

# **B.Sc. (Hons./ Hons.with Research) MATHEMATICS**

## **Scheme and Syllabus**

**in accordance to NEP 2020**

**ACADEMIC SESSION**

**(w.e.f. 2023-2024)**



**DEPARTMENT OF MATHEMATICS**

**FACULTY OF SCIENCES**

**J C BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA,  
FARIDABAD HARYANA -121006**



## **J. C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD**

### **VISION**

J C BOSE University of Science and Technology, YMCA aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

### **MISSION**

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.



## **DEPARTMENT OF MATHEMATICS**

### **VISION**

To emerge as a department of science, which will provide strong foundations in the areas of Pure and Applied Mathematics in order to develop innovative minds for interdisciplinary research.

### **MISSION**

- To develop strong communication skills among students.
- To develop strong moral values.
- To develop strong foundations in mathematics to have sound analytical and critical thinking ability for innovative solutions in practical problems.
- To continuously improve the basic infrastructure in pursuit of providing the necessary environment for academic excellence.
- To develop a nurturing environment for lifelong learning.

## **ABOUT THE PROGRAM: B.Sc. (Hons./Hons. With Research) Mathematics**

B.Sc. (Hons./Hons. With Research) Mathematics is a three/ four-year (3/4 years) undergraduate program which is being divided into six/ eight semesters. After successful completion of six semesters the student will be awarded with Honours degree in Mathematics and after successfully completion of eight semesters the student will be awarded with Honours with research degree in Mathematics This degree has been awarded to those who complete the program. In this degree, candidates get a deeper knowledge of mathematics through a vast preference of subjects such as Linear algebra, abstract algebra, real analysis, analytic geometry, complex analysis, mechanics, differential equations, numerical methods etc.

Bachelor of Science is abbreviated as 'B.Sc.' is one of the most popular undergraduate course in India. With the advancements in the field of science and technology, this course has become an inevitable course in colleges of India. Students with an academic background of science at their 10+2 level with mathematics as one of the major subject can pursue this course in different branches. In this field of science, undergraduates are taught to acquire higher level of understanding using scientific analysis, experimentation and application of scientific principles to solve various scientific issues.

Awarding UG Certificate, UG Diploma and UG Degrees

**UG Certificate:** Students who opt to exit after completion of the first year and have secured 44 credits will be awarded a UG certificate if, in addition, they complete one vocational Course / summer internship of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

**UG Diploma:** Students who opt to exit after completion of the 2nd year and have secured 90 credits will be awarded the UG diploma if, in addition, they complete one vocational Course /summer internship of 4 credits during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.

**3-year UG Degree:** Students who wish to undergo a 3-year UG programme will be awarded UG Degree in the Major discipline after successful completion of three years, securing 136 credits and satisfying the minimum credit requirement.

**4-year UG Degree (Honours):** A four—year UG Honours degree in the major discipline will be awarded to those who complete a 4-year degree programme with 184 credits and have satisfied the credit requirements.

**4-year UG Degree (Honours with Research):** Students who secure 75% marks and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. They should do a research project or dissertation under the guidance of a faculty member of the University/College. The research project/dissertation will be in the major discipline. The students, who secure 184 credits including 12 credits from a research project/dissertation, are awarded UG Degree (Honours with Research).

**PROGRAM OUTCOMES OF UG PROGRAM OF FACULTY OF SCIENCES**

<b>PO1</b>	<b>Knowledge</b>	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study
<b>PO2</b>	<b>Research Aptitude</b>	Capability to ask relevant/appropriate questions for identifying, formulating and analyzing the research problems and to draw conclusion from the analysis
<b>PO3</b>	<b>Communication</b>	Ability to communicate effectively on general and scientific topics with the scientific community and with society at large
<b>PO4</b>	<b>Problem Solving</b>	Capability of applying knowledge to solve scientific and other problems
<b>PO5</b>	<b>Individual and Team Work</b>	Capable to learn and work effectively as an individual, and as a member or leader in diverse teams, in multidisciplinary settings
<b>PO6</b>	<b>Investigation of Problems</b>	Ability of critical thinking, analytical reasoning and research-based knowledge including design of experiments, analysis and interpretation of data to provide conclusions
<b>PO7</b>	<b>Modern Tool usage</b>	Ability to use and learn techniques, skills and modern tools for scientific practices
<b>PO8</b>	<b>Science and Society</b>	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices
<b>PO9</b>	<b>Life-Long Learning</b>	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life
<b>PO10</b>	<b>Ethics</b>	Capability to identify and apply ethical issues related to one's work, avoid unethical behavior such as fabrication of data, committing plagiarism and unbiased truthful actions in all aspects of work
<b>PO11</b>	<b>Project Management</b>	Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

The program specific outcomes (PSO's) are the statement of competencies/abilities that describes the knowledge and capabilities the under-graduate will have by the end of program studies.

After successful completion of B.Sc. (Hons.) Mathematics, the students will be able to:

<b>PSO1</b>	Acquire an understanding and in-depth knowledge of core areas of mathematics like algebra, calculus, geometry, differential equations. This also leads to study of related areas like computer science and statistics. Thus, this program helps learners in building a solid foundation for higher studies in mathematics
<b>PSO2</b>	Learn to logically question assertions, to recognize patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing interdependent society. They will be capable to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of Mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of Mathematics to non-mathematicians.
<b>PSO3</b>	Attain abilities of critical thinking, problem mapping and solving using fundamental principles of Mathematics, systematic analysis and interpretation of results, and unambiguous oral and writing/presentation skills. This program has a strong foundation in basic and practical aspects of Mathematics enabling the students to venture into research in front-line areas of mathematical sciences, to pursue higher studies in Mathematics, and to enhance their employability for teaching jobs, government jobs, jobs in banking, insurance and investment sectors, data analyst jobs etc.

**DEPARTMENT OF MATHEMATICS**  
**SCHEME**  
**B.Sc. (Hons.) MATHEMATICS**  
**SEMESTER-I**

Subject Code	Title	L	P	Internal Assessment	End- semester Examination	Total	Credits	Category Code
Discipline Specific Course (DSC)								
BMH23-101	Calculus-I	3	0	25	75	100	3	DSC
BMH23-102	Calculus-I (Lab)	0	2	15	35	50	1	DSC
BMH23-103	Algebra	4	0	25	75	100	4	DSC
Minor Course (MIC)								
BMH23-104	Probability and Statistics -I	4	0	25	75	100	4	MIC
Multidisciplinary Course (MDC) (Choose any one 3 Credit course)								
OPHY23-101	Electricity & Magnetism	2	0	25	75	100	2	MDC
OEC-CE-1011	Introduction to Progaming	2	0	25	75	100	2	MDC
BCH-S-101	Chemistry I	2	0	25	75	100	2	MDC
OPHY23-102	Electricity & Magnetism (Lab)	0	2	15	35	50	1	MDC
OEC-CE-1012	Introduction to Progaming (Lab)	0	2	15	35	50	1	MDC
BCH-S-102	Chemistry I(Lab)	0	2	15	35	50	1	MDC
Ability Enhancement Course (AEC)								
AEC-101-N1	Writing Skills and Art of Rhetoric	2	0	25	75	100	2	AEC
Skill Enhancement Course (SEC) (Choose any one 3 credit course )								
SEC23-M-101	Calculation Skills with Vedic	3	0	25	75	100	3	SEC



	Mathematics							
SEC23-M-102	Finance for Everyone	3	0	25	75	100	3	SEC
Value Added Course (VAC)								
VAC-101-N1	Environmental Studies-I	2	0	25	75	100	2	VAC
<b>Total Credits</b>							<b>22</b>	

**SEMESTER - II**

Subject Code	Title	L	P	Internal Assessment	End- semester Examination	Total	Credits	Category Code
Discipline Specific Course (DSC)								
BMH23-201	Calculus-II	3	0	25	75	100	3	DSC
BMH23-202	Calculus-II (Lab)	0	2	15	35	50	1	DSC
BMH23-203	Differential Equations	3	0	25	75	100	3	DSC
BMH23-204	Differential Equations (Lab)	0	2	15	35	50	1	DSC
Minor Course (MIC)								
BMH23-205	Probability and Statistics -II	4	0	25	75	100	4	MIC
Multidisciplinary Course (MDC) (Choose any one 3 Credit course)								
OPHY23-201	Mechanics	2	0	25	75	100	2	MDC
OEC-CE-1013	Introduction to Database System	2	0	25	75	100	2	MDC
BCH-S-201	Chemistry - II	2	0	25	75	100	2	MDC
OPHY23-202	Mechanics (Lab)	0	2	15	35	50	1	MDC
OEC-CE-1014	Introduction to Database System (Lab)	0	2	15	35	50	1	MDC
BCH-S-202	Chemistry II (Lab)	0	2	15	35	50	1	MDC

Ability Enhancement Course (AEC)								
AEC-102-N1	Communication, Mediation and Resolution	2	0	25	75	100	2	AEC
Skill Enhancement Course (SEC)								
OEC-CE-1015	Python	3	0	25	75	100	3	SEC
Value Added Course (VAC)								
VAC-103-N1	Yoga and Meditation	2	0	25	75	100	2	VAC
<b>Total Credits</b>							<b>22</b>	

**Grand Total Credits: 44**

**NOTE: 1. Discipline Specific Course (DSC) papers may be added or deleted as per UGC guidelines.  
2. Skill Enhancement Course (SEC) papers may be added or deleted as per UGC guidelines.**

### Grading Scheme

*Percentage	Grade	Grade Points	Category
90-100	O	10	Outstanding
80-90	A+	9	Excellent
70-80	A	8	Very Good
60-70	B+	7	Good
50-60	B	6	Above Average
45-50	C	5	Average
40-45	P	4	Pass
<40	F	0	Fail
.....	Ab	0	Absent

**\*Lower limit included, upper limit excluded**

**The multiplication factor for CGPA is 10**

1. Automatic Rounding
2. Average difference between actual percentage and CGPA percentage  $\pm 2.5\%$
3. Worst case difference between actual percentage and CGPA percentage  $\pm 5\%$  if somebody in all the 8 semesters in all the exams (around 75 in numbers) consistently scores at the bottom of the range, say 55 of 55-65 which is a very remote possibility

**Syllabus  
of  
B.Sc. (Hons.) Mathematics**

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**Semester - I**

**Discipline Specific Course (DSC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-I**  
**CODE: BMH23-101**  
**SUBJECT NAME: Calculus-I**  
**NO. OF CREDITS: 3**

L    P  
 3    0

Internal Assessment: 25  
 End Semester:        75  
 Total:                    100

**COURSE OUTCOMES**

Students will be able to:

- CO1: Examine the continuity and differentiability of a function at a point.  
 CO2: Perform successive differentiation of functions.  
 CO3: Understand various mean value theorems for differentiable functions.  
 CO4: Sketch curves in Cartesian and polar coordinate systems.

**UNIT – I**

Limit of a function,  $\epsilon$ - $\delta$  definition of limit, Limit at infinity, Infinite limits, Continuity of a real valued function, Types of discontinuities, Properties of continuous functions, Geometrical interpretation of continuity, Indeterminate forms, L'Hôpital's rule.

**UNIT – II**

Differentiability of a real valued function, Geometrical interpretation of differentiability, Relation between differentiability and continuity, Chain rule of differentiation, Successive differentiation, Calculation of  $n^{\text{th}}$  derivatives, Leibnitz's theorem.

**UNIT - III**

Darboux's theorem, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Geometrical interpretation of mean value theorems, Taylor's theorem, Maclaurin's and Taylor's series expansions.

**UNIT - IV**

Asymptotes, Asymptotes parallel to axes, Concavity, Points of inflection, First and second derivative test for relative extrema, Singular points, Tangents at origin, Tracing of curves, Parametric representation of curves, Tracing of parametric curves, Polar coordinates, Tracing of curves in polar coordinates.

**TEXT BOOKS**

1. Howard Anton, I. Bivens and Stephan Davis, *Calculus*, 10<sup>th</sup> edition, Wiley India, 2016.
2. Tom M. Apostol, *Calculus*, Vol 1, An Indian Adaptation, 2nd edition, Wiley India, 2023.
3. George B. Thomas Jr., Joel Hass, Christopher Heil and Maurice D. Weir, *Thomas' Calculus*, 14<sup>th</sup> edition, Pearson Education, 2018.

**REFERENCE BOOKS**

1. Monty J. Strauss, Gerald L. Bradley and Karl J. Smith, *Calculus*, 3<sup>rd</sup> edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
2. George B. Thomas and R.L. Finney, *Calculus and Analytic Geometry*, 9<sup>th</sup> edition, Pearson Education, Delhi, 2010.
3. Gorakh Prasad, *Differential Calculus*, 19<sup>th</sup> edition, Pothishala Pvt. Ltd, 2016.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

**CO-PO and CO-PSO matrix for the course Calculus-I**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	3	3	3	3	2	3	3	3	3
CO2	3	3	2	3	2	2	1	2	2	3	2	2	3	3
CO3	3	3	3	3	2	2	3	2	2	3	2	3	2	3
CO4	3	3	2	2	3	3	3	3	3	3	3	3	3	2
Average	3	2.75	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.75	2.5	2.75	2.75	2.75

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)



**Discipline Specific Course (DSC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-I**  
**CODE: BMH23-103**  
**SUBJECT NAME: Algebra**  
**NO. OF CREDITS: 4**

L      P  
 4      0

Internal Assessment: 25  
 End Semester:        75  
 Total:                    100

**COURSE OUTCOMES:**

This course will enable the students to :

- CO1: Explore different types of matrices  
 CO2: Have knowledge of system of Linear Equations, Echelon form  
 CO3: Know importance of rank of a Matrix, EigenValues and EigenVectors  
 CO4: Find roots of cubic polynomials

**UNIT – I**

Symmetric, Skew symmetric, Hermitian and skew Hermitian matrices. Elementary Operations on matrix. Rank of a matrix. Inverse of a matrix. Linear dependence and independence of rows and columns of a matrix. Row rank and column rank of a matrix. Eigen values, eigen vectors and the characteristic equation of a matrix. Minimal polynomial of a matrix.

**UNIT – II**

Cayley - Hamilton theorem and its use in finding the inverse of a matrix, Applications of matrices to a system of linear ( homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices. Diagonalisation of Matrices. Quadratic form.

**UNIT –III**

Relations between the roots and coefficients of a general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

**UNIT-IV**

Nature of the roots of an equation, Descartes's rule of signs, Solution of cubic and biquadratic equations.

**TEXT BOOKS**

1. Andreescu, Titu & Andrica Dorin. (2014). Complex Numbers from A to...Z. (2nd ed.). Birkhäuser.
2. David C. Lay, *Linear Algebra and its Applications*, 3<sup>rd</sup> Edition, Pearson Education Asia, Indian Reprint, 2007.
3. Seymour Lipschutz and Marc L. Lipson, *Schaum's outline of Linear Algebra*, 4<sup>th</sup> Edition, McGraw Hill, 2009.

**REFERENCE BOOKS**

1. Kolman, Bernard, & Hill, David R. (2001). *Introductory Linear Algebra with Applications* (7th ed.). Pearson Education, Delhi. First Indian Reprint 2003.
2. Dickson, Leonard Eugene (1922). *First Course in The Theory of Equations*. John Wiley & Sons, Inc. New York. The Project Gutenberg EBook.
3. Goodaire, Edgar G., & Parmenter, Michael M. (2005). *Discrete Mathematics with Graph Theory* (3rd ed.). Pearson Education Pvt. Ltd. Indian Reprint 2015.
4. Sudesh K. Shah and Subhash C. Garg, *A Textbook of Algebra*, 1<sup>st</sup> Edition, Vikas Publishing House Pvt. Ltd., 2017.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

**CO-PO and CO-PSO matrix for the course Algebra**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
<b>CO1</b>	3	2	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO2</b>	3	3	2	3	2	2	2	2	2	3	2	2	3	3
<b>CO3</b>	3	3	3	3	2	2	3	2	2	3	2	3	2	3
<b>CO4</b>	3	3	2	2	3	3	3	3	3	3	3	3	3	2
<b>Average</b>	3	2.75	2.5	2.5	2.5	2.5	2.75	2.5	2.5	2.75	2.5	2.75	2.75	2.75

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)



**Minor Course (MIC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-I**  
**CODE: BMH23-104**  
**SUBJECT NAME: Probability and Statistics-I**  
**NO. OF CREDITS: 4**

		Internal Assessment:	25
L	P	End Semester:	75
4	0	Total:	100

**COURSE OUTCOMES**

This course will enable the students to:

CO1: Learn basic Probability basic Statistics

CO2: Learn basic Statistics

CO3: Formulate and analyze mathematical and statistical problems based on central tendency

CO4: Establish a formulation helping to predict one variable in terms of the other that is, correlation and linear regression

**UNIT-I**

Probability Theory: Introduction, Fundamental concepts of probability, Laws of probability, Conditional probability, Bayes theorem.

**UNIT-II**

Introduction to Statistics: Definition, Types of Data, Applications of Statistics in Business and Economics, Continuous frequency distribution, Graphic presentation of data, Measure of central tendency (Mean, Median, Mode).

**UNIT-III**

Measure of Dispersion: Absolute and Relative measure of dispersion, Range, Standard deviation, Measure of Skewness, Kurtosis.

**UNIT-IV**

Correlation Analysis: Introduction, Types of correlation, Correlation coefficient, Rank correlation. Regression Analysis: Introduction, Regression lines, method of least square, Regression coefficient

**TEXT BOOKS**

1. Irwin Miller and Marylees Miller, John E. Freund's Mathematical Statistics with Applications (8th edition). Pearson. Dorling Kindersley Pvt. Ltd. India, 2014.
2. Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics, S. Chand Pub., New Delhi., 1970.

**REFERENCE BOOKS**

1. Robert V. Hogg, Joseph W. McKean & Allen T. Craig ,Introduction to Mathematical Statistics ,7th edition, Pearson Education, 2013.
2. Jim Pitman, Probability, Springer-Verlag, 1993.
3. Sheldon M. Ross, Introduction to Probability Models ,11th edition, Elsevier, 1993.
4. A. M. Yaglom and I. M. Yaglom, Probability and Information. D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi, 1993.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

**CO-PO and CO-PSO matrix for the course Probability and Statistics -I**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	3	3	3	3	2	3	3	3	3
CO2	3	3	2	3	2	2	2	2	2	3	2	2	3	3
CO3	3	3	3	3	2	2	3	2	2	3	2	3	2	3
CO4	3	3	2	2	3	3	3	3	3	3	3	3	3	2
Average	3	2.75	2.5	2.5	2.5	2.5	2.75	2.5	2.5	2.75	2.5	2.75	2.75	2.75

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)

**Multidisciplinary Course (MDC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-I**  
**CODE: OPHY23-101**  
**ELECTRICITY AND MAGNETISM**

			Internal Assessment:	25
L	P		End Semester:	75
2	0		Total:	100

**Course Outcomes:**

After the completion of the course, students will be able to:

1. Know the basic concepts of electric field and potential
2. Understand of dielectric behavior of matter
3. Learn the laws of magnetism and electromagnetic induction.
4. Have an understanding of electromagnetic wave propagation.

**UNIT-I**

Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields (statements only), Gauss-divergence theorem and Stoke's theorem of vectors (statement only)

**UNIT-II**

Electrostatics: Electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

**UNIT-III**

Magnetism: Magnetostatics: Biot-Savart's law. Divergence and curl of magnetic field. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro- magnetic materials.

**UNIT-IV**

Electrodynamics: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves.

**TEXT BOOKS**

1. Edward M. Purcell, Electricity and Magnetism, 1986, McGraw-Hill Education
2. , J.H. Fewkes & J.Yarwood, Electricity & Magnetism. Vol. I, 1991, Oxford Univ.Press

**REFERENCE BOOKS**

1. D C Tayal, Electricity and Magnetism, 1988, Himalaya Publishing House.
2. Ronald Lane Reese, University Physics, 2003, Thomson Brooks/Cole.
3. D.J.Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

**CO-PO and CO-PSO matrix for the course Electricity and Magnetism**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	3	3	3	3	2	3	3	3	3
CO2	3	3	2	3	2	2	2	2	2	3	2	2	3	3
CO3	3	3	3	3	2	2	3	2	2	3	2	3	2	3
CO4	3	3	2	2	3	3	3	3	3	3	3	3	3	2
Average	3	2.75	2.5	2.5	2.5	2.5	2.75	2.5	2.5	2.75	2.5	2.75	2.75	2.75

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)

**Multidisciplinary Course (MDC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-I**  
**CODE: OEC-CE-1011**  
**SUBJECT NAME: Fundamentals of Programming**  
**NO. OF CREDITS: 02**

L      P  
 2      0

Internal Assessment:    25  
 End Semester:            75  
 Total:                        100

**COURSE OUTCOMES**

After the completion of the course, students will be able to :

CO1: Differentiate between Procedure-Oriented programming and Object-Oriented programming

CO2: Have understanding the syntax of the language

CO3: Implement various object oriented features like inheritance, data abstraction encapsulation and polymorphism to solve various computing problems using C++ language

CO4: Apply object oriented concepts in real world programs

**UNIT-I**

Introduction to C and C++ : History of C and C++, Overview of Procedural Programming and Object-Oriented Programming, Using main() function, Compiling and Executing Simple Programs in C++. Data Types, Variables, Constants, Operators and Basic I/O: Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Data Types, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise).

**UNIT-II**

Expressions, Conditional Statements and Iterative Statements: Simple Expressions in C++ (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions, Conditional Statements (if construct, switch-case construct), Understanding syntax and utility of Iterative Statements (while, do-while, and for loops), Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative).

**UNIT-III**

Functions and Arrays: Utility of functions, Call by Value, Call by Reference, Functions returning value, Void functions, Inline Functions, Return data type of functions, Functions parameters, Differentiating between Declaration and Definition of Functions, Command Line Arguments/Parameters in Functions. Creating and Using One Dimensional Arrays ( Declaring and Defining an Array, Initializing an Array, Accessing individual elements in an Array, Manipulating array elements using loops), Use various types of arrays (integer, float and character arrays / Strings) Two- dimensional Arrays (Declaring, Defining and Initializing Two Dimensional Array, Working with Rows and Columns).

**UNIT-IV**

Using Classes in C++: Principles of Object-Oriented Programming, Defining & Using Classes, Class Constructors, Constructor Overloading, Function overloading in classes, Class Variables & Functions, Specifying the Protected and Private Access, Copy Constructors,. Inheritance and Polymorphism: Introduction to Inheritance and Polymorphism.

### TEXT BOOKS

1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
2. Sharma A. K., "Computer Fundamentals and Programming in C ", 2018
3. Herbtz Schildt, "C++: The Complete Reference", Fourth Edition, McGraw Hill, 2017.

### REFERENCE BOOKS

1. Kanetkar Yashavant P. , "Let us C", BPB Publications, 2010.
2. E. Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw-Hill Education, 2008.
3. Paul Deitel, Harvey Deitel, "C++ How to Program", 8th Edition, Prentice Hall, 2011.

### SUGGESTED WEB SOURCES:

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

### CO-PO and CO-PSO matrix for the course Fundamentals of Programming

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	3	3	3	3	2	3	3	3	3
CO2	3	3	2	3	2	2	2	2	2	3	2	2	3	3
CO3	3	3	3	3	2	2	3	2	2	3	2	3	2	3
CO4	3	3	2	2	3	3	3	3	3	3	3	3	3	2
Average	3	2.75	2.5	2.5	2.5	2.5	2.75	2.5	2.5	2.75	2.5	2.75	2.75	2.75

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)

**Multidisciplinary Course (MDC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-I**  
**CODE: BCH-S-101**  
**SUBJECT NAME: Chemistry I**  
**NO OF CREDITS: 2**

			Internal Assessment: 25
<b>L</b>	<b>P</b>		End Semester: 75
2	0		Total: 100

**COURSE OUTCOMES:**

After the successful completion of the course, the learner would be able to

CO1 : Have understanding the basic concept of atomic structure

CO2: Explore the chemical bonding concept

CO3 :Explain the role of inorganic chemistry in biological systems

CO4: basic concept of Bio-Inorganic Chemistry

**UNIT-I**

**Atomic Structure and Chemical bonding:** Review of Bohr's theory and its limitations, Heisenberg Uncertainty principle. Dual behavior of matter and radiation, de-Broglie's relation. Hydrogen atom spectra. Significance of  $\psi$  and  $\psi^2$ , Schrödinger equation for hydrogen atom. Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR ( $H_2O$ ,  $NH_3$ ,  $PCl_5$ ,  $SF_6$ ,  $ClF_3$ ) and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for  $s-s$ ,  $s-p$  and  $p-p$  combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods and heteronuclear diatomic molecules such as  $CO$ ,  $NO$ .

**UNIT-II**

Bio-Inorganic Chemistry:

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to  $Na^+$ ,  $K^+$  and  $Mg^{+2}$  ions: Na/K pump; Role of  $Mg^{+2}$  ions in energy production and chlorophyll.

**TEXT BOOKS**

1. J. D. Lee: A new Concise Inorganic Chemistry, E L. B. S.17, 2008.
2. F. A. Cotton & G. Wilkinson: *Basic Inorganic Chemistry*, John Wiley, 3<sup>rd</sup> Ed., 1995.

**REFERENCE BOOKS**

1. Douglas, McDaniel and Alexander: *Concepts and Models in Inorganic Chemistry*, John Wiley, 3<sup>rd</sup> Ed. 1994.
2. James E. Huheey, Ellen Keiter and Richard Keiter: *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Publication, 1997.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

**CO-PO and CO-PSO matrix for the course Chemistry - 1**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
<b>CO1</b>	3	2	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO2</b>	3	3	2	3	2	2	2	2	2	3	2	2	3	3
<b>CO3</b>	3	3	3	3	2	2	3	2	2	3	2	3	2	3
<b>CO4</b>	3	3	2	2	3	3	3	3	3	3	3	3	3	2
<b>Average</b>	3	2.75	2.5	2.5	2.5	2.5	2.75	2.5	2.5	2.75	2.5	2.75	2.75	2.75

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)



**Multidisciplinary Course (MDC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-I**  
**CODE: OPHY23-102**  
**ELECTRICITY AND MAGNETISM LAB**  
**Credits: 01**

**L**    **P**  
**0**    **2**

Internal Assessment: 15  
 End Semester: 35  
 Total: 50

*At least 05 experiments from the following:*

1. To compare capacitances using De'Sauty's bridge.
2. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx)
3. To study the Characteristics of a Series RC Circuit.
4. To study a series LCR circuit LCR circuit and determine its  
 (a) Resonant frequency, (b) Quality factor
5. To study a parallel LCR circuit and determine its  
 (a) Anti-resonant frequency and (b) Quality factor Q
6. To determine a Low Resistance by Carey Foster's Bridge.
7. To find the inductance of a coil using Anderson's brodge.

**Reference Books**

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S. Panigrahi and B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed.2011, Kitab Mahal

**CO-PO and CO-PSO matrix for the course Electricity and Magnetism Lab**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
<b>CO1</b>	3	2	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO2</b>	3	3	2	3	2	2	1	2	2	3	2	2	1	2
<b>CO3</b>	3	3	3	3	2	2	3	2	2	3	2	3	2	2
<b>CO4</b>	3	3	2	2	3	3	3	3	3	3	3	3	3	2
<b>Average</b>	3	2.75	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.75	2.5	2.8	2.3	2.3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)

**Multidisciplinary Course (MDC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-I**  
**CODE: OEC-CE-1012**  
**SUBJECT NAME: Fundamentals of Programming (Lab)**  
**NO OF CREDITS: 1**

**L**     **P**  
 0     2

Internal Assessment: 15  
 End Semester: 35  
 Total: 50

Introduction to Programming Lab

1. Write a program to print "HELLO"
2. Write a program to add two numbers.
3. Write a program to calculate simple interest.
4. Write a program to calculate absolute value of a number.
5. Write a program to swap the values of two numbers.
6. Write a program to find gross salary of a person.
7. Write a program to check if a number is even or odd.
8. Write a program to find greatest of three numbers.
9. Write a program to find grade of a student given his marks.
10. Write a program to find divisor or factorial of a given number.
11. Write a program to print the Fibonacci series.
12. Write a program to print first ten natural numbers.
13. Write a program to print the reverse of a number.
14. Write a program to print the multiplication table of a given number.
15. Write a program to find grade of a list of students given their marks.
16. Write a program using function power (a, b) to calculate the value of a raised to b.
17. Write a program to print a 1-D array of 10 numbers in reverse order.

**CO-PO and CO-PSO matrix for the course Fundamentals of Programming Lab**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	3	3	3	3	2	3	3	3	3
CO2	3	3	2	3	2	2	1	2	2	3	2	2	1	2
CO3	3	3	3	3	2	2	3	2	2	3	2	3	2	2
CO4	3	3	2	2	3	3	3	3	3	3	3	3	3	2
Average	3	2.75	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.75	2.5	2.8	2.3	2.3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)



**Ability Enhancement Course (AECC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER- I**  
**CODE: AEC-101-N1**  
**SUBJECT NAME: Writing Skills and the Art of Rhetoric (WSAAR)**  
**NO. OF CREDITS: 02**

			Internal Assessment:	25
L	P		End Semester:	75
2	0		Total:	100

**Course Outcomes:**

- CO1: Students will demonstrate great interpersonal communication skills.  
 CO2: Students will adopt the habit of rational thinking and reflection.  
 CO3: Students will adopt cognitive skills for better problem-solving.  
 CO4: Students will practise communication for mediation and conflict-resolution.

**Unit-I: Communication and Barriers to Communication:** 7C's of Communication, Win-Win Communication, Strategies for Effective Communication, Zero-Sum; Reasons for Conflict; Communication Barriers.

**Unit-II: Critical Thinking and Cognitive Skills:** reason; analysis, synthesis, divide and rule; root-cause analysis; logic and logical fallacies.  
 Reasoning; Logic; Inductive and Deductive Reasoning; Logical fallacies: *Ad hominem*, straw man fallacy; bandwagon fallacy; hasty generalization; false dilemma; false dichotomy; *Tu Quoque*; circular reasoning and hasty generalization; Recognizing fallacies.

**Unit-III: Mediation and Conflict-Resolution:** Cognitive Skills and Critical thinking; Listening for key words, phrases and hints, Creative Communicating, Managing and celebrating Diversity, Adaptability and Negotiation; Dispute-resolution; arbitration; mediator's role; caucuses, third party, objectivity, impartiality, neutrality, offers, counter offers, questions, demands, and proposals, impasse, settlement. Brainstorming, Problem solving strategies, Stress management, Significance of Collaboration, Confronting challenges.

**Unit-IV: Mediation in Practice:** Exercises in role-playing and mediation and one case study assignment as directed by the teacher.

**TEXT BOOKS**

1. Kaul Asha, The Effective Presentation, Response Books, New Delhi.
2. Sanghi Seema, Towards Personal Excellence, Response Books, New Delhi.

**REFERENCE BOOKS**

1. Robbins Stephen and Sanghi Seema, Organizational Behaviour. Pearson. Latest Edition.
2. Brettag, Crossman and Bordia. Communication Skills. Tata Mc Graw-Hill.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

**CO-PO and CO-PSO matrix for the course Writing Skills and the Art of Rhetoric (WSAAR)**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
<b>CO1</b>	3	2	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO2</b>	3	3	2	3	2	2	2	2	2	3	2	2	3	3
<b>CO3</b>	3	3	3	3	2	2	3	2	2	3	2	3	2	3
<b>CO4</b>	3	3	2	2	3	3	3	3	3	3	3	3	3	2
<b>Average</b>	3	2.75	2.5	2.5	2.5	2.5	2.75	2.5	2.5	2.75	2.5	2.75	2.75	2.75

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)

**Skill Enhancement Course (SEC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER- I**  
**CODE: SEC23-M-101**  
**SUBJECT NAME: Calculation Skills with Vedic Mathematics**  
**NO OF CREDITS: 3**

L     P  
 3     0

Internal Assessment: 25  
 End Semester: 75  
 Total: 100

**COURSE OUTCOMES:**

Students will be able to

- CO1: Learn about the history of Vedic Mathematics, Sutras and Upsutras from Vedic Mathematics.  
 CO2: Perform arithmetic calculations with speed and accuracy.  
 CO3: Use Vedic sutras to find LCM and HCF of numbers.  
 CO4: Calculate squares of numbers speedily with accuracy..

**UNIT-I**

History of Vedic Mathematics, Introduction to Sutras and Upsutras, Addition in Vedic Mathematics without carrying, Dot method, Subtraction in Vedic Mathematics, Nikhilam Navatashcaramam Dashatah (All from 9 last from 10), Fraction-Addition and subtraction.

**UNIT-II**

Multiplication of two numbers of two digits, Multiplication of two numbers of three digits  
 Multiplication by Urdhva Tiryak sutra.

**UNIT-III**

Division: two digit divisor, Paravartya Yojyet method (three digit divisor), Division by Urdhva Tiryak Sutra (Vinculum method), LCM, HCF.

**UNIT-IV**

Square of two digit numbers: Base method, squares of numbers ending in 5: Ekadhikena Purvena Sutra, Square roots: Dwandwa Yoga (duplex) Sutra.

**TEXT BOOKS**

1. Rajesh K. Thakur, The Essential of Vedic Mathematics, Rupa Publications, New Delhi, 2019.
2. S.B.K. Krishna Trithaji, *Vedic Mathematics*, Motilal Banarasidas, New Delhi, 1990

**REFERENCE BOOKS**

1. Chaitanya A. Patil, Learn Vedic Speed Mathematics Systematically, 2018/

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

**CO-PO and CO-PSO matrix for the course Calculation Skills with Vedic Mathematics**

Cos	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
<b>CO1</b>	3	3	3	3	3	3	2	2	3	2	3	3	3	3
<b>CO2</b>	3	3	3	3	3	3	3	2	3	2	2	3	3	3
<b>CO3</b>	3	3	3	3	3	3	3	2	3	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3	3	3	2	3	3	3	3	3	3
<b>Average</b>	3	3	3	3	3	3	2.75	2	3	2.5	2.75	3	3	3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)

**Skill Enhancement Course (SEC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER- I**  
**CODE: SEC23-M-102**  
**SUBJECT NAME: Finance for Everyone**  
**NO OF CREDITS: 3**

	L	P		Internal Assessment:	25
	3	0		End Semester:	75
				Total:	100

**COURSE OUTCOMES:**

Students will be able to

CO1: Learn about the importance of financial literacy.

CO2: Prepare a financial plan, budget and manage personal finances.

CO3: Learn about the tax structure.

CO4: Plan for life insurance and property insurance.

**UNIT-I**

Financial goals, steps in financial planning, budgeting incomes and payments, time value of money, Introduction to savings, benefits of savings, management of spending & financial discipline, Setting alerts and maintaining sufficient funds for fixed commitments

**UNIT-II**

Process and objectives of investment, concept and measurement of return & risk for various asset classes, measurement of portfolio risk and return, diversification & portfolio formation, Gold bond; Real estate; Investment in greenfield and brownfield Projects; Investment in fixed income instruments, financial derivatives & commodity market in India. Mutual fund schemes; International investment avenues, Currency derivatives and digital currency

**UNIT-III**

Tax structure in India for personal taxation, Scope of personal tax planning, exemptions and deductions available to individuals under different heads of income and gross total income, Comparison of benefits - Special provision u/s 115 BAC vis-à-vis General provisions of the Income-tax Act, 1961, tax avoidance versus tax evasion

**UNIT-IV**

Need for insurance. Life insurance, health insurance, property insurance, credit life insurance and professional liability insurance

**TEXT BOOKS**

1. Halan, M. "Let's Talk Money: You've Worked Hard for It, Now Make It Work for You" Harper Collins Publishers, New York.
2. Indian Institute of Banking & Finance. "Introduction to Financial Planning" Taxmann Publication, New Delhi.



**REFERENCE BOOKS**

1. Keown A.J. "Personal Finance" Pearson, New York.
2. Madura, J. "Personal Finance", Pearson
3. Pandit, A. "The Only Financial Planning Book that You Will Ever Need" Network 18 Publications Ltd., Mumbai.
4. Sinha, M. "Financial Planning: A Ready Reckoner" McGraw Hill Education, New York

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

**CO-PO and CO-PSO matrix for the course finance for everyone**

Cos	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
<b>CO1</b>	3	3	3	3	3	3	2	2	3	2	3	3	3	3
<b>CO2</b>	3	3	3	3	3	3	3	2	3	2	2	3	3	3
<b>CO3</b>	3	3	3	3	3	3	3	2	3	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3	3	3	2	3	3	3	3	3	3
<b>Average</b>	3	3	3	3	3	3	2.75	2	3	2.5	2.75	3	3	3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)

**Value Added Course (VAC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER- I**  
**CODE: VAC-101-N1**  
**SUBJECT NAME: Environmental Studies I**  
**NO OF CREDITS: 2**

		Internal Assessment:	25
L	P	End Semester:	75
2	0	Total:	100

**COURSE OUTCOMES:**

At the completion of this course, the learner will be able to:

- CO1: Understand human interaction with the environment and efforts taken at international level to protect and conserve environment.
- CO2: Understand concept of natural resources, their distribution, conservation, management and sustainable utilization.
- CO3: Develop critical thinking towards local, regional and global environmental issue.
- CO4: Describe the concept of ecosystem, biodiversity and their conservation.

**Unit I: Humans and the Environment**

*The man-environment interaction:* Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment, Indic Knowledge and Culture of sustainability; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change. *Environmental Ethics and emergence of environmentalism:* Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.

**Unit II: Natural Resources and Sustainable Development**

*Overview of natural resources:* Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable.

*Biotic resources:* Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges.

*Water resources:* Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water.

*Soil and mineral resources:* Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation.

*Energy resources:* Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment.

*Introduction to sustainable development:* Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

**Unit III: Environmental Issues: Local, Regional and Global**

*Environmental issues and scales:* Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena.

*Pollution:* Impact of sectoral processes on Environment; Types of Pollution- air, noise, water, soil, thermal, radioactive; municipal solid waste, hazardous waste; transboundary air pollution; acid rain; smog.

*Land use and Land cover change:* land degradation, deforestation, desertification, urbanization.

*Biodiversity loss:* past and current trends, impact.

*Global change:* Ozone layer depletion; Climate change. Disasters – Natural and Man-made (Anthropogenic)

#### **Unit IV: Conservation of Biodiversity and Ecosystems**

*Biodiversity and its distribution:* Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories.

*Ecosystems and ecosystem services:* Major ecosystem types in India and their basic characteristics-forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance.

*Threats to biodiversity and ecosystems:* Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; Gender and conservation.

#### **Field Work**

The students are expected to be engaged in some of the following or similar identified activities:

- Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report.
- Discussion on one national and one international case study related to the environment and sustainable development.
- Participation in plantation drive and nature camps.
- Documentation of campus flora and fauna.

#### **TEXT BOOKS**

- Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson.
- Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson)

#### **REFERENCE BOOKS**

- Kaushik, A., & Kaushik, C. P. (2006). Perspectives in environmental studies. New Age International.
- Sharma, P. D., & Sharma, P. D. (2012). Ecology and environment. Rastogi Publications.
- William P. Cunningham and Mary A. (2015). Cunningham Environmental Science: A global concern, Publisher (Mc-Graw Hill, USA)

#### **SUGGESTED WEB SOURCES:**

- <https://nptel.ac.in/>
- <https://swayam.gov.in/>

#### **CO-PO and CO-PSO matrix for the course finance for everyone**

Cos	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
<b>CO1</b>	3	3	3	3	3	3	2	2	3	2	3	3	3	3
<b>CO2</b>	3	3	3	3	3	3	3	2	3	2	2	3	3	3
<b>CO3</b>	3	3	3	3	3	3	3	2	3	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3	3	3	2	3	3	3	3	3	3
<b>Average</b>	3	3	3	3	3	3	2.75	2	3	2.5	2.75	3	3	3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)

**Syllabus  
of  
B.Sc. (Hons.) Mathematics**



**Semester II**

**Discipline Specific Course (DSC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-II**  
**CODE: BMH23-201**  
**SUBJECT NAME: Calculus-II**  
**NO. OF CREDITS: 3**

L	P					Internal Assessment:	25		
3	0					End Semester:	75		
						Total:	100		

**COURSE OUTCOMES:**

Students will be able to

CO1: Obtain reduction formulae of various functions.

CO2: Learn techniques of sketching conics.

CO3: Visualize three dimensional figures and calculate their volumes and surface areas.

CO4: Understand limit, continuity and differentiation of vector-valued functions.

**UNIT – I**

Indefinite integration, Definite integration, Fundamental theorem of Calculus, Exponential and logarithmic functions, Derivatives and integrals involving logarithmic and exponential functions, Inverse trigonometric functions, Hyperbolic functions, Reduction formulae.

**UNIT – II**

Techniques of sketching conics, Reflection properties of conics, Rotation of axes and second degree equations, Classification into conics using the determinant, Polar equations of conics.

**UNIT - III**

Volume by slicing, disks and washer methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution, curvature.

**UNIT - IV**

Introduction to vector-valued functions and their graphs, Operations with vector functions, Limit, continuity, differentiation and integration of vector functions, Planetary motion, Kepler's second law, Unit tangent, Normal and binomial vectors.

**TEXT BOOKS**

1. Howard Anton, I. Bivens and Stephan Davis, *Calculus*, 10<sup>th</sup> edition, Wiley India, 2016.
2. Monty J. Strauss, Gerald L. Bradley and Karl J. Smith, *Calculus*, 3<sup>rd</sup> edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
3. Tom M. Apostol, *Calculus*, Vol 1, An Indian Adaptation, 2nd edition, Wiley India, 2023.

**REFERENCE BOOKS**

1. George B. Thomas Jr., Joel Hass, Christopher Heil and Maurice D. Weir, *Thomas' Calculus*, 14<sup>th</sup> edition, Pearson Education, 2018.
2. George B. Thomas and R.L. Finney, *Calculus*, 9<sup>th</sup> edition, Pearson Education, Delhi, 2005.
3. Gorakh Prasad, *Differential Calculus*, 19<sup>th</sup> edition, Pothishala Pvt. Ltd, 2016.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

**CO-PO and CO-PSO matrix for the course Calculus-II**

Cos	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO1 1	PS O1	PSO 2	PS O3
CO1	3	3	3	3	3	3	2	3	3	2	2	3	2	3
CO2	3	3	2	3	2	2	2	3	2	2	2	3	3	2
CO3	3	3	3	3	2	2	2	3	2	3	2	3	3	2
CO4	3	3	2	3	3	3	2	3	3	3	2	3	3	2
Average	3	3	2.5	3	2.5	2.5	2	3	2.5	2.5	2	3	2.75	2.25

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)



**Discipline Specific Course (DSC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-II**  
**CODE: BMH23-203**  
**SUBJECT NAME: Differential Equations**  
**NO. OF CREDITS: 3**

			Internal Assessment: 25
L	P		End Semester: 75
3	0		Total: 100

**COURSE OUTCOMES:**

The course will enable the students to

CO1: Learn the basics of ordinary differential equations.

CO2: Learn various techniques to solve first order differential equations.

CO3: Solve linear differential equations of an arbitrary order using various techniques.

CO4: Apply various techniques to solve and analyze various mathematical models.

**Unit-I**

Basic concepts of ordinary differential equations, Order and degree of a differential equation, General solution of first order ordinary differential equation, Separable equations, Homogeneous equations, Bernoulli's equation, Linear differential equations and equations reducible to linear form, Exact differential equations, Integrating factor, Initial value problems.

**Unit-II**

Clairaut's form and singular solution, Picard's method of successive approximations and the statement of Picard's theorem for the existence and uniqueness of the solutions of the first order differential equations, equations solvable for  $x$ ,  $y$  and  $p$ .

**Unit-III**

Principle of superposition for a homogeneous linear differential equation, Linearly dependent and linearly independent solutions on an interval, Wronskian and its properties, General solution of second order homogeneous differential equation with constant coefficients, Method of undetermined coefficients, Method of variation of parameters, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler-Cauchy equation.

**Unit-IV**

Orthogonal trajectories, Compartmental models, Exponential growth and decay models, Radioactive decay, Lake pollution model, Drug assimilation into the blood of a single cold pill, Limited growth of population, Limited growth with harvesting, Equilibrium points and stability.

**TEXT BOOKS**

1. Shepley L. Ross, *Differential Equations*, 3<sup>rd</sup> edition, Wiley India, 2014.
2. Belinda Barnes and Glenn R. Fulford, *Mathematical Modeling with Case Studies: A Differential Equation Approach Using Maple and MATLAB*, 3<sup>rd</sup> edition, CRC Press, Taylor & Francis, 2015.



**REFERENCE BOOKS**

1. C. Henry Edwards, David E. Penny and David T. Calvis, *Differential Equations and Boundary Value Problems: Computing and Modeling*, 5<sup>th</sup> edition, Pearson Education, 2015.
2. George F. Simmons, *Differential Equations with Applications and Historical Notes*, 3<sup>rd</sup> edition, CRC Press, Taylor & Francis, 2017.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources.

**CO-PO and CO-PSO matrix for the course Differential Equations**

COs	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	PS O1	PS O2	PSO 3
CO1	3	2	3	3	2	2	3	2	3	3	3	3	2	2
CO2	3	2	3	3	2	2	3	2	3	3	2	3	2	2
CO3	3	2	3	3	2	3	3	2	3	3	3	3	3	2
CO4	3	2	3	3	2	3	3	3	3	3	3	3	3	3
Average	3	2	3	3	2	2.5	3	2.25	3	3	2.75	3	2.5	2.25

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)



**Minor Course (MIC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-II**  
**CODE: BMH23-205**  
**SUBJECT NAME: Probability and Statistics -II**  
**NO. OF CREDITS: 4**

L	P
4	0

Internal Assessment:	25
End Semester:	75
Total:	100

**COURSE OUTCOMES:**

This course will enable the students to

- CO1: Explore distributions in the study of the joint behavior of two random variables.  
 CO2: Acquire mathematical and statistical knowledge of various distributions like Binomial, Poisson and Normal  
 CO3: Acquire knowledge about the curve fitting  
 CO4: Learn basic Hypothesis testing

**UNIT-I**

Probability Distribution: Random variable, Discrete random variable, Cumulative distribution function, Expectation and variance of discrete random variable, Binomial and poisson distribution, Continuous random variable, Probability density function, Expectation and variance of continuous random variable, Normal distribution.

**UNIT-II**

Bivariate Distribution: Joint probability, Joint probability mass function, Marginal and conditional probability function, Joint probability distribution function, Joint continuous density function, Marginal and conditional probability density function, Conditional cumulative distribution.

**UNIT-III**

Curve Fitting: Introduction, Principle of least squares, Fitting of straight line, Fitting a second degree parabola, Fitting of an exponential curve =  $ae^{bx}$

**UNIT-I**

Hypothesis Testing: Introduction, Null hypothesis, Alternative hypothesis, Level of significance, Hypothesis testing for large samples (Test for single mean, Test for difference of means), Test for single proportion, Test for difference of proportions, T-test.

**TEXT BOOKS**

1. Irwin Miller & Marylees Miller, John E. Freund's Mathematical Statistics with Applications (8th edition). Pearson. Dorling Kindersley Pvt. Ltd. India, 2014.
2. Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics, S. Chand Pub., New Delhi., 1970.

**REFERENCE BOOKS**

1. Robert V. Hogg, Joseph W. McKean & Allen T. Craig ,Introduction to Mathematical Statistics ,7th edition, Pearson Education, 2013.
2. Jim Pitman, Probability, Springer-Verlag, 1993.
3. Sheldon M. Ross, Introduction to Probability Models ,11th edition, Elsevier, 1993.
4. A. M. Yaglom and I. M. Yaglom, Probability and Information. D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi, 1993.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources

**CO-PO and CO-PSO matrix for the course Probability and Statistics –II**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3
<b>CO1</b>	3	2	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO2</b>	3	3	2	3	2	2	1	2	2	3	2	2	1	2
<b>CO3</b>	3	3	3	3	2	2	3	2	2	3	2	3	2	2
<b>CO4</b>	3	3	2	2	3	3	3	3	3	3	3	3	3	2
<b>Average</b>	3	2.75	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.75	2.5	2.8	2.3	2.3

**Multidisciplinary Course (MDC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-II**  
**CODE: OPHY23-201**  
**SUBJECT NAME: Mechanics**  
**NO OF CREDITS: 2**

L     P  
 2     0

Internal Assessment: 25  
 End Semester: 75  
 Total: 100

**COURSE OUTCOMES:**

After the completion of the course, students will be able to,

- CO1: Have knowledge of fundamentals of Mechanics
- CO2: Have an understanding of rotational dynamics
- CO3: Explore the laws of gravitation and central force motion
- CO4: Know relative variation of length, mass and time with the velocity of an event
- CO5: Analyze elasticity and various elastic parameters

**UNIT-I**

Vectors: Vector algebra, Scalar and vector products. Derivatives of a vector with respect to a parameter, Ordinary Differential Equations: 1<sup>st</sup> order homogeneous differential equations, 2<sup>nd</sup> order homogeneous differential equations with constant coefficients, Momentum and Energy: Conservation of momentum, Work and energy, Conservation of energy, Motion of rockets.

**UNIT-II**

Laws of Motion: Frames of reference, Newton's Laws of motion, Dynamics of a system of particles, Centre of Mass, Rotational Motion: Angular velocity and angular momentum, Torque, Conservation of angular momentum.

**UNIT-III**

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws (statement only), Satellite in circular orbit and applications, Oscillations: Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages, Damped oscillations

**UNIT-IV**

Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion - Torsional pendulum-Determination of Rigidity modulus and moment of inertia -  $Y$ ,  $\eta$  and  $K$  by Searles method.

Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.

**TEXT BOOKS**

1. University Physics. FW Sears, MW Zemansky & HD Young 13/e, Addison-Wesley, 1986.
2. Mechanics Berkeley Physics course, v.1: Charles Kittel, et.al. 2007, Tata McGraw-Hill
3. Physics – Resnick, Halliday & Walker 9/e, Wiley, 2010.

**REFERENCE BOOKS**

1. Engineering Mechanics, Basudeb Bhattacharya, 2<sup>nd</sup> edn., Oxford University Press, 2015.
2. University Physics, Ronald Lane Reese, Thomson Brooks/Cole, 2003.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources

**CO-PO and CO-PSO matrix for the course Mechanics**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3
<b>CO1</b>	3	2	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO2</b>	3	3	2	3	2	2	1	2	2	3	2	2	1	2
<b>CO3</b>	3	3	3	3	2	2	3	2	2	3	2	3	2	2
<b>CO4</b>	3	3	2	2	3	3	3	3	3	3	3	3	3	2
<b>Average</b>	3	2.75	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.75	2.5	2.8	2.3	2.3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)

**Multidisciplinary Course (MDC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-II**  
**CODE: OEC-CE-1013**  
**SUBJECT NAME: Fundamentals of Database System**  
**NO OF CREDITS: 2**

			Internal Assessment:	25
L	P		End Semester:	75
2	0		Total:	100

**COURSE OUTCOMES:**

The students will be able to

CO1: Explore the basic concepts, applications and architecture of database systems

CO2: Master the basics of ER diagram

CO3: Know relational database algebra expressions and construct queries using SQL

CO4: Analyze sound design principles for logical design of databases, normalization

**UNIT-I**

Database: Introduction to database, relational data model, DBMS architecture, data independence, DBA, database users, end users, front end tools.

**UNIT-II**

Modeling: Entity types, entity set, attribute and key, relationships, relation types, E- R diagrams, database design using ER diagrams.

**UNIT-III**

Relational Data Model: Relational model concepts, relational constraints, primary and foreign key, normalization: 1NF, 2NF, 3NF.

**TEXT BOOKS**

1. Fundamentals of Database Systems by R. Elmasri and S.B. Navathe, 3 rd edition, Addison- Wesley, Low Priced Edition,2000.
2. An Introduction to Database Systems by C.J. Date, 7 th edition, Addison-Wesley, Low Priced Edition, 2000.
3. Database Management and Design by G.W. Hansen and J.V. Hansen, 2 nd edition, Prentice- Hall of India, Eastern Economy Edition,1999.

**REFERENCE BOOKS**

1. Database Management Systems by A.K. Majumdar and P. Bhattacharyya, 5 th edition, Tata McGraw-Hill Publishing. , 1999.
2. P. Rob, C. Coronel, Database System Concepts by, Cengage Learning India, 2008.

3. R. Elmasri, S. Navathe Fundamentals of Database Systems, Pearson Education, Fifth Edition, 2007. 9. MySQL : Reference Manual.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources

**CO-PO and CO-PSO matrix for the course Fundamentals of Database System**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3
CO1	3	2	3	2	3	3	3	3	3	2	3	3	3	3
CO2	3	3	2	3	2	2	1	2	2	3	2	2	1	2
CO3	3	3	3	3	2	2	3	2	2	3	2	3	2	2
CO4	3	3	2	2	3	3	3	3	3	3	3	3	3	2
Average	3	2.75	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.75	2.5	2.8	2.3	2.3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)



**Multidisciplinary Course (MDC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-II**  
**CODE: BCH-S-201**  
**SUBJECT NAME: Chemistry II**  
**NO OF CREDITS: 2**

L     P  
 2     0

Internal Assessment: 25  
 End Semester: 75  
 Total: 100

**COURSE OUTCOMES**

After the successful completion of the course the learner would be able to

CO1: Explore the basic concept chemical thermodynamics

CO2: Analyze chemical ionic equilibrium Know

CO3: Know phase equilibrium

CO4: Know about congruent and incongruent points

**UNIT-I**

Review of thermodynamics and the Laws of Thermodynamics, Important principles and definitions of thermochemistry, Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution, Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, Variation of enthalpy of a reaction with temperature – Kirchhoff's equation, Statement of Third Law of thermodynamics and calculation of absolute entropies of substances, Concept of EMF of a cell, Nernst equation and its importance, Types of electrodes, Standard electrode potential. Electrochemical series, Thermodynamics of a reversible cell, calculation of thermodynamic properties: G, H and S from EMF data.

**UNIT-II**

Free energy change in a chemical reaction, Thermodynamic derivation of the law of chemical equilibrium, Le Chatelier's principle and Relationships between  $K_p$ ,  $K_c$  and  $K_x$  for reactions involving ideal gases. Phases, components and degrees of freedom of a system, criteria of phase equilibrium, Gibbs Phase Rule and its thermodynamic derivation, Derivation of Clausius–Clapeyron equation and its importance in phase equilibria, Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead- silver,  $\text{FeCl}_3\text{-H}_2\text{O}$  and Na-K only).

**TEXT BOOKS**

1. G. M. Barrow: Physical Chemistry Tata McGraw Hill, 2007.
2. G. W. Castellan: Physical Chemistry 4th Edn. Narosa, 2004.
3. J. C. Kotz, P. M. Treichel & J. R. Townsend: General Chemistry Cengage Lening India Pvt. Ltd., New Delhi, 2009.

**REFERENCE BOOKS**

1. B. H. Mahan: University Chemistry 3rd Ed. Narosa, 1998.
2. R. H. Petrucci: General Chemistry 5th Ed. Macmillan Publishing Co.: New York, 1985.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources

**CO-PO and CO-PSO matrix for the course Chemistry-II**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3
<b>CO1</b>	3	2	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO2</b>	3	3	2	3	2	2	1	2	2	3	2	2	1	2
<b>CO3</b>	3	3	3	3	2	2	3	2	2	3	2	3	2	2
<b>CO4</b>	3	3	2	2	3	3	3	3	3	3	3	3	3	2
<b>Average</b>	3	2.75	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.75	2.5	2.8	2.3	2.3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)



**Multidisciplinary Course (MDC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER-II**  
**CODE: OEC-CE-1014**  
**SUBJECT NAME: Fundamentals of Database System (Lab)**  
**NO OF CREDITS: 1**

			Internal Assessment: 25
L	P		End Semester: 35
0	2		Total: 50

**UNIT 1:**

Create a database having two tables with the specified fields, to computerize a library system of a Delhi University College.

Library Books (Accession number, Title, Author, Department, Purchase Date, Price) Issued  
 Books (Accession number, Borrower)

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) Delete the record of book titled “Database System Concepts”.
- c) Change the Department of the book titled “Discrete Maths” to “CS”.
- d) List all books that belong to “CS” department.
- e) List all books that belong to “CS” department and are written by author “Navathe”.
- f) List all computer (Department=“CS”) that have been issued.
- g) List all books which have a price less than 500 or purchased between “01/01/1999” and “01/01/2004”.

**UNIT 2:**

Create a database having three tables to store the details of students of Computer Department in your college. Personal information about Student (College roll number, Name of student, Date of birth, Address, Marks (rounded off to whole number) in percentage at 10 + 2, Phone Number) Paper Details (Paper code, Name of the Paper) Student’s Academic and Attendance details (College roll number, Paper code, Attendance, Marks in home examination).

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) Design a query that will return the records (from the second table) along with the name of student from the first table, related to students who have more than 75% attendance and more than 60% marks in paper
- c) List all students who live in “Delhi” and have marks greater than 60 in paper1. d) Find the total attendance and total marks obtained by each student. e) List the name of student who has got the highest marks in paper2.

**UNIT 3:**

Create the following tables and answer the queries given below: Customer (Cust ID, email, Name, Phone, Referrer ID) Bicycle (Bicycle ID, Date Purchased, Color, Cust ID, Model No) Bicycle Model (Model No, Manufacturer, Style) Service (Start Date, Bicycle ID, End Date)

- a) Identify primary and foreign keys. Create the tables and insert at least 5 records in each table.
- b) List all the customers who have the bicycles manufactured by manufacturer “Honda”.
- c) List the bicycles purchased by the customers who have been referred by customer “C1”.
- d) List the manufacturer of red colored bicycles. e) List the models of the bicycles given for

service.

#### UNIT 4:

Create the following tables, enter at least 5 records in each table and answer the queries given below. EMPLOYEE (Person Name, Street, City) WORKS (Person Name, Company Name, Salary) COMPANY ( Company Name, City ) MANAGES ( Person Name, Manager Name )

- Identify primary and foreign keys.
- Alter table employee, add a column “email” of type varchar(20).
- Find the name of all managers who work for both Samba Bank and NCB Bank.
- Find the names, street address and cities of residence and salary of all employees who work for “Samba Bank” and earn more than \$10,000.
- Find the names of all employees who live in the same city as the company for which they work.
- Find the highest salary, lowest salary and average salary paid by each company.
- Find the sum of salary and number of employees in each company.
- Find the name of the company that pays highest salary.

#### CO-PO and CO-PSO matrix for the course Fundamentals of Database System Lab

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3
CO1	3	3	2	3	2	3	3	2	3	2	2	3	3	3
CO2	3	3	2	3	2	3	3	2	3	2	2	3	1	2
CO3	3	3	2	3	2	3	3	2	3	2	2	3	2	2
CO4	3	3	2	3	2	3	3	2	3	2	3	3	3	2
Average	3	3	2	3	2	3	3	2	3	2	2.25	3	2.3	2.3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)



**Ability Enhancement Course (AEC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER- I**  
**CODE: AEC-102-N1**  
**SUBJECT NAME: Communication Mediation and Resolution**  
**NO OF CREDITS: 2**

			Internal Assessment: 25
L	P		End Semester: 75
2	0		Total: 100

**Course Outcomes:**

CO1: Students will revise grammar basics for correct and effective writing.

CO2: Students will learn organising techniques for formal writing.

CO3: Students will learn the art of essay writing and drafting of proposals.

CO4: Students will be able to draft proposals fine-tuned to corporate requirements.

**Unit-I:**

**Writing Skills and Basics of Grammar:** Subject-verb agreement; sentence correction; tense-verb usage; Composition of a Paragraph; Characteristics of a Good Paragraph; Use of Idioms and Proverbs, Literary Tropes and Use of Figures of Speech.

**Unit-II:**

**Technical Writing and Reports:** SPSE structure; IMRD structure; Report Writing: Types of Reports and Structure of a Long Report.

Definitions; Comparisons and Contrasts; Hedging; Nominalization, Proposal Presentations; Memos; Agenda and MoM; Case Study Method; Business Letters-quotation and placing order

**Unit-III:****Drafting proposals:**

From essays to proposals; Types of Essay Writing: Structure of an essay; Argumentative essays; Expository essays; Narrative essays; and Descriptive essays; Structure of an Essay; Reading, Writing and Comprehension. Drafting proposals; Synopsis Writing;

**Unit-IV: Exercises in Proposal Presentations:** Drafting and Presenting Proposals.

**TEXT BOOKS**

1. Raman Sharma, Technical Communication, Oxford Publication, London.
2. Sharma, R. and Mohan, K. Business Correspondence and Report Writing TMH New Delhi.
3. Practical English Usage. Michael Swan. OUP.

**REFERENCE BOOKS**

1. On Writing Well. William Zinsser. Harper Resource Book.
2. Remedial English Grammar. F.T.Wood. Macmillan.

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources

**CO-PO and CO-PSO matrix for the course Communication, Mediation and Resolution**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3
<b>CO1</b>	3	2	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO2</b>	3	3	2	3	2	2	1	2	2	3	2	2	1	2
<b>CO3</b>	3	3	3	3	2	2	3	2	2	3	2	3	2	2
<b>CO4</b>	3	3	2	2	3	3	3	3	3	3	3	3	3	2
<b>Average</b>	3	2.75	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.75	2.5	2.8	2.3	2.3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)



**Skill Enhancement Course (SEC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER- II**  
**CODE:OEC-CE-1015**  
**SUBJECT NAME: Basic of Python**  
**NO OF CREDITS: 3**

L	P
3	0

Internal Assessment:	25
End Semester:	50
Total:	75

### **COURSE OUTCOMES:**

Students will be able to

CO1: Understand the fundamentals of Python

CO2: Use loops and understand the conditional flow of control

CO3: Make use of functions in Python

CO4: Understand the basics of Object Oriented Programming & Exception Handling

### **UNIT 1: BASICS OF PYTHON**

Introduction To Python, Its applications , Data Types (primitive and non-primitive data types), Understanding Python variables, Python basic Operators, Understanding python blocks, Using string data type and string operations.

### **UNIT 2: FLOW CONTROL IN PYTHON**

Understanding Program Flow Control, Conditional blocks using if, else and elif, simple for loops in python, For loop using ranges, string ,Use of while loops in python, Nested Loops, Loop manipulation using pass ,continue and break. Programming using Python conditional and loops block.

### **UNIT 3: FUNCTIONS & MODULES**

Understanding Python Functions, Types of Arguments, Lambda Function (need & use), Modules, Organizing python projects into modules Importing own module as well as external modules , Basic understanding Packages.

### **UNIT 4 : CONCEPTS OF OOP**

Python Object Oriented Programming, Concept of class, object and instances, Constructor, class attributes and destructors, Inheritance, overlapping and overloading operators, Basics of Exception Handling Mechanism.

### **TEXT BOOKS**

1. Python Programming using Problem Solving Approach—Reema Thareja, Oxford university Press

### **REFERENCE BOOKS**

1. Head First Python, A brain friendly guide – Paul Barry, O reilly, 2nd Edition.
2. A byte of Python- C.H. Swaroop

**SUGGESTED WEB SOURCES:**

1. <https://nptel.ac.in/>
2. <https://swayam.gov.in/>

**MODE OF TRANSACTION:** Lecture, demonstration, E-tutoring, discussion, assignments, quizzes, case study, power point; **LMS/ICT Tools:** Digital Classrooms, DLMS, ZOOM, G-Suite, MS Power-Point, Online Resources

**CO-PO and CO-PSO matrix for the course Basic of Python**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3
<b>CO1</b>	3	2	3	2	3	3	3	3	3	2	3	3	3	3
<b>CO2</b>	3	3	2	3	2	2	1	2	2	3	2	2	1	2
<b>CO3</b>	3	3	3	3	2	2	3	2	2	3	2	3	2	2
<b>CO4</b>	3	3	2	2	3	3	3	3	3	3	3	3	3	2
<b>Average</b>	3	2.75	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.75	2.5	2.8	2.3	2.3

\*\*Mapping Scale: 1 to 3 (3: Strong correlation; 2: medium correlation; 1: weak correlation)

**Value Added Course (VAC)**  
**B.Sc. (H) MATHEMATICS**  
**SEMESTER- II**  
**CODE: VAC-103-N1**  
**SUBJECT NAME: YOGA AND MEDITATION**  
**NO OF CREDITS: 2**

L	P
3	0

Internal Assessment:	25
End Semester:	50
Total:	75

**Course Outcomes:**

CO1: Students will be able to know about YOGA.

CO2: Students will learn Meditation

CO3: Students will learn Pranayam

CO4: Students will be able to do Aasan.

**UNIT-I**

Introduction to yoga and its different levels, food habits, Sanskar of a yogi, Patanjali Yogsutra, its importance in life, benefits and history of yoga.

**UNIT-II**

Meditation and its relation with yoga, mind relaxation, development of morality and ethics, prayer and its meaning, its importance in life, benefits and history of meditation. Mantra and their importance, introduction to some chanting mantras, practicing some of mantras, Gayatri Mantra, Namokar Jaap etc.

**UNIT-III**

Pranayam and its introduction, types of pranayam, breathing exercises, preliminary preparation before pranayam, its importance and benefits in life. Practice of different types of Pranayam: Anulom-Vilom, Kapalbhathi, Nadi Shodhan, Agni Sar, Bhastrika, Bharamari etc.

**UNIT-IV**

Aasan and their types, benefits of different aasans, practicing of different aasans: Padamaasan, surya-namaskar, tadaasan, navaasan, gomukh aasan, bhujang aasan etc.

**TEXT BOOKS**

1. PATANJALI YOGSUTRA – GITA PRESS GORAKHPUR

**REFERENCE BOOKS**

1. AASAN PRANYAM MUDRA BANDH – SATYANANDA SARASWATI

2. YOGA SADHNA -SWAMI RAMDEV