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

FACULTY OF SCIENCES

DEPARTMENT OF MATHEMATICS

B.Sc. (Hons.) Mathematics

(2018-2021)

ACADEMIC SESSION 2018-2019

Under the

Choice Based Credit System

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

VISION

YMCA University of Science and Technology 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

HUMANITIES AND SCIENCES DEPARTMENT

VISION

A department that can effectively harness its multidisciplinary strengths to create an academically stimulating atmosphere; evolving into a well-integrated system that synergizes the efforts of its competent faculty towards imparting intellectual confidence that aids comprehension and complements the spirit of inquiry.

MISSION

- To create well-rounded individuals ready to comprehend scientific and technical challenges offered in the area of specialization.
- To counsel the students so that the roadmap becomes clearer to them and they have the zest to turn the blueprint of their careers into a material reality.
- To encourage critical thinking and develop their research acumen by aiding the nascent spirit for scientific exploration.
- Help them take economic, social, legal and political considerations when visualizing the role of technology in improving quality of life.
- To infuse intellectual audacity that makes them take bold initiatives to venture into alternative methods and modes to achieve technological breakthroughs.

B.Sc. (Hons.) Mathematics

Bachelor of Science which 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 academic background of science at their 10+2 level with mathematics as one of the 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.

PROGRAM OBJECTIVES

The graduates of this course will :

- Demonstrate engagement with current research and developments in the subject. Critically interpret data, write reports and apply the basics of rules of evidence. Select, interpret and critically evaluate information from a range of sources that include books, scientific reports, journals, case studies and the internet.
- Develop proficiency in the analysis of complex physical problems and the use of mathematical or other appropriate techniques to solve them. Graduates will show skills in the use of computers for control, data acquisition, and data analysis in experimental investigations
- Function on multidisciplinary teams by working cooperatively, creatively and responsibly as a member of a team. provide a systematic understanding of the concepts and theories of mathematics and there application in the real world – to an advanced level

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA FARIDABAD
DEPARTMENT OF HUMANITIES AND SCIENCES
STRUCTURE AND SYLLABI OF B.Sc. (Hons.)MATHEMATICS
(6 SEMESTER COURSE)

SEMESTER I

Subject Code	Title	L	T	P	Internal Assessment	End-semester Examination	Total	Credits	Category Code
Discipline Core Course (DCC) – Compulsory									
BMH 101	Calculus	4	0	0	25	75	100	4	DCC
BMH 102	Algebra	5	1	0	25	75	100	6	DCC
BMH 103	Calculus Lab	0	0	4	15	35	50	2	DCC
Ability Enhancement Compulsory Course (AECC) – Compulsory									
BENG 101	English	2	0	0	25	75	100	2	AEC
Open Elective Course (OEC-I) * - Select one course along with respective Lab from the following discipline:									
OPHY 101	Electricity & Magnetism	4	0	0	25	75	100	4	OEC
OCSC 101	Introduction to programing	4	0	0	25	75	100	4	OEC
OCHE 101	Inorganic Chemistry	4	0	0	25	75	100	4	OEC
OPHY 102	Electricity & Magnetism (Lab)	0	0	4	15	35	50	2	OEC
OCSC 102	Introduction to programing (Lab)	0	0	4	15	35	50	2	OEC
OCHE 102	Inorganic Chemistry (Lab)	0	0	4	15	35	50	2	OEC
Massive Open Online Course (MOOC)**- Online Compulsory Course in any one semester from Sem-I to Sem-V									
XXX	MOOC	4/6	0	0	25	75	100	4/6	MOOC
Total Credits								**20**	

OEC- A student has to choose one course out of the given courses and he/ she will continue with open elective courses from the same discipline during Sem-I to Sem-IV.

**The students have to pass at least one mandatory MOOC course with 4-6 credits (12-16 weeks) from the list given on the Swayam portal or the list given by the Department/ University from 1st semester to 5th semester as notified by the University. (Instructions to students overleaf)

L – Lecture; T - Tutorial; P - Practical

SEMESTER II

Subject Code	Title	L	T	P	Internal Assessment	End-semester Examination	Total	Credits	Category Code
Discipline Core Course (DCC) – Compulsory									
BMH 201	Real Analysis	5	1	0	25	75	100	6	DCC
BMH 202	Differential Equations	4	0	0	25	75	100	4	DCC
BMH 203	Differential Equations Lab	0	0	4	15	35	50	2	DCC
Ability Enhancement Compulsory Course (AECC) – Compulsory									
BEVS 101	Environmental Science	2	0	0	25	75	100	2	AEC
Open Elective Course (OEC-2) - Select one course along with respective Lab from the following discipline									
OPHY 201	Mechanics	4	0	0	25	75	100	4	OEC
OCSC 201	Introduction to Database System	4	0	0	25	75	100	4	OEC
OCHE 201	Physical Chemistry	4	0	0	25	75	100	4	OEC
OPHY 202	Mechanics (Lab)	0	0	4	15	35	50	2	OEC
OCSC 202	Introduction to Database System (Lab)	0	0	4	15	35	50	2	OEC
OCHE 202	Physical chemistry (Lab)	0	0	4	15	35	50	2	OEC
Massive Open Online Course (MOOC) – Online Compulsory Course in any one semester from Sem-I to Sem-V									
XXX	MOOC	4/6	0	0	25	75	100	4/6	MOOC
Mandatory Audit Course (MAC)									
XXX	Audit Course	2	0	0	25	75	100	0	AUD
Total Credits								**20**	

As per the list provided on the University website

SEMESTER III

Subject Code	Title	L	T	P	Internal Assessment	End-semester Examination	Total	Credits	Category Code
Discipline Core Course (DCC) – Compulsory									
BMH 301	Theory of real functions	5	1	0	25	75	100	6	DCC
BMH 302	Group Theory	5	1	0	25	75	100	6	DCC
BMH 303	Multivariate calculus	4	0	0	25	75	100	4	DCC
BMH 304	Multivariate calculus(lab)	0	0	4	15	35	50	2	DCC
Skill Enhancement Course (SEC) – Select one course from the following:									
SEC 301	Latex	2	0	0	25	75	100	2	SEC
SEC 302	French –I	2	0	0	25	75	100	2	SEC
SEC 303	German- I	2	0	0	25	75	100	2	SEC
SEC 304	Elementary Statistical Techniques	2	0	0	25	75	100	2	SEC
Open Elective Course (OEC-3) – Select one course along with respective Lab from the following discipline:									
OCSC 301	Computer Networks & Internet Technology	4	0	0	25	75	100	4	OEC
OPHY 301	Wave & Optics	4	0	0	25	75	100	4	OEC
OCHE 301	Organic Chemistry	4	0	0	25	75	100	4	OEC
OCSC 302	Computer Networks & Internet Technology (Lab)	0	0	4	15	35	50	2	OEC
OPHY 302	Wave & Optics(Lab)	0	0	4	15	35	50	2	OEC
OCHE 302	Organic Chemistry Lab	0	0	4	15	35	50	2	OEC
Massive Open Online Course (MOOC) – Online Compulsory Course in any one semester from Sem-I to Sem-V									
XXX	MOOC	4/6	0	0	25	75	100	4/6	MOOC
Total Credits								**26**	

SEMESTER IV

Subject Code	Title	L	T	P	Internal Assessment	End-semester Examination	Total	Credits	Category Code
Discipline Core Course (DCC) – Compulsory									
BMH 401	Analytical Geometry	5	1	0	25	75	100	6	DCC
BMH 402	Ring Theory & Linear Algebra	5	1	0	25	75	100	6	DCC
BMH 403	Partial Differential Equations	4	0	0	25	75	100	4	DCC
BMH 404	Partial Differential Equations (Lab)	0	0	4	15	35	50	2	DCC
Skill Enhancement Course (SEC) – Select one course from the following discipline:									
SEC 401	Seminar	2	0	0	25	75	100	2	SEC
SEC 402	French-II	2	0	0	25	75	100	2	SEC
SEC 403	German –II	2	0	0	25	75	100	2	SEC
SEC-404	Basics of Operating System	2	0	0	25	75	100	2	SEC

Open Elective Course (OEC-4) - Select one course along with respective lab from the following discipline:

OCSC 401	Information Security	4	0	0	25	75	100	4	OEC
OPHY 401	Nuclear and Particle Physics	5	1	0	25	75	100	6	OEC
OCSC 402	Information Security(Lab)	0	0	4	15	35	50	2	OEC

XXX	MOOC	4/6	0	0	25	75	100	4/6	MOOC
Total Credits								**26**	

Massive Open Online Course (MOOC) – Online Compulsory Course in any one semester from Sem-I to V sem.

SEMESTER V

Subject Code	Title	L	T	P	Internal Assessment	End-semester Examination	Total	Credits	Category Code
Discipline Core Course (DCC) – Compulsory Papers									
BMH 501	Statics	5	1	0	25	75	100	6	DCC
BMH 502	Numerical Methods	4	0	0	25	75	100	4	DCC
BMH 503	Numerical Methods Lab	0	0	4	15	35	50	2	DCC

Discipline Elective Course (DEC) - Select any two courses from the following:

DEMH 501	Discrete Mathematics	5	1	0	25	75	100	6	DEC
DEMH 502	Mathematical Modelling	5	1	0	25	75	100	6	DEC
DEMH 503	Special functions and Integral Transform	5	1	0	25	75	100	6	DEC
DEMH 504	Application of Algebra & Graph Theory	5	1	0	25	75	100	6	DEC

Massive Open Online Course (MOOC) – Online Compulsory Course in any one semester from Sem-I to V sem.

XXX	MOOC	4/6	0	0	25	75	100	4/6	MOOC
Total Credits								**24**	

SEMESTER VI

Subject Code	Title	L	T	P	Internal Assessment	End-semester Examination	Total	Credits	Category Code
Discipline Core Course (DCC) – Compulsory Papers									
BMH 601	Complex Analysis	4	0	0	25	75	100	4	DCC
BMH 602	Riemann Integration and Metric Space	5	1	0	25	75	100	6	DCC
BMH 603	Complex Analysis(Lab)	0	0	4	15	35	50	2	DCC
Discipline Elective Course (DEC) – Select any two courses from the following:									
DEMH 601	Financial Mathematics	5	1	0	25	75	100	6	DEC
DEMH 602	Dynamics	5	1	0	25	75	100	6	DEC
DEMH 603	Basics of Statistics	5	1	0	25	75	100	6	DEC
DEMH 604	Number Theory	5	1	0	25	75	100	6	DEC
Total Credits								**24**	

Grand Total Credits: 144-148 [140+ 4/6 (for MOOC Course)]

NOTE: 1. Discipline Elective Course (DEC) 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.

Instructions to the students regarding MOOC

1. Two types of courses will be circulated: branch specific and general courses from the website https://swayam.gov.in in the month of June and November every year for the forthcoming semester.
2. The department coordinators will be the course coordinators of their respective departments.
3. Every student has to pass a selected MOOC course within the duration as specified below:

Programme	**Duration**
B. Tech.	Sem. I to Sem. VII
M.Sc./M. Tech./MA/MBA	Sem. I to Sem. III
B.Sc./MCA	Sem. I to Sem. V

The passing of a MOOC course is mandatory for the fulfilment of the award of the degree of concerned programme.

4. A student has to register for the course for which he is interested and eligible which is approved by the department with the help of course coordinator of the concerned department.
5. A student may register in the MOOC course of any programme. However, a UG student will register only in UG MOOC courses and a PG student will register in only PG MOOC courses.
6. The students must read all the instructions for the selected course on the website, get updated with all key dates of the concerned course and must inform his/her progress to their course coordinator.
7. The student has to pass the exam (online or pen-paper mode as the case may be) with at least 25% marks.
8. The students should note that there will be a weightage of Assessment/quiz etc. and final examination appropriately as mentioned in the instructions for a particular course.
9. A student must claim the credits earned in the MOOC course in his/her mark sheet in the examination branch by forwarding his/her application through course coordinator and chairperson.

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 ± 2.5%
3. Worst case difference between actual percentage and CGPA percentage ± 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

Semester I

Discipline Core Course (DCC)
B.Sc. (H) MATHEMATICS
SEMESTER I
CODE: BMH 101
SUBJECT NAME: **Calculus**
NO OF CREDITS: 4

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

NOTE: Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The course will develop a deeper and more rigorous understanding of Calculus including Hyperbolic functions, higher order derivatives, maxima and minima, asymptotes, reduction formulas and volume of shells. The course will also develop understanding of conics and vector functions.

UNIT – I

Differentiation of Hyperbolic functions. Higher order derivatives: Leibnitz's rule and its applications to problems of type e^{ax+b} sinx, e^{ax+b} cosx, $(ax+b)^n$ sinx , $(ax+b)^n$ cosx. First derivative test, concavity and inflection points, second derivative test. Asymptotes , L'Hospital's rule, applications in business, economics and life sciences.

UNIT – II

Reduction formulae: derivations and illustrations of reduction formulae of the type $\int \sin nx\, dx$, $\int \cos nx\, dx$, $\int \tan nx\, dx$, $\int \sec nx\, dx$, $\int (\log x)^n dx$, $\int \sin^n x \sin^m x\, dx$. Volumes by slicing, disks and washers methods, volumes by cylindrical shells, arc length, arc length of parametric curves, area of surface of revolution.

UNIT - III

Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics.

UNIT - IV

Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration , Curvature.

COURSE OUTCOMES

Students will be able to

- Understand hyperbolic functions , maxima and minima and asymptotes.
- Prove reduction formulas and find volume of shells.
- Sketch conics and polar equation of conics.
- Define vector valued function and curvature.

REFERENCE BOOKS

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus*, 3rd Ed., Dorling Kindersley (India) P.Ltd. (Pearson Education), Delhi, 2007.
3. H. Anton, I. Bivens and S. Davis, *Calculus*, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.
4. R. Courant and F. John, *Introduction to Calculus and Analysis* (Volumes I & II), Springer-Verlag, New York, Inc., 2004

B.Sc. (H) MATHEMATICS
SEMESTER I
CODE: BMH 102
SUBJECT NAME: **Algebra**
NO OF CREDITS: 6

			SESSIONAL:	25
L	P	T	THEORY EXAM:	75
5	0	1	TOTAL:	100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE
The course will develop understanding and knowledge of Complex Numbers, Linear algebra , Fundamental Theorem of Arithmatic , Division Algorithm and Congruences and Equivalence Relations.

UNIT – I
Polar representation of complex numbers, nth roots of Unity, De Moivre's theorem for rational indices and its applications.

UNIT – II
Equivalence relations, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set, Well-ordering property of positive integers. Division algorithm, Divisibility and Euclidean algorithm, Congruence relation between integers, Principles of Mathematical Induction, statement of Fundamental Theorem of Arithmetic.

UNIT – III
Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation Ax = B, solution sets of linear systems, applications of linear systems, linear independence.

UNIT – IV
Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Rank of a matrix, Eigen values, Eigen Vectors and Characteristic Equation of a matrix.

COURSE OUTCOMES
Students will have the knowledge of

- Complex Numbers, De Moivre's Theorem.
- Functions and Equivalence Relations, Division Algorithm, Fundamental Theorem of Arithmetic
- **S**olving System of Linear Equations, Echelon form.
- Linear Transformation , Rank Of a Matrix, Eigen Values, Eigen Vectors

REFERENCE BOOKS

1. Titu Andreescu and Dorin Andrica, Complex Numbers from A to …. Z, Birkhauser, 2006.
2. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory (3rd Edition), Pearson Education (Singapore) Pvt. Ltd., Indian Reprint, 2005.
3. David C.Lay, Linear Algebra and its Applications (3rd Edition) Pearson Education Asia, Indian Reprint, 2007

B.Sc. (H) MATHEMATICS
SEMESTER I
CODE: BMH 103
SUBJECT NAME: **Calculus Lab**
NO OF CREDITS: 2

		Internal Assessment:	15
L	P	End Semester :	35
0	4	Total:	50

Practical / Lab work to be performed on a computer:

Modelling of the following problems using Matlab / Mathematica etc.

1. Plotting of graphs of function of type (greatest integer function, even and odd positive integer, even and odd positive integer, a positive integer) . Discuss the effect of and on the graph.

2. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.

3. Tracing of conics in Cartesian coordinates.

4. Obtaining surface of revolution of curves.

5. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic paraboloid, hyperbolic paraboloid using Cartesian co-ordinates.

6. To find numbers between two real numbers and plotting of finite and infinite subset of R.

7. Matrix operations (addition, multiplication, inverse, transpose, determinant, rank, eigenvectors, eigen values, Characteristic equation and verification of Cayley Hamilton equation, system of linear equations)

8. Graph of Hyperbolic functions.

9. Computation of limit, differentiation and integration of vector functions.

10. Complex numbers and their representations, operations like addition, multiplication, division, modulus. Graphical representation of polar form.

Ability Enhancement Compulsory Course (AECC)
B.Sc. (H) MATHEMATICS
SEMESTER- I
CODE: BENG-101
SUBJECT NAME: English
NO OF CREDITS: 2

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

COURSE OBJECTIVE

To discuss communication process and elements of communication with the help of popular models, discuss types of communication, improve spoken English and ability to articulate ideas, improve comprehension, improve formal writing skills.

UNIT-I

Introduction: Theory of Communication, Types and modes of Communication

UNIT-II

Language of Communication: Verbal and Non-verbal (Spoken and Written) Personal, Social and Business Barriers and Strategies Intra-personal, Inter-personal and Group communication

UNIT-III

Speaking Skills: Monologue Dialogue Group Discussion Effective Communication/ Mis-Communication Interview Public Speech

UNIT-IV

Reading and Understanding Close Reading Comprehension Summary Paraphrasing Analysis and Interpretation Translation(from Indian language to English and vice-versa) Literary/Knowledge Texts. Writing Skills Documenting Report Writing Making notes Letter writing.

COURSE OUTCOMES

After completion of course students would be able:

- To learn about communication process and ways to make communication effective by giving attention to all elements involved.
- To understand the value of verbal communication as well as non- verbal aspects of communication in making inter personnel communication effective and intrapersonnel communication insightful.
- To gain confidence by enhancing their abilities to articulate their ideas.
- To able to scan, skim and revise documents for fruitful reading and comprehension.
- To acquire better writing skills in formal communication.

REFERENCE BOOKS

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas, Primus books, 2016

Open Elective Paper
B.Sc. (H) MATHEMATICS
SEMESTER-I
CODE: OPHY-101
SUBJECT NAME:-Electricity And Magnetism
NO OF CREDITS: 4

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

COURSE OBJECTIVE
The objective of the course is to have an understanding the laws of electricity and magnetism which makes the foundation of electromagnetic theory and explains the 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, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

UNIT-II

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to infinite line, splane and charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per UNIT volume in electrostatic field.

UNIT-III

Electric Field in Dielectrics: Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Magnetism: Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. 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
Electromagnetic Induction: 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.
Maxwell`s equations and Electromagnetic wave propagation: 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.

COURSE OUTCOMES

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

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

REFERENCE BOOKS

1. Electricity and Magnetism, Edward M. Purcell, McGraw-Hill Education, 1986.
2. Electricity & Magnetism, J.H. Fewkes & J.Yarwood. Vol. I, Oxford Univ.Press,1991.
3. Electricity and Magnetism, D C Tayal, Himalaya Publishing House, 1988.
4. University Physics, Ronald Lane Reese, Thomson Brooks/Cole, 2003.
5. D.J.Griffiths, Introduction to Electrodynamics, 3rd Edn, Benjamin Cummings,1998.

Open Elective Paper
B.Sc. (H) MATHEMATICS
SEMESTER-I
CODE: OCSE-101
SUBJECT NAME: Introduction To Programming
NO. OF CREDITS: 04

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

COURSE OBJECTIVE
Be able to explain the difference between object oriented programming and procedural programming, to familiarize students with the features of C language including data-types, variables, Operators ,Functions and Arrays, be able to program using more advanced C++ features such as composition of objects, operator overloading, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, templates etc., be able to apply object oriented techniques to solve bigger Real World Computing problems.

UNIT-I

Introduction to C and C++
History of C and C++, Overview of Procedural Programming and Object-Orientation 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), Using Comments in programs, Character I/O (getc, getchar, putc, putcharetc), Formatted and Console I/O (printf(), scanf(), cin, cout), Using Basic Header Files (stdio.h, iostream.h, conio.hetc).

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)

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, Functions with variable number of Arguments.

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), Introduction to Multi-dimensional arrays

UNIT-III

Derived Data Types (Structures and Unions)

Understanding utility of structures and unions, Declaring, initializing and using simple structures and unions, Manipulating individual members of structures and unions, Array of Structures, Individual data members as structures, Passing and returning structures from functions, Structure with union as members, Union with structures as members.

File I/O, Preprocessor Directives

Opening and closing a file (use of fstream header file, if stream, of stream and ftream classes), Reading and writing Text Files, Using put(), get(), read() and write() functions, Random access in files, Understanding the Preprocessor Directives (#include, #define, #error, #if, #else, #elif, #endif, #ifdef, #ifndef and #undef), Macros

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, Objects as parameters, Specifying the Protected and Private Access, Copy Constructors, Overview of Template classes and their use.

Inheritance and Polymorphism

Introduction to Inheritance and Polymorphism

COURSE OUTCOMES

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

- Differentiate between Procedure-Oriented programming and Object-Oriented programming.
- Understand the syntax of the language.
- Understand and apply various object oriented features like inheritance, data abstraction encapsulation and polymorphism to solve various computing problems using C++ language.
- Apply object oriented concepts in real world programs

REFERENCE BOOKS

1. Herbtz Schildt, "C++: The Complete Reference", Fourth Edition, McGraw Hill, 2017.
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.
4. John R. Hubbard, "Programming with C++", Schaum's Series, 2nd Edition, 2000.
5. Harry, H. Chaudhary, "Head First C++ Programming: The Definitive Beginner's Guide", First Create space Inc, O-D Publishing, LLC USA, 2014.

Open Elective Paper
B.Sc. (H) MATHEMATICS
SEMESTER-I
CODE: OCHE-101
SUBJECT NAME: Inorganic Chemistry
NO. OF CREDITS: 02

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

COURSE OBJECTIVE

To learn and understand the basic concepts of inorganic chemistry and its role in biological systems.

UNIT- I

Atomic Structure: Review of: Bohr's theory and its limitations, Heisenberg Uncertainty principle.

Dual behaviour of matter and radiation, de-Broglie's relation. Hydrogen atom spectra. Need of a new approach to Atomic structure.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of *s, p* and *d* atomic orbitals, nodal planes. Discovery of spin, spin quantum number (*s*) and magnetic spin quantum number(m_s).

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

UNIT- II

Chemical Bonding and Molecular Structure

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. Statement of Born-Landé equation for calculation of lattice energy (no derivation), Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

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, SF_4) and hybridization with suitable examples of

linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

Concept of resonance and resonating structures in various inorganic and organic compounds. 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 (including idea of *s-p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+.

UNIT -III
Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeise'ssalt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IRfrequencies).

UNIT- IV
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. Role of iron in oxygen transport, haemoglobin, myoglobin, storage and transport of iron.

COURSE OUTCOMES

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

- Understand the basic concept of atomic structure.
- Understand the chemical bonding concept.
- Understand the bonding and structure in organometallic compounds.
- Understand the role of inorganic chemistry in biological systems.

REFERENCE 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, 3rd Ed., 1995.
3. Douglas, McDaniel and Alexader: *Concepts and Models in Inorganic Chemistry*, John Wiley, 3rd Ed. 1994.
4. James E. Huheey, *Ellen Keiter and Richard Keiter: Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Publication, 1997.

Open Elective Paper
B.Sc. (H) MATHEMATICS
SEMESTER-I
CODE: OPHY102
SUBJECT NAME: Electricity And Magnetism (Lab)
NO. OF CREDITS: 04

		Internal Assessment:	15
L	P	End Semester :	35
0	4	Total:	50

At least 05 experiments from the following:

1. Ballistic Galvanometer:
   (i) Measurement of charge and current sensitivity
   (ii) Measurement of CDR
   (iii) Determine a high resistance by Leakage Method
   (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
2. To compare capacitances using De'Sauty's bridge.
3. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx)
4. To study the Characteristics of a Series RC Circuit.
5. To study a series LCR circuit LCR circuit and determine its (a) Resonant frequency, (b) Quality factor.
6. To study a parallel LCR circuit and determine its
   (a) Anti-resonant frequency and
   (b) Quality factor Q.
7. To determine a Low Resistance by Carey Foster's Bridge.
8. To verify the Thevenin and Norton theorems.
9. To verify the Superposition, and Maximum Power Transfer Theorems.

REFERENCE BOOKS

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

Open Elective Paper
B.Sc. (H) MATHEMATICS
SEMESTER-I
CODE: OCSE-102
SUBJECT NAME: Introduction To Programming (LAB)
NO. OF CREDITS: 2

		Internal Assessment:	15
L	P	End Semester :	35
0	2	Total:	50

Introduction to Programming Lab

1. Write a program to find greatest of three numbers.
2. Write a program to find gross salary of a person
3. Write a program to find grade of a student given his marks.
4. Write a program to find divisor or factorial of a given number.
5. Write a program to print first ten natural numbers.
6. Write a program to print first ten even and odd numbers.
7. Write a program to find grade of a list of students given their marks.
8. Create Matrix class. Write a menu-driven program to perform following Matrix operations (2-D array implementation):
   a) Sum b) Difference c) Product d) Transpose

Syllabus of B.Sc. (Hons.) Mathematics

Semester II

Ability Enhancement Compulsory Course (AECC)
B.SC. (H) MATHEMATICS
SEMESTER II
CODE: BMH 201
SUBJECT NAME: **Real Analysis**
NO OF CREDITS: 6

Internal Assessment : 25
L T P End Semester: 75
5 1 0 Total: 100

NOTE: Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The course will develop a deeper and more rigorous understanding of Real analysis including limit point , neighbourhood of a point countability of sets, boundedness and unboundedness of sets, sequence and series of numbers , their convergence and related results.

UNIT – I

Algebraic and Order Properties of *R,* delta-neighborhood of a point in *R,* idea of countable sets, uncountable sets and uncountability of R

UNIT – II

Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of *R,* The Archimedean Property, Limit points of a set, Isolated points, Bolzano-Weierstrass theorem for sets.

UNIT - III

Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.

UNIT - IV

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's n_{th} root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

COURSE OUTCOMES

Students will be able to

- Understand countability of sets.
- Understand boundedness of sets and Prove Archimedean Property & Bolzano Weierstrass theorem for sets.
- Understand sequences and convergence of sequences.
- Understand series and test for convergence of series

REFERENCE 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.
5.S.C. Malik and Savita Arora, *Mathematical Analysis,* New age Publications, 2009.

Ability Enhancement Compulsory Course (AECC)
B.Sc. (H) MATHEMATICS
SEMESTER II
CODE: BMH 202
SUBJECT NAME: **Differential Equations**
NO OF CREDITS: 4

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

NOTE: Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The course is designed to develop in students:

Appreciation for ODE and system of ODEs concepts that are encountered in the real world, understand and be able to communicate the underlying mathematics involved to help another person gain insight into the situation, work with Differential Equations and systems of Differential Equations in various situations and use correct mathematical terminology, notation, and symbolic processes in order to engage in work, study, and conversation on topics involving Differential equations.

The students will learn to solve exact differential equations, linear differential equations and understand the basics of models based on differential equations. They will develop ability to solve differential equations

UNIT – I

Differential equations and mathematical models. 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, linear equation and Bernoulli equations, special integrating factors and transformations.

UNIT – II

Linear homogeneous equations with constant coefficients, Complementary factor ,Particular Integral, linear non –homogeneous equations, method of variation of parameters,Solution of initial value problems, The Cauchy Euler equation, Proofs of theorems on second order homogeneous linear equation.Types of linear system, operator method for linear system with constant coefficients.

UNIT – III

Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators *(d/dx)* or *(d/dt)* etc. Simultaneous equation of the form $dx/P = dy/Q = dz/R$. Total differential equations. Condition for $Pdx + Qdy + Rdz = 0$ to be exact. General method of solving $Pdx + Qdy + Rdz = 0$ by taking one variable constant. Method of auxiliary equations.

UNIT – IV

Introduction to compartmental model, exponential decay model, lake pollution model (case studyof 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.

COURSE OUTCOMES

Upon completion of course, students will be able to:

- Solve exact differential equations and linear differential equations.
- Solve differential equations by method of variation of parameters.
- Solve homogeneous and non- homogeneous differential equations.
- Solve ordinary simultaneous differential equations.
- Study and understand the various models related to the subject.

REFERENCE 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.
4. Martha L Abell, James P Braselton, Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
5. D.A. Murray, Introductory Course in Differential Equations. Orient Longaman (India) 1967.
6. A.R.Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd., London E.A. Codington, Introduction to Differential Equations,1996.

Ability Enhancement Compulsory Course (AECC)
B.Sc. (H) MATHEMATICS
SEMESTER II
CODE: BMH 203
SUBJECT NAME: **Differential Equations (LAB)**
NO OF CREDITS: 2

		Internal Assessment:	15
L	P	End Semester :	35
0	4	Total:	50

List of Practicals (using any software)

1. Plotting of second order solution family of differential equation.
2. Plotting of third order solution family of differential equation.
3. Growth model (exponential case only).
4. Decay model (exponential case only).
5. Lake pollution model (with constant/seasonal flow and pollution concentration).
6. Case of single cold pill and a course of cold pills.
7. Limited growth of population (with and without harvesting).
8. Predatory-prey model (basic volterra model, with density dependence, effect of DDT, two prey one predator).
9. Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers).
10. Plotting of recursive sequences.
11. Study the convergence of sequences through plotting.
12. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.

Ability Enhancement Compulsory Course (AECC)
B.Sc. (H) MATHEMATICS
SEMESTER- II
PAPER CODE: BEVS 101
SUBJECT NAME: **Environmental Science**
NO OF CREDITS: 2

		Internal Assessment:	15
L	P	End Semester :	35
2	4	Total:	50

UNIT -I

Introduction to environmental studies

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

UNIT -II

Ecosystems

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems :
  a) Forest ecosystem
  b) Grassland ecosystem
  c) Desert ecosystem
  d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT -III

Natural Resources : Renewable and Non-renewable Resources

- Land resources and landuse change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water : Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT-IV

Biodiversity and Conservation

- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity : Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT V

Environmental Pollution

- Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Pollution case studies.

UNIT VI

Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human commUNITies and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection
- Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

UNIT VII

Human CommUNITies and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management : floods, earthquake, cyclones and landslides.
- Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

UNIT VIII

Field work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.

REFERENCE BOOKS

1. Carson, R. ,*Silent Spring*. Houghton Mifflin Harcourt, 2002.
2. Gadgil, M., & Guha, R., *This Fissured Land: An Ecological History of India*. Univ. of California Press., 1993.
3. Gleeson, B. and Low, N. (eds.) ,*Global Ethics and Environment*, London, Routledge., 1999.
4. Gleick, P. H. *Water in Crisis*.,Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press., 1993.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll, *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K., Threats from India's Himalaya dams. *Science*, 339: 36-37., 2013.
7. McCully, P. , *Rivers no more: the environmental effects of dams* (pp. 29-64). Zed Books., 1996.
8. McNeill, John R. , Something New Under the Sun: An Environmental History of the Twentieth Century.,2000.
9. Odum, E.P., Odum, H.T. & Andrews, J., *Fundamentals of Ecology*. Philadelphia: Saunders., 1971.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L.,Environmental and Pollution Science. Academic Press, 2011.
11. Rao, M.N. & Datta, A.K. ,*Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd., 1987.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R.,*Environment*. 8th edition. John Wiley & Sons, 2012.
13. Rosencranz, A., Divan, S., & Noble, M. L.,*Environmental law and policy in India*. *Tripathi, 1992*.
14. Sengupta, R., *Ecology and economics*: An approach to sustainable development. OUP, 2003.
15. Singh, J.S., Singh, S.P. and Gupta, S.R., *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi, 2014.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). ,*Conservation Biology*: *Voices from the Tropics*. John Wiley & Sons, 2013.

Open Elective Paper
B.Sc. (H) MATHEMATICS
SEMESTER-II
CODE: OPHY-201
SUBJECT NAME: **Mechanics**
NO OF CREDITS: 4

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

COURSE OBJECTIVE

The emphasis of course is to understand laws of mechanics and their applications in various physical systems.

UNIT-I

Vectors: Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter.

Ordinary Differential Equations: 1^{st} order homogeneous differential equations. 2^{nd} 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, η and K by Searles method.

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

Note: *Students are not familiar with vector calculus. Hence all examples involve differentiation either in one dimension or with respect to the radial coordinate.*

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

- Learn fundamentals of Mechanics.
- Have an understanding of rotational dynamics.
- Understand the laws of gravitation and central force motion.
- Learn relative variation of length, mass and time with the velocity of an event.
- Learn elasticity and various elastic parameters

REFERENCE 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.
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., Oxford University Press, 2015.
5. University Physics, Ronald Lane Reese, Thomson Brooks/Cole, 2003.

Open Elective Paper
B.Sc. (H) MATHEMATICS
SEMESTER –II
CODE: OCSC 201
SUBJECT NAME: **Introduction To Database System**
NO OF CREDITS: 4

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

COURSE OBJECTIVES

To make the students able to understand basic terminology used in database systems, basic concepts, the applications of database systems and understand role of Database administrator in DBMS. Teaching them various data model like Hierarchical model, Network Model, Relational model, E-R model , E-R diagram from data given by user and table from E-R diagram,. Make them familiar with relational database theory and be able to write relational algebra expressions for query, the logical design guidelines for databases, normalization approach, primary key, super key, foreign key concepts.

UNIT-I

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

UNIT-II

E-R 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.

UNIT-IV

Structured Query Language: SQL queries, create a database table, create relationships between database tables, modify and manage tables, queries, forms, reports, modify, filter and view data.

COURSE OUTCOMES

The Student will be able

- to understand the basic concepts, applications and architecture of database systems.
- to master the basics of ER diagram.
- to understand relational database algebra expressions and construct queries using SQL.
- to understand sound design principles for logical design of databases, normalization.

REFERENCE BOOKS

1. Fundamentals of Database Systems by R. Elmasri and S.B. Navathe, 3rd edition, Addision-Wesley, Low Priced Edition,2000.
2. An Introduction to Database Systems by C.J. Date, 7th edition, Addison-Wesley, Low Priced Edition, 2000.
3. Database Management and Design by G.W. Hansen and J.V. Hansen, 2nd edition, Prentice-Hall of India, Eastern Economy Edition,1999.
4. Database Management Systems by A.K. Majumdar and P. Bhattacharyya, 5th edition,Tata McGraw-Hill Publishing. ,1999.
5. A Guide to the SQL Standard, Date, C. and Darwen,H. 3rd edition, Reading, MA:, Addison-Wesley,1994.
6. Data Management & file Structure by Loomis, PHI, 1989.
7. P. Rob, C. Coronel, Database System Concepts by, Cengage Learning India, 2008.
8. R. Elmsasri,S. Navathe Fundamentals of Database Systems, Pearson Education, Fifth Edition, 2007.
9. MySQL : Reference Manual

Open Elective Paper
B.Sc. (H) MATHEMATICS
SEMESTER-II
CODE: OCHE 201
SUBJECT NAME: **Physical Chemistry**
NO OF CREDITS: 4

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

COURSE OBJECTIVES

To learn and understand the elements of physical chemistry and physical phenomenon.

UNIT- I

Chemical Energetics

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.

UNIT -II

Chemical Equilibrim:

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between *G* and *G*o, Le Chatelier's principle. Relationships between*Kp, Kc* and *Kx* for reactions involving ideal gases.

Ionic Equilibria:

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

UNIT -III

Solutions:

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature- composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation.Nernst distribution law and its applications, solvent extraction.

Phase Equilibrium:

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, FeCl3-H2O and Na-K only).

UNIT- IV

Electrochemistry

Reversible and irreversible cells. Concept of EMF of a cell. Measurement 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 EMFdata. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge.pH determination using hydrogen electrode and quinhydrone electrode. Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).

COURSE OUTCOMES

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

- Understand the basic concept chemical thermodynamics
- Understand chemical ionic equilibrium
- Understand phase equilibrium
- Understand electrochemistry.

REFERENCE 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* CengageLening India Pvt. Ltd., New Delhi , 2009.
4. B. H. Mahan: *University Chemistry* 3rd Ed. Narosa ,1998.
5. R. H. Petrucci: *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York ,1985.

Open Elective Paper

B.Sc. (H) MATHEMATICS

SEMESTER-II

CODE: OPHY-202

SUBJECT NAME: **Mechanics (LAB)**

NO OF CREDITS: 4

		Internal Assessment:	15
L	P	End Semester :	35
0	4	Total:	50

At least 05 experiments from the following:

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To study the Motion of a Spring and calculate (a) Spring Constant, (b) g.

REFERENCE BOOKS

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

Open Elective Paper

B.Sc. (H) MATHEMATICS

SEMESTER-II

CODE: OCSC 202

SUBJECT NAME: **Introduction To Database System (LAB)**

NO OF CREDITS: 2

L	P	Internal Assessment:	15
		End Semester :	35
0	4	Total:	50

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

LibraryBooks (Accession number, Title, Author, Department, PurchaseDate, Price)
IssuedBooks (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".

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 2.
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

3) Create the following tables and answer the queries given below:

Customer (CustID, email, Name, Phone, ReferrerID)
Bicycle (BicycleID, DatePurchased, Color, CustID, ModelNo)
BicycleModel (ModelNo, Manufacturer, Style)
Service (StartDate, BicycleID, EndDate)

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.

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)

a)Identify primary and foreign keys.

b)Alter table employee, add a column "email" of type varchar(20).

c)Find the name of all managers who work for both Samba Bank and NCB Bank.

d) 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.

e) Find the names of all employees who live in the same city as the company for which they work.

f) Find the highest salary, lowest salary and average salary paid by each company.

g) Find the sum of salary and number of employees in each company.h)
Find the name of the company that pays highest salary.

5) Create the following tables, enter at least 5 records in each table and answer the queries given below.

Suppliers (SNo, Sname, Status, SCity) Parts
(PNo, Pname, Colour, Weight, City) Project
(JNo, Jname, Jcity)
Shipment (Sno, Pno, Jno, Qunatity)

a) Identify primary and foreign keys.

b) Get supplier numbers for suppliers in Paris with status>20.

c) Get suppliers details for suppliers who supply part P2. Display the supplier list in increasing order of supplier numbers.

d) Get suppliers names for suppliers who do not supply part P2.

e) For each shipment get full shipment details, including total shipment weights.

f) Get all the shipments where the quantity is in the range 300 to 750 inclusive.

g) Get part nos. for parts that either weigh more than 16 pounds or are supplied by suppliers S2, or both.
h) Get the names of cities that store more than five red parts.
i) Get full details of parts supplied by a supplier in London.
j) Get part numbers for part supplied by a supplier in London to a project in London. k) Get the total number of project supplied by a supplier (say, S1).
l) Get the total quantity of a part (say, P1) supplied by a supplier (say, S1)

Syllabus of B.Sc. (Hons.) Mathematics

Semester III

Discipline Core Course (DCC)
B.Sc. (H) MATHEMATICS
SEMESTER III
CODE: BMH 301
SUBJECT NAME: **Theory Of Real Functions**
NO OF CREDITS: 6

	Internal Assessment: 25
L T P	End Semester: 75
5 1 0	Total: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE

The course will develop a deeper and more rigorous understanding of Limit ,continuity and differentiability Real functions. The course will also develop understanding of various theorems of differentiability and their applications.

UNIT – I

Limits of functions (epsilon-delta approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits & limits at infinity. Continuous functions, sequential criterion for continuity & discontinuity. Algebra of continuous functions.

UNIT – II

Continuous functions on an interval, intermediate value theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem. Differentiability of a function at a point and in an interval, Carathéodory's theorem, algebra of differentiable functions.

UNIT - III

Relative extrema, interior extremum theorem.Rolle's theorem, Mean value theorem, intermediate value property of derivatives - Darboux's theorem. Applications of mean value theorem to inequalities & approximation of polynomials.Taylor's theorem to inequalities.

UNIT - IV

Cauchy's mean value theorem.Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema.Taylor's series &Maclaurin's series expansions of exponential & trigonometric functions.

COURSE OUTCOMES

Students will be able to`

- understand limit and continuity of real functions.
- understand uniform continuity and differentiability.
- Prove Rolles's Theorem, Mean value Theorem and Darboux's Theorem.
- apply Taylor's and Maclaurin's Theorem to expand exponential and trigonometric functions.

REFERENCE BOOKS

1 R.G. Bartle and D. R. Sherbert, *Introduction to Real Analysis*, 4th Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2014.

2 K. A. Ross, *Elementary Analysis: The Theory of Calculus*, Springer (2004)

3 Gerald G. Bilodeau , Paul R. Thie, G.E. Keough, *An Introduction to Analysis,* 2nd Ed., Jones & Bartlett, 2010.

4 Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, *Elementary Real Analysis,*Prentice Hall, 2001.

5 S.K. Berberian, *A First Course in Real Analysis*, Springer Verlag, New York, 1994.

Discipline Core Course (DCC)
B.Sc. (H) MATHEMATICS
SEMESTER III
CODE: BMH 302
SUBJECT NAME: **Group Theory**
NO OF CREDITS: 6

	Internal Assessment: 25
L T P	End Semester: 75
5 1 0	Total: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE

The course will develop a base of Group theory. The students will learn various types of groups like subgroups, cyclic groups , their properties and basic theorems.

UNIT – I

Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups.

UNIT – II

Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups. Properties of cyclic groups, classification of subgroups of cyclic groups.

Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group.

UNIT – III

Cosets, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem. External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

UNIT – IV

Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.

COURSE OUTCOMES

Students will be able to

- Understand and basic concepts of groups and elementary properties.
- To know about subgroups, centralizer, normalizar and cyclic groups.
- Understand the idea of cosets and their properties, Cauchy's theorem, Lagranges theorem.
- Understand Group homomorphisms and isomorphism theorems.

REFERENCE BOOKS

1. Joseph A. Gallian, Contemporary Abstract Algebra (4th Edition), Narosa Publishing House, New Delhi, 1999.(IX Edition 2010).
2. Joseph J. Rotman, An Introduction to the Theory of Groups (4th Edition), Springer Verlag, 1995.
3. I.N. Herstein, Abstract Algebra (3^{rd} Edition), Wiley Publication,1996.

Discipline Core Course (DCC)
B.Sc. (H) MATHEMATICS
SEMESTER III
CODE: BMH-303
SUBJECT NAME: **Multivariate Calculus**
NO OFCREDITS: 4

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

NOTE**:** Question paper will have two parts.Part-1 contains 10 questions each of 1.5 marks. It covers the entire syllabus. Part-2 has 6 questions each of 15 marks attempt any 4 questions out of these.

COURSE OBJECTIVE

The objective of this course to introduce functions of several variables to a student after he has taken a course in one variable calculus. The course will introduce partial derivatives and several of its consequences and will introduce double and triple integrals along with line integrals which are fundamental to all streams where calculus can be used.

UNIT – I
Functions of several variables, limit and continuity of functions of two variables. Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters, Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems

UNIT – II
Double integration over rectangular region, double integration over nonrectangular region. Double integrals in polar co-ordinates, Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical coordinates. Change of variables in double integrals and triple integrals.

UNIT – III
Directional derivatives, the gradient, maximal and normal property of the gradient, tangent planes. Definition of vector field, divergence and curl, Laplacian operator and its properties

UNIT - IV
Line integrals, Applications of line integrals: Mass and Work. Fundamental theorem for line integrals, conservative vector fields, independence of path. Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stokes' theorem, The Divergence theorem.

COURSE OUTCOMES

Students will be able to calculate

- partial derivatives, directional derivatives, extremum values
- double, triple and line integrals
- basic vector calculus problems including green's theorem, divergence theorem and Stokes theorem
- numerical computations involving several variables

REFERENCE BOOKS

1. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus (3rd Edition), Dorling Kindersley (India) Pvt.Ltd. (Pearson Education), Delhi, 2007.
2. E. Marsden, A. J. Tromba and A. Weinstein, *Basic multivariable calculus*, Springer (SIE), Indian reprint, 2005.
3. B. S. Grewal,Higher Engineering Mathematics, Khanna Publishers, 2010.
4. David B. Damiano ,Multivariable Calculus , Jones & Bartlett Learning, LLC, 2011.

Discipline Core Course (DCC)
B.Sc. (H) MATHEMATICS
SEMESTER III
CODE: BMH-304
SUBJECT NAME: **Multivariate Calculus (LAB)**
NO OFCREDITS: 4

			Internal Assessment:	15
L	T	P	End Semester:	35
0	0	4	Total:	50

Modeling of the following problems using MATLAB.

1. Draw different surfaces and find level curves at the given heights:
2. Draw different surfaces and discuss whether limit exits or not as approaches to the given points. Find the limit, if it exists
3. Discuss the limit of different functions when n tends to infinity
4. Discuss the limit of different functions when n tends to 0
5. Draw the tangent plane to different surfaces at the given point
6. Find critical points and identify relative maxima, relative minima or saddle points to given surfaces, if it exist
7. Illustrate the geometric meaning of Rolle's theorem for different functions on the given interval
8. Illustrate the geometric meaning of Lagrange's mean value theorem for different functions on the given interval
9. Verification of Maximum –Minimum theorem, boundedness theorem & intermediate value theorem for various functions and the failure of the conclusion in case of any of the hypothesis is weakened
10. Locating points of relative & absolute extremum for different functions
11. Relation of monotonicity & derivatives along with verification of first derivative test.

REFERENCE BOOKS

1. S. N. Alam, S. S. Alam,Understanding MATLAB: A Textbook for Beginners , 2013.
2. Pramote Dechaumphai, Calculus and Differential Equations with MATLAB , Narosa Publishing House,2016.
3. Rudra Pratap,Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers, 2016.
4. Stormy Attaway, Matlab: A Practical Introduction to Programming and Problem Solving, Elsevier,2018.

Skill Enhancement Course(SEC)
B.Sc. (H) MATHMATICS
SEMESTER III
CODE: SEC 301
SUBJECT NAME: Latex
NO. OF CREDITS – 2

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

NOTE: Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE

The aim of this paper is to familiarize students with the basics of LaTeX , using LaTeX for mathematical documentation, to draw and Plot Pictures and to set up beamer document and create presentations.

UNIT-I

Getting Started With Latex : Introduction to TeX and LaTeX, Creating and typesetting a simple LaTeX document, Adding basic information to documents, Environments, Footnotes, Sectioning, Displayed material.

UNIT-II

Mathematical Type setting : Accents and symbols; Mathematical typesetting (elementary and advanced): Subscript/ Superscript, Fractions, Roots, Ellipsis, Mathematical symbols, Arrays, Delimiters, Multiline formulas, Putting one thing above another, Spacing and changing style in math mode; Page Layout ;Titles, Abstract Chapters, Sections, References, Equation references, citation. List making environments Table of contents, Figure handling, numbering, List of figures, List of tables, Generating index.

UNIT-III

Graphics and PSTricks : Pictures and graphics in LaTeX, Simple pictures using PSTricks, Plotting of functions.

UNIT-IV

Getting Started with Beamer : Beamer, Frames, Setting up beamer document, Enhancing beamer presentation.

COURSE OUTCOMES

Students will be able to

- Create and Typeset a LaTeX document
- Typeset a mathematical document
- Draw pictures in LaTeX
- create Beamer Presentations

REFERENCE BOOKS

1. Dick Oliver, Teach Yourself HTML 4 in 24 Hours, Techmedia,2002.
2. Craig Zacker: 10 Minutes Guide to HTML, Style sheets, PHI ,1997.
3. Martin J. Erickson and Donald Bindner, A Student's Guide to the Study,Practice, and Tools of Modern Mathematics, CRC Press,2010.
4. Stefan Kottwitz, Latex Beginners Guide, Packt Publishing,2011.
5. Lamport, Leslie, LaTeX: A Document Preparation System, User's Guide and Reference Manual (2nd ed.). Pearson Education. Indian Reprint, 1994.

Skill Enhancement Course(SEC)
B.Sc. (H) MATHMATICS
SEMESTER III
CODE: SEC 302
SUBJECT NAME : French-I
NO. OF CREDITS – 2

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

Each lesson is divided into three parts whichconsist of Dialogue, Vocabulary and Grammar. There will be periodical test & written examination at the end of each semester. There will also be a viva-voice
Examination at the end of semester.
Students are expected to pass the viva-voice separately to qualify for the exam.

Description du materiel

1objectifscommunicatifs

- S'initiera'la culture francaise
- De'crire line personne
- Dire la nationalite'
- Parler des saisons
- Localizer des objects
- Demander l donner des goûts et des préférences

2Grammaire/ vocabulaire

- Les verbes en(er)
- Les pronomssujels
- Les articles definis
- Le corps humain
- Les verbes en(ir)
- Les articles inde'finis
- La negation
- Les verbes en (ger)
- Le fe'minim et le pluriel
- Les expressions avec faire
- Les (nombres) (1-100)
- Les prepositions
- L'interrogations
- Les verbs en (re) et irreguliers
- Les repasfrancais
- Les adjectifspossessifs
- De'crireuneville

REFERENCE BOOKS

1) APPRENONS LE FRANCAIS Methode de Francais by MahithaRanjit , Monica Singh

   b) LE NOUVEAU SANS FRONTIERESMethode de Francais by Philippe Domonique, Jacky Girardet.

2) Took reference from Bhartia VidyaBhawaninstitute of foreign languages.

Skill Enhancement Course(SEC)
B.Sc. (H) MATHMATICS
SEMESTER III
CODE: SEC 303
SUBJECT NAME : German-I
NO. OF CREDITS – 2

L T P
2 0 0

Internal Assessment: 25
End Semester: 75
Total: 100

UNIT-1	• Introduction • Basic Greetings in German
UNIT-2	• Counting 1-100 • Basic questions in German • Introduce yourself
UNIT-3	• Personal Pronouns • Verb conjugations (regular verbs)
UNIT-4	• Articles- der, die, das • Vocabulary (classroom objects with articles)
UNIT-5	• Days, months, seasons + im/am • Time (formal & informal) • Counting 1000+
UNIT-6	• Verb Conjugations (Irregular verbs) • Separable Verbs

REFERENCE BOOKS

1. Netzwerk A1 by Paul Rusch
2. Studio d A1 by Funk, Kuhn, Demme

Skill Enhancement Course(SEC)
B.Sc. (H) MATHMATICS
SEMESTER III
CODE:SEC-304
SUBJECT NAME: Elementary Statistical Techniques
NO. OF CREDITS – 2

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

NOTE**:** Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The objective of the course is to have an understanding the knowledge of probability, moments, different types of sampling, classical and repeated measures multivariate methods and computational techniques.

UNIT-I.

Types of data, Primary data, Secondary data, Cross-sectional data, time series data, failure data, industrial data, directional data. Notion of a statistical population: Finite population, infinite population, homogeneous population and heterogeneous population. Notion of sample, random sample and non-random sample. Methods of sampling (Description only): Simple random sampling with and without replacement (SRSWR and SRWOR) stratified random sampling, systematic sampling, cluster sampling and two-stage sampling.

UNIT -II.

Classification: Raw data and its classification, Discrete frequency distribution, Sturge's rule, continuous frequency distribution, inclusive and exclusive methods of classification, Open end classes, cumulative frequency distribution and relative frequency distribution. Graphical Presentation of Data: Histogram, frequency curve, frequency polygon, Ogive curves, stem and leaf chart. Check sheet, Parato diagram. Examples and Problems.

UNIT -III.

Concept of central tendency of statistical data: Statistical average, characteristics of a good statistical average. Arithmetic Mean (A.M.): Definition, effect of change of origin and scale, combined mean of a number of groups, merits and demerits, trimmed arithmetic mean, Mode: Definition, formula for computation (with derivation) graphical method of determination of mode, merits and demerits. Median: Definition, formula for computation (with derivation) graphical method of determination of median, merits and demerits. Empirical relation between mean, median and mode. Partition Values: Quartiles, Deciles and Percentiles.

UNIT -IV.

Concept of dispersion, characteristics of good measure of dispersion. Range: Definition, merits and demerits. Mean square deviation, Variance and standard deviation : Definition, merits and demerits, effect of change of origin and scale. Measures of dispersion for comparison: coefficient of range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation.

COURSE OUTCOMES

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

- analyze and develop the integrity, reasoning process in inferential statistics using the concept of probability.
- analyze and develop the integrity, meaning and mechanics of the hypothesis testing reasoning process in inferential statistics using the techniques of descriptive statistics.
- learn about concept of sampling.
- learn concept of central tendency of statistical data.

REFERENCE BOOKS

1. A.M. Goon, M.K. Gupta and Das Gupta: Fundamentals of Statistics, Vol. 1, The World Press Pvt. Ltd., Kolkata, 1966.
2. Mukhopadhyay, P. : Mathematical Statistics, New Central Book Agency, Calcutta,1996.
3. Introduction to Mathematical Statistics, Ed. 4 , MacMillan Publishing Co. New York, 1989.
4. Gupta and Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi, 1970.

Open Elective Course (OEC-3)
B.Sc. (H) MATHMATICS
SEMESTER III
CODE: OCSC 301
SUBJECT NAME: Computer Network & Internet Technology
NO. OF CREDITS – 4

L	T	P
4	0	0

Internal Assessment: 25
End Semester: 75
Total: 100

NOTE**:** Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

To understand basic computer network technology, different types of network topologies and to differentiate among various communication models. To familiarize the students with the basic concepts of internet, its history and ways to connect to internet and various fundamental features of world wide web like HTTP, TCP,IP protocols etc. To provide a detailed understanding of search engines and also familiarize him with the fundamental language of internet i.e. HTML & the concepts of cascading style sheets.

UNIT -I

Computer Networks: Uses of Computer Network, Network Hardware, Network Software, Goals and Applications of Computer networks, Structure of Computer Network: Point-to-point structure, Broadcasting structure.

UNIT -II

Types of Networks, Topologies. Reference Models: OSI Reference Model, TCP/IP reference Model, Comparison of OSI and TCP Reference Model. Data Communication: Transmission media, Wireless communication, and the Telephone system, Introduction to cellular radio and communication satellite, Data Rate of Channel, Electromagnetic spectrum.

UNIT-III

World Wide Web : Introduction, Miscellaneous Web Browser details, searching the www: Directories search engines and meta search engines, search fundamentals, search strategies, working of the search engines, Telnet and FTP, E Mail, Chat Servers, net meeting, video conferencing.

UNIT-IV

Hypertext markup language: The anatomy of an HTML document: Marking up for structure and style: basic page markup, absolute and relative links, ordered and unordered lists, embedding images and controlling appearance, table creation and use, frames, nesting and targeting.

COURSE OUTCOMES:

After the completion of the course, the student will be :

- Acquainted with the concepts of Computer Networks, Its topologies and various communication Models.
- Able to use internet terminologies like searching fundamentals and its types on internet, Telnet, Email, Chat Servers,FTP and Net Meeting etc. in order to solve problems.
- Able to develop a web page by using various tags and concepts of Hyper Text Markup Language.

REFERENCE BOOKS

1. Computer Networks (3rd edition), Tanenbaum Andrew S., International edition, 1996.
2. Forouzan, Data Communications and Networking, TMH, 4 th Edition, 2006.
3. William Stallings, Data and Computer Communications, PHI, 7 th Edition, 2003
4. Fundamentals of the Internet and the World Wide Web, Raymond Greenlaw and Ellen Hepp 2001, TMH
5. Internet &World Wide Programming, Deitel, Deitel& Nieto, 2000, Pearson Education
6. Data Communications, Computer Networks and Open Systems (4th edition), Halsall Fred,2000, Addison Wesley, Low Price Edition.

Open Elective Course (OEC-3)
B.Sc.(H) MATHMATICS
SEMESTER III
CODE: OPHY-301
SUBJECT NAME: Waves & Optics
NO. OF CREDITS – 4

L	T	P
4	0	0

Internal Assessment: 25
End Semester: 75
Total: 100

NOTE: Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The objective of the course is to have an understanding the of waves and optics which later on makes the foundation of spectroscopy.

UNIT-I

Superposition of Two Collinear Harmonic oscillations: Simple harmonic motion (SHM). Linearity and Superposition Principle.(1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).

Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures (1:1 and 1:2) and theiruses.

UNIT-II

Waves Motion- General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity.

Sound: Sound waves, production and properties. Intensity and loudness of sound. Decibels. Intensity levels,musical notes. musical scale. Acoustics of buildings (General idea).

UNIT-III

Wave Optics: Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle.

Interference: Interference: Division of amplitude and division of wave front. Young's Double Slit experiment. Lloyd's 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); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index.

Michelson's Interferometer: Construction and working. Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index, and Visibility offringes.

UNIT-IV

Diffraction: Fraunhofer diffraction- Single slit; Double Slit. Multiple slits and Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.

Polarization: Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.

COURSE OUTCOMES

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

- Understand the superposition of linear and perpendicular oscillations.
- Learn the basics of wave motion and SHM.
- Analyze interference phenomena in various systems.
- Know the phenomenon of Diffraction of light in various systems.

REFERENCE BOOKS

1. Fundamentals of Optics, F.A Jenkins and H.E White, McGraw-Hill, 1976.
2. Principles of Optics, B.K. Mathur, Gopal Printing, 1995.
3. Fundamentals of Optics,A. Kumar, H.R. Gulati and D.R. Khanna, R. Chand Publications, 2011.
4. University Physics.F.W. Sears, M.W. Zemansky and H.D. Young.13/e,1986.
5. Addison-Wesley Series.

Open Elective Course (OEC-3)
B.Sc.(H). MATHMATICS
SEMESTER III
CODE: OCHE-301
SUBJECT NAME: Organic Chemistry
NO. OF CREDITS – 4

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

NOTE**:** Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

To learn and understand the basic concepts Organic chemistry.

UNIT- I

Fundamental of organic chemistry

Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and perconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Reaction intermediates: Carbocations, Carbanions and free radicals. Electrophiles and nucleophiles Aromaticity: Benzenoids and Hückel's rule.

Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Intercon version of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (up to two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; *cis- trans*nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

UNIT- II

Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations physical property & chemical reactions) to be studied with mechanism in context to their structure.

Alkanes: *Preparation:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, Grignard reagent. *Reactions:* Free radical Substitution: Halogenation.

Alkenes: *Preparation:* Elimination reactions: Dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). *Reactions:* cis-addition (alk. KMnO4) andtrans-addition (bromine), Addition of HX (Markownikoff'sand anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Alkynes: *Preparation:* Acetylene from CaC2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. *Reactions:* formation of metal acetylides and acidity of alkynes, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alk. KMnO4. Hydration to form carbonyl compounds

UNIT- III

Aromatic hydrocarbons:*Preparation* (benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.
Reactions: (benzene): Electrophilic substitution reactions:nitration, halogenation sulphonation. Friedel-Craft's reaction (alkylation and acylation) Side chain oxidation of alkyl benzenes.

Alkyl Halides :*Preparation:* from alkenes *and* alcohols.
Reactions: Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions, hydrolysis, nitrite & nitro formation, nitrile &isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Aryl Halides: *Preparation:* (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer&Gattermann reactions.
Reactions (Chlorobenzene): Aromatic electrophilic and nucleophilic substitution (replacement by – OHgroup) and effect of nitro substituent. Benzyne Mechanism: KNH2/NH3 (or NaNH2/NH3).
Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards Nucleophilic substitution reactions. .

UNIT- IV

Alcohols: *Preparation:* Preparation of 1o, 2o and 3o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.
Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO4, acidic dichromate, conc. HNO3), factors affecting acidity, Oppeneauer oxidation
Diols: oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case) *Preparation:* Cumene hydroperoxide method from diazonium salts. *Reactions:* Electrophilic substitution: Nitration, halogenation and phonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction. acidity and factors affecting

Ethers (aliphatic and aromatic).Preparation : Williamson ether synthesis. **Reactions:** Cleavage of ethers with HI

Aldehydes and ketones (aliphatic and aromatic):*Preparation:* from acid chlorides and from nitriles.
Reactions – Nucleophilic addition, Nucleophilic addition – elimination reaction including Reaction with HCN, ROH, NaHSO3, NH2-G derivatives.Iodoform test.Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction.

COURSE OUTCOMES

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

- Understand the basic concept of organic chemistry.
- Understand stereochemistry of organic compunds
- Understand mechanisms of organic reactions.
- Understand the methods of preparation and reaction of different functional groups in organic chemistry.

REFERENCE BOOKS

1. T. W. Graham Solomons: *Organic Chemistry, John Wiley and Sons,2015*.
2. Peter Sykes: *A Guide Book to Mechanism in Organic Chemistry,* Orient Longman,2003.
3. I.L. Finar: *Organic Chemistry* (Vol. I & II), E. L. B. S,2002.
4. R. T. Morrison & R. N. Boyd: *Organic Chemistry*, Prentice Hall,2016.
5. Arun Bahl and B. S. Bahl: *Advanced Organic Chemistry,* S. Chand,2016.

Open Elective Course (OEC-3)
B.Sc.(H). MATHMATICS
SEMESTER III
Paper code: OCSC-302
SUBJECT NAME:: Computer Networks and Internet Technologies (LAB)
NO. OF CREDITS – 2

L	**T**	**P**
0	**0**	**4**

Internal Assessment: 15
End Semester: 35
Total: 50

Practical exercises based on concepts listed in theory using HTML.

1. Create HTML document with following formatting – Bold, Italics, Underline, Colors, Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes, Horizontal Line, Blinking text as well as marquee text.

2. Create HTML document with Ordered and Unordered lists, Inserting Images, Internal and External linking
3. Create HTML document with Table:

<table>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td colspan="2" rowspan="3">Some image here</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3"></td></tr>
</table>

4. Create Form with Input Type, Select and Text Area in HTML.
5. Create an HTML containing Roll No., student's name and Grades in a tabular form.
6. Create an HTML document (having two frames) which will appear as follows:

<table>
<tr><td>About
Department 1
Department 2
Department 3</td><td>This frame would show the contents according to the link clicked by the user on the left frame</td></tr>
</table>

7. Create an HTML document containing horizontal frames as follows:

<table>
<tr><td>Department Names (could be along with Logos)</td></tr>
<tr><td>Contents according to the Link clicked</td></tr>
</table>

8. Create a website of 6 – 7 pages with different effects as mentioned in above problems.

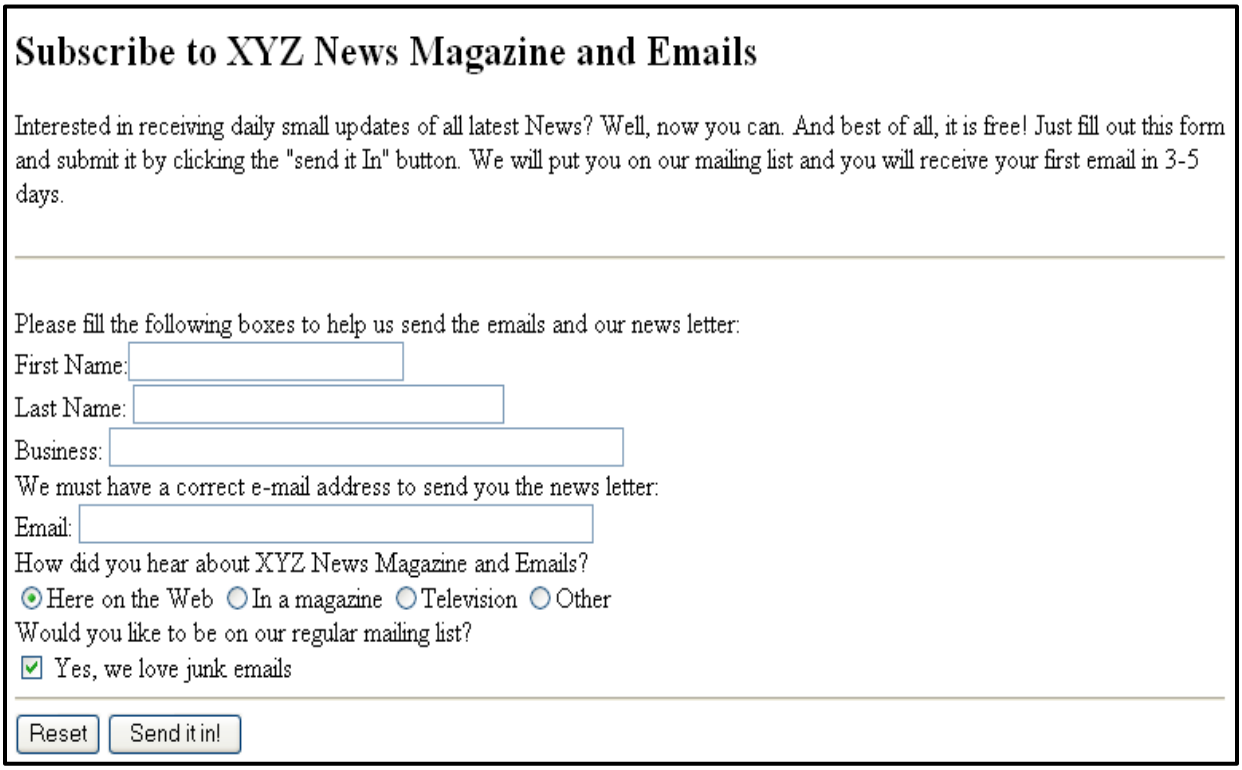
9. Create HTML documents (having multiple frames) in the following formats

Frame 1
Frame 2

Frame 1	
Frame 2	Frame 3

10. Create a form using HTML which has the following types of controls:

I. Text Box
II. Option/radio buttons
III. Check boxes
IV. IV. Reset and Submit buttons



List of Practicals using Javascript :

Create event driven program for following:

1. Print a table of numbers from 5 to 15 and their squares and cubes using alert.
2. Print the largest of three numbers.
3. Find the factorial of a number n.
4. Enter a list of positive numbers terminated by Zero. Find the sum and average of these numbers.
5. A person deposits Rs 1000 in a fixed account yielding 5% interest. Compute the amount in the account at the end of each year for n years.
6. Read n numbers. Count the number of negative numbers, positive numbers and zeros in the List.

Open Elective Course (OEC-3)
B.Sc.(H). MATHMATICS
SEMESTER III
CODE: OPHY-302
SUBJECT NAME: Waves & Optics (LAB)
NO. OF CREDITS – 2

L	T	P
0	0	4

Internal Assessment: 15
End Semester: 35
Total: 50

AT LEAST 05 EXPERIMENTS FROM THE FOLLOWING

1. To investigate the motion of coupled oscillators
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law.
3. To study Lissajous Figures
4. Familiarization with Schuster`s focussing; determination of angle of prism.
5. To determine the Refractive Index of the Material of a Prism using Sodium Light.
6. To determine Dispersive Power of the Material of a Prism using Mercury Light
7. To determine the value of Cauchy Constants.
8. To determine the Resolving Power of a Prism.
9. To determine wavelength of sodium light using Fresnel Biprism.
10. To determine wavelength of sodium light using Newton's Rings.
11. To determine the wavelength of Laser light using Diffraction of Single Slit.
12. To determine wavelength of (1) Sodium and (2) Spectral lines of the Mercury light using plane diffraction Grating
13. To determine the Resolving Power of a Plane Diffraction Grating.
14. To determine the wavelength of laser light using diffraction grating.

REFRENCE BOOKS

1. B.L.Flint and H.T.Worsnop ,Advanced Practical Physics for students,Asia Publishing House,1971.
2. Michael Nelson and Jon M. Ogborn ,Advanced level PhysicsPracticals, , 4th Edition, reprinted V Heinemann Educational Publishers, 1985.
3. Indu Prakash and Ramakrishna,A Text Book of Practical Physics, 11th Edition, Kitab Mahal, New Delhi, 2011.

Open Elective Course (OEC-3)
B.Sc(H). MATHMATICS
SEMESTER III
CODE: OCHE-302
SUBJECT NAME:Organic Chemistry (LAB)
NO. OF CREDITS – 2

L	T	P	Internal Assessment:	15
0	0	4	End Semester:	35
			Total:	50

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents:
   a. Water
   b. Alcohol
   c.Alcohol Water
3. Determination of the melting points of unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)
6. 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)
7. Detection of extra elements
8. Organic Preparations
   (i) Bromination of acetanilide / aniline / phenol
   (ii) Nitration of nitrobenzene / toluene.

REFERENCE BOOKS

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)

Syllabus of B.Sc. (Hons.) Mathematics

Semester IV

Discipline Core Course(DCC)
B.Sc. (H) MATHEMATICS
SEMESTER IV
CODE: BMH 401
SUBJECT NAME: Analytic Geometry
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE
The course will develop understanding and knowledge of Conics, Sphere, Cylinder, Central conicoids and Paraboloids.

UNIT – I
General equation of second degree. Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic. System of conics. Confocal conics. Polar equation of a conic, tangent and normal to the conic.

UNIT – II
Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, radical plane of two spheres. Co-axial system of spheres .Cones: Right circular cone, enveloping cone and reciprocal cone. Cylinder: Right circular cylinder and enveloping cylinder.

UNIT – III
Central Conicoids: Equation of tangent plane. Director sphere. Normal to the conicoids. Polar plane of a point. Enveloping cone of a coincoid. Enveloping cylinder of a coincoid.

UNIT – IV
Paraboloids: Circular section, Plane sections of conicoids. Generating lines. Confocal conicoid. Reduction of second degree equations

COURSE OUTCOMES
Students will have the knowledge of

- Equation of second degree and conics.
- Sphere, cones and cylinder.
- Central conicoids, enveloping cone of a conicoid and enveloping cylinder of a conicoid.
- Paraboloids and generating lines.

REFERENCE BOOKS

1. R.J.T. Bill, Elementary Treatise on Coordinary Geometry of Three Dimensions, MacMillan India Ltd. 1994.
2. P.K. Jain and Khalil Ahmad : A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. ,1999.

Discipline Core Course(DCC)
B.Sc. (H) MATHEMATICS
SEMESTER IV
CODE: BMH 402
SUBJECT NAME: Ring Theory & Linear Algebra
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE**:** Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE
The course will develop understanding and knowledge of Ring, Field, Ideal, Ring Homomorphism, Vector Space and Linear Transformations.

UNIT – I
Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideals, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

UNIT – II
Ring Homomorphism, properties of ring Homomorphism, Isomorphism theorems I, II and III, field of quotients.

UNIT – III
Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

UNIT – IV
Matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

COURSE OUTCOMES
Students will have the knowledge of

- Rings, Subrings and Fields
- Ring Homomorphism and Isomorphism Theorems
- Vector Space and Quotient Space.
- Linear Transformation and properties.

REFERENCE BOOKS

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra* (4th Edition), Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. Joseph A. Gallian, *Contemporary Abstract Algebra* (4th Edition), Narosa Publishing House, New Delhi, 1999.
3. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra 2nd Ed., Prentice-Hall Of India Pvt. Limited, 1971 .

Discipline Core Course(DCC)
B.Sc. (H) MATHEMATICS
SEMESTER IV
CODE: BMH 403
SUBJECT NAME: Partial Differential Equations
NO OF CREDITS: 4

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
4 0 0	TOTAL: 100

NOTE**:** Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The main objectives of this course are to teach students to form and solve partial differential equations and use them in solving some physical problems

UNIT – I
Partial differential equations: Formation, order and degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, singular solution, General solution, Solution of Lagrange's linear equations, Charpit's general method of solution. Compatible systems of first order equations, Jacobi's method.

UNIT – II
Linear partial differential equations of second and higher orders, Linear and non-linear homogenous and non-homogenous equations with constant coefficients, Partial differential equation with variable coefficients reducible to equations with constant coefficients, their complimentary functions and particular Integrals, Equations reducible to linear equations with constant coefficients.

UNIT – III
Classification of linear partial differential equations of second order, Hyperbolic, parabolic and elliptic types, Reduction of second order linear partial differential equations to Canonical (Normal) forms and their solutions, Solution of linear hyperbolic equations, Monge's method for partial differential equations of second order.

UNIT – IV
Cauchy's problem for second order partial differential equations, Characteristic equations and characteristic curves of second order partial differential equation, Method of separation of variables: Solution of Laplace's equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system.

COURSE OUTCOMES

Students will be able to

- Formulate, classify and transform partial differential equations into canonical form
- Solve linear and non-linear partial differential equations using various methods and apply these methods in solving some physical problems
- To classify, hyperbolic, parabolic and elliptic types (linear partial differential equations of second) and reduction of Canonical (Normal) forms and their solutions.
- To solve Laplace's equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system .

REFERENCE BOOKS

1. D.A.Murray: Introductory Course on Differential Equations, Orient Longman, (India), 1967.
2. Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999.
3. Ian N.Sneddon: Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.
4. Frank Ayres: Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972.

Discipline Core Course (DCC)
B.Sc. (H) MATHEMATICS
SEMESTER IV
CODE: BMH 404
SUBJECT NAME: Partial Differential Equations (LAB)
NO OF CREDITS: 4

	INTERNAL ASSESSMENT: 15
L T P	END SEMESTER: 35
0 0 4	TOTAL: 50

Practical /Lab work to be performed in a Computer Lab:

Modelling of the following similar problems using Mathematica /MATLAB/ Maple/ Maxima etc.

1. Solution of Cauchy problem for first order PDE.
2. Write a program to solve non-linear PDE using Char pit's method.
3. Plotting the characteristics for the first order PDE.
4. Plot the integral surfaces of a given first order PDE with initial data.
5. Write a program to solve Lagrange's equation using Lagrange method.
6. Write a program to solve homogenous partial differential equation.
7. Write a program to solve the heat equation.
8. Write a program to solve the wave equation.

REFERENCE BOOKS

1. Jichun Li and Yi-Tung Chen, Computational partial differential equations using MATLAB , 2008.
2. Mathew P. Coleman, An introduction to partial differential equations with MATLAB ,2013.

Skill Enhancement Course(SEC)
B.Sc. (H) MATHEMATICS
SEMESTER IV
CODE: SEC 401
SUBJECT NAME: Seminar
NO OF CREDITS: 2

INTERNAL ASSESSMENT:	25
END SEMESTER:	75
TOTAL:	100

NOTE**:** Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

A student will be required to present two seminars , one during ongoing semester of 25 marks and other at the end of semester of 75 marks.
The evaluation of the semester end seminar will be done by a departmental committee consisting of three faculty members to be constituted by chairperson.

Skill Enhancement Course(SEC)
B.Sc. (H) MATHEMATICS
SEMESTER IV
CODE: SEC 402
SUBJECT NAME: French II
NO OF CREDITS: 2

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
2 0 0	TOTAL: 100

Each lesson is divided into three parts whichconsist of Dialogue, Vocabulary and Grammar. There will be periodical test & written examination at the end of each semester. There will also be a viva-voice examination at the end of semester.
Students are expected to pass the viva-voice separately to qualify for the exam.

Description du materiel

1 objectifs communicatifs

- S'initier a'la culture francaise
- Salut
- Parler dela quantite
- Decrire une personne
- Parler de la famille
- Decrire la journee
- Dire l'heure
- Parler des saisons
- Interroger sur/ Parler de la Sante

2 Grammaire/ vocabulaire

- Les verbes en(er, ir, re)
- La negation
- Les articles
- Les adverbes de quantite
- Le feminin et le pluriel des noms et des adjectifs
- La position des adjectifs
- L'infinitif apres un autre verb
- Les membres de la famille
- Les verbes pronominaux
- Les nombres cardinaux et ordinaux
- Les saisons, les jours de la semaine et les mois de l'annee
- Trois formes d'interrogation
- L'interrogation negative et (si)
- Les expressions avec (avoir)

- Les animaux
- Les couleurs

REFERENCE BOOKS

1. (a) APPRENONS LE FRANCAIS Methode de Francais by Mahitha Ranjit , Monica Singh

(b) LE NOUVEAU SANS FRONTIERES Methode de Francais by Philippe Domonique, Jacky Girardet

2) Took reference from Bhartia Vidya Bhawan institute of foreign languages.

.

Skill Enhancement Course(SEC)
B.Sc. (H) MATHEMATICS
SEMESTER IV
CODE: SEC 403
SUBJECT NAME: German II
NO OF CREDITS: 2

INTERNAL ASSESSMENT: 25
L T P — END SEMESTER: 75
2 0 0 — TOTAL: 100

UNIT-1	• Hobbies • Professions
UNIT-2	• Family • Possesive pronouns and articles
UNIT-3	• Nominative and Accusative case • Definite and indefinite articles in German
UNIT-4	• Articles- der, die, das • Vocabulary (classroom objects with articles)
UNIT-5	• Modal Verbs • Imperative
UNIT-6	• W-questions • Introduction

REFERENCE BOOKS

1. Netzwerk A1 by Paul Rusch
2. Studio d A1 by Funk, Kuhn, Demme

Both the books are used at Goethe Institut (Max Mueller Bhavan), New Delhi for teaching German as a foreign language.

Skill Enhancement Course(SEC)
B.Sc. MATHMATICS
SEMESTER IV
CODE: SEC-404
SUBJECT NAME: Basics of Operating System
NO. OF CREDITS – 2

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
2 0 0	TOTAL: 100

Note: Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE

The course will develop understanding of the basic concepts and functions of operating systems, structure and functions of OS.

UNIT -I
Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT- II
Processes-Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Windows 7 – Thread and SMP Management. Process Synchronization – Critical Section Problem, Mutex Locks, Semophores, Monitors; CPU Scheduling and Deadlocks.

UNIT- III
Main Memory-Contiguous Memory Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT- IV
Linux System- Basic Concepts;System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen,VMware on Linux Host and Adding Guest OS.

COURSE OUTCOMES

Students will be able to

- learn about Processes, Threads and Scheduling algorithms.
- understand the principles of concurrency and Deadlocks.
- learn various memory management schemes.
- learn the basics of Linux system and perform administrative tasks on Linux Servers.

REFERENCE BOOKS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.
2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.

Open Elective Course (OEC-4)
B.Sc. (H) MATHEMATICS
SEMESTER IV
CODE: OCSC-401
SUBJECT NAME: Information Security
NO. OF CREDITS: 4

L	T	P	INTERNAL ASSESSMENT:	25
			END SEMESTER:	75
4	0	0	TOTAL:	100

Note:Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE

- Learn the fundamentals of Information Security
- To understand various types of cryptographic techniques and ciphers
- To gain an insight of various security threats in network and email in particular.
- To become familiar with the security aspects needed in management and get acquainted with the recent trends and challenges of information security.

UNIT I: Information Security Basics

Introduction to Information Security: Attacks, Vulnerability, Security Goals, Security Services and mechanisms. Classification of Attacks, Introduction to "What is Infosphere", Difference between Information Security, Computer Security and Cyber Security.

Unit II: Conventional Cryptographic Techniques

Conventional substitution and transposition ciphers, One-time Pad, Block cipher and Stream Cipher**;** Symmetric and Asymmetric Cryptographic Techniques: DES, RSA algorithms, Authentication and Digital Signatures: Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos.

Unit III: Security in Networks

Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP,S/MIME.

Unit IV: Information Security in Management

System Administration policies, Security audit, Penetration testing and ethical hacking, Mandatory Access control, Discretionary Access Control, Monitoring and logging tools, Legal aspects. Current trends and challenges in Information Security.

COURSE OUTCOMES

After the successful completion of the course, the student will be able to :

- Understand the basics of Information Security
- Become acquainted with various types of cryptographic techniques and ciphers
- Have an insight of various security threats in network and email in particular.
- Become familiar with the security aspects needed in management and get acquainted with the recent trends and challenges of information security.

REFERENCE BOOKS

1. William Stalling, Cryptography and Network Security, 3rd Edition,PHI New Delhi,2018.
2. William Stalling, Network Security Essentials, 2nd Edition,PHI New Delhi,2017.
3. Charles P. Pfleeger, Security in computing, 4th Edition Pearson,New Delhi,2018.

Open Elective Course (OEC-4)
B.Sc.(H) MATHMATICS
SEMESTER IV
CODE:OPHY-401
SUBJECT NAME: Nuclear and Particle Physics
NO. OF CREDITS – 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

Note:Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE

The objective of the course is to make students to understand the of basic interactions in nature and the fundamental constituent particles of the universe.

UNIT-I

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

UNIT-II

Radioactivity decay: (a) Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) -decay: energy kinematics for -decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission and kinematics, internal conversion.

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound & direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering).

UNIT-III

Interaction of Nuclear Radiation with matter: Energy loss due to ionization (Bethe- Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.

Detector for Nuclear Radiations: Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube. Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector.

UNIT-IV

Particle Accelerators: Accelerator facility available in India:Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model.

COURSE OUTCOMES

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

- Understand the basic nuclear properties and the basic nuclear models.
- Learn the radioactivity process and nuclear reactions and fission, fusion processes..
- .Learn how nuclear radiations interact with matter.
- Learn how nuclear radiations are detected physics of various detectors
- Know the basic nuclear particle's conservation laws and quark model.

REFERENCE BOOKS

1. Introductory nuclear Physics by Kenneth S.Krane ,Wiley India Pvt. Ltd., 2008.
2. Concepts of nuclear physics by Bernard L.Cohen,Tata Mcgraw Hill,1998.
3. Introduction to the physics of nuclei &particles, R.A.Dunlap, Thomson Asia, 2004.
4. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons,2008.
5. Radiation detection and measurement, G.F. Knoll ,John Wiley & Sons, 2000.

Open Elective Course (OEC-4)
B.Sc.(H) MATHMATICS
SEMESTER IV
CODE: OCSC 402
SUBJECT NAME: Information Security (LAB)
NO. OF CREDITS – 2

INTERNAL ASSESSMENT: 15
L T P END SEMESTER: 35
0 0 4 TOTAL: 50

S.NO	Name of the Practical
1	Implement Caesar Cipher in 'C'
2	Implement Playfair Cipher with Key enetered by User in 'C'
3	Implement Polyalphabetic Cipher in 'C'
4	Implement simple Columnar Transposition Technique in 'C'
5	Implement Simple RSA Algorithm with small numbers in 'C'
6	Implement Simplified DES in 'C'
7	Generration of keys in DES Algorithm in 'C'
8	Implement Vignere cipher in 'C'
9	Implement Hill Cipher in 'C'
10	Implement Vernam Cipher in 'C'
11	Implementation of Cryptoanalysis of Monoalphabetic Cipher in 'C'
12	Implementation of Cryptoanalysis of Polyalphabetic Cipher in 'C'

Syllabus of B.Sc. (Hons.) Mathematics

Semester V

Discipline Core Course(DCC)
B.Sc. (H) MATHEMATICS
SEMESTER V
CODE: BMH 501
SUBJECT NAME: Statics
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE**:** Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVES

The aim of the course is to familiarize students with the concept of composition and resolution of forces, equilibrium of forces and its stability. The course will introduce idea about centre of gravity for different configurations and also introduce idea about virtual work and forces in three dimensions.

UNIT – I
Composition and resolution of forces, Parallelogram of forces, Triangle of forces, Polygon of forces, Graphical construction, Parallel forces and resultant of two parallel forces acting upon a rigid body, Moments and Couples.

UNIT – II
Analytical conditions of equilibrium of coplanar forces (equilibrium of a rigid body acted upon by three forces in a plane, equilibrium of a rigid body acted on by a system of forces in one plane), Friction (laws of friction, equilibrium on a rough inclined plane, machines with friction)

UNIT –III
Centre of Gravity (centre of gravity of a triangle, a tetrahedron etc.), General formula for determination of the centre of gravity, Virtual work. Forces in three dimensions.

UNIT –IV
Poinsot's central axis, Wrenches. Null lines and planes, Stable and unstable equilibrium for different cases like (i) portions of two bodies in contact are spherical (ii) one surface is concave and other is convex (iii) either of one is plane

COURSE OUTCOMES

Students will be able to

- learn about forces, moments and couples
- understand equilibrium of forces, stability of equilibrium, laws of friction
- describe center of gravity, virtual work, forces in 3D etc.
- learn about Poinsot axis, wrenches, null lines and planes

REFERENCE BOOKS

1. S.L. Loney : Statics, Macmillan Company, London, 2002.
2. R.S. Verma : A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.
3. Dr. J. K. Goyal & K. P. Gupta ,Statics , Krishna Prakashan Media P. Ltd., 2002.
4. Andrew Pytel & Jaan Kiusalaas ,Engineering Mechanics: Statics , Lib Wright Publisher,2016.

Discipline Core Course (DCC)
B.Sc. (H) MATHEMATICS
SEMESTER V
CODE: BMH 502
SUBJECT NAME: Numerical Methods
NO OF CREDITS: 4

L	T	P	INTERNAL ASSESSMENT:	25
4	0	0	END SEMESTER:	75
			TOTAL:	100

NOTE**:** Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE

The main objective of this course is to give the solutions of applied problems and it helps students to have an in-depth knowledge of various advanced methods in numerical analysis.

UNIT-I

Finite Differences And Interpolation:

Various difference operators and relation between them ,Newton‘s forward and backward interpolation formulae. Central difference interpolation formula. Gauss forward and backward interpolation formulae. Langrage’s interpolation formula and Newton‘s divided difference formulae.

UNIT-II

Solution of Algebraic And Transcendental Equations: Bisection method, method of false position, secant method, iteration method, Newton's Raphson method.

UNIT-III

Solutions of Simultaneous Algebraic Equations: Jacobi's method, Gauss-Seidal method, Gauss Elimination mehod ,Gauss-Jorden method , LUD Decomposition.

UNIT-IV

Numerical Differentiation And Integration: Formula for derivatives, Newton’s forward interpolation formula, Newton’s backward difference formula, striling’s formula, Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

COURSE OUTCOMES

On successful complete of this course, the students should be able to:

- Understand about Newton‘s interpolation ,Central difference interpolation formula , Gauss interpolation formulae, Langrage’s interpolation formula and Newton‘s divided difference formulae.
- Understand about the solution of algebraic and transcendental equations
- Understand about the solution of simultaneous algebraic equations
- Understand about the solution of Trapezoidal rule, Simpson's 1/3rd and 3/8th rules.

REFERENCE BOOKS

1. B.S. Grewal ,Numerical Methods in Engg. & Science, khanna Publications,eleventh edition, 2013.
2. M.K. Jain, S.R.K. Iyenger and R.K. Jain, Numerical Methods for Scientific and Engg. Computations,Wiley Eastern Ltd .
3. C.E.Froberg; Introduction to Numerical Analysis Addison Wesly publication company,1970.
4. S.S Shastri ,Introduction Methods of Numerical Analysis ,PHI learning pvt limited .

Discipline Core Course(DCC)
B.Sc. (H) MATHEMATICS
SEMESTER V
CODE: BMH 503
SUBJECT NAME: Numerical Methods (LAB)
NO OF CREDITS: 4

L	T	P	INTERNAL ASSESSMENT:	15
			END SEMESTER:	35
0	0	4	TOTAL:	50

PRACTICALS:

1. Write a program for Newton‘s forward interpolation formulae
2. Write a program for Newton‘s backward interpolation formulae
3. Write a program for Gauss forward interpolation formulae.
4. Write a program for Gauss backward interpolation formulae.
5. Write program for Langrage’s interpolation formula
6. W.A.P for Newton‘s divided difference formulae
7. W.A.P to solve the equation using Bisection method
8. W.A.P to solve the equation using method of false position
9. W.A.P to solve the equation using secant method
10. W.A.P to solve the equation using iteration method
11. W.A.P to solve the equation using Newton's Raphson method
12. W.A.P to find the solutions of Simultaneous Algebric Equations using Jacobi's method,
13. W.A.P to find the solutions of Simultaneous Algebric Equations using Gauss-Seidal method.
14. W.A.P to evaluate the integral using Trapezoidal rule,
15. W.A.P to evaluate the integral Simpson's $1/3^{rd}$
16. W.A.P to evaluate the integral using Simpson’s $3/8^{th}$ rules

Discipline Elective Course(DEC)
B.Sc. (H) MATHEMATICS
SEMESTER V
CODE: DEMH 501
SUBJECT NAME: Discrete Mathematics
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE: Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVE
The course will develop understanding and knowledge of ordered sets, Recurrence relations, Propositions, Logical operators and Lattices.

UNIT – I
Definition, examples and basic properties of ordered sets, maps between ordered sets, Mappings, Composition of Mappings, Countability of sets, Partially ordered sets, Hasse diagram, Isomorphic ordered sets, Principle of Mathematical Induction.

UNIT – II
Recurrence Relations, Explicit formula for a sequence, solution of Recurrence Relations, Homogeneous Recurrence Relations with constant coefficients, Particular solution of a Difference Equation, Recurssive functions, generating functions, Convolution of Numeric functions, Solution of Recurrence Relation by the method of Generating functions.

UNIT – III
Propositions, Basic Logical Operations, Logical Equivalence involving Tautologies and Contradictions, conditional propositions, Quantifier.

UNIT – IV
Lattice, Properties of lattice, lattice as algebraic system, lattice isomorphism, Bounded, complemented and distributive lattice.

COURSE OUTCOMES
Students will have the knowledge of
- Ordered sets and Partial Ordered Sets
- Recurrence relations Numeric Functions.
- Proposiions and Quantifiers.
- Lattices and properties of lattices.

REFERENCE BOOKS

1. B A. Davey and H. A. Priestley, *Introduction to Lattices and Order,* Cambridge University Press, Cambridge, 1990.
2. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory* (2nd Edition), Pearson Education (Singapore) Pte. Ltd., Indian Reprint 2003.
3. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra* (2nd Edition), Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Discipline Elective Course(DEC)
B.Sc. (H). MATHEMATICS
SEMESTER V
CODE: DEMH 502
SUBJECT NAME: Mathematical Modelling
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE**:** Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The aim of the course is to familiarize students with the concept of Differential Equations and using them in making Mathematical Model which is an abstract, simplified, mathematical construct related to a part of reality and created for a particular purpose. .

UNIT – I

Simple situations requiring mathematical modeling, techniques of mathematical modeling, Classifications, Characteristics and limitations of mathematical models, Some simple illustrations.

UNIT - II

Mathematical modeling through differential equations, linear growth and decay models, Non linear growth and decay models, Compartment models, Mathematical modeling in dynamics through ordinary differential equations of first order.

UNIT - III

Mathematical models through difference equations, some simple models, Basic theory of linear difference equations with constant coefficients, Mathematical modeling through difference equations in economic, finance, population dynamics and genetics.

UNIT - IV

Situations that can be modeled through graphs. Mathematical models in terms of Directed graphs, in terms of signed graphs and in terms of weighted digraphs. Mathematical modeling through linear programming.

COURSE OUTCOMES

Students will be able to

- describe the concept of Differential Equations
- construction of Mathematical models through difference equations
- construction of Mathematical models through different graphs
- construction of mathematical models through linear programming

REFERENCE BOOKS

1. J. N. Kapur, Mathematical Modeling, New age international publishers, 2015.
2. F. Charlton, Ordinary Differential and Difference Equations, Van Nostrand, 1965.
3. Tyn Myint-U and Lokenath Debnath, Linear Partial Differential Equation for Scientists and Engineers, Springer, Indian reprint, 2006.
4. Frank R. Giordano, Maurice D. Weir and William P. Fox, A First Course in Mathematical Modeling, Thomson Learning, London and New York, 2003.

Discipline Elective Course(DEC)
B.Sc. (H) MATHEMATICS
SEMESTER V
CODE: DEMH 503
SUBJECT NAME: Special Functions And Integral Transform
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE: Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The aim of the course is to familiarize students with the concept of Laplace Transform, Fourier Transform, Bessel functions, Legendre Polynomials and use them in solving Ordinary Differential Equations.

UNIT – I

Series solution of differential equations – Power series method, Bessel equation and its solution: Bessel functions and their properties-Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions, Integral representation of Bessel functions..

UNIT – II

Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions. Orhogonality of Legendre and Hermite polynomials. Rodrigues' Formula for Legendre & Hermite Polynomials, Laplace Integral Representation of Legendre polynomial.

UNIT – III

Laplace Transforms – Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using Laplace transforms.

UNIT – IV

Fourier transforms: Linearity property, Shifting, Modulation, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Convolution Theorem, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms.

COURSE OUTCOMES

Students will be able to

- describe the concept of Bessel functions and Legendre Polynomials.
- solve ODE using Laplace Transform.
- describe the concept of Fourier Transforms.
- solve ODE using Fourier Transform.

REFERENCE BOOKS

1. Lokenath Debnath and Dambaru Bhatta. Integral transforms and their applications, Taylor and Francis group, 2015.

2. Erwin Kreyszig : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999.

3. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd, 2005.

4. I.N. Sneddon : Special Functions on mathematics, Physics & Chemistry,1966.

5. W.W. Bell : Special Functions for Scientists & Engineers, 2004.

6. I.N. Sneddon: the use of integral transform, McGraw Hill, 1972 .

7. Murray R. Spiegel: Laplace transform, Schaum's Series,1965.

Discipline Elective Course(DEC)
B.Sc. (H) MATHEMATICS
SEMESTER V
CODE: DEMH 504
SUBJECT NAME: Application Of Algebra And Graph Theory
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE**:** Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The aim of the course is to familiarize students with the concept of Graph Theory and make them understand different concepts of matrices and apply them in Image Processing and Statistics.

UNIT –I

Special types of matrices: idempotent, nilpotent, involution, and projection tri diagonal matrices, circulant matrices, Vandermonde matrices, Hadamard matrices, permutation and doubly stochastic matrices. Frobenius- König theorem, Birkhoff theorem. Positive Semi-definite matrices: positive semi-definite matrices, square root of a positive semi-definite matrix, a pair of positive semi-definite matrices, and their simultaneous diagonalization.

UNIT –II

Symmetric matrices : diagonalization of symmetric matrices, quadratic forms, constrained optimization, singular value decomposition, and applications to image processing and Statistics.

UNIT – III

Graph Theory Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bi-partite graphs, isomorphism of graphs, paths and circuits, Eulerian circuits, Hamiltonian cycles, the adjacency matrix, weighted graph, travelling salesman's problem, shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm.

UNIT –IV

Directed Graphs, Trees, Isomorphism of Trees, Representation of Algebraic Expressions by Binary Trees, Spanning Tree of a Graph, Shortest Path Problem, Minimal spanning Trees, Cut Sets and Tree Searching.

COURSE OUTCOMES

Students will be able to

- Describe the concept of Graph Theory
- Understand Different Type of Matrices
- Learn about trees.
- Learn Application of Matrices

REFERENCE BOOKS

1. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 2nd Edition, Pearson Education (Singapore) P. Ltd., Indian Reprint 2003.
2. David C. Lay, Linear Algebra and its Applications. 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. C.L. Liu, Elements of Discrete Mathematics: A computer oriented approach, McGraw-Hilll Book Co. 5,2017.
4. Babu Ram, Discrete Mathematics, Vinayak Publishers and Distributors, Delhi, 2004.
5. J.P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997.

Syllabus of B.Sc. (Hons.) Mathematics

Semester VI

Discipline Core Course(DCC)
B.Sc. (H) MATHEMATICS
SEMESTER VI
CODE: BMH 601
SUBJECT NAME: Complex Analysis
NO OF CREDITS: 4

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
4 0 0	TOTAL: 100

NOTE: Question paper has two parts. Part I has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any 4 questions out of 6 from part II.

COURSE OBJECTIVES

The main objective of this course is to introduce the basic theory of complex numbers and some applications. The aim of the course is to teach the principal techniques and methods of analytic function theory.

UNIT-I

Complex number system, Algebraic properties, Geometric interpretation, Properties of moduli, Regions in complex plane, Functions of complex variable, Limit, continuity and derivatives.

UNIT-II

Analytic functions, Cauchy-Riemann equations, sufficient conditions for differentiability, polar conditions, Harmonic functions, Construction of analytic function, exponential function, logarithmic function, trignometric functions, Line integral.

UNIT-III

Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals, Cauchy Goursat theorem, Cauchy integral formula, Derivatives of analytic function, Liouville's theorem and the Fundamental theorem of calculus in the complex plane.

UNIT-IV

Taylor's and Laurent series, Absolute and uniform convergence of power series, Zeros of analytic function, Residues, Residue at poles, Residue theorem, Evaluation of Integrals involving sine and cosine series.

COURSE OUTCOMES

Students will have the knowledge of

- Complex numbers and its properties, Limit, Continuity and Derivatives.
- Analytic functions and Cauchy Riemann equations in Cartesian and polar coordinates
- Theorems of complex analysis
- Taylors series, Laurent series, Power series and Residue.

REFERENCE BOOKS

1. R.V. Churchill and J W Brown: Complex Variable & Applications. McGraw Hill, International Book Company, London., 2009.
2. Ponnuswamy: An Introduction to Complex Analysis, Narosa Publication, 2011.
3. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford, 1990.
4. B. Conway, Functions of one Complex variable, Springer-Verlag, International student-Edition, Narosa Publishing House, 1980.

Discipline Core Course(DCC)
B.Sc. (H) MATHEMATICS
SEMESTER VI
CODE: BMH 602
SUBJECT NAME: Riemann Integral And Metric Space
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE**:** Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

To understand the integration of bounded functions on a closed and bounded interval and its extension to the cases where either the interval of integration is infinite, or the integrand has infinite limits at a finite number of points on the interval of integration. Also, the course aims at providing the basic knowledge pertaining to metric spaces such as open and closed balls, neighbourhood, interior, closure, subspace, continuity.

UNIT-I

Definition of Riemann integration, Inequalities for upper and lower Darboux sums, Necessary and sufficient conditions for the Riemann integrability, Definition of Riemann integration by Riemann sum and equivalence of the two definitions, Riemann integrability of monotone functions and continuous functions, Properties of Riemann integrable functions.

UNIT-II

Definitions of piecewise continuous and piecewise monotone functions and their Riemann integrability, intermediate value theorem for integrals, Fundamental theorems (I and II) of calculus and the integration by parts, improper integrals of Type-I, Type-II and mixed type, Convergence of Beta and Gamma functions, and their properties.

UNIT-III

Metric spaces**:** Definition and examples, Sequences in metric spaces, Cauchy sequences, Complete metric space, Open and closed ball, Neighbourhood, Open set, Interior of a set, limit point of a set, derived set, closed set, closure of a set, Subspaces, Dense set.

UNIT-IV

Continuous mappings, Sequential criterion and other characterizations of continuity, Uniform continuity, Homeomorphism, Contraction mapping, Banach fixed point theorem.

COURSE OUTCOMES

Students will be able to

- Some of the families and properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.
- The valid situations for the inter-changeability of differentiability and inerrability with infinite sum, and approximation of transcendental functions in terms of power series
- Understand the basic concepts of metric spaces;
- Appreciate the abstractness of the concepts such as open balls, closed balls, compactness, connectedness etc. beyond their geometrical imaginations.

REFERENCE BOOKS

1. Bartle, Robert G. &Sherbert, Donald R., *Introduction to Real Analysis*,4th ed., Wiley India, Edition. Delhi,2015.
2. Shirali, Satish&Vasudeva, H. L., *Metric Spaces*, Springer, First Indian Print,2009.
3. Simmons, George F., *Introduction to Topology and Modern Analysis*, McGraw-Hill Education. New Delhi,2004.
4. S.C. Malik and Savita Arora, *Mathematical Analysis*, New age Publications, 2009.

Discipline Core Course(DCC)
B.Sc. (H) MATHEMATICS
SEMESTER VI
CODE: BMH 603
SUBJECT NAME: Complex Analysis(LAB)
NO OF CREDITS: 2

	INTERNAL ASSESSMENT: 15
L T P	END SEMESTER: 35
0 0 4	TOTAL: 50

LAB WORK TO BE PERFORMED ON A COMPUTER (MODELING OF THE FOLLOWING PROBLEMS USING MATLAB)

1. Declaring a complex number and graphical representation.
2. Program to discuss the algebra of complex numbers.
3. To find conjugate, modulus and phase angle of an array of complex numbers.
4. To compute the integral over a straight line path between the two specified end points.
5. To perform contour integration, e.g.,
   (i) where C is the Contour given by x = y^2 +1; .
   (ii) where C is the contour given by , which can be parameterized by x = cos (t), y = sin(t).
6. To plot the complex functions and analyze the graph, e.g.,
   (i) f(z) = z (ii) f(z)= z^4etc.
7. To perform the Taylor series expansion of a given function f(z) around a given point z. The number of terms that should be used in the Taylor series expansion is given for each function. Hence plot the magnitude of the function and magnitude of its Taylors series expansion. e.g. (i) f(z) = exp(z) around z = 0, n =40. (ii) f(z)=exp(z^2) around z = 0,
8. To determines how many terms should be used in the Taylor series expansion of a given function f(z) around z = 0 for a specific value of z to get a percentage error of less than 5 % e.g., For f(z) = exp(z) around z =0, execute and determine the number of necessary terms to get a percentage error of less than 5 % for the following values of z: z = 30 + 30 i
9. To perform Laurent's series expansion of a given function f(z) around a given point z. e.g., (i) f(z)= (sin z -1)/ z^4 around z = 0 (ii) f(z) = cot (z)/z4 around z = 0.
10. To compute the poles and corresponding residues of complex functions.

Discipline Elective Course(DEC)
B.Sc. (H) MATHEMATICS
SEMESTER VI
CODE: DEMH 601
SUBJECT NAME: Financial Mathematics
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE**:** Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The aim of the course is to familiarize students with the mathematical properties and relations between concepts and elements related to the structure of financial and currency markets in inflation processes analysis, investment and other economic activities.

UNIT – I

Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete and continuous), Interest rates, Present value analysis, Rate of return, continuously varying interest rates

UNIT - II

Time value of money, inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson methods), comparison of NPV and IRR. Bonds, bond prices and yields, Macaulay and modified duration, term structure of interest rates: spot and forward rates, explanations of term structure, running present value, floating-rate bonds, immunization, convexity, putable and callable bonds.

UNIT - III

Asset return, short selling, portfolio return, (brief introduction to expectation, variance, covariance and correlation), random returns, portfolio mean return and variance, diversification, portfolio diagram, feasible set, Markowitz model (review of Lagrange multipliers for 1 and 2 constraints), Two fund theorem, risk free assets, One fund theorem, capital market line, Sharpe index. Capital Asset Pricing Model (CAPM), betas of stocks and portfolios, security market line, use of CAPM in investment analysis and as a pricing formula, Jensen's index.

UNIT - IV

Forwards and futures, marking to market, value of a forward/futures contract, replicating portfolios, futures on assets with known income or dividend yield, currency futures, hedging (short, long, cross, rolling), optimal hedge ratio, hedging with stock index futures, interest rate futures, swaps. Lognormal distribution, Lognormal model, Geometric Brownian Motion for stock prices

COURSE OUTCOMES

Students will be able to

- calculate simple and compound interest for discrete and continuous cases
- learn about time value of money, bond prices and yields
- describe asset return, short selling, portfolio return etc.
- work on Brownian Motion for stock prices

REFERENCE BOOKS

1. David G. Luenberger, Investment Science, Oxford University Press, Delhi, 1998.
2. John C. Hull, Options, Futures and Other Derivatives (6th Edition), Prentice-Hall India, Indian reprint, 2006.
3. Sheldon Ross, An Elementary Introduction to Mathematical Finance (2nd Edition), Cambridge University Press, USA, 2003.
4. Kevin J Hastings, Introduction to Financial Mathematics , CRC Press,2015.

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Discipline Elective Course(DEC)
B.Sc. (H) MATHEMATICS
SEMESTER VI
CODE: DEMH 602
SUBJECT NAME: Dynamics
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE: Question paper will have two parts. Part-A is compulsory and contains 10 questions each of 1.5 marks covering the entire syllabus. Part-B has 6 questions each of 15 marks and students are required to attempt any four questions from this part.

COURSE OBJECTIVE

The aim of the course is to familiarize students with the concept of Velocity, Acceleration, Motion of Particle. To teach the student Simple Harmonic Motion which is a Mathematical Model for a variety of motions, such as the oscillation of a spring.

UNIT-I

Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Periodicity, Amplitude, Phase, Geometrical Representation, Elastic strings, Hooke's Law, Work Done in Stretching an Elastic String, Heavy particle suspended by an elastic String, Simple Pendulum.

UNIT-II

Mass, Momentum and Force. Newton's laws of motion. Work, Power and Energy (Kinetic and Potential). Formula For Kinetic Energy. Conservation of Energy. Definitions and examples of Conservative forces and Impulsive forces.

UNIT-III

Motion on smooth curves. Projectile motion of a particle in a plane. Relative and angular velocity.

UNIT-IV

Rigid Body. Fundamental Principles, Kinetic Energy of a Rigid Body. General motion of a rigid body. Central Orbits, Law of Forces, Kepler's laws of planetary motion.

COURSE OUTCOMES

Students will be able to

- learn concepts of Velocity and Acceleration.
- describe the Motion of Particle
- learn about Harmonic Motion
- learn law of planetary motion

REFERENCE BOOKS

1. S.L.Loney : An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956.
2. F. Chorlton : Dynamics, CBS Publishers, New Delhi,1983.
3. A.S. Ramsey: Dynamics, Cambridge University Press,1932.
4. Dr. K.L. Kumar: Engineering Fluid Mechanics, S. Chand, 2010.

Discipline Elective Course(DEC)
B.Sc. (H) MATHEMATICS
SEMESTER VI
CODE: DEMH 603
SUBJECT NAME: Basics Of Statistics
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE**:**Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

COURSE OBJECTIVES
Course is designed to make students capable of using their knowledge in modern industry or teaching, or secure acceptance in high-quality programs/jobs in mathematics and other fields. To formulate and analyze mathematical and statistical problems, precisely define the key terms, and draw clear and reasonable conclusions. The course will help students understand the basic statistical terms, concept of correlation and regression, use of various distributions.

UNIT – I
Measurement of Central Tendency and variation: Mean, Median and Mode, Mean Deviation , Standard Deviation, Variance, Coefficient of Variation.

UNIT – II
Correlation Analysis: meaning, significance ,types and methods, Regression Analysis: meaning equations and lines, Difference between correlation and regression.

UNIT - III
Probability: Definition and various approaches of probability, addition theorem, multiplication theorem and Conditional probability, Independent events, Mutual and pair wise independence of events, Baye's theorem and its applications.

UNIT – IV
Discrete Distributions: Uniform distribution, Bernoulli distribution, Binomial Distribution, and Poisson Distribution, with their properties.
Continuous Distributions: Normal Distribution, Area under Normal Probability Curve. Importance of normal distribution.

COURSE OUTCOMES

After completion of course, students will be able to:

• Formulate and analyze mathematical and statistical problems based on central tendency

• Use statistical methods to solve well-defined problems based on correlation and regression.

• Learn about concept of probability and theorems based on it.

• Acquire mathematical and statistical knowledge of various distributions like binomial, poisson and normal.

REFERENCE BOOKS

1. Baisnab and Jas,M., Element of Probability and statistics, Tata McGraw Hill,2000..

2. Freund,J.E., Mathematical Statistics, Prentice Hall of India.

3. Hogg,R.V. and Craig,A.T., Introduction to Mathematical Statistics, MawellMcmillian,1978.

4. Gupta, S.C., Mathematical Statistics, Himalayan Publications.

5. Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics, S. Chand Pub., New Delhi.,1970.

6. Speigel, M., Probability and Statistics, Schaum Outline Series,1975.

7. S.P.Gupta, Statistical Methods S.Chand&Co., New Delhi ,2007.

Discipline Elective Course(DEC)
B.Sc. (H) MATHEMATICS
SEMESTER VI
CODE: DEMH 604
SUBJECT NAME: Number Theory
NO OF CREDITS: 6

	INTERNAL ASSESSMENT: 25
L T P	END SEMESTER: 75
5 1 0	TOTAL: 100

NOTE**:** Question paper has two parts. Part-1 has 10 questions each of 1.5 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2

COURSE OBJECTIVES
The course will develop understanding and knowledge of Congruence, Linear Diophantine equation and various theorems, Dirichlet product, Euler's phi function and Euler's criterion and theorems. Quadratic congruence.

UNIT – I
Divisibility, G.C.D(Greatest Common Divisors), L.C.M(least common multiple), primes, Fundamental Theorem of Arithmatic, linear congruences, Linear Diophantine equation, Fermat's little theorem, Wilson's theorem.

UNIT – II
Complete residue system and reduced residue system, Chinese remainder theorem, Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Möbius inversion formula, the greatest integer function.

UNIT – III
Euler's phi-function, Euler's theorem, some properties of Euler's phi-function. Order of an integer modulo *n*, primitive roots for primes, composite numbers having primitive roots, Euler's criterion.

UNIT – IV
The Legendre symbol and its properties, quadratic reciprocity, quadratic congruences with composite moduli. Public key encryption, RSA encryption and decryption, the equation $x^2 + y^2 = z^2$, Fermat's Last Theorem.

COURSE OUTCOMES
Students will have the knowledge of

- Linear Diophantine equation, linear congruences and various theorems.
- Sum and number of divisors, Dirichlet product, Mobius inversion formula.
- Euler's phi-function, Euler's theorem and Euler's criterion.
- Quadratic congruences, Fermat's Last theorem.

REFERENCE BOOKS

1. David M. Burton, Elementary Number Theory (6th Edition), Tata McGraw Hill Edition, Indian reprint, 2007.
2. Neville Robinns**,** Beginning Number Theory (2nd Edition), Narosa Publishing House Pvt. Limited, Delhi, 2007.