B.Sc. (Hons.) Mathematics

Course Structure and Syllabus
University Campus
(Based on Choice Based Credit System)
Batch 2022 & onwards

DEPARTMENT OF APPLIED SCIENCES (Mathematical Sciences)

VISION

To be among the best mathematics departments in the region and to establish a national reputation as a centre for research and teaching in mathematics. Moreover, the department will contribute to the development of students as mathematical thinkers, and to function as productive citizens.

MISSION

- To discover, mentor, and nurture mathematically inclined students, and provide them a supportive environment that fosters intellectual growth.
- To prepare our undergraduate and graduate students to develop the attitude and ability to apply mathematical methods and ideas in a wide variety of careers.
- To perform widely recognized research in focused areas of mathematical and statistical theory, methodology, and education.
- To advocate for mathematical sciences and UTEP in schools and the local community.

B.Sc. (Honours Mathematics) Program

PROGRAM OBJECTIVES

Objective of the program is to catch young and talented students to motivate them 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 skilful 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 (Bachelor 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: B.Sc. (Hons.) Mathematics

SEMESTER FIRST   **Contact Hrs. 24 Hrs.**

S.No.	Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Cr
				L	T	P	Internal	External		
1.	BSHM-101-22	Compulsory	Calculus-I	4	-	-	40	60	100	4
2.	BSHM-102-22		Algebra	5	1	-	40	60	100	6
3.	BSHM-103-22		Programming Lab-I	-	-	4	30	20	50	2
4.	BHHL-115-22		Communicative English	2	-	-	20	30	50	2
5.*	BSHP-111-21	Elective	Optics	3	1	-	40	60	100	4
	BSHP-113-21		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	30	20	50	2
							Total			20

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

Note*: Physics (BSHP-111-21 & BSHP-113-21) are compulsory for the Students with Non-Medical background. Students without Non-medical background should opt Fundamentals of Computer and IT (UGCA-1902 & UGCA-1906).

SEMESTER SECOND   **Contact Hrs. 24 Hrs.**

S.No.	Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Cr
				L	**T**	**P**	**Internal**	**External**		
1.	BSHM-201-22	Compulsory	Real Analysis	5	1	-	40	60	100	6
2.	BSHM-202-22		Differential Equations	4	-	-	40	60	100	4
3.	BSHM-203-22		Programming Lab-II	-	-	4	30	20	50	2
4.*	BHHL-116A-22 **Or** BHHL-116B-22		Punjabi Compulsory **Or** Mudli Punjabi	2	-	-	20	30	50	2
5.**	BHIC-111-22	Elective	Chemistry-I	3	1	-	40	60	100	4
	BHIC-112-22		Chemistry Lab-I	-	-	4	30	20	50	2
	BBA-GE-201-18		Managerial Economics-II	5	1	0	40	60	100	6
							Total			20

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

Note 1*: Students with Punjabi as a passing subject in 10th class will study Punjabi Compulsory (BHHL-116A-22). Students without Punjabi as a subject in 10th class will study Mudli Punjabi (BHHL-116B-22).

Note 2: Chemistry (BHIC-111-22 & BHIC-112-22) is compulsory for the Students with Non-Medical background. Students without Non-medical background should opt Managerial Economics-I (BBA-GE-201-18)**

Examination and Evaluation

Theory			
S. No.	**Evaluation criteria**	**Weightage in Marks**	**Remarks**
1	Mid term/sessional Tests	24	Internal evaluation (40 Marks) MSTs, Quizzes, assignments, attendance, etc., constitute internal evaluation. Average of two mid semester test will be considered for evaluation.
2	Attendance	6	
3	Assignments/Seminars/Presentations/Continuous Evaluation	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 syllabus and format as prescribed by the University.

2. The question paper should cover the entire syllabus with uniform distribution among each unit 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 student's intelligence 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 up to 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 in all, 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 (Regular/reappear)	**Date:**	
Programmse: B.Sc. (Hons.) Mathematics	**Semester:**	
Course Code:	**Course:**	
Maximum Marks: 24	**Time: 1 hour 30 minutes**	

❖ <u>Note: Section A is compulsory; Attempt any two questions from Section B and one question from Section C.</u>

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

BSHM-101-22	Calculus-I	L-4, T-0, 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 calculus.
2. The geometrical meaning of functions, limits, continuity, derivatives, mean value theorems.
3. Applications of derivatives.
4. The definition of Higher order derivatives and its basic applications.
5. The usability of Higher order derivatives to establish Taylor's theorem, Leibnitz theorem and Maclaurin theorem.

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.

<table>
<tr><td colspan="6" align="center">Mapping of course outcomes with the program outcomes</td></tr>
<tr><td></td><td>PSO 1</td><td>PSO 2</td><td>PSO 3</td><td>PSO 4</td><td>PSO 5</td></tr>
<tr><td>CO1</td><td>3</td><td>3</td><td>2</td><td>2</td><td>3</td></tr>
<tr><td>CO2</td><td>3</td><td>2</td><td>2</td><td>2</td><td>3</td></tr>
<tr><td>CO3</td><td>3</td><td>2</td><td>2</td><td>2</td><td>3</td></tr>
<tr><td>CO4</td><td>2</td><td>3</td><td>2</td><td>2</td><td>3</td></tr>
<tr><td>CO5</td><td>3</td><td>2</td><td>2</td><td>2</td><td>3</td></tr>
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Course Title: Calculus-I
Course Code: BSHM-101-22

UNIT-I

Functions, their limits and continuity: 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, limits using L' Hospital's rule, The precise definition of limit and continuity (ε-δ definition), continuous functions and classification of discontinuities, uniform continuity.

UNIT-II

Differentiation: 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, differentiation of determinants.

UNIT-III

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

UNIT-IV

Higher order derivatives, calculation to the nth derivative, determination of nth derivative of rational functions. The nth derivative of the products of power of sines and cosines, Leibnitz's theorem, the nth 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.

BSHM-102-22	Algebra	L-5, T-1, P-0	6 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 and use Cardano's method, Ferrari method and Descarte's method for finding solutions of equations.

Mapping of course outcomes with the program 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: Algebra
Course Code: BSHM-102-22

Unit I

Polynomials and Complex Numbers: Polynomials, The remainder and factor theorem, Synthetic division, Factored form of a polynomial, Fundamental theorem of algebra, Polar representation of complex numbers, De Moivre's theorem for integer and rational indices and their applications. The nth roots of unity.

Unit II

Roots of a Polynomial: Relations between the roots and the coefficients of polynomial equations, Theorems on imaginary, integral and rational roots 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 III

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

Unit IV

System of Equations: Systems of linear equations (homogeneous and non-homogeneous), Row reduction and echelon forms, Row rank, column rank and their equivalence, Vector equations, The matrix equation $Ax = b$, Solution sets of linear systems, Gauss elimination method, Consistency of Linear System of equations, Augmented matrices, The inverse of a matrix, Gauss Jordon method.

RECOMMENDED BOOKS:

- Andreescu, Titu & Andrica Dorin, Complex Numbers from A to...Z. (2nd ed.). Birkhäuser (2014).

- Dickson, Leonard Eugene First Course in the Theory of Equations. The Project Gutenberg E-Book (http://www.gutenberg.org/ebooks/29785), (2009)

- Kolman, Bernard, & Hill, David R., Introductory Linear Algebra with Applications (7th ed.). Pearson Education, Delhi. First Indian Reprint 2003.

BSHM-103-22	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 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: BSHM-103-22

The following topics to be practiced using MATLAB:

i) Introduce the programming through MATLAB

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. Higham, D.J. and Higham, N.J., MATLAB Guide, 2nd Edition. Society for Industrial and Applied Mathematics (SIAM), 2005.
2. Gilat, A., MATLAB: An Introduction with Applications, 5th Edition. John Wiley & Sons, 2014.

BHHL-115-22	Communicative English	L-2, T-0, P-0	2 Credits

Pre-requisite: Basic proficiency in Communication Skills

Course objectives:
- To help the students become proficient in LSRW-Listening, Speaking, Reading & Writing skills
- To help the students become independent users of the 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 the job market in their respective domains of specialization.

Course Outcomes: At the end of the course, the students 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 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

Course Code: BHHL-115-22

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. I Sit and Look Out: Walt Whitman
3. Women's Rights: Annie Louise Walker

(B) *Prose Parables* **(Orient Black Swan, 2013)**
The following stories from the above volume are prescribed:

1. Grief: Anton Chekov
2. The Doctor's Word: R.K. Narayan
3. The Doll's House: Katherine Mansfield

UNIT-II

Vocabulary: Synonyms, Antonyms; Standard Abbreviations; One-word substitution
Grammar: Subject-Verb Agreement; Noun- Pronoun Agreement; Use of phrases and clauses in sentences; Sentence Structures; Transformation of Sentences

UNIT-III

Reading and Understanding: Comprehension; Summarizing; Paraphrasing; Translation (from Hindi/Punjabi to English and vice-versa); Précis Writing

UNIT-IV

Mechanics of Writing & Speaking Skills: Business letters; Report writing; Career Documents- Job applications, Resume/CV writing, Conversations & Dialogues, Formal Presentations; Dynamics of Group Discussion.

Text & 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.

BSHP-111-21	**Optics**	**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 of Interference, Diffraction and Polarization among students. They 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 physics 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 coherence and phenomenon of interference and their applications
CO3	Acquainted with Fresnel's and Fraunhofer's diffraction and their applications.
CO4	Get thorough knowledge of the polarization of light, changes upon reflection and transmission and will learn to analyze the polarization in optical systems.
CO5	Describe the different types of lasers, its principle, properties and applications 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: Optics

Course Code: BSHP-111-21

PART-A

UNIT I

Interference: Definition and properties of wave front, Temporal and Spatial Coherence, Young's double slit experiment, Lloyd's single mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes), Newton's Rings: Measurement of wavelength and refractive index, Interferometer: Michelson Interferometer-(1) idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, Fabry-Perot interferometer.

UNIT-II

Diffraction: 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, Resolving power of grating. Fresnel Diffraction: Fresnel's Assumptions, Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light, Theory of a Zone Plate: Multiple Foci of a Zone Plate, Fresnel diffraction pattern of a straight edge and circular aperture.

PART-B

UNIT-III

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, Nicol Prism, Huygen's theory of Double Refraction, Polaroid, Elliptically and Circularly polarized lights, Quarter and Half wave plates.

UNIT-IV

Laser and Application: Lasers, Spontaneous emission, Stimulated absorption, Stimulated emission, Einstein coefficients, Einstein relations, 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, CO_2 laser, applications of laser: Holography, Principle of Holography.

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 Textbook of Optics: Subrahmaniyam N. & et al., S. Chand Publishing, 2006.

4.   O. Svelto: Principles of Lasers, Springer Science & Business Media, 2010.

BSHP-113-21		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: BSHP-113-21

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; wavelength, 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 angle of prism and 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).

Text and Reference Books:

1. A Textbook of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 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.
Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks.
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. A. Goel, Computer Fundamentals, Pearson Education, 2010.
3. P. K. Sinha & P. Sinha, Fundamentals of Computers, BPB Publishers, 2007.
4. R.K. Jain, IT Tools, Khanna Publishing House.
5. Satish Jain, Ambrish Rai & Shashi Singh, Introduction to Information Technology, Paperback Edition, BPB Publications, 2014.
6. www.sakshat.ac.in
7. 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.

Topics covered include: 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, Design Templates, Hidden slides, Auto content wizard, Slide Transition, 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/postonablogandtousetorrentsforaccelerateddownloads.

3) Hands on experience in online banking and making an online payment for any domestic bill.

RECOMMENDED BOOKS:

1. R.K. Jain, IT Tools, Khanna Publishing House.

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

3. Turban, Rainer and Potter, Introduction to information technology, John Wiley and Sons.

4. Joseph Brady & Ellen F Monk, Problem Solving Cases in Microsoft Excel, Thomson Learning.

SEMESTER-II

BSHM-201-22	Real Analysis	L-5, T-1, P-0	6 Credits

Pre-requisite: Elementary calculus

Course Objectives: The objectives of this course are to make the students understand the fundamental concepts of Real line and its property. Students will understand the bounded, unbounded and limit suprema and infima. They will use monotone convergence theorem for the calculation of square roots.They observe theconvergent and divergent sequences.They can apply various teststo check the convergence or divergence of sequences and series.

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

CO1	Understand the basic concepts of Real line and its property.
CO2	Understand the bounded, unbounded and limit suprema and infima.
CO3	Use of monotone convergence theorem for the calculation of square roots.
CO4	Check the convergence and divergence sequences and infinite series.
CO5	Apply the knowledge of various test to establish the convergence and divergence sequences and infinite series.

Mapping of course outcomes with the program 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: Real Analysis
Course Code: BSHM-201-22

UNIT-I

Real Numbers: Field and order structure of R, Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Supremum and Infimum.

UNIT-II

Completeness of ℝ: Completeness Property of R, The Archimedean Property, Density of Rational (and Irrational) numbers in R, Intervals. Limit points of a set, Isolated points, Closed sets, Countable and Uncountable sets.

UNIT-III

Sequences: Sequences, Limit points of a sequence, Limit Inferior and Superior, Convergent Sequences, Non convergent sequences (Definitions), Cauchy's sequence, Cauchy's General Principle of Convergence, Algebra of sequences, Some Important Theorem, [Ref. Text Book 1], Monotonic sequences.

UNIT-IV

Infinite Series: Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, D'Alembert's Ratio Test, Rabb's. Gauss and Logrithmic test (Statement of these three tests only). Cauchy's Root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

TEXT BOOKS:

1. S. C. Malik and Savita Arora, Mathematical Analysis, New Age International (P) Ltd., New Delhi, 2017.

RECOMMENDED BOOKS:

1. R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
2. Gerald G. Bilodeau , Paul R. Thie, G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones & Bartlett, 2010.
3. Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Elementary Real Analysis, Prentice Hall, 2001.
4. S.K. Berberian, A First Course in Real Analysis, Springer Verlag, New York, 1994.

BSHM-202-22	**Differential Equations**	**L-4, T-0, P-0**	**4 Credits**

Pre-requisite: - Functions, Differentiation, Integration.

Course Objectives: The Objective of this course is to introduce ordinary differential equations and basic theory ofexistence and uniqueness of solutions. This course further explains the analytic techniques incomputing the solutions of various ordinary differential equations appearing in various fields ofscience 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 ofinitial 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 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: Differential Equations
Course Code: BSHM-202-22

Unit I

Differential equations: General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, Cauchy's linear equation and Bernoulli equations.

Unit II

Mathematical models (Linear Models): Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), drug assimilation into the blood (case of a single cold pill, case of a course of cold pills), exponential growth of population, limited growth of population, limited growth with harvesting.

Unit III

Higher Order Linear Differential Equations: General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters.

Unit IV

Mathematical Models (Non-linear Models): Equilibrium points, Interpretation of the phase plane, predatory-prey model and its analysis, epidemic model of influenza and its analysis, battle model and its analysis.

TEXT BOOKS:

1. J. N. Kapur,, Mathematical Modelling, 1st Ed., New Age International (P) Ltd.,, New Delhi, 2021.

2. Shanti Narayan, Differential Equations and it's Applications,

RECOMMENDED BOOKS:

1. Belinda Barnes and Glenn R. Fulford, Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and MATLAB, 2nd Ed., Taylor and Francis group, London and New York, 2009.
2. C.H. Edwards and D.E. Penny, Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India, 2005.
3. S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.

BSHM-203-22	**Programming Lab-II**	**L-0, T-0, P-2**	**2 Credits**

Pre-requisite: Knowledge of basic concepts in Differential equations and Real analysis, such as, ODE, Order, Degree, Linear Differential Equations, sequence, series, limit point, convergence, divergence, etc.

Course Objectives: This course is designed to introduce the basic knowledge of computer programming to simple differential equations and to visualize the convergence and divergence of sequences and series. The major focus of this course will be on understanding the mathematical models behind a real-life situation.

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

CO1	Explain the basic concepts of MATLAB and Mathematica.
CO2	Apply the knowledge of programming in different Differential equations.
CO3	Use programming in plotting the solution and visualization of growth and decay mathematical models.
CO4	Plotting the recursive sequences and study the convergence of sequences through plotting.
CO5	Study the convergence/divergence of infinite series

Mapping of course outcomes with the program 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-II

Course Code: BSHM-203-22

The following topics to be practiced using MATLAB/MATHEMATICA:

vii)   Introduce the programming through MATLAB and MATHEMATICA

viii) Plotting of second order solution family of differential equation.

ix)   Plotting of third order solution family of differential equation.

x)   Growth model (exponential case only).

xi)   Decay model (exponential case only).

xii)   Plotting of recursive sequences.

xiii) Study the convergence of sequences through plotting.

xiv)   Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.

xv)   Study the convergence/divergence of infinite series by plotting their sequences of partial sum.

xvi)   Cauchy's root test by plotting nth roots.

xvii) Ratio test by plotting the ratio of nth and (n+1)th term.

RECOMMENDED BOOKS:

1. Gilat, A., MATLAB: An Introduction with Applications, 5th Edition. John Wiley & Sons, 2014.
2. Martha L Abell, James P Braselton, Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
3. ……………………………………………..

ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ

BHHL-116A-22

ਬੈਚੁਲਰ ਆਫ ਸਾਇੰਸ

(ਸਲੇਬਸ) ਸਮੈਸਟਰ -ਦੂਜਾ

Credit-2-0-0

ਯੂਨਿਟ-1

ਕਵਿਤਾ ਭਾਗ:

ਭਾਈ ਵੀਰ ਸਿੰਘ: ਚਸ਼ਮਾ

ਪ੍ਰੋ.ਪੂਰਨ ਸਿੰਘ : ਹੱਲ ਵਾਹੁਣ ਵਾਲੇ

ਪ੍ਰੋ.ਮੋਹਨ ਸਿੰਘ : ਕੋਈ ਆਇਆ ਸਾਡੇ ਵਿਹੜੇ

ਅੰਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ: ਅੰਨਦਾਤਾ

ਡਾ.ਹਰਿਭਜਨ ਸਿੰਘ: ਤੇਰੇ ਹਜ਼ੂਰ ਮੇਰੀ ਹਾਜ਼ਰੀ ਦੀ ਦਾਸਤਾਨ

ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ: ਕੰਡਿਆਲੀ ਥੋਹਰੁ

ਪਾਸ਼: ਇਨਕਾਰ

ਸੁਰਜੀਤ ਪਾਤਰ: ਹੁਣ ਘਰਾਂ ਨੂੰ ਪਰਤਣਾ

ਕਹਾਣੀ ਭਾਗ:

ਸੁਜਾਨ ਸਿੰਘ :ਕੁਲਫੀ

ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ : ਤੂੜੀ ਦੀ ਪੰਡ

ਗੁਰਦਿਆਲ ਸਿੰਘ : ਸਾਂਢ

ਸੰਤੋਖ ਸਿੰਘ ਧੀਰ: ਕੋਈ ਇਕ ਸਵਾਰ

ਮੋਹਨ ਭੰਡਾਰੀ :ਘੋਟਣਾ

ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ : ਆਪਣਾ ਆਪਣਾ ਹਿੱਸਾ

ਯੂਨਿਟ-2 (ਭਾਸ਼ਾ ਤੇ ਲਿਪੀ)

ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ, ਭਾਸ਼ਾ ਤੇ ਉਪ-ਭਾਸ਼ਾ ਵਿਚ ਅੰਤਰ, ਪੰਜਾਬੀ ਦੀਆਂ ਉਪ-ਭਾਸ਼ਾਵਾਂ

ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਉਪਰ ਪਏ ਪ੍ਰਭਾਵ

ਭਾਸ਼ਾ ਤੇ ਲਿਪੀ, ਗੁਰਮੁਖੀ ਲਿਪੀ ਦੀਆਂ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ

ਯੂਨਿਟ-3 (ਲੇਖਣੀ-ਕਲਾ)

ਪੈਰਾ ਰਚਨਾ

ਅਨੁਵਾਦ: ਅੰਗਰੇਜ਼ੀ ਤੋਂ ਪੰਜਾਬੀ, ਪੰਜਾਬੀ ਤੋਂ ਅੰਗਰੇਜ਼ੀ

ਦਫਤਰੀ ਚਿੱਠੀ ਪੱਤਰ

ਸਾਹਿਤ ਦੇ ਰੰਗ (ਸੰਪ.ਡਾ.ਮਹਿਲ ਸਿੰਘ),ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ,ਪਹਿਲੀ ਵਾਰ, 2016.

ਮੁਢਲੀ ਪੰਜਾਬੀ

BHHL-116B-22

ਬੈਚੁਲਰ ਆਫ ਸਾਇੰਸ

(ਸਲੇਬਸ) ਸਮੈਸਟਰ -ਦੂਜਾ

Credit-2-0-0

ਯੂਨਿਟ-1

ਪੈਂਤੀ ਅੱਖਰੀ (ਵਰਣਮਾਲਾ), ਅੱਖਰ ਕ੍ਰਮ

ਮਾਤਰਾਵਾਂ : ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ

ਲਗਾਖਰ :ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ

ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ: ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ

ਮੂਲ ਸ਼ਬਦ , ਅਗੇਤਰ, ਪਿਛੇਤਰ

ਸਮਾਨਾਰਥਕ ਸ਼ਬਦ, ਵਿਰੋਧਾਰਥਕ ਸ਼ਬਦ

ਸ਼ੁੱਧ- ਅਸ਼ੁੱਧ: ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿੱਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ

ਯੂਨਿਟ-2

ਹਫਤੇ ਦੇ ਸੱਤ ਦਿਨਾਂ ਦੇ ਨਾਂ

ਬਾਰ੍ਹਾਂ ਮਹੀਨਿਆਂ ਦੇ ਨਾਂ

ਰੁੱਤਾਂ ਦੇ ਨਾਂ

ਇਕ ਸੌ ਤੱਕ ਗਿਣਤੀ ਸ਼ਬਦਾਂ ਵਿਚ

ਰੋਜ਼ਾਨਾ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ:

ਬਾਜ਼ਾਰ, ਵਪਾਰ,ਰਿਸ਼ਤੇ-ਨਾਤੇ ਤੇ ਕਿੱਤਿਆਂ ਸਬੰਧੀ।

ਯੂਨਿਟ-3

ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਪਛਾਣ ਤੇ ਵਰਤੋਂ-

ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ

ਪੰਜਾਬੀ ਵਾਕ ਬਣਤਰ :

ਸਧਾਰਣ ਵਾਕ

ਸੰਯੁਕਤ ਵਾਕ

ਮਿਸ਼ਰਤ ਵਾਕ

BHIC-111-22	**CHEMISTRY-I**	L-3, T-1, P-0	**Credits:4**

Prerequisite: Subject knowledge of senior secondary level		
Objective(s):	1. To teach the fundamental concepts of Inorganic Chemistry and chemical bonding. 2. To teach the basic principles, chemical reaction and reaction mechanisms of organic compounds.	

At the end of the course, the student will be able to	
CO1.	Understand the fundamental concepts and postulates of various theories regarding the structure of atom
CO2.	Learn about the various theories pertaining to the different types of bonding
CO3.	**Understand the fundamental concepts of organic chemistry i.e structure, bonding and various effects in organic compounds**
CO4.	**To study the various known reactive intermediate in organic synthesis**
CO5.	**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**

Mapping of course outcomes with the program outcomes				
	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	1	-	-	2	2
CO2	2	1	1	2	1
CO3	1	2	2	2	2
CO4	-	2	1	1	2
CO5	-	2	1	1	2

Course Title: Chemistry-I
Course Code: BHIC-111-22

Unit-I

Atomic Structure: Bohr's theory and 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. 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.

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.

Unit-II

Chemical Bonding-II: Covalent bond: Lewis structure, Valence Bond theory (Heitler London approach), Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. 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.

Unit-III

Basics of Organic Chemistry Organic Compounds:
Classification, and Nomenclature, Hybridization, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyper conjugation and their applications; Dipole moment; Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes.

Chemistry of Aliphatic Hydrocarbons-I:
Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

Unit-IV

Chemistry of Aliphatic Hydrocarbons-II:
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).

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.

Reference Books

1 Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2 Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH, 1999
3 Douglas, B.E; Mc Daniel, D.H. & Alexander, J.J. Concepts & Models of Inorganic Chemistry 3rd Ed., John Wiley Sons, N.Y. 1994
4 Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5 Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)

BHIC-112-22	Chemistry Lab-I	L-0, T-0, P-4	Credits: 02

Pre-requisite: Understanding of senior secondary level Chemistry

Course Objectives: The objective of this course is to provide practical knowledge and illustrative experiments about various types of inorganic titrations and general organic techniques

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

CO1	Learn the quantitative analysis of various metal ions/cations and anions.
CO2	Understand the various principles of different techniques involved in the quantitative analysis.
CO3	Learn the basic qualitative techniques
CO4	Learn chromatographic techniques for the identification and separation of compounds
CO5	Learn about the applications of basic techniques

Mapping of course outcomes with the program outcomes					
	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	2	1	2
CO2	2	1	2	2	2
CO3	1	2	2	2	2
CO4	2	2	1	2	2
CO5	1	1	1	2	2

Course Title: Chemistry Lab-I
Course Code: BHIC-112-22

Part-I

(A) 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

(B) Oxidation-Reduction Titrations

(i)   Estimation of Fe(II) and oxalic acid using standardized $KMnO_4$ 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, anthranilic acid) and external indicator.

Part-II

(i)   Checking the calibration of the thermometer
(ii)   Purification of organic compounds by crystallization using the following solvents: a) Water b) Alcohol, and c) Alcohol-Water.
(iii)   Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
(iv)   Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
(v)   Determination of boiling point of liquid compounds. (boiling point lower than and more than 100°C by distillation and capillary method)
(vi)   Chromatography a) Separation of a mixture of two amino acids by ascending and horizontal paper chromatography b) Separation of a mixture of two sugars by ascending paper chromatography, c) Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)

Reference Books:

1. Vogel, A.I. A Textbook of Quantitative Inorganic Analysis, ELBS.
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).
3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).

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 outcomes

	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.