

Curriculum and Credit Framework for Undergraduate Programme

(Single Major) as per NEP-2020

B.Sc. MATHEMATICS

(Four Year Degree Programme)

1st & 2nd Semesters

For Batch w.e.f Session: 2023-24



University School for Graduate Studies,
Chaudhary Devi Lal University
Sirsa-125055, Haryana
2023

B.Sc. Mathematics
(Four Year Degree Programme)
1st and 2nd Semester

Exit options and Credit requirements

SINGLE-MAJOR

| <i>Exit with</i> | <i>Credit requirement</i> |
|---|--|
| <i>Certificate in Mathematics:</i> <i>After successful completion of First Year (Two Semesters) of the Four-Year Undergraduate Degree Programme.</i> | 48 (Including Internship of 4 Credits) |
| <i>Diploma in Mathematics:</i> <i>After successful completion of Two Year (Four Semesters) of the Four-Year Undergraduate Degree Programme.</i> | 94 (Including Internship of 4 Credits) |
| <i>Bachelor of Science in Mathematics:</i> <i>After successful completion of Three Year (Six Semesters) of the Four-Year Undergraduate Degree Programme.</i> | 136 |
| <i>Bachelor of Science in Mathematics (Honours/Honours with Research):</i> <i>After successful completion of Four Year (Eight Semesters) of the Four-Year Undergraduate Degree Programme.</i> | 184 |

Exit options and Credit requirements

MULTI-DISCIPLINARY

| <i>Exit with</i> | <i>Credit requirement</i> |
|---|----------------------------------|
| <i>Certificate in Mathematics:</i> <i>After successful completion of First Year (Two Semesters) of the Four-Year Undergraduate Degree Programme.</i> | 48 |
| <i>Diploma in Mathematics:</i> <i>After successful completion of Two Year (Four Semesters) of the Four-Year Undergraduate Degree Programme.</i> | 92 |
| <i>Bachelor of Science in Mathematics:</i> <i>After successful completion of Three Year (Six Semesters) of the Four-Year Undergraduate Degree Programme.</i> | 132 |
| <i>Bachelor of Science in Mathematics (Honours/Honours with Research):</i> <i>After successful completion of Four Year (Eight Semesters) of the Four-Year Undergraduate Degree Programme.</i> | 180 |

Table: Courses code and Title along with credit details

| Course Category | Course Code | Course Title | Level | Credits | | | Marks | | |
|-------------------|----------------------|---|-------|---------|---|-----------|-------|-----|------------|
| | | | | L | P | Total | Int | Ext | Total |
| SEMESTER-I | | | | | | | | | |
| 1. DSC | BSC/SM/MAT/1/DSC/101 | Algebra | 100 | 4 | - | 4 | 30 | 70 | 100 |
| | BSC/SM/MAT/1/DSC/102 | Calculus | 100 | 4 | - | 4 | 30 | 70 | 100 |
| 2. MIC | BSC/SM/MAT/1/MIC/101 | Descriptive Statistics | 100 | 4 | - | 4 | 30 | 70 | 100 |
| 3. MDC | BSC/SM/MAT/1/MDC/101 | E-Commerce | 100 | 3 | - | 3 | 25 | 50 | 75 |
| 4. AEC | Hindi/AEC/101 | Hindi-I | 100 | 2 | - | 2 | 15 | 35 | 50 |
| 5. SEC | BSC/SM/MAT/1/SEC/101 | Programming in C & Numerical Methods (theory) | 100 | 3 | - | 3 | 25 | 50 | 75 |
| 6. VAC | EVS/VAC/101 | EVS-I | 100 | 2 | - | 2 | 15 | 25 | 50 |
| TOTAL | | | | | | 22 | | | 550 |

| Course Category | Course Code | Course Title | Level | Credits | | | Marks | | |
|--------------------|----------------------|--|-------|---------|---|-----------|-------|-----|------------|
| | | | | L | P | Total | Int | Ext | Total |
| SEMESTER-II | | | | | | | | | |
| 1. DSC | BSC/SM/MAT/2/DSC/103 | Number Theory and Trigonometry | 100 | 4 | - | 4 | 30 | 70 | 100 |
| | BSC/SM/MAT/2/DSC/104 | Ordinary Differential Equations | 100 | 4 | - | 4 | 30 | 70 | 100 |
| 2. MIC | BSC/SM/MAT/2/MIC/102 | Regression Analysis and Probability | 100 | 4 | - | 4 | 30 | 70 | 100 |
| 3. MDC | BSC/SM/MAT/2/MDC/102 | Cyber Space | 100 | 3 | - | 3 | 25 | 50 | 75 |
| 4. AEC | ENG/AEC/101 | English-I | 100 | 2 | - | 2 | 15 | 35 | 50 |
| 5. SEC | BSC/SM/MAT/2/SEC/102 | Programming in C & Numerical Methods (Practical) | 100 | - | 3 | 3 | - | 75 | 75 |
| 6. VAC | CDLU/VAC/105 | Vedic Mathematics | 100 | 2 | - | 2 | 15 | 35 | 50 |
| TOTAL | | | | | | 22 | | | 550 |

BSC/SM/MAT/1/DSC/101
ALGEBRA

Marks (Theory) : 70

Marks (Internal Assessment) : 30

Credits: 04

Marks(Total) : 100

Time : 3 Hrs.

Note for the Paper Setter: The question paper will consist of **nine** questions in all. The first question will be compulsory and will consist of **seven** short questions of **2** marks each covering the whole syllabus. In addition, **eight** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **four** units. The candidates are required to attempt **one compulsory question** and **four more questions** selecting one question from each unit.

Course Outcomes: This course will enable the students to:

1. Determine rank of a matrix, eigen values, eigen vectors, characteristic equation and characteristic polynomial of square matrices. Understand unitary and orthogonal matrices and to solve related problems.
2. Find solution of homogeneous and non-homogeneous system of linear equations using matrices. Determine relation between roots and coefficients of a general polynomial equation.
3. Identify multiple roots. Application of Descarte's rule of sign. Solve cubic and biquadratic equations.
4. Understand the basic concepts of number theory and their applications in problem solving. Prove Fermat and Wilson's theorems and their applications.

Unit-I

Symmetric, Skew-symmetric, Hermitian and skew Hermitian matrices. Elementary operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

Unit-II

Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

Unit-III

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

Unit-IV

Nature of the roots of an equation, Descarte's rule of signs. Solutions of cubic equations(Cardon's method). Biquadratic equations and their solutions.

Recommended Books:

1. Shanti Narayan, A Text Book of Matrices.
2. Chandrika Prasad, Text Book on Algebra and Theory of Equations. Pothishala Private Ltd., Allahabad.
3. A.I. Kostrikin (1984). *Introduction to Algebra*. Springer Verlag.
4. Bernard Kolman & David R. Hill (2003). *Introductory Linear Algebra with Applications* (7th edition). Pearson Education Pvt. Ltd. India.
5. S. H. Friedberg, A. L. Insel and L.E. Spence (2004). *Linear Algebra*, Prentice Hall of India Pvt. Ltd.
6. David C. Lay, Steven R. Lay & Judi J. McDonald (2016). *Linear Algebra and its Applications* (5th edition). Pearson Education Pvt. Ltd. India.
7. H.S. Hall and S.R. Knight (2016). *Higher Algebra*, Arihant Publications.
8. Leonard Eugene Dickson (2009). *First Course in the Theory of Equations*. The Project GutenbergEBook (<http://www.gutenberg.org/ebooks/29785>)

BSC/SM/MAT/1/DSC/102
CALCULUS

Marks (Theory) : 70

Marks (Internal Assessment) : 30

Credits: 04

Marks(Total) : 100

Time : 3 Hrs.

Note for the Paper Setter: The question paper will consist of **nine** questions in all. The first question will be compulsory and will consist of **seven** short questions of **2** marks each covering the whole syllabus. In addition, **eight** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **four** units. The candidates are required to attempt **one compulsory question** and **four more questions** selecting one question from each unit.

Course Outcomes: This course will enable the students to:

1. Calculate the limit of functions, examine the continuity of functions, understand differentiability of different type of functions, successive differentiation of functions and series expansions.
2. Understand concepts of tangents, normals, asymptotes, curvature, evolutes and involutes of a curve; the geometrical meanings of these terms and to solve related problems
3. Determine singular points of a curve and their types. To understand rectification of curves and to apply the reduction formulae.
4. Determine area bounded by curves and volumes and surface area of solids formed by revolution of curves

Unit-I

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

Unit-II

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

Unit-III

Tracing of curves in Cartesian, parametric and polar co-ordinates. Reduction formulae. Rectification, intrinsic equations of curve.

Unit-IV

Quadrature (area) Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution. Theorems of Pappus and Guldin.

Recommended Books:

1. Differential and Integral Calculus, Shanti Narayan.
2. Murray R. Spiegel, Theory and Problems of Advanced Calculus. Schaum's Outline series. Schaum Publishing Co., New York.
3. N. Piskunov, Differential and Integral Calculus. Peace Publishers, Moscow.
4. Howard Anton, I. Bivens & Stephan Davis (2016). *Calculus* (10th edition). Wiley India.
5. Gabriel Klambauer (1986). *Aspects of Calculus*. Springer-Verlag.
6. Wieslaw Krawcewicz & Bindhyachal Rai (2003). *Calculus with Maple Labs*. Narosa.
7. Gorakh Prasad (2016). *Differential Calculus* (19th edition). Pothishala Pvt. Ltd.
8. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). *Thomas' Calculus* (14th edition). Pearson Education.
9. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2011). *Calculus* (3rd edition). Pearson Education. Dorling Kindersley (India) Pvt. Ltd.

BSC/SM/MAT/1/MIC/101
Descriptive Statistics

Marks (Theory) : 70
Marks (Internal Assessment) : 30
Credits: 04

Marks(Total) : 100
Time : 3 Hrs.

***Note for the Paper Setter:** The question paper will consist of **nine** questions in all. The first question will be compulsory and will consist of **seven** short questions of **2** marks each covering the whole syllabus. In addition, **eight** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **four** units. The candidates are required to attempt **one compulsory question** and **four more questions** selecting one question from each unit.*

Course Outcomes: This course enables the students:

1. To understand the basic knowledge of data and their classification, tabulation. To represent the data in different type of graphs like Histogram, ogives, frequency polygons and curves.
2. To know how to calculate the mean, median, Mode, range, quartile deviation, standard deviation, coefficient deviation.
3. Be familiar with moments, Skewness, Kurtosis and the theory of attributes, order of class frequencies, Yule coefficients.
4. To learn the correlation for Bivariate Data, concept of Scatter Diagram, Karl Pearson coefficient and rank correlation coefficient.

Unit-I

Introduction of Statistics, Basic knowledge of various types of data, Collection, classification and tabulation of data. Presentation of data: histograms, frequency polygon, frequency curve and ogives. Stem- and- Leaf and Box plots.

Unit-II

Measures of Central Tendency and Location: Mean, median, mode, geometric mean, harmonic mean, partition values.

Measures of Dispersion: Absolute and relative measures of range, quartile deviation, mean deviation, standard deviation (σ), coefficient of variation.

Unit-III

Moments, Skewness and Kurtosis: Moments about mean and about any point and derivation of their relationships, effect of change of origin and scale on moments, Sheppard's correction for moments (without derivation), Charlier's checks, Concepts of Skewness and Kurtosis.

Unit-IV

Theory of Attributes: Symbolic notation, dichotomy of data, class frequencies, order of class frequencies, consistency of data, independence and association of attributes, Yule's coefficient of association and coefficient of colligation.

Correlation for Bivariate Data: Concept and types of correlation, Scatter diagram, Karl Pearson Coefficient (r) of correlation and rank correlation coefficient.

Books Recommended:

1. A.M. Goon, M.K. Gupta, and B. Das Gupta: Fundamentals of Statistics, Vol-I.
2. S. Bernstein and R. Bernstein, Elements of Statistics, Schaum's outline series, McGraw-Hill.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2

E-COMMERCE
BSC/SM/MAT/1/MDC/101

DURATION: 3 HOURS
CREDIT: 3

MAXIMUM MARKS: 75
EXTERNAL: 50, INTERNAL: 25

Course Objective: The objective of this course is to enable the student to become familiar with the mechanism for conducting business transactions through electronic means.

Course Learning Outcomes: After completing the course, the student shall be able to:

CO1: Understand the basics of E-commerce, current and emerging business models. Present scenario of e commerce in India.

CO2: Identify the emerging modes of e-payment, familiarize with basic business operations such as online business transactions, sales, marketing, e tailing, online services, online shopping etc. on the web.

CO3: Understand the importance of security, privacy needs and concepts of e commerce and technology solutions.

UNIT-I

Introduction: Electronic Commerce Framework, History, Basics and Tools of E-Commerce, Comparison of Web-based with Traditional Business; Growth of E-Commerce – Present and potential; E-Business: Meaning, Importance, Models Based on the Relationships of Transacting Parties (B2B, B2C, C2C and C2B); Present Status of E-Commerce in India; Technology used in E-commerce: The dynamics of World Wide Web and internet (meaning, evolution and features).

UNIT-II

E-payment System: Models and methods of E-payments (Debit Card, Credit Card, Smart Cards, e-money), Digital signatures, Payment gateways, Risks involved in E-payments; On-line Business Transactions: Meaning, purpose, advantages and disadvantages of transacting online; E-commerce applications in various industries, online services (financial, travel and career), auctions, online portal, online learning, publishing and entertainment}; Online shopping (Amazon, snap deal, alibaba, flipkart, etc.).

UNIT-III

Security and Encryption: Need and concepts, the E-commerce security environment: (Dimensions, definition and scope of security), Security threats in the E-commerce Environment (security intrusions and breaches, attacking methods like hacking, sniffing, cyber-vandalism etc.), Technology solutions (Encryption, security channels of communication, Protecting networks and protecting servers and clients).

Suggested Readings:

- Kalakota &Whinston, *Electronic Commerce: A Manager's Guide*, Pearson Education.
- Greenstien & Vasarhelyi, *Electronic Commerce: Security, Risk Management and Control*, Tata McGraw Hill.
- Joseph, *E-Commerce: An Indian Perspective*, Prentice Hall of India.
- Turbon, *et. al.*, *Electronic Commerce: A Managerial Perspective*, Pearson Education.

Note for the Paper Setter: The question paper will consist of *seven* questions in all. The first question will be compulsory and will consist of four short questions of 2 marks each covering the whole syllabus. In addition, six more questions of 14 marks each will be set unit-wise comprising of two questions from each of the three units. The candidates are required to attempt one compulsory question and three more questions selecting at least one question from each unit.

Hindi -1
हिंदी भाषा परिचय सामान्य :
Hindi/AEC/101

Credit – 2

Duration: 2 Hours per week

परीक्षा समयघंटे 2 :

कुल अंक50 :

लिखित परीक्षा :35 अंक

आंतरिक मूल्यांकन: 15 अंक

Note for the Paper Setter: The question paper will consist of *five* questions in all. The first question will be compulsory and will consist of seven short questions of 1 marks each covering the whole syllabus. In addition, four more questions of 14 marks each will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt one compulsory question and two more questions selecting one question from each unit.

पाठ्यक्रम के उद्देश्य:

हिंदी भाषा की विकास करवाना परिचय से यात्रा-

पाठ्यक्रम के अपेक्षित परिणाम

1. हिंदी भाषा के विकास व उसकी बोलियों का ज्ञान होगा
2. हिंदी भाषा के विविध रूप व प्रयोजनमूलकता से परिचित होंगे

खंड एक—

हिंदी भाषाविकास एवं उद्भव :

हिंदी की उपभाषाएं एवं बोलियों का वर्गीकरण

ब्रजप्रवृत्तियाँ एवं परिचय सामान्य का बोली खड़ी और अवधि ,

खंड दो-

कंप्यूटर-परिभाषा, स्वरूप एवं महत्व

पारिभाषिक शब्दावली – बैंकिंग, वाणिज्य, मंत्रालय, उपक्रम, निगम, औद्योगिक क्षेत्र व मीडिया क्षेत्र

अनुवाद लेखन- अर्थ परिभाषा, स्वरूप, महत्व, प्रकिया प्रकार

टिप्पणी लेखन ,परिभाषा अर्थ -नियम, लेखन विधि, उदाहरण

संदर्भ सूची:

1. हिंदी भाषा का उद्भव एवं विकास तिवारी उदयनारायण ,
2. भाषा विज्ञान तिवारी भोलानाथ .डॉ ,
3. हिंदी भाषा का इतिहास वर्मा धीरेन्द्र लेखक ,
4. समसामयिक भाषा विज्ञाननारंग वैष्णव लेखक ,
5. हिंदी,विकास और उद्भव : हरदेव बाहरी1965 इलाहबाद ,महल किताब ,

BSC/SM/MAT/1/SEC/101
Programming in C & Numerical Methods (theory)

Marks (Theory) : 50

Marks (Internal Assessment) : 25

Credits: 03

Marks(Total) : 75

Time : 3 Hrs

***Note for the Paper Setter:** The question paper will consist of **seven** questions in all. The first question will be compulsory and will consist of **four** short questions of **2** marks each covering the whole syllabus. In addition, **six** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **three** units. The candidates are required to attempt **one compulsory question** and **three more questions** selecting at least one question from each unit.*

Course Outcomes: The course will enable the students to:

1. Understand the Programme Model of computer, Algorithms, Flow Charts, Input/Output functions.
2. To learn the Decision Control structure, Logical and Conditional Statements, Concepts of Functions, Preprocessors and Arrays.
3. Understand strings and structures, pointers, solution of algebraic and transcendental equations by different methods.
4. Understand the concept of solution of Simultaneous linear algebraic equations by different methods.

Unit– I

Programmer's model of a computer, Algorithms, Flow charts, Data types, Operators and expressions, Input / Output functions.

Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops, Switch Statement & Case control structures. Functions, Preprocessors and Arrays.

Unit– II

Strings: Character Data Type, Standard String handling Functions, Arithmetic Operations on Characters. Structures: Definition, using Structures, use of Structures in Arrays and Arrays in Structures. Pointers: Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method. Newton's iterative method for finding pth root of a number.

Unit– III

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

Books Recommended:

1. B.W. Kernighan and D.M. Ritchie, The C Programming Language, 2nd Edition
 2. V. Rajaraman, Programming in C, Prentice Hall of India, 1994
 3. Byron S. Gottfried, Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1998
 4. Babu Ram, Numerical Methods, Pearson Publication.
 5. M.K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
 6. M.K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999.
 7. E. Balagurusamy, Programming in ANSI C, Tata McGraw
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Environmental Studies –I
EVS/VAC/101

Credits: 2
Duration of Examination:-2 hrs

Internal Assessment: 15
Semester End Examination: 35
Total Marks: 50

Objective: The objective of this paper is to create the awareness among the students towards Environmental concepts and issues for smooth life of species and human at earth.

UNIT I

Introduction to Environment: The multidisciplinary nature of environmental studies: Definition, scope and importance, need for public awareness. Environmental Ethics: anthropocentric and eco-centric perspective.

Natural resources: Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: use and over-exploitation, Deforestation, Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, dams- conflicts over water and problems. Minerals resources: Use and exploitation, environmental effects of extracting and using minerals resources. Food resources: World food issues, changes caused by agriculture and overgrazing, effects of modern agriculture on agro ecosystem, agrochemical issues, water logging, salinity, Energy resources; Growing energy needs, renewable and non-renewable energy resources. Land resources: Land as resource: land degradation man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable life style. Sustainable development: concept, initiatives for sustainable development: regional, state and global, Sustainable Development Goals.

UNIT II

Ecosystem: Concept, Structure and Function. Producers, Consumers and Decomposers, Energy flow in the ecosystem, Concept and type of ecological succession, Food chains, food webs and Ecological pyramids, Introduction, types, characteristics features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, desert ecosystem, Aquatic ecosystem (Ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity and its conservation: Introduction-Definition: Genetic, species and Ecosystem diversity, Biogeographical classification of India. Value of Biodiversity: consumptive use, productive use, social, ethical; aesthetic and optional. Biodiversity at local, National and Local levels. India as Mega-diverse a Nation. Hot spots of Biodiversity. Threats to biodiversity, Habitat loss, poaching of wildlife, man-wildlife conflicts. Endemic species, conservation of biodiversity: In situ and Ex-situ, conservation of biodiversity. Convention on biological diversity, Aichi targets.

Water pollution: Natural and anthropogenic sources of water pollution and their effects. Marine pollution, Thermal pollution, Eutrophication, Ground water pollution.

Air pollution: Sources, Classification and properties of air pollutants (Particulate matter, Inorganic gaseous pollutants, Organic gaseous pollutants), Smog, Acid rain, Ozone layer depletion, Green house effects, Global warming, Effects of air pollution on Human health

Soil pollution: Soil pollution from the use of agrochemicals (viz. Fertilizers and Pesticides), Heavy metals, Industrial effluents and Detrimental effects of soil pollutant, Remedial measures for soil pollution. Types and sources Solid waste, Electronic waste

Radioactive and Noise pollution: Definition Sources of radioactive pollution, Radioactivity, effects of radioactive pollution, Sound pressure level, Frequency, noise monitoring and sound level meter, Sources and effects of noise pollution, Effects of noise pollution on human health. Role of individual in prevention of pollution.

Note for the Paper Setter: The question paper will consist of *five* questions in all. The first question will be compulsory and will consist of seven short questions of 1 marks each covering the whole syllabus. In addition, four more questions of 14 marks each will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt one compulsory question and two more questions selecting one question from each unit.

SEMESTER-II

NUMBER THEORY AND TRIGONOMETRY

Marks (Theory) : 70

Marks (Internal Assessment) : 30

Marks(Total) : 100

Time : 3 Hrs.

Credits: 04

Note for the Paper Setter: The question paper will consist of **nine** questions in all. The first question will be compulsory and will consist of **seven** short questions of **2** marks each covering the whole syllabus. In addition, **eight** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **four** units. The candidates are required to attempt **one compulsory question** and **four more questions** selecting one question from each unit.

Course Outcomes: This course will enable the students to:

1. Understand the basic concepts of number theory and their applications in problem solving. Prove Fermat and Wilson's theorems and their applications.
2. Know residue system, Euler's ϕ function, Quadratic residues. Legendre symbols, Moebius function and Moebius inversion formula.
3. Understand De Moivre's Theorem and its Applications. Trigonometrical and hyperbolic functions along with their properties.
4. Know inverse circular and hyperbolic functions and their properties along with their related problems.

Unit-I

Divisibility, G.C.D. (greatest common divisors), L.C.M. (least common multiple) Primes, Fundamental Theorem of Arithmetic. Linear Congruences, Fermat's theorem. Wilson's theorem and its converse. Linear Diophantine equations in two variables

Unit-II

Complete residue system and reduced residue system modulo m . Euler's ϕ function Euler's generalization of Fermat's theorem. Chinese Remainder Theorem. Quadratic residues. Legendre symbols. Lemma of Gauss; Gauss reciprocity law. Greatest integer function $[x]$. The number of divisors and the sum of divisors of a natural number n (The functions $d(n)$ and $\sigma(n)$). Moebius function and Moebius inversion formula.

Unit-III

De Moivre's Theorem and its Applications. Expansion of trigonometrical functions. Direct circular and hyperbolic functions and their properties.

Unit-IV

Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity. Gregory's series. Summation of Trigonometry series.

Recommended Books:

1. S.L. Loney, Plane Trigonometry Part – II, Macmillan and Company, London.
2. R.S. Verma and K.S. Sukla, Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.
3. Gareth A. Jones & J. Mary Jones (2005). *Elementary Number Theory*. Springer.
4. Neville Robbins (2007). *Beginning Number Theory* (2nd edition). Narosa.
5. I. Niven (2012). *An Introduction to the Theory of Numbers* (5th edition). John Wiley & Sons.
6. Ivan Ninen and H.S. Zuckerman, An Introduction to the Theory of Numbers.

BSC/SM/MAT/2/DSC/104

ORDINARY DIFFERENTIAL EQUATIONS

Marks (Theory) : 70

Marks (Internal Assessment) : 30

Marks(Total) : 100

Time : 3 Hrs.

Credits: 04

Note for the Paper Setter: The question paper will consist of **nine** questions in all. The first question will be compulsory and will consist of **seven** short questions of **2** marks each covering the whole syllabus. In addition, **eight** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **four** units. The candidates are required to attempt **one compulsory question** and **four more questions** selecting one question from each unit.

Course Outcomes: The course will enable the students to:

1. Understand the basic concepts of ordinary differential equations and to learn various techniques of finding exact solutions of certain solvable first order differential equations.
2. Develop the skills of solving homogeneous and non-homogeneous second order linear ordinary differential equations with constant coefficients.
3. Know the skills of solving non-homogeneous second order linear ordinary differential equations with variable coefficients.
4. Develop the skills and methods of solving ordinary simultaneous differential equations with constant coefficients.

Unit-I

Geometrical meaning of a differential equation. Exact differential equations, integrating factors. First order higher degree equations solvable for x, y, p Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form. Singular solutions.

Unit-II

Orthogonal trajectories: in Cartesian coordinates and polar coordinates. Self orthogonal family of curves. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous.

Unit-III

Linear differential equations of second order: Reduction to normal form. Transformation of the equation by changing the dependent variable/ the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation. Method of variations of parameters. Method of undetermined coefficients.

Unit-IV

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.

Recommended Books:

1. Erwin Kreyszig (2011). *Advanced Engineering Mathematics* (10th edition). J. Wiley & Sons
2. Shepley L. Ross (2007). *Differential Equations* (3rd edition). Wiley.
3. George F. Simmons (2017). *Differential Equations with Applications and Historical Notes* (3rd edition). CRC Press. Taylor & Francis.
4. D.A. Murray, *Introductory Course in Differential Equations*. Orient Longaman (India). 1967
5. A.R.Forsyth, *A Treatise on Differential Equations*, Macmillan and Co. Ltd., London
6. E.A. Codington, *Introduction to Differential Equations*.
7. B.Rai & D.P. Chaudhary, *Ordinary Differential Equations*, Narosa Publishing House Pvt. Ltd.

BSC/SM/MAT/2/MIC/102
Regression Analysis and Probability

Marks (Theory) : 70

Marks (Internal Assessment) : 30

Credits: 04

Marks(Total) : 100

Time : 3 Hrs.

***Note for the Paper Setter:** The question paper will consist of **nine** questions in all. The first question will be compulsory and will consist of **seven** short questions of **2** marks each covering the whole syllabus. In addition, **eight** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **four** units. The candidates are required to attempt **one compulsory question** and **four more questions** selecting one question from each unit.*

Course Outcomes: This course enables the students:

1. To understand the basic knowledge of regression, principle of least squares and fitting of straight line. To calculate the coefficient of regression and Angle between two lines.
2. To understand the concepts in probability sample space, different kind of events, addition and Multiplication laws of probability, Boole's Inequality and Bayes theorem.
3. Be familiar with continuous and discrete Random variables. PMFs and their PDFs.
4. To understand the concept of Mathematical expectation and bivariate Random variable Skewness and Kurtosis.

Unit-I

Linear Regression: Concept of regression, principle of least squares and fitting of straight line, derivation of two lines of regression, properties of regression coefficients, standard error of estimate obtained from regression line, correlation coefficient between observed and estimated values. Angle between two lines of regression. Difference between correlation and regression.

Curvilinear Regression: Fitting of second degree parabola, power curve of the type $Y=ax^b$, exponential curves of the types $Y=ab^x$ and $Y=ae^{bx}$.

Unit-II

Concepts in Probability: Random experiment, trial, sample point, sample space, operation of events, exhaustive, equally likely and independent events, Definition of probability—classical, relative frequency, statistical and axiomatic approach, Addition and multiplication laws of probability, Boole's inequality. Bayes' theorem and its applications.

Unit-III

Random Variable and Probability Functions: Definition and properties of random variables, discrete and continuous random variable, probability mass and density functions, distribution function.

Unit-IV

Concepts of bivariate random variable: joint, marginal and conditional distributions. Mathematical Expectation: Definition and its properties –moments, measures of location, dispersion, skewness and kurtosis.

Books Recommended:

1. A.M. Mood, F.A. Graybill and D.C. Boes, Introduction to the theory of Statistics, McGraw Hill, 1974.
2. Baisnab and M. Jas, Element of Probability and statistics, Tata McGraw Hill.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2002.
4. P.L.Meyer, Introductory Probability and Statistical Applications, Addison-Wesley Publishing Company, 1970.

BSC/SM/MAT/2/MDC/102: Cyber Space

| Course Type | Course Component | Course Credit | Contact Hours/ Week | Delivery Mode | Maximum Marks | | Exam Duration | Assessment Methods |
|-------------|------------------|---------------|---------------------|---------------|---------------|----------|---------------|---------------------------------------|
| | | | | | External | Internal | | |
| MDC | Theory | 03 | 03 | Lecture | 50 | 25 | 3 Hours | TEE/MTE/ Assignment/ Attendance |

Note for the Paper Setter: The question paper will consist of **seven** questions in all. The first question will be compulsory and will consist of **four** short questions of 2 marks each covering the whole syllabus. In addition, **six** more questions of **14 marks each** will be set unit-wise comprising of **two** questions from each of the **three** units. The candidates are required to attempt **one compulsory question** and **three more questions** selecting at least one question from each unit.

Course Objectives: Objective of this course is to make the students familiar with the functioning of the Internet, email, web-browsers, and e-commerce; surfing the Internet and downloading contents therefrom; legal and payment issues in e-commerce.

| Course Outcomes | At the end of this course, the student will be able to: |
|-----------------|--|
| CO1 | define: Internet and its applications, ISP, HTML, Email, Web Browsers, Social Media and E-commerce. |
| CO2 | explain: internet, intranet, internet service provider, HTML, structure and working of email, configuration of mail client like Outlook Express with mail server, functionality of web browsers, social media and concept of E-commerce. |
| CO-3 | illustrate: internet and its applications, evolution of internet, structure of HTML, various tags with their uses in HTML, structure and working of email, concept and use of different type of web browser, searching and downloading from websites, use of social media and introduction to E-commerce |
| CO4 | categorize: applications of internet, ISP, HTML elements, email messaging, function of web browsers, searching software's, various social media networks, their impact and issues and concept of e-commerce with payment issues. |
| CO5 | compare: internet and intranet, different internet service providers on the basis of their service, email advantages and disadvantages, working of various web browsers and social media types. |
| CO6 | design: various types of HTML application with the help of different elements along with their attributes and development of webpages. |

**Course Content
Cyber Space**

| | |
|-----------|---|
| Unit - I | Basics of internet and Intranet, Applications of Internet, Evolution of Internet, Internet Service Provider (ISP). Introduction to HTML, Structure of HTML, Web Page, Head and Body Sections, General structure of HTML tags-starting and ending a tag, various text formatting tags in HTML, Adding images, audio and video objects, Hyper linking. |
| Unit - II | Email: Basic Introduction, Advantages and Disadvantage, Structure of an E-Mail Message, Working of E-Mail (sending & receiving messages), Managing Email (creating new folders, deleting messages, forwarding messages, filtering messages), Configuration of Outlook Express. |

| | |
|-----------------------------|---|
| Unit - III | Introduction to the Functionality of Web Browsers: Internet Explorer, Netscape Navigator Concept of WWW, surfing through web sites. Web Browsing (opening, viewing, saving a web page and book mark). Searching and downloading of different sites and software. Introduction to Social Media: Twitter, Facebook, YouTube, Whatsapp, LinkedIn, their advantages/disadvantages and issues. Introduction to E-commerce, its history, advantages, challenges, payment issues, legal issues. |
| Text/Reference Books | |
| Text Books | <ol style="list-style-type: none"> 1. Ritendra Goel, "e-commerce", New Age International Publisher, 2008 2. Dougals E. Comer, "Computer Network and Internet", Pearson, 2008 3. Thomas A. Powell, "HTML - The Complete Reference", Tata McGraw-Hill, ISBN: 0074633325 4. Khurana R., "HTML", APH Publishing |
| Reference Books | <ol style="list-style-type: none"> 1. Oliver Heathcote, "Internet Right From The Start" BPB Publications |

ENGLISH-I
Communicative English-1
ENG/AEC/101

Credits: 2

Duration of Examination:-2 hrs

Internal Assessment: 15

Semester End Examination: 35

Total Marks: 50

Course Objective: The course aims to introduce students to the theory, fundamentals and tools of communication and to develop effective communication skills for personal, social and professional interactions. Besides, the students shall learn the basics of English grammar and language.

Course Learning Outcomes:

- i) They will learn the importance and basics of communication
- ii) They will learn to receive, comment and respond to correspondences in English language.
- iii) They will learn to use English in their life practically.

Unit - I: Listening, Reading and Speaking Skills

Definition, The Listening Process; Importance of Listening; Basic Types of Listening; Barriers to Effective Listening, Reading Comprehension, Intonation, Group Discussion, Interview

Unit II: Writing Skills:

- Report Writing
- Paragraph Writing
- Letter Writing
- E-Mail
- Resume
- Blogs and Comments on Social Media

Suggested Reading:

- I) Kumar, Sanjay and Pushp Lata. 2015. *Communication Skills*. Second Edition, New Delhi: Oxford University Press (OUP).
- II) Sethi, J. and P.V. Dhamija. 2006. *A Course in Phonetics and Spoken English*. Second Edition. New Delhi: Prentice-Hall of India.
- III) Balasubramanian. T. *A Text Book of English Phonetics for Indian Students*. Chennai: Macmillan Publishers India Ltd., 1981.
- IV) *On Track: English Skills For Success* by Orient Blackswan (Board of Editors, Solapur University).

Note for the Paper Setter: The question paper will consist of **five** questions in all. The **first** question will be compulsory and will consist of **seven** short questions of **1** mark each covering the whole syllabus. In addition, **four** more questions of **14** marks each will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one** compulsory question and **two** more questions selecting at least **one** question from each unit.

BSC/SM/MAT/2/SEC/102

Programming in C & Numerical Methods –Lab (Practical)

Credit: 3 (PRACTICAL)

Marks (Total): 75

There will be a separate practical paper based on the theory paper **BSC/SM/MAT/1/SEC/101**

CDLU/VAC/105

Vedic Mathematics

Marks (Theory): 35
Marks (Internal Assessment) : 15
Credits: 02

Marks(Total) : 50
Time : 2 Hrs

*Note for the Paper Setter: The question paper will consist of **five** questions in all. The first question will be compulsory and will consist of **seven** short questions of **1** marks each covering the whole syllabus. In addition, **four** more questions of **14** marks each will be set unit-wise comprising of **two** questions from each of the **two** units. The candidates are required to attempt **one compulsory question** and **two more questions** selecting at least one question from each unit.*

Course Outcomes (COs): At the end of the course, the students will be able

CO1: Discuss the rich heritage of mathematical temper of Ancient India Learning Outcomes: Overcome the fear of maths, Improved critical thinking

CO2: Familiarity with the mathematical underpinnings and techniques, Ability to do basic maths faster and with ease.

UNIT-I

Vedic Maths- High Speed Addition and Subtraction Sessions/Lectures, Vedic Maths: History of Vedic Maths and its Features, Vedic Maths formulae: Sutras and Upsutras, Addition in Vedic Maths: Without carrying, Dot Method, Subtraction in Vedic Maths: Nikhilam Navatashcaramam Dashatah, Fraction–Addition and Subtraction.

UNIT II

Vedic Math - Miracle Multiplication and Excellent Division, Multiplication in Vedic Maths: Base Method (any two numbers upto three digits), Multiplication by Urdhva Tiryak Sutra, Miracle multiplication: Any three-digit number by series of 1's and 9's, Division by Urdhva Tiryak Sutra (Vinculum method).

Books suggested:

1. The Essential of Vedic Mathematics, Rajesh Kumar Thakur, Rupa Publications, New Delhi 2019.
 2. Vedic Mathematics Made Easy, Dahaval Bathia, Jaico Publishing, New Delhi 2011
 3. Vedic Mathematics: Sixteen Simple Mathematical formulae from the Vedas, Jagadguru Swami Sri Bharati Krishna Trithaji, Motilal Banarasidas, New Delhi 2015.
 4. Learn Vedic Speed Mathematics Systematically, Chaitnaya A. Patil 2018. 17 Suggested Readings
 5. A Modern Introduction to Ancient Indian Mathematics, T S Bhanumurthy, Wiley Eastern Limited, New Delhi.
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