, Antibody.

Unit V:Microbial, Immunological Techniques and Vaccination (No. of lectures: 10):
1. Microbial Techniques:
1.1. Principle, Working and applications of instruments -Laminar airflow, Autoclave, Hot air oven.
2. Immunological techniques:
2.1. RIA, ELISA, Western blotting.Principles of Precipitation, Agglutination, Immunodiffsion, Immunoelectophorosis.

3. Vaccination:
3.1. Vaccines and vaccination: Rubella, Varicella(Chickenpox),Polio, Diptheria, Hepatitis

vaccine.

Key Worlds: RIA, ELISA, Laminar air flow, Autoclave, Vaccine.

Part C Learning Resources

Text Books:

1. Fundamentals of microbiology and immunology; A.K.Banerjee and Nirmalaya Banerjee, New Central Book Agency, New Delhi
2. Modern concepts of microbiology: H.D. Kumar and Swati Kumar., VikasPublishing HousePvt Ltd., 2nd Edition.
3. Microbiology:M.J. Pelczar, E.C.S. Chan and N.R.Krieg, McGraw Hill Book company.1993, 5th edition
4. A text book of microbiology:R.C.Dubey and D.K.Maheshwari . S Chand and Company Ltd 2004, 1" edition.
5. Microbiology;P.D.Sharma, Rastogi Publication, Meerut.
6. General Microbiology Vol I and II; C.B. Powar and H.F.Dagniwala.
Himalaya Publication.
7. Microbiology Fundamental and Applications: S.S.Purohit, Agrobias, 7th Edition.
8. Immunology :K.R. Joshi, Agrobios. 5th edition.

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: Biotechnology Lab II

Part A - Introduction

Course Code: UBIOTBT104

Course Title: Biotechnology Lab II

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 objective of the course is to prepare students competent in subject through in-depth lecture and laboratory practices-

1. The students will be able to identify microbes using modern techniques.
2. The students will acquire skill and competence in microbiological and immunological laboratory practices applicable to microbiological research or clinical methods of immunology, including accurately reporting observations and analysis. On completion of this course, learners will be able to have sufficient scientific understanding of microbiology and immunology-
    1. Students apply concept, Principle and types of sterilization methods viz performing microbiological experiments.
    2. Students apply the concept and characteristics of antiseptic, disinfected and their mode of action in day to day life.
    3. Students will apply principle, working and applications of instruments -Laminar airflow, Autoclave, Hot air oven etc.

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

List of experiments:

1. To perform Aseptic technique, Cleaning of glassware's, preparation of Cotton Plugging and Sterilization.
2. To prepare Bacterial and Fungal media.
3. To isolate microbes from Air, Water and Soil.
4. To Study dilution and plating by Pour Plate, Spread Plate methods.
5. To Study microorganisms by Staining method - Simple staining, Gram staining, Endospore staining, Fungal staining. Negative staining.
6. To identify bacteria based on staining, Shape and Size.
7. To enumerate microorganism - Total and Viable count.
8. To study Antibiotic sensitivity of microbes by the use of antibiotic discs.
9. To isolate and identify pathogenic bacteria from sewage and waste water.
10. To Determine growth curve and generation time of E. coli.
11. To identify of human blood groups.
12. To enumerate total WBC of the given blood sample by hemocytometer.

13. To enumerate differential Leukocyte of the given blood sample.
14. To enumerate total RBC of the given blood sample by hemocytometer.
15.To isolate and Identify aquatic Fungi from Local water body.

Part C Learning Resources

Text Books:Suggested Readings

1. Laboratory Techniques in Modem Biology: N.Swarup, S.C. Pathak, &S. Arora, KalyanimPublication, New Delhi.
2. Integrated Methodologies in Biology :ShashiShrivatava Banerjee, ArunPrakashan, Gwalior.
3.Experiment in Microbiology Plant Pathology and Biotechnology : K.R.Anejan, New AgeInternational New Delhi, 2007.
4. Laboratory Manual ofBiotechnology: P.N.Swamy, Rastogi Publication Meerut.
5. Practical Microbiology: R.C.Dubey, D.K.Maheshwari, S Chand & Company, Delhi.
6. Manual of Experiments in Biotechnology:LeenaLakhani, Sheeba Khan.KailashPustakSadan, Bhopal.

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: Microbial Techniques

Part A– Introduction

Course Code: UMICRMB103
Course Title: Microbial 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
Course Learning Outcomes (CLO): After completing this course in Microbiology, a student shall have understanding of —
a. Recall the basic lab glassware to be used in the laboratory.
b. Summarize different methods of sterilization and isolation of pure cultures.
c. Understand the working of different kinds of instruments and microscopes.
d. Apply serial dilution technique to isolate the bacteria.
e. Practice different methods to culture bacteria in the laboratory.
f. Illustrate a method to differentiate between Gram positive and Gram negative bacteria.

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

Unit: 1 Microscopy and Staining
1.1 Microscopy - Principles and applications of simple andcompound Bright-field microscopy, Dark-field microscopy,Fluorescence microscopy, Phase-contrast microscopy,Transmission electron microscopy and Scanning electronmicroscopy .
1.2 Preparation for Light Microscope Examination - Wet-mount and hanging-drop techniques.Preparation for smear and fixation.
1.3 Staining - Principles of staining, negative staining,simple staining, differential staining (Gram and acid faststaining), flagella staining, capsule and endospore staining.

Key words: Microscopy, Light microscope, Wet mount,Hanging drop method, Bacterial staining.

Unit :2 Instruments
Electronic Balance, Autoclave, Centrifuge, Colony counter, Deep freezer, Homogenizer, Hot air Oven, Incubator, Laminar air flow, Magnetic stirrer, pH Meter,Spectrophotometer, Vortex mixture, Water bath, Waterdistiller, Chromatography Chambers, Anaerobic chamberand Electrophoresis apparatus .

Key words: Instruments in microbiology laboratory
Unit: 3 Sterilization and Culture Medium
3.1 Physical methods of sterilization - Dry heat, Moistheat, Radiation, Filtration and Incineration.
3.2 Chemical methods of sterilization — Phenol andphenolic compounds, Alcohol, Halogens and Detergents.

3.3 Types of culture media —Natural, synthetic, complex,enriched and selective. Anaerobic (Thioglycolate broth,Robertson's media, Microaerophilic), broth culture ofaerobic bacteria.

Key words: Physical sterilization, Chemical sterilization,Microbial culture media.

Unit : 4 Isolation, Cultivation and Preservation
4.1 Natural microbial population - Pure culture.
4.2 Isolation of microbial population - From air, water andsoil.
4.3 Methods for isolation - Streak plate, Pour plate andSpread plate. Serial dilution and Micromanipulator methods.Cultivation on liquid and solid media.Isolation ofmicroorganisms on potato slice and bread.
4.4Maintenance and preservation for short term and longterm.
4.5Cultivation of anaerobic bacteria and accessing non-cultivable microorganisms.

Key words: Pure culture, Isolation of microbes,Preservation of culture.

Part C - Learning Resources

Text Books, Reference Books and Other Resources
1. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R.., "Microbiology". Tata McGraw-Hill, New Delhi.(2001).
2. Tortora G.J., Funke B.R., and Case C.L., "Microbiology: An Introduction." 9th edition Pearson Education. (2008).
3. Willey J.M., Sherwood L.M., and Woolverton C.J., "Prescott's Microbiology".9th edition.McGraw Hill Higher Education. (2013).
4. Madigan, M.T., Martinko, J.M., Dunlap, P.V. and Clark D.P., "Brock Biology of Microorganisms, 12" Edition. Pearson Benjamin Cummings, San Francisco. (2009).
5. Sumbali, Geeta and Mehrotra, R.S., "Principles of Microbiology". McGraw Hill Edition. (2017).
6. Ananthanarayana, R. and Panicker, C.K.S., "Text Book of Microbiology", 6" Edition. Oriental Longman Publications, USA. (2000).
7. Dubey, R.C. and Maheshwari,D.K., "A Textbook of Microbiology". S. Chand & Company Ltd., New Delhi. (2008).
8. Sharma, P.D.,"Microbiology".Rastogi Publications, Meerut. (2014).
9. Singh, R.P., "Applied Microbiology". Kalyani Publishers, New Delhi. (2007).
10. Shammi, Q.J., "Microbiology-I" .KailashPustakSadan, Bhopal. ISBN: 978-8 1-89900-43-4.
11. Shammi, Q.J. and Uike, J., "Cell Biology and Immunology". KailashPustakSadan, Bhopal. ISBN: 978-81-89900-95-3.

Suggested equivalent online courses:
l.https://www.mooc-list.com/course/small-and-mighty-introduction-microbiology-futurelearn
2. https://www.mooc-list.com/course/microbiology-saylororg
3. https://www.mooc-list.com/course/bacteria-and-chronic-infections-coursera
4. https://www.coursera.org/lecture/bacterial-infections/1-1 -introduction-to-bacteria-by-bioinformatician-phd-peder-worning-HZ64m
5. https://openstax.org/books/microbiology/pages/1 -3-types-of-microorganisms

6. https://openstax.org/books/microbiology/pages/4-1 -prokaryote-habitats-relationships-and microbiomes

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: Microbiology Lab II

Part A– Introduction

Course Code: UMICRMB104
Course Title: Microbiology Lab II
Credit value: 2
Total Marks: 100
Pre-requisition: To study this course a student must have had the subject Biology in class12th
Course LearningOutcomes (CLO):On completion of this course, learners will be able to understand:

1. Basic knowledge of glassware, microscopes and different kindsof instruments used in the microbiology laboratory.
2. Basic media preparation technique, autoclaving, cleaning andsterilization of glassware.
3. Preparation of liquid and solid culture media.
4. Isolation of microorganisms by different plating methods.

Part B- Content of the Course **[Total No. of Lectures**- 30]
Name of the Exercise No. of Lab

1. Demonstration and briefing about principles and working of basicinstruments.
2. Basic media preparation technique, autoclaving, cleaning andsterilization of glassware.
3. Preparation of liquid culture media - Peptone water, nutrient broth PR
4. Preparation of solid culture media - Nutrient agar (agar slant/ agar plate)
5. Isolation of microbes from water, soil and air by serial dilution 3agar plating method.
6. Isolation of fungi from water, soil and air by serial dilution agar 3plating method.
7. Isolation of microorganisms by pour plate method.
8. Isolation of microorganisms by streak plate method.
9. Isolation of microorganisms by spread plate method.
10. Any other experiment may be designed on the basis of theoreticalaspects.

Key words: Basic instruments, Culture media, Pour plate, Streak plate, Spread plate.

Part C - Learning Resources

Text Books, Reference Books and Other Resources

Suggested Reading:

1. Cappuccino, J. and Sherman, N., "Microbiology: A Laboratory Manual", 9th edition. Pearson Education Limited. (2010).

2. Dubey, R.C. and Maheswari, D.K. , "Practical Microbiology",. S. Chand & Co. Ltd., New Delhi.(2002).

3. M. GopalReddy,M., Reddy, M.N., Saigopal, D.V.R. and Mallaiah K.V., "LaboratoryExperiments in Microbiology",. Himalaya Publishing House, Mumbai. (2007).

4. Aneja, K.R., "Laboratory Manual of Microbiology and Biotechnology. 2" Edition", Meditech Scientific International. (2018).

5. Patel, Rakesh J. and Patel Kiran, R., "Experimental Microbiology Vol. I and Vol. II",.AdityaPrakashan, Ahmadabad. (2009).

6. Varghese, Naveena and Joy, V, "Microbiology Laboratory Manual" Ed.1, Aromatic andMedicinal Plants Research Station, Odakkali, Ernakulam, Kerala. (2014).

7. Shammi, Q.J. "Microbiology - Tools and Techniques", KailashPustakSadan, Bhopal. ISBN:978-8 1-89900-38-0 (In Hindi also).

8. Grainger.John, Hurst. Janet and Burdass.Dariel, "Basic Practical Microbiology: A Manual",.TheSociety for General Microbiology. (2001).

Suggested Digital Platforms/Web Links:

1. https://www.mooc-list.com/course/introduction-practical-microbiology-futurelearn

2.https://study.com/articles/List_of_Free_Online_Microbiology_Courses_and_Training_Options.htm

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: Biochemistry

Course Title: Chemistry of Biomolecules

Part A– Introduction

Course Code: UCHEMBC103
Course Title: Chemistry of Biomolecules
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 CARBOHYDRATES
Applications and scope of Biochemistry, Water as a biological solvent, fitness of the aqueous environment for living organisms.
Structure of monosaccharides, stereoisomerism and optical isomerism of sugars, reactions of aldehyde and ketone groups, ring structure and anomeric forms, mutarotation, reactions of sugars due to hydroxyl groups, important derivatives of monosaccharides.
Structure, occurrence, and functions of important disaccharides and trisaccharides.
Structure, occurrence and biological importance of polysaccharides (starch, glycogen, cellulose, chitin).
Blood group polysaccharides, Cell wall polysaccharides, Glycoproteins.

Unit 2 LIPIDS
Definition and classification of Lipids.
Fatty acids: Introduction, classification, nomenclature, Structure, properties of Triacylglycerols: Nomenclature, physical properties, chemical properties and characterization of fats- hydrolysis, saponification value, rancidity of fats, Reichert- Meissl number and biological significance of fats; reaction of glycerol.
Phospholipids: Properties and functions of Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidylserine, phosphatidylinositol, plasmalogens), Sphingomyelins.
Glycolipids: cerebrosides, gangliosides.
Derived lipids: Prostaglandins, isoprenoids and sterols.

Unit 3 AMINO ACIDS AND PROTEINS
Amino acids: Classification and Structures, Zwitterions, physical and chemical properties.
Peptides: Peptide bond and its formation, determination of the amino acid sequence of a polypeptide chain, specific chemical and enzymatic cleavage of polypeptide chain and separation of peptides.
Proteins: Introduction, classification based on solubility, shape, compositions and function; the behavior of proteins in solutions, salting in and salting out of proteins.
Levels of organization in protein structure: Primary structure of proteins, secondary structure (Alpha- helix and Beta-pleated sheets), tertiary structure and quaternary structure; Denaturation

and renaturation of proteins.
Structure and biological functions of fibrous proteins (keratins, collagen and elastin), globular proteins (hemoglobin, myoglobin).

Unit 4 NUCLEIC ACID

Nature of genetic material, Evidence that DNA is the genetic material.
Composition of RNA and DNA, generalized structural plan of nucleic acids, other functions of nucleotides - source of energy, component of coenzymes and second messengers,
Features of DNA double helix, Denaturation and annealing of DNA, effect of Ultra- Violet (UV) absorption, acid and alkali on DNA.
Structure and roles of different types of RNA.

Unit 5 PORPHYRINS AND VITAMINS

Porphyrins: Porphyrin nucleus and classification of porphyrins: Important metalloporphyrins occurring in nature. Detection of porphyrins spectrophotometrically and by fluorescence.
Vitamins: Brief introduction of vitamins, Structure and biological role of water soluble and fat soluble vitamins.

Part C – Learning Resources

Suggested Reading:

1. Garrett and Grisham, "Biochemistry", Publisher: Belmont CA: Brooks /Cole. Cengage Learning, Sth Ed., ISBN- (e book) 9781133106296, P book -1 133 106293
2. Matthews, Holde van, and Ahern, "Biochemistry", Publisher: Pearson, 3rd Ed., ISBN- (e book) 100805330666, P book -139780805330663
3. Berg, Tymoczko and Stryer, "Biochemistry," Publisher: W.H.Freeman& Co, 6th Edition.
4. Lodish, Harvey, Berk, Kaisr Chris. "A Molecular Cell Biology", Publisher: Macmillan, 7th Edition.
5. Devlin T.M., "Textbook of Biochemistry with Clinical Correlations', Publisher: Wiley-Liss, 7th Edition, ISBN- (e book) 9780470281734
6. Voet Donald and Voet Judith, "Biochemistry", Publisher: John Wiley & Sons, 4th edition, ISBN- (e book) 9780470570951
7. Satyanarayana U. "Biochemistry", Publisher: Elsevier India, 5th Edition, ISBN- (e book) 9788131249406
8. Nelson DL, Cox MM, "Lehninger's Principles of Biochemistry", Publisher: Newyork WH Freeman, Sth Edition, ISBN- (e book) 9781464109621, P Books 1464109621
9. Boyer Rodney, "Concepts in Biochemistry", Publisher: John Wiley & Sons, 3rd Edition, ISBN- (e book) 9780471661795, P Books 0471661791
10. Carlson P., "Introduction to Modern Biochemistry" by Publisher: Academic Press INC. ISBN- (e book) 9780123997630, P Books 0123997631
11. Purkar SR, Hemant U Chikhale, "A text book of Biochemistry", Publisher: Birla Publications Pvt. Ltd. ISBN- (e book) 9789384266639.

Course Title: Biochemistry Lab II

Part A - Introduction

Course Code: UBIOCBC104
Course Title: Biochemistry Lab II
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. Introduction to Biochemistry Lab. Safety aspects in Biochemical Laboratorry.
2. Calibration of instruments & volumetric glassware (burette, pipette etc.)
3. Preparation of Distilled water in Laboratory.
4. Biochemical reagent preparations for various solutions with respect to different Normality, Molarity, % Slutions (W/V). (V/V).
5. Preparation of buffer and its pH determination.
6. Determination of pKa of acetic acid and glycine.
7. Qualitative tests for carbohydrates and microscopic examination of osazones.
8. Qualitative tests for amino acids, proteins and nuclele acids.
9. Quantitative estimation of sugars and proteins.
10. Estimation of vitamin C.

Keyword: Calibrations of instruments and volumetric glassware, normality, molarity, qualitative test for biomolcules, chromatographic separations.

Part C – Learning Resources

Suggested Reading:
I. Plummer T., Introduction to Practical Biochemistry, Publication: McGraw Hill Education, ISBN e- book 9780070994874
2. GeethabDamodaran K, Practical Biochemistry I] edition, Jaypee Brothers Medical Publishers. ISBN e- book 9789351529941
3. Litwalk G., Experimental Biochemistry, A Laboratory Manual, Publishers: John Wiley and Sons, ISBN e- book 9780471541202,0471541206 |
4. Rajendran Soundravally, Biochemistry practical Manual Publishers: Elsevier India, ISBN e-book 9788131253519
5. Jackson ML, Chemical analysis, Publisher: Scientific Publisher India, ISBN- (e book) 9788192686028, P Books 819268627
6. KAUSHIK G.G. Practical Manual of Biochemistry, CBS Publishers and Distributors, 2020

Subject: Food Technology

Course Title: Fundamentals of Food Processing

Part A– Introduction

Course Code: UFUNDFT103
Course Title: Fundamentals of Food Processing
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: Definition and: scope of Food technology
Definition of food processing and its scope. Historical evolution of food processing
Methods of cooking and Preventing Nutrient Losses- Principle of
Microwave cooking: advantages, disadvantages; Effect of different methods of cooking and processing on nutrient quality and loss.

Unit-II Basics of Food engineering
Systems for heating and freezing food products.
Modes of heat transfer
Thermal Properties of Food

Unit-III
Carbohydrates: General introduction, classification, properties, Functions of carbohydrates, role of starch in food industries.
Browning reactions in food: Enzymatic and non-enzymatic browning of foods of vegetable and animal origin during storage and processing of foods.

Unit IV
Proteins: General introduction, classification, structure, properties purification and denaturation of proteins and sources of protein.
Lipids: General introduction, classification, properties, functions of lipids and sources of lipids.

Unit-V
Colorimetry: Introduction, and general principles of colorimeter, application in food industry.
Spectrophotometry: General principle and instrumentation & applications in food industry
Flourimetry: Introduction, principle and Instrumentation & application in food industry.

Part C- Learning Resources
Suggested Readings:
1. Essentials of food process engineering, Rao C G 2006, BS publigations
2. Food Science, Potter, N. 1987, CBS Publishers and Distributors, Delhi,

3. Fruits and Vegetable Preservation: Principles and Practices, Srivastava, R P and Kumar S International Brol Distributing Co.2006.
4. Handbook of Analysis and Quality Control for fruits and‘yegeta le products-Rangana S, 1986 Tata McGraw Hill publishing Co. Ltd. II Ed.
5. Food science, 3rd Edition, New Age international publishers, New Delhi Srilakshmi, B., 2003,
6. Preservation of Fruits and Vegetables, Khader V, 2010, Kalyani Publishers, 262 edition.

Suggested Equivalent Online Courses / Web links. .
1 . http://www.vouranis.com
2. http://www.fao.org
3. http:/Awww.intechopen.com
4. http://det.gov/in

Course Title: Food Technology Lab II

Part A - Introduction
Course Code: UFOODFT104
Course Title: Food Technology Lab II
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 12^{th} class

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

List of experiments -

1. Qualitative analysis of carbohydrates.
2. Qualitative analysis of Proteins.
3. Estimation of acid Value, iodine value and saponin value etc in lipids.
4. Estimation of carbohydrates in food materials.
5. Estimation of proteins in food materials.
6. Estimation of crude fibres in food materials.
7. Estimation of ascorbic acid in food materials.
8. Estimation of calcium in food materials.
9. Determination of acidity and pH in different food samples.
10. Determination of ash in food samples.
11. Instruments used for food processing.
12. To perform gelatinization in given food sample.
13. Stages of sugar cookery
14. Estimation of gluten content

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, V K Joshi (http://www.nipabooks.com) &,
4. The complete book on Fruits, Vegetable and Food processing (http://www.etrepreneurindia.co)