B.Sc. (Hons.) Mathematics

Course Structure and Syllabus

University Campus

(Based on Choice Based Credit System)

2019 onwards

DEPARTMENT OF MATHEMATICAL SCIENCES

VISION

To be a knowledge nerve center in Mathematics, Pure and Applied Research and industry requirements for creating sustainable infrastructure and enhancing quality of life

MISSION

1. To offer globally-relevant, industry-linked, research-focused, technology-enabled seamless education at the graduate, postgraduate and research levels in various areas of Mathematical sciences keeping in mind that the manpower so spawned is excellent in quality, is relevant to the global scientific and technological needs, is motivated to give its best and is committed to the growth of the Nation;
2. To develop and conduct continuing education programs for Science graduates with a view to update their fundamental knowledge base and problem-solving capabilities in the various areas of core specialization of the University;
3. To develop comprehensive linkages with premier academic and research institutions within the country and abroad for mutual benefit.

B.Sc. (Honours Mathematics) Program

PROGRAM OBJECTIVES

Objectives of the program are to catch young and talented students, motivated to study Mathematics and to nurture them to develop their mathematical reasoning and logics. Other objectives of the program are to inspire students to pursue study in higher mathematics and grow as a skillful mathematician to cater the needs of knowledgeable society.

Duration: B.Sc. (Hons) Mathematics is a graduate level program offered by the Department of Mathematical Sciences. This is a 3-years program, consisting of six semesters with two semesters per year.

Program Code: BSHM (Bachelors of Science (Hons) in Mathematics)

Eligibility: 10+2 in any stream with Mathematics as one of the subjects with at least 50% marks in aggregate.

PROGRAM EDUCATIONAL OBJECTIVES: At the end of the program, the student will be able to:

PEO1	Apply principles of basic science concepts in understanding, analysis and prediction of mathematical systems.
PEO2	Develop human resource with knowledge, abilities and insight in Mathematics and related fields required for career in academia and industry.
PEO3	Engage in lifelong learning and adapt to changing professional and societal needs.

PROGRAM SPECIFIC OUTCOMES

At the end of the program,

PSO1	Students will be able to understand the nature of Mathematics and shall be ready to study higher 'Abstract Mathematics'.
PSO2	Students will be able to visualize the importance of Mathematics and apply the knowledge of Mathematics in Physical, Chemical and Social Sciences.
PSO3	Students will be able to use latest mathematical tools and software.
PSO4	Students will be able to formulate computer codes to tackle the complex mathematical problems.
PSO5	Students will become more confident due to enhanced level of reasoning, logics, skills and shall be able to understand the needs of the society.

PROGRAM OUTCOMES: At the end of the program, the student will be able to:

PO1	Understand the concepts of different branches of Mathematics.
PO2	Demonstrate expertise to conduct wide range of scientific modelling.
PO3	Apply the concepts of mathematics in areas of mechanics, analysis, calculus, algebra, geometry, mathematical modelling etc., in industry, academia, and day-to-day life.

Scheme of the Program:

SEMESTER FIRST **Contact Hrs. 34 Hrs.**

S.No.	Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Cr
			L	T	P	Internal	External		
1.	UC-BSHM-101-19	Calculus -1	**4**	**1**	-	**40**	**60**	**100**	**4**
2.	UC-BSHM-102-19	Co-ordinate Geometry	**4**	**1**	-	**40**	**60**	**100**	**4**
3.	UC-BSHM-103-19	Programming Lab-I	-	-	**4**	**30**	**20**	**50**	**2**
4.*	UC-BSHP-112-19	Electricity and Magnetism	**3**	**1**	-	**40**	**60**	**100**	**4**
	UC-BSHP-113-19	Physics Lab-I	-	-	**4**	**30**	**20**	**50**	**2**
	UGCA-1902	Fundamentals of Computer and IT	**3**	**1**	-	**40**	**60**	**100**	**4**
	UGCA-1906	Fundamentals of Computer and IT Laboratory	-	-	**4**	**60**	**40**	**100**	**2**
5.**	UC-BHCL-I-101-19	Inorganic Chemistry	**3**	**1**	-	**40**	**60**	**100**	**4**
	UC-BHCP-I-102-19	Chemistry Lab-I	-	-	**4**	**30**	**20**	**50**	**2**
	BBA-GE 101	Managerial Economics-I	**5**	**1**	**0**	**40**	**60**	**100**	**6**
6.	UC-BSHL-105-19	Communicative English -I	**2**	-	-	**20**	**30**	**50**	**2**
7.	UC-BSHL-106A/106B-19	Punjabi Compulsory-I/ Mudhli Punjabi-I	**2**	-	-	**20**	**30**	**50**	**2**
Total									**26**

L:Lectures T: Tutorial P:Practical Cr: Credits

Note 1*: Physics (UC-BSHP-112-19 & UC-BSHP-113-19) and Chemistry (UC-BHCL I-101-19 & UC-BHSP-I-102-19) are compulsory for the Students with Non-Medical background.

Note 2: Students without Non-medical background may opt Fundamentals of Computer and IT (UGCA-1902 & UGCA-1906) and Managerial Economics-I (BBA-GE-101).**

SEMESTER SECOND **Contact Hrs. 34 Hrs.**

S.No.	Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Cr
			L	T	P	Internal	External		
1.	UC-BSHM-201-19	Calculus-II	**4**	**1**	-	**40**	**60**	**100**	**4**
2.	UC-BSHM-202-19	Solid Geometry	**4**	**1**	-	**40**	**60**	**100**	**4**
3.	UC-BSHM-203-19	Programming Lab-II	-	-	**4**	**30**	**20**	**50**	**2**
4.*	UC-BSHP-124-19	Waves and Vibrations	**3**	**1**	-	**40**	**60**	**100**	**4**
	UC-BSHP-125-19	Physics Lab-II	-	-	**4**	**30**	**20**	**50**	**2**
	UGCA-1909	Object Oriented Programming using C++	**3**	**1**	-	**40**	**60**	**100**	**4**
	UGCA-1910	Object Oriented Programming using C++ Laboratory	-	-	**4**	**60**	**40**	**100**	**2**
5.**	UC-BHCL-113-19	Organic Chemistry	**3**	**1**	-	**40**	**60**	**100**	**4**
	UC-BHCP-119-19	Chemistry Lab-II	-	-	**4**	**30**	**20**	**50**	**2**
	BBA-GE 201-18	Managerial Economics-II	**5**	**1**	**0**	**40**	**60**	**100**	**6**
6.	UC-BHHL-115-19	Communicative English -II	**2**	**-**	**-**	**20**	**30**	**50**	**2**
7.	UC-BHHL-116A/116B-19	Punjabi Compulsory-II/ Mudhli Punjabi-II	**2**	**-**	**-**	**20**	**30**	**50**	**2**
Total									**26**

L:Lectures T: Tutorial P:Practical Cr: Credits

Note 1*: Physics (UC-BSHP-112-19 & UC-BSHP-113-19) and Chemistry (UC-BHCL-113-19 & UC-BHCP-119-19) are compulsory for the Students with Non-Medical background.

Note 2: Students without Non-medical background may opt Object Oriented Programming using C++ (UGCA-1909 & UGCA-1910) and Managerial Economics-II (BBA-GE-201)**

Scheme of the Program:

SEMESTER THIRD **Contact Hrs. 34 Hrs.**

S.No.	Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Cr
			L	T	P	Internal	External		
1.	UC-BSHM-301-19	Calculus -III	**4**	**1**	-	**40**	**60**	**100**	**4**
2.	UC-BSHM-302-19	Real Analysis-I	**4**	**1**	-	**40**	**60**	**100**	**4**
3.	UC-BSHM-303-19	Algebra-I	-	-	**4**	**40**	**60**	**100**	**4**
4.	UC-BSHM-304-19	Programming Lab-III	-	-	**4**	**30**	**20**	**50**	**2**
5.*	UC-BSHP-214-19	Elements of Modern Physics	**3**	**1**	-	**40**	**60**	**100**	**4**
	UC-BSHP-215-19	Physics Lab-III	-	-	**4**	**30**	**20**	**50**	**2**
	UGCA1914	Programming in Python	**3**	**1**	-	**40**	**60**	**100**	**4**
	UGCA-1917	Programming in Python Laboratory	-	-	**4**	**60**	**40**	**100**	**2**
6.**	UC-BHCL-I-204-19	Physical Chemistry	**3**	**1**	-	**40**	**60**	**100**	**4**
	UC-BHCP-I-208-19	Chemistry Lab-III	-	-	**4**	**30**	**20**	**50**	**2**
	BBA-301-18	Organizational Behavior	**5**	**1**	**0**	**40**	**60**	**100**	**6**
Total									**26**

L:Lectures T: Tutorial P:Practical Cr: Credits

Note 1*: Physics (UC-BSHP-214-19 & UC-BSHP-215-19) and Chemistry (UC-BHCL I-204-19 & UC-BHSP-I-208-19) are compulsory for the Students with Non-Medical background.

Note 2: Students without Non-medical background may opt Programming in Python(UGCA-1914 & UGCA-1917) and Organizational Behavior (BBA-GE-301-18).**

SEMESTER FOURTH **Contact Hrs. 34 Hrs.**

S.No.	Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Cr
			L	T	P	Internal	External		
1.	UC-BSHM-401-19	Vector Calculus	**4**	**1**	-	**40**	**60**	**100**	**4**
2.	UC-BSHM-402-19	Ordinary Differential Equations	**4**	**1**	-	**40**	**60**	**100**	**4**
3.	UC-BSHM-403-19	Linear Algebra	**4**	**1**	-	**40**	**60**	**100**	**4**
4.	UC-BSHM-404-19	Probability and Statistics	**4**	**1**	-	**40**	**60**	**100**	**4**
5.	UC-BSHM-405-19	Programming Lab-IV	-	-	**4**	**30**	**20**	**50**	**2**
6.	UC-BSHM-406-19	Project Work	**6**	-	-	**40**	**60**	**100**	**6**
7.	UC-BSHM-407-19	Skill Enhancement Course (Audit)	**2**	-	-	-	-	-	-
8.	EVS-101A	Environmental Studies	**2**	-	-	**40**	**60**	**100**	**2**
Total									**26**

L:Lectures T: Tutorial P:Practical Cr: Credits

Examination and Evaluation

Theory			
S. No.	**Evaluation criteria**	**Weightage in Marks**	**Remarks**
1	Mid term/sessional Tests	24	Internal evaluation (40 Marks) MSTs, Quizes, assignments, attendance, etc., constitute internal evaluation. Average of two mid semester test will be considered for evaluation.
2	Attendance	6	
3	Assignments	10	
4	End semester examination	60	External evaluation
5	Total	100	Marks may be rounded off to nearest integer.
Practical			
1	Evaluation of practical record/ Viva Voice/Attendance/Seminar/ Presentation	30	Internal evaluation
2	Final Practical Performance + Viva-Voce	20	External evaluation
3	Total	50	Marks may be rounded off to nearest integer.

Instructions for Paper-Setter in B. Sc (Hons.) Mathematics

A. Scope

1. The question papers should be prepared strictly in accordance with the prescribed syllabus and pattern of question paper of the University.

2. The question paper should cover the entire syllabus with uniform distribution among each units and Weightage of marks for each question.

3. The language of questions should be simple, direct, and documented clearly and unequivocally so that the candidates may have no difficulty in appreciating the scope and purpose of the questions. The length of the expected answer should be specified as far as possible in the question itself.

4. The distribution of marks to each question/answer should be indicated in the question paper properly.

B. Type and difficulty level of question papers

1. Questions should be framed in such a way as to test the students intelligent grasp of broad principles and understanding of the applied aspects of the subject. The Weightage of the marks as per the difficulty level of the question paper shall be as follows:

    i) Easy question 30%

    ii) Average questions 50%

    iii) Difficult questions 20%

2. The numerical content of the question paper should be upto 40%.

C. Format of question paper

1. Paper code and Paper-ID should be mentioned properly.
2. The question paper will consist of three sections: Sections-A, B and C.
3. Section-A is COMPULSORY consisting of TEN SHORT questions carrying two marks each (total 20 marks) covering the entire syllabus.
4. The Section-B consists of FOUR questions of eight marks each covering Unit I & II of syllabus (Taking two questions from each unit I & II).
5. The Section-C consists of FOUR questions of eight marks each covering Unit III & IV of syllabus (Taking two questions from each unit III & IV).
6. Sub-parts of the questions in Section B and C should be preferred for numerical/conceptual questions.
7. Attempt any five questions from Section-B and Section-C, selecting at least two questions from each of the two sections.

Question paper pattern for MST:

Roll No:	**No of pages:**
IK Gujral Punjab Technical University- Jalandhar	
Department of Mathematical Sciences	
Academic Session:	
Mid-Semester Test: I/II/III (Regular/reappear)	**Date:**
Programme: B.Sc.(Hons.) Mathematics	**Semester:**
Course Code:	**Course:**
Maximum Marks: 24	**Time: 1 hour 30 minutes**

- Note: Section A is compulsory; Attempt any two questions from Section B and one question from Section C.

Section: A		**Marks**	**Cos**
1		2	
2		2	
3		2	
4		2	
Section: B			
5		4	
6		4	
7		4	
Section: C			
8		8	
9		8	

Details of Course Objectives

CO1	
CO2	
CO3	
CO4	
CO5	

SEMESTER-I

UC-BSHM-101-19	**Calculus-I**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: Elementary calculus of senior secondary level.

Course Objectives: The objectives of this course are to make the students understand the following:

1. The fundamental concepts of differential and integral calculus.
2. The geometrical meaning of functions, limits, continuity, derivatives, mean value theorems.
3. Applications of derivatives and sketching of curves.
4. The definition of Integral calculus and its basic applications.
5. The relation between derivative and the integration of a function.

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the basic concepts of Differential and Integral Calculus.
CO2	Visualize all concepts geometrically.
CO3	Sketch curves of the functions intuitively with the help of Differential Calculus.
CO4	Apply the knowledge of Differential and Integral Calculus.
CO5	Understand the fundamental relation between differential and Integral Calculus.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	3	3	2	2	3
CO2	3	2	2	2	3
CO3	3	2	2	2	3
CO4	2	3	2	2	3
CO5	3	2	2	2	3

Course Title: Calculus-I
Course Code: UC-BSHM-101-19

UNIT-I

Real line, intervals, order properties of real numbers, the least upper bound and the greatest lower bound properties, Archimedean property. Functions, Graphs of functions, Exponential functions, Inverse functions and Logarithmic functions, implicitly defined functions, some special functions, one-one functions, onto functions, composition of functions, limit of a function, calculating limits through limit laws, The precise definition of limit (ε-δ definition), continuity, limit at infinity, asymptotes, continuous functions and classification of discontinuities, uniform continuity.

UNIT-II

Derivative of a function, the derivative as a function, derivatives of polynomials and exponential functions, the product and quotient rules, rates of change in natural and social sciences, derivatives of trigonometric, inverse trigonometric, logarithmic and hyperbolic functions, the chain rule, implicit differentiation, higher derivatives, preliminary transformations, differentiation of determinants.

UNIT-III

Application of derivative: maximum and minimum values, increasing and decreasing functions, mean value theorems, Intermediate value theorems, How derivatives affect the shape of graph, L' Hospital's rule, concavity and convexity, the second derivative test, points of inflexion, Rolle's theorem, Lagrange's theorem, Cauchy's mean value theorem.

UNIT-IV

Higher order derivatives, calculation to the n^{th} derivative, determination of n^{th} derivative of rational functions. The n^{th} derivative of the products of power of sines and cosines, Leibnitz's theorem, the n^{th} derivative of the product of two functions, Maclaurin's theorem, Taylor's theorem.

TEXT BOOKS

1. Shanti Narayan and P. K. Mittal, Differential Calculus, S. Chand, 2015

RECOMMENDED BOOKS:

2. James Stewart, Calculus, 5th Edition, Brooks/Cole(Thomson), 2003.
3. Robert Wrede and Murray R. Spiegel, Advanced Calculus, 3rd Edition, Schaum's Outline Series (McGraw Hill), 2010.
4. Maurice D Weir, Frank R. Giordano and Joel Hass, Thomas' Calculus, 11th Edition, Pearson, 2008.
5. N. Piskunov, Differential and Integral Calculus, Mir Publishers, Moscow (CBS Publishers & Distributors, India), 1996.

UC-BSHM-102-19	**Co-ordinate Geometry**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: A basic knowledge of two-dimensional Cartesian plane.

Course Objectives: This course is designed to introduce the geometry of two dimensions. The major focus of this course will be on geometric definition of two-dimensional shapes and a rigorous discussion on their properties and use.

Course Outcomes: At the end of the course, the students will be able to

CO1	Explain the different types of plane figures.
CO2	Visualize two-dimensional shapes geometrically.
CO3	Apply the knowledge of geometry of two dimensions in advance courses in mathematics.
CO4	Explain the Cartesian and Polar coordinate systems to study two dimensional shapes.
CO5	Study further the geometry of three dimensions.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	1	3	2	2	3
CO2	1	3	2	2	3
CO3	2	3	2	2	3
CO4	3	3	2	2	3
CO5	1	1	2	2	3

Course Title: Co-ordinate Geometry
Course Code: UC-BSHM-102-19

UNIT-I

Joint equation of pair of straight lines and angle between them, condition of parallelism and perpendicularity, joint equation of the angle bisectors, joint equation of lines joining origin to the intersection of a line and a curve.

UNIT-II

General equation of circle, circle through intersection of two lines, tangent and normal, Chord of contact, pole and polar, pair of tangents from a point, equation of chord in midpoint form, angle of intersection and orthogonality, power of a point w.r.t. circle, radical axis, co-axial family of circles, limiting points.

UNIT-III

Parabola, ellipse and hyperbola, tangent and normal, chord of contact, pole and polar of tangent from a point, equation of chord in terms of midpoint, diameter, conjugate diameters of ellipse and hyperbola, conjugate hyperbola, asymptotes of hyperbola, rectangular hyperbola.

UNIT-IV

Transformation of axes in two dimensions: shifting of origin, rotation of axes, the second degree equation $S = ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, its invariants *t*, Δ and *O*. Reduction of the second degree equation into standard form. Identification of curves represented by *S=0* (including pair of lines).Polar equations of straight lines, circles and conics. Polar equation of chords, tangent and normal.

TEXT BOOKS

1. P. K. Jain, Khalid Ahmed, A Text book of Analytical Geometry of Two Dimensions, Wiley Eastern Ltd, 1999.

RECOMMENDED BOOKS:

2. S. L. Loney, The Elements of Coordinate Geometry, Macmillian & Comp., London, 2007

UC-BSHM-103-19	**Programming Lab-I**	**L-0, T-0, P-2**	**2 Credits**

Pre-requisite: Knowledge of basic concepts in Mathematics, such as, graphs, functions, conics, matrices etc.

Course Objectives: This course is designed to introduce the basic knowledge of computer programming t simple algebraic operations on matrices and to visualize the geometry of curves and conics. two dimensions. The major focus of this course will be on geometric definition of two-dimensional shapes and a rigorous discussion on their properties and use.

Course Outcomes: At the end of the course, the students will be able to

CO1	Explain the basic concepts of programming.
CO2	Apply the knowledge of programming in different Matrix Operations.
CO3	Use programming in plotting and visualization of graphs of algebraic and transcendental functions.
CO4	Obtain Surface of revolution of curves.
CO5	Study further the tracing of conics.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	1	3	3	3	3
CO2	1	3	3	3	3
CO3	2	2	3	3	3
CO4	3	3	2	2	3
CO5	2	3	2	2	3

Course Title: Programming Lab-I

Course Code: UC-BSHM-103-19

The following programs with following methods are to be practiced to:

i) Introduce the programming through (FORTRAN, C etc.)
ii) Perform Matrix Operations, such as, Addition, Multiplication, inverse, Transpose etc.
iii) Plot the graphs of algebraic and transcendental functions (For example, $e^{ax+b}, \log(ax+b), \frac{1}{ax+b,}$ with constants a, b, etc.)
iv) Obtain the surface of revolution of curves.
v) Trace of conics in Cartesian Coordinates /Polar Coordinates.
vi) Applications of derivative.

RECOMMENDED BOOKS:

1. V. Rajaraman, Computer Programming in Fortran 90 and 95, PHI Learning, 2004.
2. Ian Chivers and Jane Sleightholme, Introduction to Programming with Fortran, Springer, 4th edition, 2018.
3. Walter S. Brainerd, Guide to Fortran 2008 Programming, Springer Nature, 2015.

UC-BSHP-112-19	**Electricity and Magnetism**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite: Basic knowledge of Electricity and Magnetism at high school level.

Course Objectives: The objective of the course is to expose the students to the formal structure of electricity and magnetism so that they can use these as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand and describe the different concepts of electromagnetism
CO2	To obtain the electric and magnetic fields for simple configurations under static conditions.
CO3	To analyse time varying electric and magnetic fields.
CO4	To understand Maxwell's equation in different forms and different media.
CO5	have a solid foundation in fundamentals required to solve problems and also to pursue higher studies.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	2	1	2	2	2	3	2	2
CO2	3	2	1	-	2	2	1	2	2	3	2	3
CO3	3	2	3	-	2	1	2	1	2	3	2	3
CO4	3	2	3	2	-	2	2	3	2	3	3	3
CO5	2	2	3	2	-	2	2	3	2	3	3	3

Course Title: Electricity and Magnetism

Course Code: UC-BSHP-112-19

UNIT-I

Review of Vector Analysis: Vector algebra, scalar and vector product; Concept of Fields; scalar and vector field; gradient, divergence and curl and their physical significance; Conservative field, Line, surface and volume integral of a vector field, Gauss-divergence theorem and Stoke's theorem.

UNIT II

Electrostatics: Electrostatic field; electric flux; Gauss's law in differential and integral form; Applications of Gauss law-Electric filed due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charge sheet; Electric potential as line integral of electric field, potential due to point charge and electric dipole; calculation of electric field from potential; Poisson's equation and Laplace's equation(Cartesian coordinate); Capacitance; capacitance of a spherical conductor and cylindrical capacitor, Energy per unit volume in electrostatic field, Dielectric medium, dielectric polarization and its types, Displacement vector, Boundary conditions.

UNIT-III

Magnetostatics: Magnetic flux; magnetic flux density; Faraday's law; magnetomotive force; Biot-Savart's law and its applications-straight conductor, circular coil, divergence and curl of magnetic field; Ampere's Circuital law in differential and integral form; Magnetic vector potential; ampere's force law; magnetic vector potential; Energy stored in a magnetic field, boundary conditions on magnetic fields.

UNIT-IV

Maxwell's Equations and Electromagnetic Waves: Equation of continuity for time varying fields; Inconsistency of ampere's law; concept of sinusoidal time variations (Phasor notation); Maxwell's equations in differential and integral form, physical significance; Maxwell equations in free space, static field and in Phasor notation; Difference between displacement current and conduction current; Wave equation in free space and in homogenous medium, Concept of Poynting vector; Poynting Theorem.

RECOMMENDED BOOKS:

1.David Griffiths, Introduction to Electrodynamics, Pearson Education India Learning Private Limited; 4thEdition.

2. E.C. Jordan and K.G. Balmain, Electromagnetic waves and radiating systems, Prentice Hall

3. Kraus John D, Electromagnetics, McGraw-Hill Publisher

4. W. Saslow, Electricity, magnetism and light, Academic Press

5.A Textbook of Electricity and Magnetism, S K Sharma, Shalini Sharma, S Dinesh & Co.

6. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.

UC-BSHP-113-19	**Physics Lab-I**	**L-0, T-0, P-4**	**2 Credits**

Pre-requisite (If any): High-school education

Course Objectives: The aim and objective of the lab course is to introduce the students to the formal structure of electromagnetism and phenomenon of wave optics so that they can use these as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Able to verify the theoretical concepts/laws learnt in theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Understand the methods used for estimating and dealing with experimental uncertainties and systematic "errors".
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Document a technical report which communicates scientific information in a clear and concise manner.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	2	1	2	3	2	3
CO2	3	3	1	-	2	2	1	1	1	3	2	3
CO3	3	3	2	-	2	1	2	1	1	3	2	3
CO4	3	2	2	2	-	2	2	1	1	3	2	3
CO5	2	2	2	2	-	2	2	1	1	3	2	3

Course Title: Physics Lab-I

Course Code: UC-BSHP-113-19

Note: Students are expected to perform about 8-10 experiments from the following list, selecting minimum of 6-7 from the Physical Lab and 2-3 from the Virtual lab.

List of experiments:

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the laser beam characteristics like; wave length, aperture, spot size, etc. using diffraction grating.
3. To study the diffraction using laser beam and thus to determine the grating element.
4. To study wavelength and laser interference using Michelson's Interferometer.
5. To find the refractive index of a material/glass using spectrometer.
6. To find the refractive index of a liquid using spectrometer.
7. To determine the resolving power of a prism.
8. To study the magnetic field of a circular coil carrying current using a Steward and Gees Tangent Galvanometer.
9. Determine the radius of circular coil using the Circular coil.
10. To study B-H curve using CRO.
11. To find out polarizability of a dielectric substance.
12. To find out the horizontal component of earth's magnetic field (B_h).

RECOMMENDED BOOKS:

1. A Text -book of Practical Physics, I. Prakash & Ramakrishna, 11thEdn, 2011, Kitab Mahal.
2. Engineering Practical Physics, S. Panigrahi& B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
4. Practical Physics, C L Arora. S. Chand & Company Ltd.
5. http://www.vlab.co.in

UGCA-1902	**Fundamentals of Computer and IT**	**L-3, T-1, P-0**	**4 Credits**
Pre-requisite: NA			
Course Outcomes: At the end of the course, the student will be able to			
CO1	Understanding the concept of input and output devices of Computers		
CO2	Learn the functional units and classify types of computers, how they process information and how individual computers interact with other computing systems and devices.		
CO3	Understand an operating system and its working, and solve common problems related to operating systems		
CO4	Learn basic word processing, Spreadsheet and Presentation Graphics Software skills.		
CO5	Study to use the Internet safely, legally, and responsibly		

Course Title: Fundamentals of Computer and IT
Course Code: UGCA-1902

UNIT-I

Human Computer Interface: Concepts of Hardware and Software; Data and Information.
Functional Units of Computer System: CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors.
Devices: Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter.
Data Representation: Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.

UNIT II

Concept of Computing, Types of Languages: Machine, assembly and High level Language; Operating system as user interface, utility programs.
Word processing: Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.

UNIT-III

Spreadsheet: Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs.
Presentation Graphics Software: Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.

UNIT-IV

Electronic Payment System: Secure Electronic Transaction, Types of Payment System: Digital Cash, Electronic Cheque, Smart Card, Credit/Debit Card E-Money, Bit Coins and Crypto currency, Electronic Fund Transfer (EFT),Unified Payment Interface(UPI), Immediate Payment System(IMPS), Digital Signature and Certification Authority. Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Embedded Systems and Internet of Things (IoT).

RECOMMENDED BOOKS:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education

2. Computer Fundamentals, A. Goel, 2010, PearsonEducation.
3. Fundamentals of Computers, P. K.Sinha& P. Sinha, 2007, BPBPublishers.
4. IT Tools, R.K. Jain, Khanna PublishingHouse
5. "IntroductiontoInformationTechnology",SatishJain,AmbrishRai&Shashi Singh, Paperback Edition, BPB Publications,2014.
6. "Introduction to Computers", Peter Norton
7. Computers Today, D. H. Sanders, McGraw Hill.
8. "Computers", Larry long & Nancy long, Twelfth edition, PrenticeHall.
9. ProblemSolvingCasesinMicrosoftExcel,JosephBrady&EllenFMonk,Thomson Learning
10. www.sakshat.ac.in
11. https://swayam.gov.in/course/4067-computer-fundamentals

UGCA-1906	**Fundamentals of Computer and IT Laboratory**	**L-0, T-0, P-4**	**2 Credits**
Pre-requisite (If any):NA			
CO1	Familiarizing with Open Office (Word processing, Spreadsheets and Presentation).		
CO2	To acquire knowledge on editor, spread sheet and presentation software.		
CO3	The students will be able to perform documentation and accounting operations.		
CO4	Students can learn how to perform presentation skills.		

Course Title: Fundamentals of Computer and IT Laboratory

Course Code: UGCA-1906

List of experiments:

- **Word Orientation:** The instructor needs to give an overview of word processor. Details of the four tasks and features that would be covered Using word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.

    1) Using word to create Resume:
    Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects,Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.
    2) Creating an Assignment
    Features to be covered:- Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
    3) Creating a Newsletter
    Features to be covered :- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs
    4) Creating a Feedback form
    Features to be covered :- Forms, Text Fields, Inserting objects, Mail Merge in Word.

- **Excel Orientation:** The instructor needs to tell the importance of Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered Excel - Accessing, overview of toolbars, saving excel files.

    1) Creating a Scheduler
    Features to be covered :- Gridlines, Format Cells, Summation, auto fill, Formatting Text
    2) Creating an Assignment
    Features to be covered:- Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
    3) Creating a Newsletter
    Features to be covered :- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs
    4) Creating a Feedback form
    Features to be covered :- Forms, Text Fields, Inserting objects, Mail Merge in Word.

- **Presentation Orientation:**
    1) Students will be working on basic power point utilities and tools which help them create basic power point presentation.
       Topic covered includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows
    2) This session helps students in making their presentations interactive.
       Topicscoveredincludes:Hyperlinks,Inserting–Images,ClipArt,Audio,Video, Objects, Tables and Charts
    3) Concentrating on the in and out of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topics covered includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures,DesignTemplates,Hiddenslides.Autocontentwizard,SlideTransition, Custom
    4) Animation, Auto Rehearsing
    5) Power point test would be conducted. Students will be given model power point presentation which needs to be replicated

- **Internet and its Applications:** The instructor needs to tell the how to configure Web Browser and to use search engines by defining search criteria using Search Engines
    1) To learn to setup an e-mail account and send and receive e-mails.
    2) Tolearntosubscribe/postonablogandtousetorrentsforacceleratedddownloads.
    3) Hands on experience in online banking and Making an online payment for any domestic bill.

RECOMMENDED BOOKS:

1. IT Tools, R.K. Jain, Khanna Publishing House.
2. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
3. Introduction to information technology, Turban, Rainer and Potter, John Wiley and Sons.
4. ProblemSolvingCasesinMicrosoftExcel,JosephBrady&EllenFMonk,Thomson Learning.

Course Title: Inorganic Chemistry
Course Code: UC-BSHC-101-19

UNIT-I

Atomic Structure: Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: deBroglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

UNIT-II

Chemical Bonding-I: Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations, Packing of ions in crystals, Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy, Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids, Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment), Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.

UNIT-III

Chemical Bonding-II: Covalent bond: Lewis structure, Valence Bond theory (Heitler-London approach), Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl,BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valenceshell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths, Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization.Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ioniccharacter from dipole moment and electronegativity difference.

UNIT-IV

Chemistry of s and p Block Elements: Inert pair effect, Relative stability of different oxidation states, diagonal relationship andanomalous behaviour of first member of each group, Allotropy and catenation, Complex formation tendency of s and p block elements, Hydrides and their classification ionic, covalent and interstitial, Basic beryllium acetate and

nitrate. Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses, Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine, Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens.

RECOMMENDED BOOKS:

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2. Douglas, B.E; Mc Daniel, D.H. & Alexander, J.J. Concepts & Models of Inorganic Chemistry 3rd Ed., John Wiley Sons, N.Y. 1994.
3. Greenwood, N.N. & Earnshaw. Chemistry of the Elements, Butterworth-Heinemann. 1997.
4. Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH, 1999.
5. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 4th Ed., Pearson, 2010.
6. Shriver & Atkins, Inorganic Chemistry 5th Ed.

Course Title: Chemistry Lab-I

Course Code: UC-BSHC-102-19

List of Experiments:

(A) Titrimetric Analysis

(i) Calibration and use of apparatus

(ii) Preparation of solutions of different Molarity/Normality of titrants

(B) Acid-Base Titrations

(i) Estimation of carbonate and hydroxide present together in mixture.

(ii) Estimation of carbonate and bicarbonate present together in a mixture.

(iii) Estimation of free alkali present in different soaps/detergents

(C) Oxidation-Reduction Titrimetry

(i) Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution.

(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.

(iii) Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilicacid) and external indicator.

Reference text:

1. Vogel, A.I. *A Textbook of Quantitative Inorganic Analysis*, ELBS.

BBA-GE101-18	**Managerial Economics I**	**L-5, T-1, P-0**	**6 Credits**

Pre-requisite: Understanding of basic knowledge of Managerial Economics

Course Objectives: The primary objective of this course is to equip students with the necessary economic concepts, principles, theory and techniques and enhance their managerial decision making to address business problems in a globalized economic environment.

Course Outcomes: After completion of the course, the students shall be able to:

CO1	Understand the basic concepts of managerial economics and apply the economic way of thinking to individual decisions and business decisions.
CO2	Measure price elasticity of demand, understand the determinants of elasticity and apply the concepts of price, cross and income elasticity of demand.
CO3	Understand and estimate production function and Law of Diminishing Marginal Utility.
CO4	Understand and explain four basic market models of perfect competition, monopoly, monopolistic competition, and oligopoly, and how price and quantity are determined in each model.
CO5	Understand the different costs of production and how they affect short and long run decisions.

Course Title: Managerial Economics I

Course Code: BBA-GE101-18

UNIT-I

Introduction to Managerial Economics: Managerial Economics: Meaning, Nature, Scope & Relationship with other disciplines, Role of managerial economics in decision Making, Opportunity Cost Principle, Production Possibility Curve, Incremental Concept, Scarcity Concept.
Demand and the Firm: Demand and its Determination: Demand function; Determinants of demand; Demand elasticity – Price, Income and cross elasticity. Use of elasticity for analyzing demand, Demand estimation, Demand forecasting, Demand forecasting of new product.
Indifference Curve Analysis: Meaning, Assumptions, Properties, Consumer Equilibrium, Importance of Indifference Analysis, Limitations of Indifference Theory

UNIT-II

Production Function : Production function Meaning, Concept of productivity and technology, Short Run and long run production function Isoquants; Least cost combination of inputs, Producer's equilibrium; Return to scale; Estimation of production function.
Theory of Cost: Cost Concepts and Determinants of cost, short run and long run cost theory, **Modern** Theory of Cost, Relationship between cost and production function

UNIT-III

Revenue Curve: Concept of Revenue, Different Types of Revenues, concept and shapes of Total Revenue, Average revenue and marginal revenue, Relationship between Total Revenue, Average revenue and marginal revenue, Elasticity of Demand and Revenue relation
Market Structure: Market Structure: Meaning, Assumptions and Equilibrium of Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly: Price and output determination under collusive oligopoly, Price and output determination under non-collusive oligopoly, Price leadership model.

UNIT-IV

Pricing: Pricing practices**;** Commodity Pricing: Economics of advertisement costs; Types of pricing practices
Factor Pricing: Demand and supply of factor of production; Collective bargaining, Concept of rent, profit, interest- Rate of return and interest rates; Real vs. Nominal interest rates. Basic capital theory–Interest rate and return on capital. Measurement of profit.
Note: Relevant Case Studies will be discussed in class.

RECOMMENDED BOOKS:

1. K.K .Dewett, *Modern Economic Theory,* S. Chand Publication
2. D.M.Mithani, *Managerial Economics Theory and Applications,* Himalaya Publication
3. Peterson and Lewis, *Managerial Economic,* Prentice Hall of India
4. Gupta, *Managerial Economics,* TataMcGraw Hills
5. Geetika, *Managerial Economics,* Tata McGraw Hills
6. D.N.Dwivedi, *Managerial Economic,* Vikas Publications
7. Froeb, *Managerial Economics*, Cengage Learning
8. Koutsoyiannis, A, Modern Micro Economics, Palgrave Macmillan Publishers, New Delhi.
9. Thomas Christopher R., and Maurice S. Charles, Managerial Economics – Concepts and Applications, 8th Edition,
10. Mehta, P. L, Managerial Economics – Analysis, Problems and Cases, Sultan Chand & Sons, Delhi.
11. Peterson and Lewis, Managerial Economics, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi.
12. Shapiro, Macro Economics, Galgotia Publications.

UC-BSHL-105-19	**Communicative English -I**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisite: Basic proficiency in Communication Skills

Course Objectives: The main objective of this course is:

- To help the students become proficient in LSRW-Listening, Speaking, Reading & Writing skills
- To help the students become the independent users of English language
- To develop in them vital communication skills, integral to their personal, social and professional interactions
- To teach them the appropriate language of professional communication
- To prepare them for job market

Course Outcomes: At the end of the course, the student will

CO1	acquire basic proficiency in reading &listening, writing and speaking skills
CO2	be able to understand spoken and written English language, particularly the language of their chosen technical field.
CO3	be able to converse fluently.
CO4	be able to produce on their own clear and coherent texts.
CO1	become proficient in professional communication, such as, interviews, group discussions, office environments, important reading skills as well as writing skills and thereby will have better job prospects.

Mapping of course outcomes with the program Specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	1	1	2	2	3	2	3	2	2
CO2	1	-	-	1	1	2	2	3	2	3	2	2
CO3	1	-	-	1	1	2	2	3	2	3	2	2
CO4	1	-	-	1	1	2	2	3	2	3	2	2
CO5	2	-	-	1	1	2	2	3	2	3	2	2

Course Title: Communicative English -I
Course Code: UC-BSHL-105-19

UNIT I(Literature)

(A) The Poetic Palette (Orient Black Swan, Second Edition, 2016)

The following poems from this anthology are prescribed:

1. Pippa's Song: Robert Browning
2. Apparently With No Surprise: Emily Dickinson
3. Fool and Flea: Jeet Thayil

(B) Prose Parables (Orient Black Swan, 2013)

The following stories from the above volume are prescribed:

a. The Kabuliwallah : Rabindranath Tagore
b. The Eyes Are Not Here: Ruskin Bond
c. Grief: Anton Chekov

UNIT-II

Vocabulary: Word Formation Processes; Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives; Synonyms, antonyms

Grammar: Subject-verb agreement; Noun-pronoun agreement; Misplaced modifiers; Articles Determiners; Modals; Prepositions;

UNIT-III

Reading and Understanding: Close Reading; Comprehension;

UNIT-IV

Mechanics of Writing & Speaking Skills

Essay Writing (Descriptive/Narrative/Argumentative); Business letters; Précis Writing; Self Introductions; Group Discussion

RECOMMENDED BOOKS:

1. John Eastwood, Oxford Practice Grammar, Oxford University Press, 2014
2. Michael Swan, Practical English Usage, OUP. 1995.
3. F.T. Wood, Remedial English Grammar, Macmillan. 2007.
4. William Zinsser, On Writing Well, Harper Resource Book 2001.
5. Sanjay Kumar and Pushp Lata, Oxford University Press. 2011.
6. Communication Skills, Oxford University Press. 2011.
7. Liz Hamp-Lyons and Ben Heasly, Study Writing, Cambridge University Press. 2006.

UC-BSHL-106A-19	**ਪੰਜਾਬੀਲਾਜ਼ਮੀ (Punjabi Compulsory)-I**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisite: Understanding of senior secondary level Punjabi

Course Objectives: The objective of the course is:
1.To enhance the language ability of students.

2.To enhance the ability of Learning science and developing science literacy through local language teaching with science subjects.

Course Outcomes: At the end of the course, the student will be able to

CO1	Translate and transfer/broadcast the western scientific knowledge in the local language.
CO2	Translate and transfer the indigenous/traditional scientific knowledge available in local knowledge into English and other global languages.
CO3	Understand the society through Punjabi language, literature and culture
CO4	Learning science and in developing science literacy.
CO5	Improve the internal communication.

Course Title: ਪੰਜਾਬੀਲਾਜ਼ਮੀ (Punjabi Compulsory)-I
Course Code: UC-BSHL-106A-19

UNIT-I

ਕਵਿਤਾਭਾਗ:

ਭਾਈਵੀਰਸਿੰਘ:

ਸਮਾਂ, ਚਸ਼ਮਾ

ਪ੍ਰੋ.ਪੂਰਨਸਿੰਘ :

ਪੰਜਾਬਨੂੰਕੁਕਾਂਮੈਂ, ਹੱਲਵਾਹੁਣਵਾਲੇ

ਪ੍ਰੋ.ਮੋਹਨਸਿੰਘ :

ਮਾਂ,ਕੋਈਆਇਆਸਾਡੇਵਿਹੜੇ,ਪਿਆਰਪੰਧ

ਅੰਮ੍ਰਿਤਾਪ੍ਰੀਤਮ:

ਆਖਾਂਵਾਰਿਸਸ਼ਾਹਨੂੰ,ਅੰਨਦਾਤਾ

UNIT-II

ਕਹਾਣੀਭਾਗ:ਸੰਤਸਿੰਘਸੇਖੋਂ :

ਪੇਮੀਦੇਨਿਆਣੇ

ਸੁਜਾਨਸਿੰਘ :

ਕੁਲਫੀ

ਕੁਲਵੰਤਸਿੰਘਵਿਰਕ :

ਤੂੜੀਦੀਪੰਡ

ਗੁਰਦਿਆਲਸਿੰਘ :

ਸਾਂਝ

UNIT-III

ਭਾਸ਼ਾਦਾਟਕਸਾਲੀਰੂਪ, ਭਾਸ਼ਾਤੇਉਪ-ਭਾਸ਼ਾਵਿਚਅੰਤਰ, ਪੰਜਾਬੀਦੀਆਂਉਪ-ਭਾਸ਼ਾਵਾਂ,ਪੰਜਾਬੀਭਾਸ਼ਾ:ਨਿਕਾਸਤੇਵਿਕਾਸ।

ਭਾਸ਼ਾਤੇਲਿਪੀ, ਗੁਰਮੁਖੀਲਿਪੀਦੀਆਂਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਗੁਰਮੁਖੀਲਿਪੀ: ਨਿਕਾਸਤੇਵਿਕਾਸ।

UNIT-IV

ਸੰਖੇਪਰਚਨਾ (ਪ੍ਰੈਸੀ)

ਪੈਰ੍ਹਾਰਚਨਾ

ਸਰਲਅੰਗਰੇਜ਼ੀਪੈਰ੍ਹੇਦਾਪੰਜਾਬੀਅਨੁਵਾਦ

RECOMMENDED BOOKS:

1.ਸੰਪ.ਡਾ.ਮਹਿਲ ਸਿੰਘ, ਸਾਹਿਤ ਦੇ ਰੰਗ, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ,2016.

UC-BSHL-106B-19	ਮੁਢਲੀ ਪੰਜਾਬੀ **(Mudhli Punjabi)-I**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisite: Understanding of senior secondary level Punjabi

Course Objectives: The objective of the course is to:
1.enhance the language ability of students.

2.enhance the ability of Learning science and developing science literacy through local language teaching with science subjects.

Course Outcomes: At the end of the course, the student will be able to

CO1	Translate and transfer/broadcast the western scientific knowledge in the local language.
CO2	Translate and transfer the indigenous/traditional scientific knowledge available in local knowledge into English and other global languages.
CO3	Understand the society through Punjabi language, literature and culture.
CO4	Learning science and in developing science literacy.
CO5	Improve the internal communication.

Course Title: (Mudhli Punjabi)-I
Course Code: UC-BSHL-106B-19

UNIT-I

ਪੈਂਤੀ ਅੱਖਰੀ (ਵਰਣਮਾਲਾ), ਅੱਖਰ ਕ੍ਰਮ
ਮਾਤਰਾਵਾਂ : ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ
ਲਗਾਖਰ :ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ

UNIT-II

ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ: ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ
ਮੂਲ ਸ਼ਬਦ , ਅਗੇਤਰ, ਪਿਛੇਤਰ
ਸਮਾਨਾਰਥਕ ਸ਼ਬਦ, ਵਿਰੋਧਾਰਥਕ ਸ਼ਬਦ
ਸ਼ੁੱਧ- ਅਸ਼ੁੱਧ: ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿੱਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ

UNIT-III

ਹਫਤੇ ਦੇ ਸੱਤ ਦਿਨਾਂ ਦੇ ਨਾਂ
ਬਾਰ੍ਹਾਂ ਮਹੀਨਿਆਂ ਦੇ ਨਾਂ
ਰੁੱਤਾਂ ਦੇ ਨਾਂ
ਇਕ ਸੌ ਤੱਕ ਗਿਣਤੀ ਸ਼ਬਦਾਂ ਵਿਚ

UNIT-IV

ਸਧਾਰਣ ਸ਼ਬਦਾਂ ਦਾ ਅੰਗਰੇਜ਼ੀ ਤੋਂ ਪੰਜਾਬੀ ਅਨੁਵਾਦ

ਸਧਾਰਣ ਸ਼ਬਦਾਂ ਦਾ ਪੰਜਾਬੀ ਤੋਂ ਅੰਗਰੇਜ਼ੀ ਅਨੁਵਾਦ

ਸੰਖੇਪਰਚਨਾ (ਪ੍ਰੈਸੀ)

ਪੈਰ੍ਹਾਰਚਨਾ

ਸਰਲਅੰਗਰੇਜ਼ੀਪੈਰ੍ਹੇਦਾਪੰਜਾਬੀਅਨੁਵਾਦ

Text and Reference Books

1.ਸੁਖਵਿੰਦਰ ਸਿੰਘ ਸੰਘਾ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਗਿਆਨ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ ਜਲੰਧਰ

SEMESTER-II

UC-BSHM-201-19	**Calculus-II**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: Calculus-I

Course Objectives: The objectives of this course are to make the students understand the following:

1. The applications of differential calculus for tracing curves.
2. The concept of Integration and its definition as limit of sum and area under curve.
3. The relation between derivative and the integration of a function.
4. The concept of improper integrals.
5. Numerical techniques to find approximate integrals and applications of integration for length of arc, finding area and volume.

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the techniques to sketch a curve using the concepts of differential calculus.
CO2	Visualize all concepts of differential calculus geometrically
CO3	Understand the concept of Integration.
CO4	Understand the fundamental relation between differential and Integral Calculus.
CO5	Apply the knowledge of integral calculus in finding length of arc, area under curves, volume and area of surface swept by curve during revolution.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	3	3	2	2	3
CO2	3	3	2	2	3
CO3	3	3	2	2	3
CO4	3	3	2	2	3
CO5	3	3	2	2	3

Course Title: Calculus-II
Course Code: UC-BSHM-201-19

UNIT-I

Concavity and Convexity, points of inflexion, derivative of arc, radius of curvature, centre of curvature, chord of curvature, evolutes and involutes.

UNIT-II

Asymptotes, working rules of determining Asymptotes, Asymptotes in polar co-ordinates, Cusps, curve tracing (Cartesian and polar), introduction to envelopes.

UNIT-III

Anti derivative of function of real variable, Riemann sums, definite integrals and their properties, Indefinite integral and net change, the fundamental theorem of calculus, Improper Integrals: Infinite Integrals, Discontinuous intervals, comparison test for improper integrals (Scope: James Stewart; Chapter-), reduction formulae.

UNIT-IV

Approximate Integration: Midpoint rule, Trapezoidal rule, Simpson's rule; applications of integrals to find length of arc and area between curves, finding volumes, area of surface of revolution.

TEXT BOOKS

1.James Stewart, Calculus, 5th Edition, Brooks/Cole(Thomson), 2003.
2.Maurice D Weir, Frank R. Giordano and Joel Hass, Thomas' Calculus, 11th Edition, Pearson, 2008.
3.Shanti Narayan and P. K. Mittal: Differential Calculus, S. Chand

REFERENCE BOOKS

4.George B. Thomas and Ross. L. Finney: Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998.

UC-BSHM-202-19	**Solid Geometry**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: Two dimensional coordinate geometry.

Course Objectives: This course is designed to introduce the geometry of three dimensions. The major focus of this course will be on geometric interpretation of three-dimensional shapes and a rigorous discussion on their properties and use.

Course Outcomes: At the end of the course, the students will be able to

CO1	Use the idea of three-dimensional Cartesian coordinate system, shift of origin and rotation of axes.
CO2	Demonstrate knowledge and understanding of three dimensional shapes and their properties.
CO3	Visualize the three dimensional shapes, for example sphere, cylinder and cone etc.
CO4	Utilize the knowledge of geometry of three dimensions in other branches of mathematics, for example calculus and analysis.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	3	3	2	2	3
CO2	3	3	3	2	3
CO3	1	2	3	2	3
CO4	1	3	3	3	3

Course Title: Solid Geometry
Course Code: UC-BSHM-202-19

UNIT-I

Lines and planes in 3-dimension, change of axes, shift of origin, rotation of axes, sphere, and section of a sphere by a plane. Sphere through a given circle. Intersection of a line and sphere.

UNIT-II

Tangent and normal, tangent plane, angle of intersection of two spheres and condition of orthogonality, power of a point w.r.t. a sphere, Radical planes, radical axis, radical centre, coaxial family of spheres, limiting points.

UNIT-III

Cylinder, Cone, homogeneous equation of second degree in x, y, z, reciprocal cone, right circular and elliptic cones, surface of revolution, enveloping cones, right circular and elliptic cylinders. Hyperbolic cylinder.

UNIT-IV

Quadratic surfaces**:** Ellipsoid, hyperboloid, paraboloid, quadratic cone, tangent plane and normal.

REFERENCE BOOKS

1.P. K. Jain, Khalid Ahmad, Textbook of Analytical Geometry, 3rd Edition, New Age International Publishers, 2018.

2.Shanti Narayan, P.K. Mittal, Analytical Solid Geometry, 17th Revised Edition, S. Chand & Company, 2007.

UC-BSHM-203-19	**Computer Algebra System: MATLAB**	**L-0, T-0, P-2**	**2 Credits**

Pre-requisite: Knowledge of basic concepts in Mathematics such as graphs, functions, conics, matrices etc.

Course Objectives: This course is designed to introduce a Computer Algebra System: MATLAB which is currently used in scientific computations. The main focus will be on introduction to basic concepts of MATLAB using simple examples.

Course Outcomes: At the end of the course, the students will be able to

CO1	Explain the basic concepts of programming
CO2	Visualize functions in 2-D and 3-D
CO3	Make their own computer programs for solving problems of their interest
CO4	Use symbolic tools of MATLAB for solving problems arising in various fields of applications

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	2	3	3	3	3
CO2	1	3	3	3	3
CO3	2	2	3	3	3
CO4	3	3	2	2	3

Course Title: Computer Algebra System: MATLAB

Course Code: UC-BSHM-203-19

UNIT-I

The MATLAB environment, scalars, variables, arrays, mathematical operations with arrays, built-in and user defined functions, graphics: two-dimensional and three-dimensional, m-files: script and function files, functions: input; disp and fprintf, relational and logical operators.

UNIT-II

Symbolic math: symbolic objects and expressions; collect; expand; factor; simplify; solve; diff and int commands, Programming: if-end structure; if-else-end structure; loops: for-end and while-end.

Reference Books.

1.D. J. Highamand N. J. Higham, MATLAB Guide, 2nd Edition, Society for Industrial and Applied Mathematics (SIAM), 2005.

2.Amos Gilat, MATLAB: An Introduction with Applications, 5th Edition, John Wiley & Sons, 2014.

UC-BSHP-124-19	**Waves and Vibrations**	**L-4, T-0, P-0**	**4 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objectives: The objective of the course is to develop basic understanding of Interference, Diffraction and Polarization among students. The Students also learn about the LASER and its applications. Students will be equipped with knowledge to measure wavelength, refractive index and other related parameters, which will act as a strong background if he/she chooses to pursue sciences as a career.

Course Outcomes: At the end of the course, the student will be able to

CO1	Identify and illustrate physical concepts and terminology used in optics and other related wave phenomena
CO2	Analyze and understand the phenomenon of interference, and diffraction and their applications
CO3	Get thorough knowledge of the polarization of light and its changes upon reflection and transmission and will learn to analyze the polarization in optical systems.
CO4	Understand the simple harmonic motion and its application.
CO5	Describe the different types of lasers, its principle, properties of laser beam.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	-	1	2	1	2	3	2	2
CO2	2	2	1	2	1	1	1	1	1	3	1	1
CO3	3	2	2	2	1	1	2	1	1	3	1	1
CO4	2	2	2	2	1	1	2	1	1	3	1	1
CO5	2	2	2	2	1	1	2	1	1	3	1	1

Course Title: Waves and Vibrations
Course Code: UC-BSHP-124-19

UNIT I

Interference: Electromagnetic nature of light, Definition and properties of wave front, Huygens Principle, Temporal and Spatial Coherence, Division of amplitude and wave front, Young's double slit experiment, Lloyd's single mirror and Fresnel's Biprism, Interference in Thin Films, Newton's Rings and Michelson Interferometer. (11 Lectures)

UNIT-II

Diffraction and Polarization: Huygens Principle, Huygens-Fresnel Diffraction theory, Fraunhofer diffraction: Single slit. Circular aperture, Rayleigh criterion of resolution, Resolving Power of a telescope, Double slit, Multiple slits, Diffraction grating; Polarization, Plane polarized light, Representation of Unpolarized and Polarized light, Polarization by Reflection, Brewster's law, Malus Law, Polarization by Selective absorption by Crystals, Polarization by Scattering, Polarization by Double Refraction.
(11 Lectures)

UNIT-III

Simple Harmonic Motion: Simple harmonic motion, Energy of a SHO, Simple, Compound and Torsional pendulum, Electrical Oscillations, damped oscillations, damped harmonic oscillator – heavy, critical, and light damping, Damping coefficients, energy decay in a damped harmonic oscillator, quality factor, forced mechanical oscillators, resonance. (12 Lectures)

UNIT-IV

Laser and Application: Lasers, Spontaneous emission, Stimulated absorption, Stimulated emission, Einstein coefficients, Conditions for Laser actions, Population inversion, Different types of Laser, Pumping mechanism: Optical Pumping, Electric Discharge and Electrical pumping, Resonators, Two, Three, and Four level laser systems, Ruby laser, He-Ne gas Laser, Semiconductor laser, CO2 laser, applications of laser: Holography, Principle of Holography.

(11 Lectures)

Text and Reference Books:

1. Optics: A.K. Ghatak (Tata-McGraw Hill), 1992.
2. Fundamentals of Optics: F.A. Jenkins and H.E. White (McGraw Hill), 1981.
3. A Text Book of Optics: Subrahmaniyam N. &et al.(S. Chand Publishing) (2006).
4. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.

UC-BSHP-125-19	**Physics Lab-II**	**L-0, T-0, P-4**	**2 Credits**

Pre-requisites (if any): High-school education with Physics lab as one of the subject.

Course Objectives: The aim and objective of the Physics Lab course is to introduce the students of B. Sc. (Hons.) Physics to the formal structure of wave and vibrations and mechanics so that they can use these as per their requirement.

Course Outcomes: At the end of the course, the student will be

CO1	Able to understand the theoretical concepts learned in the theory course.
CO2	Trained in carrying out precise measurements and handling equipment.
CO3	Learn to draw conclusions from data and develop skills in experimental design.
CO4	Able to understand the principles of error analysis and develop skills in experimental design.
CO5	Able to document a technical report which communicates scientific information in a clear and concise manner.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	2	1	2	3	2	3
CO2	3	3	1	-	2	2	1	1	1	3	2	3
CO3	3	3	2	-	2	1	2	1	1	3	2	3
CO4	3	2	2	2	-	2	2	1	1	3	2	3
CO5	2	2	2	2	-	2	2	1	1	3	2	3

Note: Students are expected to perform about 8-10 experiments from the following list, selecting minimum of 6-7 from the Physical Lab and 2-3 from the Virtual lab.

List of experiments:

1. Measurement of volume using travelling microscope. Use of Plumb line and Spirit level.
2. To determine the frequency of an electrically maintained tuning fork in a) Transverse mode of vibration b) Longitudinal mode of vibration.
3. To find out the frequency of AC mains using sonometer.
4. To study the characteristic of Ge-Si junction diode.
5. To analyze the suitability of a given Zener diode as a power regulator.
6. To determine the horizontal and vertical distance between two points using a Sextant.
7. To determine the height of an inaccessible object using a Sextant.
8. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of **g** and (c) Modulus of rigidity.
9. To determine the time period of a simple pendulum for different length and acceleration due to gravity.
10. To study the variation of time period with distance between centre of suspension and centre of gravity for a compound pendulum and to determine: (i) Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length. (ii) The value of g in the laboratory.
11. To find the moment of inertia of an irregular body about an axis through its C.G with the torsional pendulum.
12. To determine the angular acceleration α, torque τ, and Moment of Inertia of flywheel.

Reference book and suggested readings:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11thEdn, 2011, Kitab Mahal.
4. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
6. Practical Physics, C L Arora, S. Chand & Company Ltd.

http://www.vlab.co.in

UGCA-1909	**Object Oriented Programming using C++**	**L-3, T-1, P-0**	**4 Credits**
Pre-requisite: NA			
Course Outcomes: At the end of the course, the student will be able to			
CO1	To learn programming from real world examples.		
CO2	To understand Object oriented approach for finding Solutions to various problems with the help of C++ language.		
CO3	To create computer based solutions to various real-world problems using C++		
CO4	To learn various concepts of object oriented approach towards problem solving		

Course Title: Object Oriented Programming using C++
Course Code: UGCA-1909

UNIT-I

Principles of object oriented programming
Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Difference between Procedure Oriented Language(C) and Object Oriented Language. (12)

UNIT-II

Classes & Objects and Concept of Constructors
Defining classes, Defining member functions, Declaration of objects to class, Access to member variables from objects, Different forms of member functions, Access specifiers (Private, public, protected), Array of objects. Introduction to constructors, Parameterized constructors, Copy Constructor, Multiple constructors in class, Dynamic initialization of objects, Destructors.
(10)

UNIT-III

Inheritance and Operator overloading
Introduction to Inheritance, Types of inheritance: - Single inheritance, Multiple inheritance, Multilevel inheritance, Hierarchical inheritance, Hybrid inheritance, Defining operator overloading, Overloading of Unary and Binary operators, Rules for overloading operators.
(10)

UNIT-IV

Polymorphism and File Handling
Early Binding, Late Binding, Virtual Functions, pure virtual functions, Abstract Classes. Opening and Closing File, Reading and Writing a file.
(10)

Text Books:
1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

UGCA-1910	**Object Oriented Programming using C++**	**L-0, T-0, P-4**	**2 Credits**
Pre-requisite (If any):NA			
CO1	To learn programming from real world examples.		
CO2	To understand Object oriented approach for finding Solutions to various problems with the help of C++ language.		
CO3	To create computer based solutions to various real-world problems using C++		
CO4	To learn various concepts of object oriented approach towards problem solving		

Course Title: Object Oriented Programming using C++ Laboratory

Course Code: UGCA-1910

Instructions: Develop all program in C++

Assignments:

1. Write a program to enter mark of 6 different subjects and find out the total mark (Using cin and cout statement)

2. Write a function using reference variables as arguments to swap the values of pair of integers.

3. Write a function to find largest of three numbers.

4. Write a program to find the factorial of a number.

5. Define a class to represent a bank account which includes the following members as Data members: a) Name of the depositor b) Account Number c) Withdrawal amount d) Balance amount in the account

Member Functions:

a) To assign initial values b)To deposit an amount c) To withdraw an amount after checking the balance d) To display name and balance.

6. Write the above program for handling n number of account holders using array of objects.

7. Write a C++ program to compute area of right angle triangle, equilateral triangle, isosceles triangle using function overloading concept.

8. Consider a publishing company that markets both book and audio cassette version to its works. Create a class Publication that stores the title (a string) and price (type float) of a publication. Derive the following two classes from the above Publication class: Book which adds a page count (int) and Tape which adds a playing time in minutes(float). Each class should have get_data() function to get its data from the user at the keyboard. Write the main() function to test the Book and Tape classes by creating instances of them asking the user to fill in data with get_data() and thenndisplaying it using put_data().

9. Consider an example of declaring the examination result. Design three classes student, exam and result. The student has data members such as rollno, name. Create the lass exam by inheriting the student class. The exam class adds data members representing the marks scored in 5 subjects. Derive the result from exam-class and it has own data members like total, avg.

10. Write a program for overloading of Unary ++ operator.

11. Write a program for overloading of Binary + operator.

12. Write a program of Virtual Functions.

13. Write a program of Abstract Classes.

14. Write a program to read and write from file.

Reference Books:

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison- Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

UC-BHCL-113-19	**Introduction to Organic Chemistry**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite: Knowledge of basic concepts in Mathematics, such as graphs, functions, conics, matrices etc.

Course Objectives:

1. To teach the basic principles, reaction mechanisms and stereochemistry of organic compounds.
2. To impart knowledge regarding physical properties and chemical reactions of alkanes, alkenes, dienes, alkynes, arenes, alkyl and aryl halides etc.
3. To predict and account for the most commonly encountered reaction mechanisms (substitution, addition and elimination) in organic chemistry.
4. To teach the basic principles, reaction mechanisms and stereochemistry of organic compounds.
5. To impart knowledge regarding physical properties and chemical reactions of alkanes, alkenes, dienes, alkynes, arenes, alkyl and aryl halides etc.
6. To predict and account for the most commonly encountered reaction mechanisms (substitution, addition and elimination) in organic chemistry

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the fundamental concepts of organic chemistry i.e structure, bonding and various effects in organic compounds.
CO2	To learn the stereochemistry viz. optical isomerism, stereoisomerism and conformational isomerism of organic compounds.
CO3	To study the various known reactive intermediate in organic synthesis
CO4	To learn the fundamental and advanced concepts of reaction mechanisms along with the study of reaction mechanisms in various types of substitution addition and elimination reactions.
CO5	To predict the relationships between organic chemical structures and their reactivity.

Mapping of course outcomes with the program outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	-	2	-	3	1	-
CO2	2	-	3	-	3	3	-
CO3	3	3	4	-	3	3	-
CO4	3	4	3	4	4	5	4
CO5	2	3	4	2	4	4	4

Course Title: Introduction to Organic Chemistry

Course Code: UC-BHCL-113-19

Unit-I

Basics of Organic Chemistry Organic Compounds:

Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyper conjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. (11)

Unit-II

Introduction to types of organic reactions: -

Introduction to the types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions. Stereochemistry: Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.

(12)

Unit-III

Chemistry of Aliphatic Hydrocarbons

A. **Carbon-Carbon sigma bonds Chemistry of alkanes**: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

B. **Carbon-Carbon π- bonds:** Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction.

(12)

Unit-IV

Aromatic Hydrocarbons Aromaticity:

Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

(10)

REFERENCE BOOKS:

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)

3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

4. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994

5. Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

UC-BHCP-119-19	**Introduction to Organic Chemistry Lab**	**L-0, T-0, P-4**	**2 Credits**

Pre-requisite: Knowledge of basic concepts in Mathematics, such as, graphs, functions, conics, matrices etc.

Course Objectives:

The objective of this course is to provide practical knowledge and illustrative experiments regarding qualitative analysis, isolation, and purification of organic compounds

Course Outcomes: At the end of the course, the students will be able to

CO1	To check the purity of organic compounds by determining the melting or boiling points.
CO2	To develop preparative skills for purification of organic compounds by crystallization method.
CO3	To determine the element or functional groups present in organic compound by organic qualitative analysis.
CO4	To present their work with practical skills and the awareness of health and safety procedures.
CO5	To apply related experiments for their research work.

Mapping of course outcomes with the program Specific outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	-	2	-	3	1	-
CO2	2	-	3	-	3	3	-
CO3	3	3	4	-	3	3	-
CO4	3	4	3	4	4	5	4
CO5	2	3	4	2	4	4	4

Course Title: Introduction to Organic Chemistry Lab
Course Code: UC-BHCP-119-19

Unit-I

Determination of melting point

Napthalene 80-82^o, Benzoic acid 121.5-122^o, Urea 132.5-133^o, Succinic acid 184.5-185^o, Cinnamic acid 132.5-133^o, Salicylic acid 157.5-158^o, Acetanilide 113.5-114^o, m-Dinitrobenzene 90^o, p-Dichlorobenzene 52^o, Aspirin 135^o

Determination of boiling point

Ethanol 78^o, Cyclohexane 81.4^o, Toluene 110.6^o, Benzene 80^o

Unit-II

Distillation

Simple distillation of ethanol-water mixture using water condenser
Distillation of nitrobenzene and aniline using air condenser

Crystallization

Concept of induction of crystallization
Phthalic acid from hot water (using fluted filter paper and stemless funnel)
Acetanilide from boiling water
Napthalene from ethanol
Benzoic acid from water

Unit-III

Qualitative Analysis

Elemental analysis

nitrogen, sulphur, chlorine, bromine, iodine

Functional groups

-phenols, carboxylic acids

Unit-IV

-carbonyl compounds - ketones, aldehydes
-carbohydrates
-aromatic amines
-amides, ureas and anilides
-aromatic hydrocarbons and their halo- derivatives

Reference Books

1.Brian S. Furniss, Antony J. Hannaford, Peter W.G. Smith and Austin R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Longman, London.

2. F.G. Mann and B. C. Saunders, Practical Organic Chemistry, Springer

3. J.T. Sharp, Practical Organic Chemistry: A student handbook of techniques.

4. Philippa B. Cranwell, Laurence M. Harwood and Cristopher J. Moody , Experimental Organic Chemistry, 3rd Edition, Wiley**.**

BBA-GE 201-18	**Managerial Economics II**	**L-5, T-1, P-0**	**6 Credits**

Pre-requisite: Understanding of basic knowledge of Managerial Economics

Course Objectives: This course aims to acquaint students with economy as a whole including measurement of national income, inflation and unemployment, which an objective to inculcate understanding of macroeconomic environment of an economy for better decision making.

Course Outcomes: After completion of the course, the students shall be able to:

CO1	Explain the concept of national income and its measurement using different approaches.
CO2	Describe the underlying theories of demand and supply of money in an economy.
CO3	Make use of employment and national income statistics students will be able to describe and analyze the economy in quantitative terms.
CO4	Interpret macroeconomic issues like money, inflation and unemployment.
CO5	Identify the phases of the business cycle and the problems caused by cyclical fluctuations in the market economy

Mapping of course outcomes with the program o Specific utcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	3	2	2	-
CO2	3	2	2	3	2	3	
CO3	2	3	3	2	2	3	3
CO4	2	2	3	3	3	2	3
CO5	2	1	1	3	1	1	3

Course Title: Managerial Economics II

Course Code: BBAGE 201-18

UNIT-I

National Income: Measuring National Income. Problems in the measurement of National Income. Theories of Money: Nature and functions of money – Types of money: Near money, inside money and outside money. Theories of demand for money – defining demand for money – Classical theories of demand for money – Friedman's re-statement of Quantity Theory of Money; Liquidity preference theory and Keynesian Liquidity Trap. Theories of Supply of money; Defining supply of money; Measuring supply of money.

UNIT-II

Theories of Inflation and Unemployment: Meaning, Types and Theories of Inflation. - Cost of inflation and sacrifice ratio. - Measurement of Inflation in India - Policies to control inflation Meaning and types of unemployment. - Cost of unemployment and Oakun's Law Measurement of unemployment in India. - Concept of Stagflation - Concept of Philips Curve.

Unit-III

Business cycle: Meaning, types and phases. Monetary, Fiscal and Income policy – Meaning and instruments. Multiplier: Concept, Features and Leakages. Foreign trade multiplier.

Unit-IV

Macro-economic Framework in Indian Economy–Public Finance–Tax system in India– Financial Administration: Finance Commission.

RECOMMENDED BOOKS:

1. Ahuja, H.L.(2015) Macroeconomics-Theory and Policy. New Delhi: Sultan Chand.

2. Jhingan, M.L. (2016) Macro Economic Theory. Delhi: Vrinda Publications Pvt. Ltd

3. Dwivedi, D.N.(2017)Macroeconomics: Theory and Practice: Theory & Practice. New Delhi: McGraw Hill.

4. Jain, T.R., Khanna, O.P.(2014) Managerial Economics: V.K. Publications

5. Dewett, K.K., Navalur, M.H., (2006) Modern Economic Theory: New Delhi: Sultan Chand.

UC-BHHL-115-19	**Communicative English -II**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisite: Basic proficiency in Communication Skills

Course Objectives: The main objective of this course is:

- To help the students become proficient in LSRW-Listening, Speaking, Reading & Writing skills
- To help the students become the independent users of English language
- To develop in them vital communication skills, integral to their personal, social and professional interactions
- To teach them the appropriate language of professional communication
- To prepare them for job market

Course Outcomes: At the end of the course, the student will

CO1	acquire basic proficiency in reading &listening, writing and speaking skills
CO2	be able to understand spoken and written English language, particularly the language of their chosen technical field.
CO3	be able to converse fluently.
CO4	be able to produce on their own clear and coherent texts.
CO5	become proficient in professional communication, such as, interviews, group discussions, office environments, important reading skills as well as writing skills and thereby will have better job prospects.

Mapping of course outcomes with the program Specific outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	2	3	2	2	2
CO2	3	2	2	3	2	3	3
CO3	2	3	3	2	2	3	3
CO4	2	2	3	3	3	2	3
CO5	2	1	1	3	1	1	3

Course Title: Communicative English-II
Course Code: BHHL115-19

UNIT-I
(Literature)

(C) ***The Poetic Palette*** **(Orient BlackSwan, Second Edition, 2016)**

The following poems from this anthology are prescribed:

4. The Soul's Prayer: Sarojini Naidu
5. I Sit and Look Out: Walt Whitman
6. Women's Rights: Annie Louise Walker

(D) ***Prose Parables*** **(Orient Black Swan, 2013)**

The following stories from the above volume are prescribed:

a. The Doctor's Word: R.K. Narayan
b. The Doll's House: Katherine Mansfield
c. Dusk: H.H. Munroe (Saki) (10)

UNIT-II

Vocabulary:
Standard abbreviations; One word substitution; Word Pairs (Homophones/Homonyms)
Grammar: Sentence Structures; Use of phrases and clauses in sentences; Transformation of Sentences; Importance of proper punctuation (6)

UNIT-III

Reading and Understanding:
Summary Paraphrasing; Analysis and Interpretation; Translation (from Hindi/Punjabi to English and vice-versa)
Close Reading; Comprehension;

(4)

UNIT-IV

Mechanics of Writing & Speaking Skills:
Report writing; Career Documents- Job applications, Resume/CV writing, Common Everyday Situations: Conversations & Dialogues, Formal Presentations

(10)

REFERENCE BOOKS

1.John Eastwood, Oxford Practice Grammar, Oxford University Press,2014
2.Michael Swan, Practical English Usage, OUP. 1995.
3. **F.T.Wood,** Remedial English Grammar,Macmillan,2007.
4. William Zinsser, On Writing, Well Harper Resource Book, 2001.
5. Sanjay Kumar and Pushp Lata, Communication Skills, Oxford University Press,2011.'
6.Liz Hamp-Lyons and Ben Heasly, Study Writing, Cambridge University Press. 2006.

UC-BHHL-116A	**PUNJABI COMPULSORY-II (ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ-II)**	**L:2 , T:0, P:0**	**Credits:2**
Pre-requisite:	**ਪੰਜਾਬੀਲਾਜ਼ਮੀ (Punjabi Compulsory)-I**		
Course Objectives	1. To enhance the language ability of students. 2. To enhance the ability of Learning science and developing science literacy through local language teaching with science subjects.		

Course Outcomes: At the end of the course, the student will be able to

CO1. Translate and transfer/broadcast the western scientific knowledge in the local language.

CO2. Translate and transfer the indigenous/traditional scientific knowledge available in local knowledge into English and other global languages.

CO3. Understand the society through Punjabi language, literature and culture.

CO4. Learning science and in developing science literacy.

CO5. Improve the internal communication.

Mapping of course outcomes with the program Specific outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2
CO2	2	2	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	3
CO5	2	3	2	2	2

Course Title: PUNJABI COMPULSORY-II (ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ-II)
Course Code: BHHL116A-19

UNIT-I

ਡਾ.ਹਰਿਭਜਨ ਸਿੰਘ:
ਅਪ੍ਰਮਾਣਿਕ, ਤੇਰੇ ਹਜ਼ੂਰ ਮੇਰੀ ਹਾਜ਼ਰੀ ਦੀ ਦਾਸਤਾਨ
ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ:
ਕੰਡਿਆਲੀ ਥੋਰ੍ਹ, ਧਰਮੀ ਬਾਬਲ ਪਾਪ ਕਮਾਇਆ, ਰੁੱਖ
ਪਾਸ਼:
ਇਨਕਾਰ,ਸਭ ਤੋਂ ਖਤਰਨਾਕ,ਦਹਿਕਦੇ ਅੰਗਿਆਰਾਂ ‘ਤੇ
ਸੁਰਜੀਤ ਪਾਤਰ:
ਹੁਣ ਘਰਾਂ ਨੂੰ ਪਰਤਣਾ, ਕੁਝ ਕਿਹਾ ਤਾਂ..., ਪੁਲ

(8)

UNIT-II

ਕਹਾਣੀ ਭਾਗ:
ਸੰਤੋਖ ਸਿੰਘ ਧੀਰ:
ਕੋਈ ਇਕ ਸਵਾਰ
ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ਼:
ਲੱਛਮੀ
ਮੋਹਨ ਭੰਡਾਰੀ :
ਘੋਟਣਾ
ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ :
ਆਪਣਾ ਆਪਣਾ ਹਿੱਸਾ

(8)

UNIT-III

ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀਆਂ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ
ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਉਪਰ ਪਏ ਪ੍ਰਭਾਵ

(6)

UNIT-IV

ਰਿਪੋਰਟਿੰਗ, ਸਮਾਚਾਰ ਲਿਖਣ ਦੀ ਵਿਧੀ ਤੇ ਤੱਤ
ਪੰਜਾਬੀ ਪੈਰ੍ਹੇ ਦਾ ਸਰਲ ਅੰਗਰੇਜ਼ੀ ਅਨੁਵਾਦ
ਦਫਤਰੀ ਚਿੱਠੀ ਪੱਤਰ

(8)

Reference Books

ਸੰਪ.ਡਾ.ਮਹਿਲ ਸਿੰਘ, ਸਾਹਿਤ ਦੇ ਰੰਗ, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ, 2016.

UC-BHHL-116B	**MUDHLI PUNJABI-II (ਮੁਢਲੀ ਪੰਜਾਬੀ-II)**	**L:2 , T:0, P:0**	**Credits:2**
Pre-requisite:	ਮੁਢਲੀ ਪੰਜਾਬੀ **(Mudhli Punjabi)-I**		
Course Objectives	1. To enhance the language ability of students. 2. To enhance the ability of Learning science and developing science literacy through local language teaching with science subjects.		

Course Outcomes: At the end of the course, the student will be able to

CO1. Translate and transfer/broadcast the western scientific knowledge in the local language.

CO2. Translate and transfer the indigenous/traditional scientific knowledge available in local knowledge into English and other global languages.

CO3. Understand the society through Punjabi language, literature and culture.

CO4. Learning science and in developing science literacy.

CO5. Improve the internal communication.

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2
CO2	2	2	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	3
CO5	2	3	2	2	2

Course Title: MUDHLI PUNJABI-II (ਮੁਢਲੀ ਪੰਜਾਬੀ-II)
Course Code: BHHL116B-19

UNIT-I

ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਪਛਾਣ ਤੇ ਵਰਤੋਂ-
ਨਾਂਵ, ਪੜਨਾਂਵ
ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ
ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ

(8)

UNIT-II

ਰੋਜ਼ਾਨਾ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ:
ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਰਿਸ਼ਤੇ-ਨਾਤੇ ਤੇ ਕਿੱਤਿਆਂ ਸਬੰਧੀ।

(8)

UNIT-III

ਪੰਜਾਬੀ ਵਾਕ ਬਣਤਰ :
ਸਧਾਰਣ ਵਾਕ
ਸੰਯੁਕਤ ਵਾਕ
ਮਿਸ਼ਰਤ ਵਾਕ

(8)

UNIT-IV

ਸਧਾਰਣ ਵਾਕਾਂ ਦਾ ਅੰਗਰੇਜ਼ੀ ਤੋਂ ਪੰਜਾਬੀ ਅਨੁਵਾਦ

ਸਧਾਰਣ ਵਾਕਾਂ ਦਾ ਪੰਜਾਬੀ ਤੋਂ ਅੰਗਰੇਜ਼ੀ ਅਨੁਵਾਦ

(8)

Reference Books

1.ਸੁਖਵਿੰਦਰ ਸਿੰਘ ਸੰਘਾ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਗਿਆਨ, ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਕਾਦਮੀ ਜਲੰਧਰ

SEMESTER-III

UC-BSHM-301-19	**Calculus-III**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: - Calculus of one variable

Course Objectives: The objectives of the course are to introduce the functions of several variable, the continuity, derivatives and integrals of the functions of several variables and their geometrical interpretations. One of the objectives is to introduce the applicability of the calculus of several variables to the students.

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the functions of several variables and their behavior.
CO2	Find the partial derivatives, understand its geometrical meaning and understand their relation with total derivative
CO3	Find the maxima and minima of function of several variables and their expansion.
CO4	Understand the integrals of the functions of several variables and their geometrical interpretation
CO5	Applications of the calculus of several variables in the real world.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	3	3	-	-	3
CO2	3	3	-	-	3
CO3	3	3	-	-	3
CO4	3	3	-	-	3
CO5	1	3	-	-	3

Course Title: Calculus-III

Course Code: UC-BSHM-301-19

UNIT-I

Real valued functions of several variables with emphasis on functions of two and three variables, Limits and continuity, Partial derivatives, Homogenous Functions, Euler's Theorem

UNIT-II

Total differentiation, Differentiation of composite functions, Implicit functions, Chain Rule, Jacobians, Directional Derivatives, Gradient Vectors, Tangent Planes.

UNIT-III

Saddle Points, Maxima and Minima of functions of two variables, Lagrange's multiplier method, Higher dimensional analogues of Lagrange's Mean value Theorem and Taylor's theorem for functions of two variables.

UNIT-IV

Double integration over rectangular and non-rectangular regions, change of order of integration, double integration in polar co-ordinates, triple integration over parallelepiped and other solid regions, Applications of double and triple integrals to area, volume, centre of gravity, moment of inertia etc.

RECOMMENDED BOOKS:

1. G. B. Thomas and R. L. Finney, Calculus and Analytic Geometry, 9th Edition, Addison Wesley, 1998. (Scope as in Ch.11-13)

2. Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand & Co.

3. Shanti Narayan and P.K. Mittal, Integral Calculus, S. Chand & Co.

4. T. M. Apostol, Mathematical Analysis, 2nd Edition, Narosa Publishing House, Reprint 2002.
5. J. Stewart, Multivariable Calculus, Concepts and Contexts, 2nd Ed., Brooks /Cole, Thomson Learning, USA, 2001.

UC-BSHM-302-19	**Algebra-I**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: - Complex numbers, Sets, Relation and Functions

Course Objectives: This course is designed to introduce the basic notions of algebra. The major focus of the course will be on: De Moivre's theorem & its applications, matrices and their use in system of equations; theoretical foundation of theory of equations and their solutions.

Course Outcomes: At the end of the course, the students will be able to

CO1	Use the De Moivre's theorem for solving problems concerning powers of complex numbers and complex roots of polynomials etc.
CO2	Use matrices in solving system of equations.
CO3	Demonstrate linear independence and dependence of a set of vectors.
CO4	Find inverse of a matrix using Gauss-Jordan method.
CO5	Demonstrate the nature of solutions of polynomial equations.
CO6	Use Cardano's method, Ferrari method and Descarte's method for finding solutions of equations.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	2	3	-	-	1
CO2	2	3	-	-	1
CO3	3	3	-	-	1
CO4	2	3	-	-	1
CO5	3	3	-	-	1
CO6	3	3	-	-	1

Course Title: Algebra-I
Course Code: UC-BSHM-302-19

UNIT-I

Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications. Linear independence and dependence of row and column vectors, elementary operations on matrices, inverse of a matrix using Gauss-Jordan method, echelon form, row rank and column rank of a matrix and their equivalence,

UNIT-II

System of linear equations (homogeneous and non-homogeneous), conditions for consistency, Polynomials, zeros of a polynomial, division algorithm, greatest common divisor, repeated roots, equal roots, fundamental theorem of algebra.

UNIT-III

Relationship between roots and the coefficients, Fundamental theorem of symmetric polynomials (without proof). Evaluation of symmetric functions of roots, Rational roots of polynomials with integral coefficients. Descartes' rule of sign.

UNIT-IV

Strum's theorem (statement only), Solution of cubic equation using Cardano's method, and biquadratic equation by Descartes method and Ferrari's method.

RECOMMENDED BOOKS

1. T. Andreescu and D. Andrica, Complex Numbers from A to Z, Springer Nature, 2016

2.Shanti Narayan and P.K. Mittal, A Textbook of Matrices, S. Chand & Company, 2010.

3.S. Lipschutz and M. L. Lipson, Schaum's Outline of Linear Algebra, McGraw Hill Education, 3rd Edition, 2017.

4.A Kurosh, Higher Algebra, Moscow Mir Publisher, 1972.

5.H. W. Turnbull, Theory of Equations, Palala Press, 2018.

6.W. S. Burnside and A. W. Panton, The Theory of Equations, Vol-1, Dublin University Press, 1954.

7. Chandrika Prasad, Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., 2017.

UC-BSHM-303-19	**Real Analysis-I**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: Students must have the knowledge of number system, limit.

Course Objectives: The objective of the course on **Real Analysis-I** is to equip the B.Sc. (Hons) students with the real line, its properties. The various concepts of sequence, infinite series. Furthermore, students will be introduced to various tests to discuss the convergence, divergence of sequences and infinite series.

Course Outcomes: At the end of the course, the student will be able to

CO1	Learn the basic concepts of Real line and its properties.
CO2	Understand about bounded, unbounded and limit suprema and infima.
CO3	Use of Monotone Convergence theorem for the calculation of square roots.
CO4	Be acquainted with knowledge of convergent and divergent sequences.
CO5	Apply the learnt tests in establishing convergence, divergence, absolute convergence and conditional convergence of infinite series.

Mapping of course outcomes with the program specific outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	2	2	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	1
CO5	2	2	2	2	1

Course Title: Real Analysis-I
Course Code: UC-BSHM-303-19

UNIT-I

Review of Algebraic properties, Rational and irrational numbers, Order properties of $\mathbb{R}$, Absolute value of a real number, Triangle inequality, Real line, δ-neighborhood of a point in $\mathbb{R}$, Idea of bounded above sets, bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of $\mathbb{R}$ (without proof).

UNIT-II

Sequence of real number, Limit of a sequence, Uniqueness of limits, Limit theorems, Bounded sequence, Convergent sequence, Squeeze theorem, Examples of divergent sequences, Monotone sequence, Monotone convergence theorem, Calculation of square roots, Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano-Weierstrass Theorem for Sequences, Cauchy sequence, Cauchy's Convergence Criterion.

UNIT-III

Infinite series, convergence and divergence of infinite series, The n^{th} term test, Harmonic series, Geometric series, Cauchy Criterion for convergence, Integral test, p-test, Comparison test, Limit Comparison test, Ratio test, Cauchy root test.

UNIT-IV

Absolute Convergence of infinite series, Comparison test, Root test, Ratio Test, Cauchy integral test, Kummer's test, Raabe's Test, Non-absolute convergence of infinite series, Alternating series, Leibniz test, Abel's Lemma, Abel's test, Dirichlet test.

RECOMMENDED BOOKS

1. R.G. Bartle and D.R. Sherbert, Introduction to Real Analysis, 3rd Edition. Singapore: John Wiley and Sons (Asia) Pvt. Ltd., 2002.
2. R.T. Smith, and R.B. Minton, R.B. Calculus, 4th Edition. McGraw-Hill Education, 2011.
3. S.R. Ghorpade and B.V. Limaye, A Course in Calculus and Real Analysis, Springer International Publishing, 2018.
4. T.M. Apostol, Calculus, Volume I &II, 2nd edition. New Delhi: Wiley, 1969.
5. R.K. Jain and S.K. Iyengar, S.K. Advanced Engineering Mathematics, 5th Edition. New Delhi: Narosa Publication, 2011.
6. W.R. Wade, An Introduction to Analysis, 4th Edition. Person, 2010.

UC-BSHP-214-19	**Elements of Modern Physics**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objectives: The objective of the course is to develop basic understanding concepts of modern physics, namely to special relativity and to the quantum nature of light and energy, emphasizing whenever possible, how classical concepts have shown up to be inadequate in explaining experiments, which will act as a strong background if he/she chooses to pursue science as a career.

Course Outcomes: At the end of the course, the student will be able to

CO1	gained a deep understanding on the motivations that have led in the past century to the relativistic and quantum revolution in physics
CO2	demonstrate ability to apply wave-particle duality and uncertainty principle to solve physics problems.
CO3	demonstrate ability to solve quantum mechanical eigenvalue equations for various operators and obtain expectation values of the corresponding observables.
CO4	demonstrate ability to solve 1-D quantum problems including the quantum particle in a box, a well, the simple harmonic oscillator, and the transmission and reflection of waves.
CO5	solve problems involving the quantization of mass, charge, light, and energy including Avogadro's number, black-body radiation, photoelectric effect, and other related issues.

Mapping of course outcomes with the program Specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	-	1	2	1	2	3	2	2
CO2	2	2	1	2	1	1	1	2	1	3	2	1
CO3	3	2	2	2	1	1	2	2	1	3	2	1
CO4	2	2	2	2	1	1	2	1	1	3	1	2
CO5	2	2	2	2	1	1	2	1	1	3	1	1

Course Title: Elements of Modern Physics
Course Code: UC-BSHP-214-19

UNIT-I

Dual Nature of Waves and Matter: Black body ration, Planck's quantum, Planck's constant and light as a collection of photons; Photo Electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment, Problems with Rutherford model-instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.

Lecture (10)

UNIT-II

Quantum Mechanics: Two slit interference experiment with photons, atoms & particles; linear superposition principle as a consequence; Matter waves and wave amplitude; wave velocity and group velocity, Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wave function, probabilities and normalization; Probability and probability current densities in one dimension. One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example.

Lecture (10)

UNIT-III

Atomic structure: The nuclear atom, Electron orbits, Atomic spectra, The Bohr Model, Energy level and spectra, Correspondence principle, Nuclear motion, Atomic excitation, Many electron atoms, Exclusion Principle, electron spin, spin orbit coupling, X-ray spectra. Zeeman effect, Stern-Garlach experiment.

Lecture (10)

UNIT-IV

Special Theory of Relativity: Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Doppler effect, Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum. Energy- Momentum Four Vector.

Lecture (10)

Recommended Books:

1. Arthur Beiser, , Concepts of Modern Physics, 2009, McGraw-Hill
2. J.R. Taylor, C.D. Zafirato and M.A. Dubson, Modern Physics, 2009, PHI Learning
3. Thomas A. Moore, Six Ideas that Shaped Physics: Particle Behave like Waves, 2003, McGraw Hill
4. E.H. Wichman, Quantum Physics, Berkeley Physics, Vol.4., 2008, Tata McGraw-Hill Co.
5. R.A. Serway, C.J. Moses, and C.A.Moyer, Modern Physics, 2005, Cengage Learning.

UC-BSHP-215-19	**Physics Lab-III**	**L-0, T-0, P-4**	**2 Credits**

Pre-requisites (if any): High-school education with Physics lab as one of the subject.

Course Objectives: The aim and objective of the Physics Lab course is to introduce the students of B. Sc. (Hons.) Physics to the formal structure of wave and vibrations and mechanics so that they can use these as per their requirement.

Course Outcomes: At the end of the course, the student will be

CO1	Able to understand the theoretical concepts learned in the theory course.
CO2	Trained in carrying out precise measurements and handling equipment.
CO3	Learn to draw conclusions from data and develop skills in experimental design.
CO4	Able to understand the principles of error analysis and develop skills in experimental design.
CO5	Able to document a technical report which communicates scientific information in a clear and concise manner.

Mapping of course outcomes with the program Specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	2	1	2	3	2	3
CO2	3	3	3	3	2	2	1	1	1	3	2	3
CO3	3	3	2	-	2	1	2	1	1	3	2	3
CO4	3	2	2	2	-	2	2	1	2	3	2	3
CO5	2	2	2	2	-	2	2	1	1	3	2	3

Course Title: Physics Lab-III
Course Code: UC-BSHP-215-19

Note: Students are expected to perform about 8-10 experiments from the following list, selecting minimum of 6-7 from the Physical Lab and 2-3 from the Virtual lab.

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To show the tunneling effect in tunnel diode using I-V characteristics.
3. To determine work function of material of filament of directly heated vacuum diode
4. To determine value of Planck's constant using LEDs of at least 4 different colors.
5. Measurement of Planck's constant using black body radiation and photo-detector.
6. To determine work function of material of filament of directly heated vacuum diode.
7. To determine the ionization potential of mercury.
8. To determine the wavelength of H-alpha emission line of Hydrogen atom.
9. To determine the absorption lines in the rotational spectrum of Iodine vapour.
10. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photosensor and compare with incoherent source – Na light.
11. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
12. To determine the value of e/m by magnetic focusing.
13. To experimentally demonstrate the concept of quantization of energy levels according to Bohr's model of atom using Franck-Hertz Apparatus.
14. To determine the wavelength of laser source using diffraction of single slit.
15. To determine the wavelength of laser source using diffraction of double slits.
16. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency.

RECOMMENDED BOOKS:

1. http://vlab.amrita.edu/?sub=1&brch=195
2. Experimental Physics - M.A. Hippargi.
3. Experimental Physics – Gadad & Hiregoudar.
4. Practical Physics - C. L. Arora.
5. Advanced Practical Physics – Worsnop and Flint.
6. Practical Physics – Gupta & Kumar Vol I, Vol II

UGCA1914	**Programming in Python**	**L-3, T-1, P-0**	**4 Credits**
Pre-requisites (if any): NA			
Course Outcomes: At the end of the course, the student will be			
CO1	Familiar with Python environment, data types, operators used in Python.		
CO2	Compare and contrast Python with other programming languages.		
CO3	Learn the use of control structures and numerous native data types with their methods.		
CO4	Design user defined functions, modules, and packages and exception handling methods.		
CO5	Create and handle files in Python and learn Object Oriented Programming Concepts.		

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	1	2	3	3	3
CO2	1	1	3	3	3
CO3	1	2	3	3	3
CO4	1	2	3	3	3
CO5	1	1	3	3	3

Course Title: Programming in Python

Course Code: UGCA-1914

UNIT-I

Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.

Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command.

Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators. (12)

UNIT-II

Control Structures: Decision making statements, Python loops, Python control statements.

Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations). (10)

UNIT-III

Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables.

Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages. (12)

UNIT-IV

Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python.

File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python. (10)

Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.

Text Books:

1. Pooja Sharma, Programming in Python, BPB Publications, 2017.
2. R. Nageswara Rao, Core Python Programming, 2nd Edition, Dreamtech.

Reference Books:

1. Martin C. Brown ,Python, The complete Reference , Mc Graw Hill Education.
2. A. Martelli, A. Ravenscroft and S. Holden, Python in a Nutshell, OREILLY.

UGCA1917	**Programming in Python Laboratory**	**L-0, T-0, P-4**	**2 Credits**

Pre-requisites (if any): NA

Additional material required in ESE: - Maintain practical note book as per the instructions given by the instructor.

CO1	Solve simple to advanced problems using Python language.
CO2	Develop logic of various programming problems using numerous data types and control structures of Python.
CO3	Implement different data structures.
CO4	Implement modules and functions.
CO5	Design and implement the concept of object oriented programming structures.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	1	2	3	3	2
CO2	1	1	3	3	2
CO3	1	2	3	3	2
CO4	1	2	3	3	2
CO5	1	1	2	3	2

Course Title: Programming in Python Laboratory

Course Code: UGCA-1917

List of assignments:

1.	Compute sum, subtraction, multiplication, division and exponent of given variables input by the user.
2.	Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3.	Compute volume of following 3D shapes: cube, cylinder, cone and sphere.
4.	Compute and print roots of quadratic equation $ax^2+bx+c=0$, where the values of a, b, and c are input by the user.
5.	Print numbers up to N which are not divisible by 3, 6, 9,, e.g., 1, 2, 4, 5, 7,….
6.	Write a program to determine whether a triangle is isosceles or not?
7.	Print multiplication table of a number input by the user.
8.	Compute sum of natural numbers from one to n number.
9.	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13…..n
10.	Compute factorial of a given number.
11.	Count occurrence of a digit 5 in a given integer number input by the user.
12.	Print Geometric and Harmonic means of a series input by the user.
13.	Evaluate the following expressions: a. $x-x^2/2!+x^3/3!- x^4/4!+\dots x^n/n!$ b. $x-x^3/3!+x^5/5!- x^7/7!+\dots x^n/n!$
14.	Print all possible combinations of 4, 5, and 6.
15.	Determine prime numbers within a specific range.
16.	Count number of persons of age above 60 and below 90.
17.	Compute transpose of a matrix.
18.	Perform following operations on two matrices. 1) Addition 2) Subtraction 3) Multiplication
19.	Count occurrence of vowels.
20.	Count total number of vowels in a word.
21.	Determine whether a string is palindrome or not.
22.	Perform following operations on a list of numbers: 1) Insert an element 2) delete an element 3) sort the list 4) delete entire list
23.	Display word after Sorting in alphabetical order.
24.	Perform sequential search on a list of given numbers.
25.	Perform sequential search on ordered list of given numbers.
26.	Maintain practical note book as per their serial numbers in library using Python dictionary.
27.	Perform following operations on dictionary

	1) Insert 2) delete 3) change
28.	Check whether a number is in a given range using functions.
29.	Write a Python function that accepts a string and calculates number of upper case letters and lower case letters available in that string.
30.	To find the Max of three numbers using functions.
31.	Multiply all the numbers in a list using functions.
32.	Solve the Fibonacci sequence using recursion.
33.	Get the factorial of a non-negative integer using recursion.
34.	Write a program to create a module of factorial in Python.
35.	Design a Python class named *Rectangle*, constructed by a length & width, also design a method which will compute the area of a rectangle.
36.	Design a Python class named *Circle* constructed by a radius and two methods which will compute the area and the perimeter of a circle.
37.	Design a Python class to reverse a string 'word by word'.
38.	Write a Python program to read an entire *text file*.
39.	Design a Python program to read first n lines of a *text file*.
40.	Construct a Python program to write and append text to a file and display the text.

Text Books:

1.Pooja Sharma, Programming in Python, BPB Publications, 2017.
2.R. Nageswara Rao, Core Python Programming, 2nd Edition, Dreamtech.

Reference Books:

3. Martin C. Brown ,Python, The complete Reference , Mc Graw Hill Education.
4. A. Martelli, A. Ravenscroft, S. Holden, Python in a Nutshell, OREILLY.

UC-BHCL-204-19	**PHYSICAL CHEMISTRY**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objectives: This course will equip students with the necessary knowledge concerning the fundamentals in the basic areas of physical chemistry viz. different states of matter, solutions and ionic equilibrium. The problem solving skills of students are expected to be enhanced through due weightage given to numerical problems in each unit.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the basic principles and theories pertaining to different states of matter
CO2	Solve various problems related to pH
CO3	Define the various laws pertaining to gaseous state and solutions.
CO4	Familiarise with the different colligative properties of solutions and the concept of abnormal molecular mass
CO5	Understand the basic structure and symmetry elements in solids

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	-	3	-	-	3
CO2	-	3	-	-	3
CO3	-	3	-	-	3
CO4	-	3	-	-	3
CO5	-	3	-	-	3

Course Tittle: Physical Chemistry
Course Code: UC-BHCP-204-19

UNIT-I

Gaseous State:
The kinetic molecular theory of gases, Postulates and derivation of kinetic gas equation and various gas laws, The ideal gas law: Applications, Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, *Z* and its variation with pressure for different gases. Causes of deviation from ideal behavior. van der Waals equation of state, its derivation and application in explaining real gas behaviour. Numericals.

UNIT-II

Liquid and Solid State
Physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity and their determination, cleansing action of detergents.

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law

UNIT-III

Ionic equilibria:
Concept of Acids and Bases. Electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids.
Buffer solutions; buffer capacity, buffer range, buffer action
Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

UNIT-IV

Solutions and Colligative Properties:
Ways of expressing the concentration, lowering of vapour pressure, Raoult's Law. Colligative properties (i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

RECOMMENDED BOOKS:

1. P.W. Atkins and J. de Paula, Atkin's Physical Chemistry, Oxford University Press (2006).
2. S.H. Maron and C.F. Prutton, Principles of Physical Chemistry, 1st edition,Oxford and IBH (1958).
3. G.W. Castellan, Physical Chemistry, 4th edition, Narosa (2004)
4. I .N. Levine, Physical Chemistry 6th Ed., Tata Mc Graw Hill (2010)
5. T. Engel and P. Reid, Physical Chemistry 3rd Ed., Prentice-Hall (2012)

UC-BHCL-208-19	**Chemistry Lab-III**	**L-0, T-0, P-4**	**2 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objectives: To provide students practical knowledge and skills about various topics taught in theory class of physical chemistry, which in turn will enhance their problem solving and analytical skills.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the basic procedures for carrying out a physical chemistry practical like preparation and standardisation of solutions, handling the equipments and measuring with precision.
CO2	Correlate the theoretical and practical aspects and know about the limits of the experimental error.
CO3	Determine the various physical parameters for the various problems under study.
CO4	Verify various laws studied in the theory part.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	-	3	-	-	3
CO2	-	3	-	-	3
CO3	-	3	-	-	3
CO4	-	3	-	-	3
CO5	-	3	-	-	3

Subject Tittle: Chemistry Lab-III
Subject Code: UC-BHCP-208-19

UNIT-I

Preparation and Standardisation of Solutions.

UNIT-II

Surface tension measurements.
a) Determine the surface tension by (i) drop number (ii) drop weight method.
b) Study the variation of surface tension of detergent solutions with concentration.

UNIT-III

Viscosity measurement using Ostwald's viscometer.
a) Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature.
b) Study the variation of viscosity of sucrose solution with the concentration of solute.

UNIT-IV

pH metry
a) Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
b) Preparation of buffer solutions of different pH;
(i) Sodium acetate-acetic acid
(ii) Ammonium chloride-ammonium hydroxide
c) pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
d) Determination of dissociation constant of a weak acid.

Recommended Books

1**.** J.B. Yadav , Practical Physical Chemistry, Krishna
2. Findlay, Practical Physical Chemistry, Longman, New York

BBA 301-18	**Organizational Behaviour**	**L-5, T-1, P-0**	**6 Credits**

Pre-requisite: Understanding of senior secondary level Physics and Mathematics

Course Objective: This course emphasizes the importance of human capital in the organizations of today. It gives an insight to the students regarding individual and group behaviour in any organization**.**

Course Outcomes: At the end of the course, the student will be able to

CO1	To explain the basics of Orgnaizational behaviour and various challenges for OB
CO2	To illustrate the foundations of Individual Behaviour and various factors influencing individual behaviour viz. learning, personality, perception, attitude and motivation.
CO3	To examine the dynamics of group development and group properties.
CO4	To understand various dimensions of organisational culture.
CO5	To analyse the process of conflict management and approaches to stress management.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	-	3	-	-	3
CO2	-	3	-	-	3
CO3	-	3	-	-	3
CO4	-	3	-	-	3
CO5	-	3	-	-	3

Course Title: Organizational Behaviour
Course Code: BBA 301-18

UNIT-I

Introduction: Meaning of organizational behaviour and its relevance in today's business environment, contributing disciplines to Organization Behaviour, challenges and opportunities for OB.
Individual behaviour in organization: Foundations of individual behaviour, Factors influencing Individual Behaviour.
Learning: Meaning, characteristics and theories: Classical conditioning theory, operant conditioning theory, social learning theory, behaviour modification.

UNIT-II

Perception: Nature, importance, perceptual process, factors influencing perception, perceptual errors.
Attitude: Meaning, importance, components and types of work related attitude.
Personality: Meaning, determinants of personality, personality traits.
Motivation: Meaning, types of motivation, theories of work motivation given by Maslow, Herzberg, McGregor, Vroom and Porter – Lawler.

UNIT-III

Group behaviour in organization: Group dynamics, Types of groups, Group development, theories of group development, Group norms and roles, Group cohesiveness,
Work Teams: Meaning, characteristics, types of team, Creating effective team.
Leadership: nature, leadership styles, Leadership theories: trait theory and behavioural theories.

UNIT-IV

Conflict Management: Meaning, types and sources of conflict, Process of conflict management, approaches to conflict management.
Stress management: sources of stress, approaches for stress management.
Organizational culture: meaning, concept, types of culture, dimensions of organizational culture.

Recommended BOOKS:

1. Robbins, Organization Behaviour, Pearson Education Asia
2. Luthans, Organization Behaviour, Tata McGraw Hill
3. Newstrom, Organizational Behaviour: Human Behaviour at Work, Tata McGraw Hill
4. L.M. Prasad, Organisation Behaviour, Sultan Chand
5. Parikh, Gupta, Organisational Behaviour, Tata McGraw Hill
6. Aswathappa, Organization Behaviour, Himalaya.

SEMESTER-IV

UC-BSHM-401-19	**Vector Calculus**	**L-4, T-1, P-0**	**5 Credits**

Pre-requisite: Students must have the knowledge of Scalar, Vectors and vector algebra.

Course Objectives: The objective of the course on **Vector Calculus** is to equip the B.Sc. (Hons) students with the theoretical as well as physical interpretations of scalar vector quantities. Their applications in real life engineering problems. Furthermore, students will be introduced to more general concept, that is, Tensors.

Course Outcomes: At the end of the course, the student will be able to

CO1	Learn the basic concepts of Vector algebra, Dot product, Cross product.
CO2	Learn about operations on vectors, such as, vector triple product, scalar triple product.
CO3	Understand the Differentiation of Vector valued functions, Scalar valued functions, gradient, Divergence and curl.
CO4	Be acquainted with Line, Surface and Volume integrals of vector (or scalar) valued functions. And, Gauss, Divergence and Stokes theorem, Tensors.
CO5	Apply the learnt techniques in solving various problems related to vectors.

Mapping of course outcomes with the program outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	2	2	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	1
CO5	2	2	2	2	1

Course Title: Vector Calculus
Course Code: UC-BSHM-401-19

UNIT-I

Vector Algebra: Dot and Cross product of two vectors, Scalar and vector product of three vectors. Scalar fields and vector fields. [Ref 2: Chapter-1B]
Introduction to Suffix notation and summation convention, Kronecker delta.

UNIT-II

Vector Differentiation: Vector functions, Differentiation of a vector function, General rules for differentiation of vector function, Chain rule, Geometric interpretation of $\frac{d\vec{r}}{dt}$, Velocity and acceleration, Scalar and vector point function. [Ref 2: Chapter-1C]

UNIT-III

Gradient, divergence and Curl: Vector Differential operator, Gradient of a scalar function, Geometric interpretation of Gradient, Directional Derivative, Properties of Gradient, Divergence of a Vector point function, Physical interpretation of Divergence, Curl of Vector point function, Physical interpretation of curl, Properties of divergence and curl, Repeated operations by ∇, Conservative vector field and Scalar Potential. [Ref 2: Chapter-1C]

UNIT-IV

Vector Integral Calculus: Introduction to Integration of vector functions, Line integral, Surface integral, Volume integral.
Integral Theorems: Green's theorem in the plane, Stoke's Theorem, Gauss' theorem of Divergence and their applications. [Ref 2: Chapter-1D]

RECOMMENDED BOOKS:

1. M. Spiegel, S. Lipschutz and D. Spellman, Vector Analysis and An Introduction to Tensor Analysis, 2nd Edition. U.K.: Schaum's Outline Series, McGraw Hill, 1980.
2. H. Anton and C. Rorres, Elementary Linear Algebra, New Delhi: Wiley, 2012.
3. P. C. Mathews, Vector Analysis, 2nd Indian reprint. Springer undergraduate Mathematics Series, Springer-Verlag London, 2008.
4. H. Lass, Vector and Tensor Analysis. McGraw Hill, 2007.
5. S. Narayan, Tensor Analysis. New Delhi: S. Chand, 2010.

UC-BSHM-402-19	**Ordinary Differential Equations**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: Calculus

The Objective of this course is to introduce ordinary differential equations and basic theory of existence and uniqueness of solutions. This course further explains the analytic techniques in computing the solutions of various ordinary differential equations appearing in various fields of science and technology.

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the basic definitions to know about ordinary differential equations, its various types and their solutions
CO2	Visualize the geometrical meaning of first order differential equation.
CO3	Understand the fundamental concepts about existence and uniqueness of solution of initial value problem
CO4	Understand the applications of differential equations in different type of phenomenon.
CO5	Apply power series method to obtain series solutions of differential equations

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	2	3	-	-	3
CO2	2	3	-	-	3
CO3	2	3	-	-	3
CO4	2	3	-	-	3
CO5	2	3	-	-	3

Course Title: Ordinary Differential Equations
Course Code: UC-BSHM-402-19

UNIT-I

Basic definitions, Formulation of differential equations, order and degree of differential equation, primitives, initial value problem and solution of differential equations, First order differential equations: Linear, non-linear differential equations, Solution by variables separable, homogeneous, non-homogeneous exact equations, reducible in exact form and integrating factors, Solution of Leibnitz and Bernoulli's differential equation.

UNIT-II

Geometrical interpretation of first order differential equation, Successive approximation, Existence and uniqueness of solution of first order differential equations, Lipschitz condition, Picard's existence and uniqueness theorem.

UNIT-III

First order and higher degree equations solvable for x, y, p and Clairaut's form, Linear differential equations of first and higher order with constant coefficients, exponential decay model, lake pollution model (case study of Lake Burley Griffin), exponential growth of population (Scope as in Chapters 1, 3 of S. L. Ross).

UNIT-IV

Linear differential equations with variable coefficients, Cauchy's Euler equation and Legendre's equation, Linear independence, Linear dependence, Wronskian, Variation of parameters method.

RECOMMENDED BOOKS

1. S.L. Ross, Differential Equations, 3rd edition, John Wiley and Sons, 2004
2. W. E. Boyce and R. C. Diprima, 4th edition, Elementary differential equations and boundary value problems, John Wiley and Sons,1986.
3. M.D. Raisinghania, Ordinary and Partial Differential Equations, S Chand Publisher,15th edition, 2013
4. E. A. Coddington, An introduction to ordinary differential equation, Prentice- Hall of India.

UC-BSHM-403-19	**Linear Algebra**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: - Sets, Relations and Functions

Course Objectives: This course is designed to introduce the basic concepts of linear algebra *viz*. vector spaces, linear transformation and eigenvalue problem etc. The main focus of the course will be on theoretical foundation of these concepts including explanation through examples.

Course Outcomes: At the end of the course, the students will be able to

CO1	Deal with the notions of vector spaces and linear transformations.
CO2	Demonstrate matrix representation of linear transformation.
CO3	Deal with the eigenvalue and eigenvector problem arising in different fields of applications, for instance, in solution of system of linear differential equations and stability of numerical methods etc.
CO4	Diagonalize a given matrix using the eigenvalues and eigenvectors of the corresponding matrix.
CO5	Demonstrate similarity of matrices and use of a method to check similarity of two matrices.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	3	3	-	-	1
CO2	3	3	-	-	1
CO3	2	3	-	-	1
CO4	2	3	-	-	1
CO5	2	3	-	-	1

Course Title: Linear Algebra
Course Code: UC-BSHM-403-19

UNIT-I

Vector spaces, subspaces, span of a set, intersection and union of subspaces, direct sum of subspaces, linear dependence and independence of vectors, basis and dimension of a vector space, finite dimensional vector spaces.

UNIT-II

Linear transformations, matrices as linear transformations, kernel and image of linear transformation, rank and nullity of a linear transformation, Rank-Nullity theorem, inverse of a linear transformation,

UNIT-III

Singular and non-singular linear transformations, isomorphism, algebra of linear maps, composition of linear maps, Matrix representation of a linear transformation, properties of matrix representation, change of basis.

UNIT-IV

Polynomials of matrices, characteristic polynomial, eigenvalues and eigenvectors, properties of eigenvalues and eigenvectors, Cayley-Hamilton theorem and its applications, similarity of matrices, diagonalization of a matrix, quadratic forms, minimal polynomial.

RECOMMENDED BOOKS

1. Serge Lang, Introduction to Linear Algebra, 2nd Edition, Springer, 1997.

2. D. C. Lay, S. R. Lay, J. J. McDonald, Linear Algebra and its Applications, 5th Edition, 2014.

3. V. Krishnamurthy, V. P. Mainra, J. L. Arora, Introduction to Linear Algebra, East-West Press, 1976.

UC-BSHM-404-19	**Probability and Statistics**	**L-4, T-1, P-0**	**4 Credits**

Pre-requisite: - Basic statistics, Permutation & combination and the basic knowledge of probability at 10+2 level.

Course Objectives: The objective of the course is to prepare students for big data analysis by introducing basic concepts of statistics and probability theory along with their applications.

Course Outcomes: At the end of the course, the students will be able to

CO1	Understand the measures of central tendency, the concepts like skewness and standard deviation of the data.
CO2	Correlate bivariate and multivariate data.
CO3	Fit the curve by collecting random data and understand regression lines.
CO4	Understand the mathematical definition of probability, conditional probability and its applications.
CO5	Understand the theoretical concepts like random variable, probability distribution, generating functions and their usage.

Mapping of course outcomes with the program Specific outcomes

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	1	3	-	-	3
CO2	1	3	-	-	3
CO3	2	3	-	-	3
CO4	2	3	-	-	3
CO5	3	3	-	-	3

Subject Title: Probability and Statistics

Code: UC-BSHM-404-19

UNIT-I

Measure of central tendency, Measure of dispersion, Coefficient of variation, relation between measure of dispersion, Standard deviation of the combination of two groups, Moments, Skewness, Kurtosis. Correlation, Rank correlation.

UNIT-II

Curve fitting, graphical method, laws reducible to linear law, Principle of least squares, Method of least square, Fitting of $y=ax^n$, $y=ae^{bx}$, $xy^n=b$; method of group averages, fitting a parabola, method of moments, Regression, lines of regression.

UNIT-III

Definition of probability, probability and set notations, Addition law of probability, Independent events-Multiplication law of probability, Baye's theorem

UNIT-IV

Random variable, discrete probability distribution, continuous probability distribution, expectation, variance, moments, moment generating function, probability generating function.

RECOMMENDED BOOKS:

1. S.C. Gupta and V.K. Kapoor, Mathematical Statistics.
2. Olive Jean Dunn, Virginia A. Clark, Basic Statistics, John Wiley & Sons, Inc., Publication.

EVS-101A	**Environmental Studies**	**L-2, T-0, P-0**	**2 Credits**

Pre-requisites (if any): NA

Course Objectives: The aim and objective of this course is to teach the fundamental concepts of Environment as a whole along with Natural Resources, their types, and issues related with sustainable use as its components along with social issues related with environment.

Course Outcomes: At the end of the course, the student will be

CO1	Understand the fundamental concepts about Environment and its components.
CO2	Know about various types of natural resources, their functions, uses, exploitation and the problems arise due to these along with suitable case studies.
CO3	Gain knowledge about working of various ecosystems, their features and functions and energy flow through them.
CO4	Know about biodiversity, its various forms, importance and important areas

Mapping of course outcomes with the program outcomes

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	1	3	-	-	3
CO2	1	2	-	-	3
CO3	1	3	-	-	3
CO4	1	2	-	-	3

Course Tittle: Environmental Studies
Course Code: EVS-101A

UNIT-I

Multidisciplinary nature of environmental studies, Definition, scope and importance, Need for public awareness. (2)

UNIT-II

Natural Resources : Renewable and non-renewable resources : Natural resources and associated problems.
a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
• Role of an individual in conservation of natural resources.
• Equitable use of resources for sustainable lifestyles. (10)

UNIT-III

Ecosystems
• Concept of an ecosystem.
• Structure and function of an ecosystem.
• Producers, consumers and decomposers.
• Energy flow in the ecosystem.
• Ecological succession.
• Food chains, food webs and ecological pyramids.
• Introduction, types, characteristic features, structure and function of the following ecosystem :-
a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (8)

UNIT-IV

Biodiversity and its conservation

• Introduction – Definition : genetic, species and ecosystem diversity.
• Biogeographical classification of India
• Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
• Biodiversity at global, National and local levels.
• India as a mega-diversity nation
• Hot-spots of biodiversity.
• Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
• Endangered and endemic species of India
• Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity (6)

RECOMMENDED BOOKS

1. K.C. Aggarwal, Environmental Biology, Nidi Publishers, 2001
2. E.P. Odum, Fundamentals of Ecology, WB Saunders, 1971
3. Erach Bharucha, The Biodiversity of India, Mapin Publishers, 2003
4. Benny Joseph, Environmental Studies, McGraw Hills, 2015.
5. R Rajagopalan, Environmental Studies, Oxford Higher Education, 2016.
6. S.P. Misra & S.N. Pandey, Essential Environmental Studies, Ane Books Pvt. Ltd. 2016