

**Curriculum and Credit Framework for  
Undergraduate Programme  
(Single Major) as per NEP-2020**

**B.Sc. MATHEMATICS  
(Four Year Degree Programme)**

**3rd & 4th Semesters**

**For Batch w.e.f. Session: 2022-23**



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



***B.Sc. Mathematics***  
***(Four Year Degree Programme)***  
**3<sup>rd</sup> and 4<sup>th</sup> Semester**

***Exit options and Credit requirements***

**SINGLE-MAJOR**

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

***Exit options and Credit requirements***

**MULTI-DISCIPLINARY**

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

**B.Sc. Mathematics**  
**(Four Year Degree Programme)**  
*session 2022-23*  
**3<sup>rd</sup> & 4<sup>th</sup> Semester**

**Table:** Course code and Title along with credit details

| Course Category     | Course Code          | Course Title                                  | Level | Credits |   |           | Marks |     |            |
|---------------------|----------------------|---|-------|---------|---|-----------|-------|-----|------------|
|                     |                      |   |       | L       | P | Total     | Int   | Ext | Total      |
| <b>SEMESTER-III</b> |                      |   |       |         |   |           |       |     |            |
| 1. DSC              | BSC/SM/MAT/3/DSC/201 | Advanced Calculus                             | 200   | 4       | - | 4         | 30    | 70  | 100        |
|                     | BSC/SM/MAT/3/DSC/202 | Vector Calculus                               | 200   | 4       | - | 4         | 30    | 70  | 100        |
| 2. MIC              | BSC/SM/MAT/3/MIC/201 | Descriptive Statistics                        | 200   | 4       | - | 4         | 30    | 70  | 100        |
|                     | BSC/SM/MAT/3/MIC/202 | Regression Analysis and Probability           | 200   | 4       | - | 4         | 30    | 70  | 100        |
| 3. MDC              | BSC/SM/MAT/3/MDC/201 | Cyber Space                                   | 200   | 3       | - | 3         | 25    | 50  | 75         |
| 4. SEC              | BSC/SM/MAT/3/SEC/201 | Programming in C & Numerical Methods (Theory) | 200   | 3       | - | 3         | 25    | 50  | 75         |
| 5. VAC              | CDLU/VAC/105         | Vedic Mathematics                             | 200   | 2       | - | 2         | 15    | 35  | 50         |
|                     |                      |   |       |         |   |           |       |     |            |
| <b>TOTAL</b>        |                      |   |       |         |   | <b>24</b> |       |     | <b>600</b> |

| Course Category    | Course Code          | Course Title                                     | Level | Credits |   |       | Marks     |     |            |
|--------------------|----------------------|--|-------|---------|---|-------|-----------|-----|------------|
|                    |                      |  |       | L       | P | Total | Int       | Ext | Total      |
| <b>SEMESTER-IV</b> |                      |  |       |         |   |       |           |     |            |
| 1. DSC             | BSC/SM/MAT/4/DSC/203 | Solid Geometry                                   | 200   | 4       | - | 4     | 30        | 70  | 100        |
|                    | BSC/SM/MAT/4/DSC/204 | Transform Techniques                             | 200   | 4       | - | 4     | 30        | 70  | 100        |
|                    | BSC/SM/MAT/4/DSC/205 | Elementary Partial Differential Equations        | 200   | 4       | - | 4     | 30        | 70  | 100        |
| 2. MIC             | BSC/SM/MAT/4/MIC/203 | Differential Geometry                            | 200   | 4       | - | 4     | 30        | 70  | 100        |
|                    | BSC/SM/MAT/4/MIC/204 | Probability Distributions                        | 200   | 4       | - | 4     | 30        | 70  | 100        |
| 3. SEC             | BSC/SM/MAT/3/SEC/202 | Programming in C & Numerical Methods (Practical) | 200   | -       | 3 | 3     | 0         | 75  | 75         |
| 4. VAC             | CDLU/VAC/101         | Communication Skills                             | 200   | 2       | - | 2     | 15        | 35  | 50         |
|                    |                      |  |       |         |   |       |           |     |            |
| <b>TOTAL</b>       |                      |  |       |         |   |       | <b>25</b> |     | <b>625</b> |

# **SEMESTER-III**

## BSC/SM/MAT/3/DSC/201

### Advanced 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. Understand the concept of continuous function and derivative and apply the knowledge to prove mean value theorems.
2. Understand the limit and continuity of the function in two variables. Know the concept of partial differentiation.
3. Know the differentiability of function in two variables and how to calculate maximum & minimum of function in two variables.
4. Know about curves in spaces, Involutes, evolutes and concept of Surface and Envelopes.

#### Unit - I

Continuity, Sequential Continuity, properties of continuous functions, Uniform continuity, chain rule of differentiability. Mean value theorems; Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives, Indeterminate forms.

#### Unit - II

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials; Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

#### Unit - III

Differentiability of real valued functions of two variables. Schwarz and Young's theorems. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

#### Unit - IV

Curves: Tangents, Principal normals, Binormals, Serret-Frenet formulae. Locus of the centre of curvature, Spherical curvature, Locus of centre of Spherical curvature, Involutes, evolutes, Bertrand Curves. Surfaces: Tangent planes, one parameter family of surfaces, Envelopes.

#### Books Recommended:

1. C.E. Weatherburn, Differential Geometry of three dimensions, Radhe Publishing House, Calcutta
2. Gabriel Klaumber, Mathematical analysis, Marcel Dekkar, Inc., New York, 1975
3. R.R. Goldberg, Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
4. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad
5. S.C. Malik, Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
6. Shanti Narayan, A Course in Mathematical Analysis, S.Chand and company, New Delhi.
7. Murray, R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing co., New York

Vector 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. Understand the concept of scalar and vector product of three vectors and four vectors product and differentiation of vectors.
2. Know the concept of Gradient, Divergence and Curl.
3. Understand the concept of orthogonal curvilinear coordinates, cylindrical coordinates and spherical coordinates.
4. Understand vector integration. Theorems of Gauss Green & Stokes and problems based on these theorems.

**Unit - I**

Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors. Vector differentiation. Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives

**Unit- II**

Gradient of a scalar point function, physical interpretation of  $\text{grad } \Phi$ , characteristics of gradient. Divergence and curl of vector point function, physical interpretations of div and curls of vector point functions, characteristics of  $\text{Div } f$  and  $\text{Curl } f$ . Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator.

**Unit - III**

Vector integration; Line integral, Surface integral, Volume integral. Theorems of Gauss, Green & Stokes and problems based on these theorems.

**Unit - IV**

Orthogonal curvilinear coordinates, Conditions for orthogonality, fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical co-ordinates.

**Books Recommended:**

1. Murraray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
2. Murraray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
3. N. Saran and S.N. Nigam, Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
4. Shanti Narayna, A Text Book of Vector Calculus. S. Chand & Co., New Delhi.

**BSC/SM/MAT/3/MIC/201**  
**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 ( $\sigma$ ), 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, 2002



**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 understands the concepts in probability sample space, different kind of events, addition and Multiplication laws of probability, Boole's Inequality an 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/3/MDC/201: 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/<br>Assignment/<br>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).<br>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<br>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.<br>Introduction to Social Media: Twitter, Facebook, YouTube, Whatsapp, LinkedIn, their |

|                             |   |
|-----------------------------|---|
|                             | <p>advantages/disadvantages and issues.<br/> Introduction to E-commerce, its history, advantages, challenges, payment issues, legal issues.</p>   |
| <b>Text/Reference Books</b> |   |
| Text Books                  | <ol style="list-style-type: none"> <li>1. Ritendra Goel, "e-commerce", New Age International Publisher, 2008</li> <li>2. Dougals E. Comer, "Computer Network and Internet", Pearson, 2008</li> <li>3. Thomas A. Powell, "HTML - The Complete Reference", Tata McGraw-Hill, ISBN: 0074633325</li> <li>4. Khurana R., "HTML", APH Publishing</li> </ol> |
| Reference Books             | <ol style="list-style-type: none"> <li>1. Oliver Heathcote, "Internet Right From The Start" BPB Publications</li> </ol>   |

**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, 2<sup>nd</sup> 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-Hill Publishing Co. Ltd.

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.

# **SEMESTER-IV**

**BSC/SM/MAT/4/DSC/203**  
**Solid Geometry**

**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. Know about the General Equation of second degree, detailed concepts of Conic Section.
2. Learn about concept of sphere and its properties, co-axial system. Understand about cone, and cylinder.
3. Understand about central conicoids.
4. Know about Paraboloids.

**Unit- I**

General equation of second degree. Tracing of conics. 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 coinoid. Enveloping cylinder of a coinoid.

**Unit- IV**

Paraboloids: Circular section, Plane sections of conicoids.

Generating lines. Confocal conicoid. Reduction of second degree equations.

**Books Recommended:**

1. R.J.T. Bill, Elementary Treatise on Coördinary 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.

**BSC/SM/MAT/4/DSC/204**  
**Transform Techniques**

**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. Understand the concept of Laplace Transforms and some theorems Differentiation & Integral of Laplace transformation and solution of Differential equation using Laplace transform.
2. Know about finite Laplace Transformation and its properties and applications, Fourier Transform and solution of Ordinary differential equations using Fourier Transformation.
3. Learn about the concept of Mellin transform and Z-Transform.
4. Understand the Hankel Transformation its properties and application to boundary value problems and PDE.

**Unit - I**

**Laplace Transform:** – Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using Laplace transform.

**Unit - II**

Finite Laplace transformation: Definition and Properties, shifting and scaling theorem.  
**Fourier transforms:** Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms.

**Unit - III**

**Mellin Transform:** Definition and Properties of Mellin transform, shifting and scaling properties, Mellin transform of derivatives and integral.

**Z-Transform:-** Z-Transform and inverse Z-Transform of elementary function, shifting theorem, Convolution theorem, initial and final value theorem.

**Unit - IV**

**Hankel Transform:** Basic properties of Hankel transform, Basic Operational properties, Hankel transform of derivatives and some elementary functions, Relation between Fourier and Hankel transform with application to boundary value problem and PDE.

**Books Recommended:**

1. Erwin Kreyszing, Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999.
2. A.R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd.
3. I.N. Sneddon, The use of integral transform, McGraw Hill, 1972
- 5 Murray R. Spiegel, Laplace transform, Schaum's Series.



**BSC/SM/MAT/4/DSC/205**  
**Elementary Partial Differential Equations**

**Marks (Theory) : 70**

**Marks(Total) : 100**

**Marks (Internal Assessment) : 30**

**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. Know about Linear and non-linear PDE of first order, their solution and Various methods of solution.
2. Learn about higher order PDE with constant and variable coefficients.
3. Understand classification of PDE of second order and Monge's methods to solve second order PDE.
4. Cauchy's problems for second order PDE, concept of characteristic curves, & equation method of separation of variables, solution of Laplace's equation, Wave equation and Heat equation.

**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 homogeneous and non-homogeneous 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.

**Books Recommended:**

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. A.R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd.
4. Ian N.Sneddon, Elements of Partial Differential Equations, McGraw Hill Book Company, 1988
5. Frank Ayres, Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972
6. J.N. Sharma and Kehar Singh, Partial Differential Equations, Alpha Sciences, 2008.

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 one and two parameter family of surface and their properties, envelopes, Characteristics, edge of regression.
2. To learn the concepts of curvilinear coordinates.
3. To understand the surface of revolution, Conjugate direction, conjugate systems, Asymptotic lines, curvatures and torsion.
4. To gain the knowledge of geodesics and the related concepts.

#### Unit-I

One Parameter family of Surfaces: Envelope, Characteristics, edge of regression , Developable surfaces.

Developables Associated with a Curve : Osculating developable, Polar developable, Rectifying developable.

Two- parameter Family of Surfaces: Envelope, Characteristics points,

#### Unit-II

Curvilinear coordinates, first order magnitudes, Directions on a surface, The normal, Second order magnitudes, Derivatives of  $\mathbf{n}$ .

#### Unit-III

Curves on a Surface: Principal directions and curvatures, First and second curvatures, Euler's theorems, Dupin's indicatrix, The surfaces  $z = f(x,y)$ , Surface of revolution. Conjugate directions, Conjugate systems. Asymptotic lines, Curvature and torsion, Isometric parameters, Null lines, or minimal curves.

#### Unit-IV

Geodesics and Geodesic Parallels: Geodesics: Geodesic property, Equation of Geodesics, Surface of revolution, Torsion of Geodesic.

Curves in Relation to Geodesics: Bonnet's theorem, Joachimsthal's theorems, Vector curvature, Geodesic curvature  $\kappa_g$ , Other formulae for  $\kappa_g$ , Bonnet's formula.

#### Books Recommended:

1. A.K. Singh and P.K. Mittal, A Textbook of Differential Geometry, Har-Anand Publications.
2. C.E. Weatherburn, Differential Geometry of Three Dimensions, Radhe Publishing House.
3. Erwin Kreyszig, Differential Geometry.

**BSC/SM/MAT/4/MIC/204**  
**Probability Distributions**

**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 generating function, cumulates and their properties.
2. To learn the concepts of Bernoulli, Binomial, Poisson, Geometric and hyper geometric distributions.
3. To understand the knowledge of uniform, gamma, Beta and Exponential distribution.
4. To learn the basic concept of Normal distribution, weak and strong Laws of Large Numbers, and central limit theorem.

**Unit-I**

Generating Functions: Moment generating function and cumulate generating function along with their properties and uses.

**Unit-II**

Bernoulli, binomial, Poisson, geometric and hyper-geometric distributions with their properties.

**Unit-III**

Uniform, gamma, beta (first and second kinds) and exponential distributions with their properties.

**Unit-IV**

Normal distribution with its properties. Tchebychev's inequality, Convergence in probability, Weak and strong laws of large numbers (Statements only). Central Limit Theorem.

**Books Recommended:**

1. Baisnab and M. Jas, Element of Probability and Statistics, Tata McGraw Hill.
2. P.L.Meyer, Introductory Probability and Statistical Applications, Addison-Wesley Publishing Company, 1970.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2002.

**BSC/SM/MAT/4/SEC/202**  
**Programming in C & Numerical Methods -Lab (Practical)**

**Marks (Total): 75**

**Credit: 3 (Practical)**

There will be a separate practical paper based on the theory paper BSC/SM/MAT/3/SEC/201.

# CDLU/VAC/101

## Communication Skills

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**Credits: 2 (Theory)**

**Max. Marks: 50**

**Lectures: 30**

**Final Term Exam: 35**

**Duration of Exam: 2 Hrs.**

**Internal Assessment: 15**

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### COURSE OBJECTIVES

- Identify common communication problems that may be holding learners back
- Perceive what the non-verbal messages are communicating to others
- Understand the role of communication in the teaching-learning process

### LEARNING OUTCOMES

- Get a clear understanding of good communication skills.
- Know what they can do to improve their communication skills.

#### Unit-1

**Listening:** Techniques of Effective Listening, Listening and Comprehension, Probing Questions Barriers to Listening.

**Speaking:** Pronunciation, Enunciation, Vocabulary, Fluency, Common Errors.

**Reading:** Techniques of Effective Reading, Gathering Ideas and Information from a Given Text, evaluating these Ideas and Information, Interpreting the Text.

**Writing and Different Modes of Writing:** The Writing Process, Effective Writing Strategies, Different Modes of Writing.

**Digital Literacy and Social Media:** Basic Computer Skills, Introduction to Microsoft (MS) Office Suite, Open Educational Resources, Basic Virtual Platforms, Trending Technologies, Machine Learning, Artificial Intelligence (AI), Internet of Things (IoT), Social Media, Introduction to Social Media Websites, Advantages of Social Media, Ethics and Etiquettes of Social Media, How to Use Google Search Better?, Effective Ways of Using Social Media, Digital Marketing, Introduction to Digital Marketing, Traditional Marketing versus Digital Marketing, Digital Marketing Tools, Social Media for Digital Marketing, Digital Marketing Analytics.

#### Unit-2

**Digital Ethics and Cyber Security:** Digital Ethics, Digital Literacy Skills, Digital Etiquette, Digital Life Skills, Cyber Security, Understanding and introducing the environment of security, Types of attacks and attackers, the art of protecting secrets.

**Nonverbal Communication:** Meaning of nonverbal communication, Advantages of using nonverbal communication, Introduction to modes of nonverbal communication, Open and Closed body language, Eye contact and Facial expression, Hand gestures, Do's and Don'ts in NVC, Learning from experts, Activities-based learning.

**Suggested Readings:** Follow Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0 at UGC website: [https://www.cdlu.ac.in/assets/admin/miscellaneous/Implementation%20of%20Curriculum%20and%20Guidelines%20on%20Life%20Skills%20\(Jeevan%20Kaushal\)%202.0.pdf](https://www.cdlu.ac.in/assets/admin/miscellaneous/Implementation%20of%20Curriculum%20and%20Guidelines%20on%20Life%20Skills%20(Jeevan%20Kaushal)%202.0.pdf)

**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.