G20
भारत 2023 INDIA
वसुधैव कुटुम्बकम्
ONE EARTH · ONE FAMILY · ONE FUTURE

SAURASHTRA UNIVERSITY
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Amrit Mahotsav

નં.એકે/વિજ્ઞાન/ ૯૧૦૯ /૨૦૨૩   તા.૧૮/૦૭/૨૦૨૩

ગણિતશાસ્ત્ર

પરિપત્ર:-

આથી સૌરાષ્ટ્ર યુનિવર્સિટીની વિજ્ઞાન વિદ્યાશાખા હેઠળ સ્નાતક કક્ષાનાં B.Sc. (ગણિતશાસ્ત્ર) નાં અભ્યાસક્રમ ચલાવતી સર્વે સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે, NEP-2020 અંતર્ગતનાં રાજય સરકારશ્રીનાં તા.૧૧/૦૭/૨૦૨૩ નાં ઠરાવ મુજબનાં અભ્યાસક્રમો ગણિતશાસ્ત્ર વિષયની અભ્યાસ સમિતિ દ્વારા રજુ કરાયેલ B.Sc. (ગણિતશાસ્ત્ર) સેમેસ્ટર-૦૧ અને ૦૨ નાં અભ્યાસક્રમો આગામી શૈક્ષણિક સત્ર જુન-૨૦૨૩ થી અમલમાં આવે તે રીતે ગણિતશાસ્ત્ર વિષયની અભ્યાસ સમિતિ, વિજ્ઞાન વિદ્યાશાખા, એકેડેમિક કાઉન્સિલ તથા સિન્ડિકેટની બહાલીની અપેક્ષાએ મંજુર કરવા માન.કુલપતિશ્રીને ભલામણ કરેલ, જે માન.કુલપતિશ્રીએ મંજુર કરેલ છે. જેથી સર્વે સંબંધિતોએ તે મુજબ તેનો અમલ કરવા વિનંતી.

(મુસદ્દો કુલસચિવશ્રીએ મંજુર કરેલ છે.)

સહી/-
(એ.એસ.પારેખ)
કુલસચિવ

બિડાણ:- ઉક્ત અભ્યાસક્રમ (સોફ્ટ કોપી)

રવાના કર્યુ

૨૮/૭/૨૩
એકેડેમિક ઓફીસર

પ્રતિ,

(૧)   વિજ્ઞાન વિદ્યાશાખા હેઠળ ગણિતશાસ્ત્ર વિષય ચલાવતી સ્નાતક કક્ષાની સર્વે સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓ તરફ.

(૨)   વિજ્ઞાન વિદ્યાશાખા હેઠળની ગણિતશાસ્ત્ર વિષયની અભ્યાસ સમિતિનાં સર્વે સભ્યશ્રીઓ

નકલ જાણ અર્થે સાદર રવાના:-

૧.   માન.કુલપતિશ્રી / કુલસચિવશ્રીનાં અંગત સચિવશ્રી

નકલ રવાના (યોગ્ય કાર્યવાહી અર્થે) :-

૧.   ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા
૨.   પરીક્ષા વિભાગ
૩.   પી.જી.ટી.આર.વિભાગ
૪.   જોડાણ વિભાગ

SAURASHTRA UNIVERSITY

Re-Accredited Grade B by NAAC

FACULTY OF SCIENCE

SYLLABUS FOR

Bachelor of Science (Mathematics) Four Years

B.Sc. Mathematics (Honours)

&

B.Sc. Mathematics (Honours with Research)

According to

NEP-2020 guidelines published by UGC
"Curriculum and Credit Framework for Undergraduate Programmes"
And
Framing of Uniform Credit Structure for all Higher Educational Institutions of the State and Implementation of the Common Curriculum and Credit Framework under the National Education Policy-2020
Government of Gujarat Education Department
GR No: KCG/admin/2023-24/0607/kh.1 Sachivalaya, Gandhinagar Date-11/07/2023

Curriculum Design Committee

Saurashtra University Rajkot

Sr. No.	Name of Faculty	Designation
1	Dr. Samir K. Vaidya	Chairman
2	Dr. Milankumar K. Kansagara	Member
3	Dr. Ankur N. Kansagara	Member
4	Dr. Vinaychandra N. Vaghasiya	Member

Re-Accredited Grade B by NAAC
FACULTY OF SCIENCE
Syllabus for
Bachelor of Science (Mathematics)
(Semester- I & II)
According to
NEP-2020 guidelines published by UGC
"Curriculum and Credit Framework for Undergraduate Programmes"
And
Framing of Uniform Credit Structure for all Higher Educational Institutions of the State and Implementation of the Common Curriculum and Credit Framework under the National Education Policy-2020
Government of Gujarat Education Department
GR No: KCG/admin/2023-24/0607/kh.1 Sachivalaya, Gandhinagar Date-11/07/2023

Effective from June – 2023
B.Sc. Mathematics (Honours /Honours with Research)

Effective From June – 2023

Programme Outcomes (PO):
By the end of the program the students will be able to:

PO 1	**Disciplinary Knowledge:** Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas.
PO 2	**Communication Skills:** Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modelling and solving of real life problems.
PO 3	**Critical thinking and analytical reasoning:** The students undergoing this programme acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real life problems.
PO 4	**Problem Solving:** The Mathematical knowledge gained by the students through this programme develop an ability to analyse the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students overall development
PO 5	**Research related skills:** The completing this programme develops the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.
PO 6	**Information/digital Literacy:** The completion of this programme will enable the learner to use appropriate software to solve system of algebraic equations and differential equations.
PO 7	**Self – directed learning:** The student completing this program will develop an ability of working independently and to make an in-depth study of various notions of Mathematics.
PO 8	**Moral and ethical awareness/reasoning:** The student completing this program will develop an ability to identify unethical behaviour such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general and Mathematical studies in general.
PO 9	**Lifelong learning:** This programme provides self-directed learning and lifelong learning skills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real world problems.
PO 10	**Advanced Studies and Research:** Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

Programme Specific Outcomes (PSO):

By the end of the program the students will be able to:

PSO 1	Student should be able to think in a critical manner and develop problem solving skills.
PSO 2	Students should be able to recall basic facts about mathematics and display knowledge of conventions such as notations, terminology etc.
PSO 3	Students are able to formulate and develop mathematical arguments in a logical manner.
PSO 4	It is to give in-depth knowledge of geometry, algebra, calculus, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas such as computer science and other allied subjects.
PSO 5	Students are motivate and prepare for research studies in mathematics and related fields.
PSO 6	Student should be able to apply their skills and knowledge in various fields of studies including, science, engineering, commerce and management etc.

Examination Skeleton of
Theory Paper (Major/ Minor/MDC) of 3-Credits

Theory	
External Examination (Conducted by Saurastra University)	**70 Marks** (Semester End Examination)
Internal Examination (Decided by College/Institute)	**30 Marks** (Comprehensive Continuous Assessment)
Total	**100 Marks**
Format of External Question Paper	
• There shall be paper of **70** marks and timing **2** hours and **30** minutes. • There shall be **FIVE** questions from each unit of **14** marks each. • Each question will be of the following form.	
Question: (A) Answer Any Two out of Four. (*)	**04 Marks**
(B) Answer any One out of Two. (*)	**04 Marks**
(C) Answer any One out of Two. (*)	**06 Marks**
TOTAL	**14 Marks**
*Paper setter could split the number of questions as per the need of subject topics in (A), (B) and (C).	

Examination Skeleton of
Practical Paper (Major/ Minor/MDC) of 1-Credit

Practical	
External Examination (Conducted by Saurastra University) Time: 3 Hours	Problems 25 Marks Via-voce 05 Marks Practical Journal 05 Marks _____ Total: **35 Marks**
Internal Evaluation (Continuous Internal Assessment of practical work)	**15 Marks**
Total	**50 Marks**

Examination Skeleton of
Paper (SEC/IKS/VAC) of 2-Credits

Internal evaluation of 50 marks will be decided by College / Institute.

B.Sc. (Major-Mathematics)
Semester-I
Major-1

Name of the Course	**Calculus-I**
Course Credit	**03**
Teaching Hours per Semester	**45**
Total Marks	**100**

Course	Outcomes
Mathematics **(Calculus-I)**	Students are able to 1) find the relation between roots and coefficients of a polynomial. 2) apply De'Movre's Theorem and could simplify some special types of complex expressions. 3) find higher order derivatives and could use it as a tool in other concepts. 4) use reduction formulae to evaluate some special types of integrals. 5) understand and could apply Mean Value Theorems. 6) find Taylor's series expansion of functions at given point. 7) evaluate indeterminate forms of limits.
Mathematics Practical (Graphs and Properties of Some Standard Functions)	Students are able to draw the graph of trigonometric, inverse trigonometric, hyperbolic, exponential and logarithmic functions and also know some properties and characteristics of functions like domain of the function, one-one, onto, periodicity, inevitability, even-odd, etc…

1) Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2) Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? હા

3) Major- Yes, Minor –No, Skill Enhancement Courses –No, Ability Enhancement Courses -No, Value Added Courses-No, Exit/ Vocational Courses- No

4) Holistic Education -No   Multidisciplinary -No   Interdisciplinary -No

5) દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6) New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7) Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8) ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objectives:

1) A primary objective of a course in Calculus is to provide a bridge to the students from high-school or lower-division Mathematics courses to upper-division Mathematics.
2) Students will be challenged to grow in mathematical maturity and to develop and strengthen problem-solving skills.
3) Students will learn higher order derivatives of a function.
4) Students will learn evaluation of some special types of integrals using reduction formulae.
5) Students will learn Mean value Theorems, expansions of functions and behaviour of functions in limiting situation.
6) The course will helps to the students for problem solving in Mathematics and also to understand other higher level concepts in Mathematics.

Unit No.	Topics	Hours	Marks
I	Relation between Roots and Coefficients of polynomial and problems based on it, Descartes' rule of sign. De'Moivre's Theorem and its applications, n^{th} roots of complex number, Results and Properties of nth roots of unity, Expansions of $\sin n\theta, \cos n\theta, \tan n\theta$ in powers of $\sin \theta, \cos \theta$.	9	14
II	Successive Differentiation, Standard Forms, Problems of successive differentiation based on standard forms, Leibnitz's Rule and its Applications.	9	14
III	Derivation of reduction formulae of $$\int \sin^n x \, dx, \int \cos^n x \, dx, \int \sin^m x \cos^n x \, dx, \int \tan^n x \, dx$$ $$\int_0^{\frac{\pi}{2}} \sin^n x \, dx, \int_0^{\frac{\pi}{2}} \cos^n x \, dx, \int_0^{\frac{\pi}{2}} \sin^m x \cos^n x \, dx, \int_0^{\frac{\pi}{4}} \tan^n x \, dx$$ Problems based on reduction formulae.	9	14
IV	Roll's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem, Geometric representation of Mean Value Theorems, Problems based on Mean Value Theorems.	9	14
V	Taylor's Theorem, Maclaurin's Theorem, Taylor's and Maclaurin's series expansions of functions. Application to evaluate approximate value of a function. Indeterminate Forms $\frac{0}{0}, \frac{\infty}{\infty}, 0 \times \infty, \infty - \infty, 0^0, \infty^0, 1^\infty$ L'Hospital's rule (Without proof) for various indeterminate forms.	9	14

B.Sc. (Major-Mathematics)
Semester-I
Major-1 Practical

Name of the Course	Graphs and Properties of Some Standard Functions
Course Credit	**01**
Teaching Hours per Semester	**30**
Total Marks	**50**

Guideline for Practical

The graphs in the entire practical (Pr. No. 1 to 10) are to be performed and visualised by the instructor using GeoGebra to explain properties of the graph and students will draw (manually) and note down its properties in journal.

Instructor will demonstrate similar kinds of relevant graphs (Other than mentioned in the list of practical) in GeoGebra and discuss its properties for more detailed knowledge and practice. It is advisable to keep record of demonstration of extra graphs but it is optional.

In the practical examination the questions should be formed from the graphs drawn by student in respective journal and graphs demonstrated by the instructor.

Pr.No.	Objective of Practical
1	To study the graphs of $y = \sin ax$ and $y = \cos ax$ and its properties.
2	To study the graphs of $y = \tan ax$ and $y = \cot ax$ and its properties.
3	To study the graphs of $y = cosec\ ax$ and $y = \sec ax$ and its properties.
4	To study the graphs of $y = \sin^{-1} x$ and $y = \cos^{-1} x$ and its properties.
5	To study the graphs of $y = \tan^{-1} x$ and $y = \cot^{-1} x$ and its properties.
6	To study the graphs of $y = cosec^{-1} x$ and $y = \sec^{-1} x$ and its properties.
7	To study the graphs of $y = e^{ax}$ and $y = a^x$ $(a > 0, a \neq 1)$ and its properties.
8	To study the graphs of $y = \log_{10} x$ and $y = \ln x$ and its properties.
9	To study the graphs of $y = \sinh x$, $y = \cosh x$ and $y = \tanh x$ and its properties.
10	To study the graphs of $y = cosech\ x$, $y = sech\ x$ and $y = \coth x$ and its properties.

Reference Books:

1) Differential Calculus, Shanti Narayan and P. K. Mital, S. Chand & Co. Ltd
2) Integral Calculus, Shanti Narayan and P. K. Mital, S. Chand & Co. Ltd
3) A Textbook of Engineering Mathematics, N. P. Bali, Manish Goyal Laxmi Publications(P) Ltd.
4) Mathematical Analysis, S. C. Malik, Savita Arora, New Age International Publishers, Fourth Edition, 2015.
5) Calculus, Thomas and Finney, Pearson Education, 9th or higher edition.
6) A basic Course in Real Analysis, Ajit kumar, S. Kumaresan, CRC Press.

B.Sc. (Major-Mathematics)
Semester-I
Major-2

Name of the Course	Matrix Algebra
Course Credit	03
Teaching Hours per Semester	45
Total Marks	100

Course	Outcomes
Mathematics **(Matrix Algebra)**	Students are able to 1) classify the types of matrices and know its properties. 2) identify the singularity of a matrix could take care of singularity during working with matrices. 3) find the rank of matrix by various ways and know the properties of rank. 4) solve system of linear equations using matrix algebra and also could classify the nature of the solution of system of linear equations by rank. 5) understand and apply the Cayley-Hamilton Theorem. 6) find eigen values and corresponding eigen vectors of a matrix and also know the properties of eigen value and eigen vectors. 7) take mathematical care whenever they deal with matrices in other concepts of Mathematics.
Mathematics Practical **(Curve Tracing)**	Students are able to draw the graph of a curve given in either Cartesian, Parametric or Polar form with the help of properties like symmetry about axis and origin, point of intersection, tangent at origin, asymptote parallel to axis, limitations, etc. and also could predict the rough shape of a give curve.

1. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? હા

3. Major- Yes,   Minor –No,   Skill Enhancement Courses -No.

   Ability Enhancement Courses - No,   Value Added Courses - No,

   Exit/ Vocational- Courses – No.

4. Holistic Education - No,   Multidisciplinary - No, Interdisciplinary -No

5. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6. New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8. ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objectives:

1) An objective of this course is to teach the concepts related to matrix theory and its applications in various aspects.
2) Students will learn Row Echelon Form (REF) and Reduced Row Echelon Form (RREF), Normal form, and rank of a matrix.
3) Students will learn applications of matrices to solve a linear system of equations.
4) Students will learn Eigenvalues and Eigenvectors.
5) Students will learn Cayley-Hemilton Theorem and its applications.

Unit No.	Topic	Hours	Marks
I	Reorientation of Matrix and Determinant, Types of Matrices, Results and Properties based on types of matrices. Singularity of Matrices, Results and properties of singularity of matrices and adjoint of matrix.	9	14
II	Row Echelon Form (REF) of a matrix, Reduced Row Echelon Form (RREF) of a matrix, Rank of a matrix by determinant, Rank of a matrix by RRF or RREF, Rank of matrix by Normal Form, Results and Properties of rank of a matrix.	9	14
III	Homogeneous System of Linear Equations, Non-Homogeneous System of Linear Equations, Results on classification of solution(s) of homogeneous and non-homogeneous system of liner equations in terms of rank (without Proof), Consistency of system of equations, Solution of system of linear equations by Gauss elimination method, Solution of system of linear equations by Gauss-Jordan elimination method, Problems based on solution of System of equations.	9	14
IV	Characteristic Equation and Characteristic roots of a matrix, Cayley-Hamilton Theorem, Applications of Cayley-Hamilton Theorem.	9	14
V	Eigen values of a matrix, Results and properties of eigen values of a matrix, Eigen vectors of a matrix.	9	14

B.Sc. (Major-Mathematics)
Semester-I
Major-2 Practical

Name of the Course	Curve Tracing
Course Credit	**01**
Teaching Hours per Semester	**30**
Total Marks	**50**

Pr. No.	Objective of Practical
1	**To learn procedure for tracing of Cartesian curves :** (A) Symmetry about the X-axis. (B) Symmetry about the Y-axis. (C) Symmetry about the origin. (D) Symmetry about the line $y = x$. (E) Intersection points with axis.
2	**To learn procedure for tracing of Cartesian curves :** (A) Origin and Tangents thereat. (B) Asymptotes parallel to the X-axis. (C) Asymptotes parallel to the Y-axis. (D) Limitations.
3	**Trace the curves :** (i) $y^2(2a - x) = x^3$, $(a > 0)$. (ii) $x^2 y = a^2(a - y)$, $(a > 0)$. **Extra Practice : Trace the following curves:** (iii) $x^2(2a - y) = y^3$, $(a > 0)$. (iv) $xy^2 = a^2(a - x)$, $(a > 0)$. (v) $y(x^2 + 4a^2) = 8a^3$, $(a > 0)$.
4	**Trace the curves :** (i) $x(x^2 + y^2) = a(x^2 - y^2)$, $(a > 0)$. (ii) $x^2 y + (y + a)^2(y + 2a) = 0$, $(a > 0)$. **Extra Practice : Trace the following curves:** (iii) $y(x^2 + y^2) = a(y^2 - x^2)$, $(a > 0)$. (iv) $xy^2 + (x + a)^2(x + 2a) = 0$, $(a > 0)$. (v) $y^2(a + x) = x^2(3a - x)$, $(a > 0)$. (vi) $y^2(a - x) = x^2(a + x)$, $(a > 0)$.
5	**Trace the curves :** (i) $a^2 y^2 = x^3(2a - x)$, $(a > 0)$ (ii) $y^2(a^2 + x^2) = x^2(a^2 - x^2)$, $(a > 0)$ **Extra Practice : Trace the following curves:** (iii) $a^2 x^2 = y^3(2a - y)$, $(a > 0)$ (iv) $ay^2 = x(x - a)^2$, $(a > 0)$ (v) $y^2(x^2 + y^2) = a^2(y^2 - x^2)$, $(a > 0)$ (vi) $a^2 y^2 = x^2(a^2 - x^2)$, $(a > 0)$

6	**To learn procedure for tracing of Parametric curves :** (A) Symmetry about X-axis. (B) Symmetry about Y-axis. (C) Symmetry in opposite quadrants. (D) Curve passing through origin. (E) Limitations of the curve. (F) Axis of Intersection. (G) Special points. (H) Region.
7	**Trace the curve :** (i) $x = a(t + \sin t); \ y = a(1 - \cos t), \ (a > 0)$. (ii) $x = a(t + \sin t); \ y = a(1 + \cos t), \ (a > 0)$. **Extra Practice : Trace the following curves:** (iii) $x = a(t - \sin t); \ y = a(1 - \cos t), \ (a > 0)$. (iv) $x = a(t - \sin t); \ y = a(1 + \cos t), \ (a > 0)$.
8	**Trace the curve :** (i) $\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} = 1, (a, b > 0)$. (ii) $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}, (a > 0)$.
9	**To learn procedure for tracing of Polar curves :** (A) Definition of polar coordinates. (B) Relation between polar and Cartesian coordinates. (C) Symmetry about the initial line (polar axis). (D) Symmetry about the line $\theta = \frac{\pi}{2}$ (Normal axis). (E) Symmetry about the pole. (F) Curve passing through pole. (G) Intersection with initial axis and Normal axis. (H) Value of ϕ. (I) Region.
10	**Trace the curve :** (i) $r = a(1 + \cos \theta), (a > 0)$. (Cardioid) (ii) $r = a(1 - \sin \theta), (a > 0)$. (Cardioid) (iii) $r^2 = a^2 \cos 2\theta, \ (a > 0)$. (Lemniscate) (iv) $r = a \sin 3\theta, (a > 0)$ (Rose curve) **Extra Practice : Trace the following curves:** (i) $r = a(1 - \cos \theta), \ (a > 0)$. (ii) $r = a(1 + \sin \theta), \ (a > 0)$. (iii) $r^2 = -a^2 \sin 2\theta \ (a > 0)$. (iv) $r^2 = -a^2 \cos 2\theta, \ (a > 0)$. (v) $r^2 = a \cos 2\theta, \ (a > 0)$. (vi) $r = a \sin 2\theta, (a > 0)$. (vii) $r = a \cos 3\theta, (a > 0)$

Reference Books:

1) A Textbook of Matrices, Shanti Narayan, P. K. Mittal, S. Chand & Co. Ltd.
2) Matrices, A. R. Vasishtha, A. K. Vasishtha, Krishna Prakashan Media(P) Ltd.
3) Linear Algebra A Geometric Approach, S. Kumaresan, PHI Learning Private Limited.
4) Linear Algebra, Vivek Sahai, Vikas Bist, Narosha Publishing House.
5) A Textbook of Engineering Mathematics, N. P. Bali, Manish Goyal Laxmi Publications(P) Ltd.
6) Calculus, Thomas and Finney, Pearson Education, 9th or higher edition.

Bachelor of Science (B.Sc.)
Semester-I
Minor (Mathematics)

Name of the Course	Calculus-I
Course Credit	03
Teaching Hours per Semester	45
Total Marks	100

Course	Outcomes
Mathematics **(Calculus-I)**	Students are able to 1) find the relation between roots and coefficients of a polynomial. 2) apply De'Movre's Theorem and could simplify some special types of complex expressions. 3) find higher order derivatives and could use it as a tool in other concepts. 4) use reduction formulae to evaluate some special types of integrals. 5) understand and could apply Mean Value Theorems. 6) find Taylor's series expansion of functions at given point. 7) evaluate indeterminate forms of limits.
Mathematics Practical (Graphs and Properties of some Standard Functions)	Students are able to draw the graph of trigonometric, inverse trigonometric, hyperbolic, exponential and logarithmic functions and also know some properties and characteristics of functions like domain of the function, one-one, onto, periodicity, inevitability, even-odd, etc.

1) Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2) Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? હા

3) Major- No   Minor –Yes   Skill Enhancement Courses -No

   Ability Enhancement Courses -No,   Value Added Courses-No

   Exit/ Vocational-No Courses

4) Holistic Education -No   Multidisciplinary -No   Interdisciplinary -No

5) દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6) New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7) Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8) ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objectives:

1) A primary objective of a course in Calculus is to provide a bridge to the students from high-school or lower-division Mathematics courses to upper-division Mathematics.
2) Students will be challenged to grow in mathematical maturity and to develop and strengthen problem-solving skills.
3) Students will learn higher order derivatives of a function.
4) Students will learn evaluation of some special types of integrals using reduction formulae.
5) Students will learn Mean value Theorems, expansions of functions and behaviour of functions in limiting situation.
6) The course will helps to the students for problem solving in Mathematics and also to understand other higher level concepts in Mathematics.

Unit No.	Topics	Hours	Marks
I	Relation between Roots and Coefficients of polynomial and problems based on it, Descartes' rule of sign. De'Moivre's Theorem and its applications, n^{th} roots of complex number, Results and Properties of nth roots of unity, Expansions of $\sin n\theta, \cos n\theta, \tan n\theta$ in powers of $\sin\theta, \cos\theta$.	9	14
II	Successive Differentiation, Standard Forms, Problems of successive differentiation based on standard forms, Leibnitz's Rule and its Applications.	9	14
III	Derivation of reduction formulae of $\int \sin^n x \, dx, \int \cos^n x \, dx, \int \sin^m x \cos^n x \, dx, \int \tan^n x \, dx$ $\int_0^{\frac{\pi}{2}} \sin^n x \, dx, \int_0^{\frac{\pi}{2}} \cos^n x \, dx, \int_0^{\frac{\pi}{2}} \sin^m x \cos^n x \, dx, \int_0^{\frac{\pi}{4}} \tan^n x \, dx$ Problems based on reduction formulae.	9	14
IV	Roll's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem, Geometric representation of Mean Value Theorems, Problems based on Mean Value Theorems.	9	14
V	Taylor's Theorem, Maclaurin's Theorem, Taylor's and Maclaurin's series expansions of functions. Application to evaluate approximate value of a function. Indeterminate Forms $\frac{0}{0}, \frac{\infty}{\infty}, 0 \times \infty, \infty - \infty, 0^0, \infty^0, 1^\infty$ L'Hospital's rule (Without proof) for various indeterminate forms.	9	14

Bachelor of Science (B.Sc.)
Semester-I
Minor (Mathematics Practical)

Name of the Course	Graphs and Properties of Some Standard Functions
Course Credit	**01**
Teaching Hours per Semester	**30**
Total Marks	**50**

Pr.No.	Objective of Practical
1	To study the graphs of $y = \sin ax$ and $y = \cos ax$ and its properties.
2	To study the graphs of $y = \tan ax$ and $y = \cot ax$ and its properties.
3	To study the graphs of $y = cosec\ ax$ and $y = \sec ax$ and its properties.
4	To study the graphs of $y = \sin^{-1} x$ and $y = \cos^{-1} x$ and its properties.
5	To study the graphs of $y = \tan^{-1} x$ and $y = \cot^{-1} x$ and its properties.
6	To study the graphs of $y = cosec^{-1} x$ and $y = \sec^{-1} x$ and its properties.
7	To study the graphs of $y = e^{ax}$ and $y = a^x$ $(a > 0, a \neq 1)$ and its properties.
8	To study the graphs of $y = \log_{10} x$ and $y = \ln x$ and its properties.
9	To study the graphs of $y = \sinh x$, $y = \cosh x$ and $y = \tanh x$ and its properties.
10	To study the graphs of $y = cosech\ x$, $y = sech\ x$ and $y = \coth x$ and its properties.

Reference Books:

1) Differential Calculus, Shanti Narayan and P. K. Mital, S. Chand & Co. Ltd.
2) Integral Calculus, Shanti Narayan and P. K. Mital, S. Chand & Co. Ltd.
3) A Textbook of Engineering Mathematics, N. P. Bali, Manish Goyal Laxmi Publications(P) Ltd.
4) Mathematical Analysis, S. C. Malik, Savita Arora, New Age International Publishers, Fourth Edition, 2015.
5) Calculus, Thomas and Finney, Pearson Education, 9th or higher edition.
6) A basic Course in Real Analysis, Ajit kumar, S. Kumaresan, CRC Press.

Bachelor of Science (B.Sc.)
Semester-I
MDC-A (Mathematics)

Name of the Course	Basic Mathematics for Physics and Chemistry-I
Course Credit	03
Teaching Hours per Semester	45
Total Marks	100

Course	Outcomes
Mathematics **(Basic Mathematics for Physics and** **Chemistry-I)**	Students are able to 1) expand determinant and understand the theory of matrices. 2) identify the singularity of a matrix could take care of singularity during working with matrices. 3) reduce a matrix in REF or RREF and could find rank using it. 4) solve system of linear equations and also could classify the nature of the solution of system of linear equations by rank. 5) find eigen values and corresponding eigen vectors of a matrix and also know properties of eigen value and eigen vectors. 6) Solve first order differential equation and second order differential equation with constant coefficients.
Mathematics Practical (Applications of Basic Mathematics to Physics and Chemistry-I)	Students are able to draw the graph of trigonometric functions and also know some properties of it; could solve system of homogeneous and non-homogeneous system of linear equations and use it to find Eigen vectors corresponding to Eigen value of a matrix. Moreover students could solve some real world problems using first order differential equation and second order differential equation with constant coefficients.

1) Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2) Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? <u>હા</u>

3) Major- No   Minor –No   Skill Enhancement Courses -No

   Ability Enhancement Courses -No,   Value Added Courses-No   Exit/ Vocational-No
   Courses

4) Holistic Education -No   Multidisciplinary -Yes   Interdisciplinary -No

5) દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6) New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7) Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8) ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objectives:

1) An objective of this course is to introduce the students to the fundamental concepts of Mathematics like functions, algebra of functions, graph of functions.
2) Students will learn determinant, matrix and its properties,.
3) Students will learn techniques to find solution and classify the nature of the solutions of system of linear equations.
4) Students will be orient by the concept of limit, continuity, differentiation, integration and its applications.
5) Students will learn first order differential equation and second order differential equation and its applications in their respective subjects.

Unit No.	Topics	Hours	Marks
I	Determinant, Expansion of Determinants, Properties of Determinant (Without Proof), Matrices, Types of Matrices, Algebra of Matrices, Singularity of Matrix, Row Echelon Form, Reduced Row Echelon Form, Rank of a matrix by REF or RREF, Nature of solution of system of linear equations by rank (Only statements), Solution of System of Linear Equation using Matrices, Eigenvalues and Eigenvectors of a matrix, Basic properties of Eigen values.	9	14
II	Function, Domain and Range of some standard functions (Constant, Identity, Linear, Quadratic, Polynomial, Trigonometric, Exponential, Logarithmic), Algebra of functions, Composition of functions, Even and odd functions, At least three examples of functions of respective discipline.	9	14
III	Orientation of Limit, Continuity and Differentiability of a function (Don't Explain the concept of Limit and Continuity by ϵ-δ definition, Don't Explain the concept of Differentiation by limit), Derivative as a gradient, Increasing and decreasing functions using derivative, Concavity of a function (Concave upwards/Concave downwards), Integration as an inverse process of differentiation, Elementary techniques of evaluation of integration.	9	14

IV	Differential equation, Order and degree of a differential equation, Solution of First Order Differential Equations (Variable separable, Homogeneous, Linear differential equation and Exact differential equation).	**9**	**14**
V	Second order differential equation with constant coefficients, Complementary function, Particular integral, General solution, Methods to find particular integral.	**9**	**14**

Bachelor of Science (B.Sc.)
Semester-I
MDC-A (Mathematics Practical)

Name of the Course	**Applications of Basic Mathematics to Physics and Chemistry-I**
Course Credit	**01**
Teaching Hours per Semester	**30**
Total Marks	**50**

Pr. No.	**Objective of Practical**
1	To study properties and graph of $y = \sin ax$ and $y = \cos ax$.
2	To study properties and graph of $y = \tan ax$ and $y = \cot ax$.
3	To study properties and graph of $y = \operatorname{cosec} ax$ and $y = \sec ax$.
4	To solve non-homogeneous system of linear equation by Gauss elimination or Gauss-Jordan method. (Include each case: No solution, Unique Solution, Infinitely many solutions)
5	To solve homogeneous system of linear equation by Gauss elimination or Gauss-Jordan method. (Include each case: Unique Solution, Infinitely many solutions)
6	To find slope and equations of tangent and normal at a given point of a given curve.
7	To find Eigen values and Eigen vectors of a given matrix. (Repeated Eigen vectors)
8	To find Eigen values and Eigen vectors of a given matrix. (Distinct Eigen vectors)
9	To study applications of first order differential equation to real life problems.
10	To study applications of second order differential equation to real life problems.

Reference Books:
1) Calculus, Thomas and Finney, Pearson Education, 9th or higher edition.
2) A Textbook of Matrices, Shanti Narayan, P. K. Mittal, S. Chand & Co. Ltd.
3) Matrices, A. R. Vasishtha, A. K. Vasishtha, Krishna Prakashan Media(P) Ltd.
4) Linear Algebra A Geometric Approach, S. Kumaresan, PHI Learning Private Limited.
5) Linear Algebra, Vivek Sahai, Vikas Bist, Narosha Publishing House.
6) Advanced Engineering Mathematics, Erwin Kreyszing, Wiley Publications.

Bachelor of Science (B.Sc.)
Semester-I
MDC-B (Mathematics)

Name of the Course	**Basic Bioinformatics-I**
Course Credit	**03**
Teaching Hours per Semester	**45**
Total Marks	**100**

Course	Outcomes
Mathematics **(Basic Bioinformatics-I)**	Students are able to 1) classify the data. 2) create and interpret frequency tables. 3) display data graphically and interpret graphs, histogram, frequency polygon, bar chart, pie chart, etc. 4) recognize, describe, and calculate the measures of the center of data: mean, median, and mode. 5) recognize, describe, and calculate the measures of the spread of data: variance, standard deviation, and range. 6) find correlation of coefficient for both types of data qualitative and quantitative. 7) Find equation of regression line for the given data or data obtained from experiment.
Mathematics Practical (Data Analysis)	After completing all the practical, in the case of large data, students are able to represent the data in graphical form and also could analyze the data with respect to measures of central tendency and measures of dispersions using Microsoft Excel. Students could predict the trend between two set of data using correlation coefficient using Microsoft Excel. Also students could find the equation of regression line using Microsoft Excel.

1) Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2) Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? <u>હા</u>

3) Major- No   Minor –No   Skill Enhancement Courses -No

Ability Enhancement Courses -No, Value Added Courses-No

Exit/ Vocational Courses -No

4) Holistic Education -No   Multidisciplinary -Yes   Interdisciplinary -No

5) દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6) New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7) Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8) ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objectives:

1) Students will learn to organize the data in tabular form.
2) Students will learn the concept of a frequency distribution for sample data, and be able to summarise the distribution by diagrams and statistics,
3) Students will learn various methods to find correlation.
4) Students will understand the theory of regression, and be able to make predictions and understand their limitations.

Unit No.	Topics	Hours	Marks
I	Data, Ungrouped Data, Grouped Data, Frequency Distribution, Graphical Representation of frequency distribution, Histogram or Bar Chart, Frequency Polygon, Frequency curve, Ogive or Cumulative Frequency Curve, Pie Chart, Good enough examples of each concept.	9	14
II	Measure of central Tendency, Mean, Weighted Mean, Median, Mode, Quartiles, Deciles, Percentiles, Geometric Mean and Harmonic Mean for Ungrouped Data, Frequency Distribution and Continuous Frequency Distribution, Good enough examples of each concept.	9	14
III	Measure of Dispersion, Range, Mean deviation, Mean deviation about mean, Mean deviation about median, Coefficient of Mean deviation, Standard deviation, Variance, Coefficient of variance, Good enough examples of each concept.	9	14
IV	Correlation, Types of correlation, Coefficient of Correlation, Methods of Correlation: Scatter Diagram Method, Karl Person's Product Moment Method and Spearman's Rank Correlation Method, Good enough examples of each concept.	9	14
V	Regression, Regression Lines, Methods to obtain Regression Lines: The Scatter Diagram Method and The Method of Least Squares, Regression Equations, Formulae for Computations of Regression Coefficients, Examples of Regression Lines, Good enough examples of each concept.	9	14

B.Sc. (Major-Mathematics)
Semester-I
MDC-B (Mathematics Practical)

Name of the Course	**Data Analysis**
Course Credit	**01**
Teaching Hours per Semester	**30**
Total Marks	**50**

The entire practical are to be performed in computer lab. **Suggested Software - Microsoft Excel.**	
Pr. No.	**Objective of Practical**
1	To draw and study the Histogram and Frequency Polygon of given data and analyse the data.
2	To draw and study the Frequency curve, Ogive or Cumulative Frequency Curve, Pie Chart of given data and analyse the data.
3	To find Mean, Weighted Mean, Median and Mode of given data and analyse the data.
4	To find Quartiles, Deciles, Percentiles, Geometric Mean and Harmonic Mean of given data and analyse the data.
5	To find Range, Mean deviation about mean, Mean deviation about median and Coefficient of Mean Deviation of given data and analyse the data.
6	To find Standard deviation, Variance and Coefficient of variance of given data and analyse the data.
7	To find correlation between two sets of data by Karl Person's Product Moment Method.
8	To find correlation between two sets of data by Spearman's Rank Correlation Method.
9	To obtain regression lines (x on y, y on x) of given data by least square method.
10	To find regression coefficients of regression lines of given data.

Reference Books:

1) S.C. Gupta and V. K. Kapoor, Fundamental of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2) G upta S. C. & Kapoor V. K. : Fundamental of Applied Statistics, Sultan Chand & Sons, New Delhi.

Bachelor of Science (B.Sc.)
Semester-I
SEC-(Mathematics)

Name of the Course	How to Write and Read Mathematics?
Course Credit	02
Teaching Hours per Semester	60
Total Marks	50

Course	Outcomes
How to Write and Read Mathematics?	Students are able to 1) understand difference between "and", "or", etc… 2) convert information in to Mathematical statements. 3) use various notations to express Mathematical ideas. 4) take care in Mathematical drafting. 5) write proof of basic results independently. 6) read reference books.

1) Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2) Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? હા

3) Major- No   Minor –No   Skill Enhancement Courses -Yes

   Ability Enhancement Courses -No,   Value Added Courses-No

   Exit/ Vocational-No Courses

4) Holistic Education -No   Multidisciplinary -No   Interdisciplinary -No

5) દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6) New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7) Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8) ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objectives:

1) Students will learn the Mathematical meaning of "and, or, for all, there, etc."
2) Students will learn Mathematical formulation of a problem.
3) The ultimate objective of this course is to make aware and conscious about writing Mathematics as well as reading Mathematics correctly.
4) Students will learn how to explore reference book and how to find required information from it.
5) Students could start to read reference books for detail study.

Unit No.	Topics
I	Mathematical Statement, Mathematical understanding of "and", "or", "for all", "there exists", "implies", "if and only if " etc.. with examples, Making of converse of a statement, Understanding and use of "Therefore", "Thus", "Hence", etc. in Mathematical arguments by suitable examples. Understanding of difference between similar Mathematical terminology like similarity and congruency of two triangles, determinant and matrix etc…AMS (American Mathematical Society) Notations.
II	Conversion of word statement in to Mathematical statement with Mathematical notations, Alignments in Mathematical writing, Necessity of proof or counter example. Proof of simple results to understand care of Mathematical draft.
III	Difference among Definition, Postulate, Proposition, Lemma, Theorem, Corollary, Conjuncture etc., How to apply Theorem or results to solve some problems by appropriate examples, How to excess library, How to find reference book, How to read reference book, How to find a concept or a topic or a term in reference book, etc. How to prepare presentations in Mathematics.

Reference Books:

1) A basic Course in Real Analysis, Ajit kumar, S. Kumaresan, CRC Press.
2) Calculus, Thomas and Finney, Pearson Education, 9th or higher edition.
3) Mathematical Analysis, S. C. Malik, Savita Arora, New Age International Publishers, Fourth Edition, 2015.
4) Student may use any standard UG Mathematics book as per his/her level of understanding.

Bachelor of Science - B.Sc.
Semester-I
IKS (Mathematics)

Name of the Course	Vedic Mathematics
Course Credit	02
Teaching Hours per Semester	60
Total Marks	50

Course	Outcomes
Indian Knowledge System **(Vedic Mathematics)**	By successfully completing this course, the learner will be able to: 1) Perform simple arithmetic calculations with speed and accuracy. 2) Will be able to generate tables of any number. 3) To perform products of large numbers quickly. 4) Develop confidence in calculating square roots and cube roots of integers. 5) Perform difficult calculations speedily. 6) Face Numerical Aptitude part of any Competitive Examination confidently.

1) Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2) Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? હા

3) Major- No   Minor - No   Skill Enhancement Courses -No

   Ability Enhancement Courses -No,   Value Added Courses-No

   Exit/ Vocational Courses - No

4) Holistic Education -No   Multidisciplinary -No   Interdisciplinary -No

5) દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6) New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7) Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8) ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? હા

Objectives:

1) To enable the students to explore the power of Vedic Mathematics.
2) To make students strong in numerical Mathematical calculations.
3) To enable students to recognize and understand simple techniques of arithmetic calculations.
4) To train studentss to use the ideas of Vedic Mathematics in daily calculations and make those calculations with accuracy and speed.

Unit No.	Topics
I	History and Evolution of Vedic Mathematics, Introduction of Basic Vedic Mathematics, Techniques in Multiplication (Special Case, Series of 9, Series of 1 etc), Tables etc., Comparison of Standard Methods with Vedic Methods.
II	Various techniques to carry out basic operations covering Addition, Subtraction, Multiplication, Division, Complements and Bases, Vinculum number, General multiplication (Vertically Crosswise), Multiplications by numbers near base, Verifying answers by use of digital roots, Divisibility tests, Division of numbers near base, Comparison of fractions.
III	Applications of Vinculum, Different methods of Squares (General method, Base method, Duplex method etc.), Cubes, Cube roots, Square roots, General division, Quadratic Equations, Simultaneous Equations, Use of various Vedic Techniques for answering numerical aptitude questions from Competitive Examinations.

Reference Books:

1) Swami Bharati Krishna Tirtha, Vasudeva Sharana Agrawala, V. S. Agrawala, Motilal Banarsidass Publishers Pvt Ltd., 1992.
2) Bhatiya Dhaval, Vedic Mathematics Made Easy, Jaico Publishing House.
3) Thakur Rajesh Kumar, Vedic Mathematics for students taking Competitive Examinations. Unicorn Books 2015 or Later Edition.
4) Gupta Atul, Power of Vedic Mathematics with Trigonometry , Jaico Books.
5) V. G. Unkalkar, Magical World of Mathematics (Vedic Mathematics), Vandana Publishers, Bangalore.

B.Sc. (Major-Mathematics)
Semester-II
Major-1

Name of the Course	Calculus-II
Course Credit	**03**
Teaching Hours per Semester	**45**
Total Marks	**100**

Course	Outcomes
Mathematics **(Calculus-II)**	Students are able to 1) understand the concept of neighborhood of a point, limit at a point and continuity at a point for a function of two variables. 2) compute first order, higher order partial derivatives by both definition and working rules. 3) understand the importance and difference of order of variables in evaluation of partial derivatives of a function. 4) apply various chain rules to calculate partial derivatives. 5) prove and apply Euler's Theorem for homogeneous function. 6) find the Taylor's series expansion of a function of two variables. 7) find approximate value of a function along with relative error and percentage error in it.
Mathematics Practical **(Applications of Partial Derivatives)**	After completing all the practical student will be able to 1) find the Jacobian of a given set of relations. 2) apply the concepts and techniques of partial derivative in to finding maxima and minima of a function of two variables. 3) apply Lagrange's Method of Undetermined Coefficient in order to find extreme values of a function of two variables. 4) solve some physical real life problems with the help of theory of partial derivative.

1. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? હા

3. Major- Yes,   Minor –No,   Skill Enhancement Courses -No.

   Ability Enhancement Courses - No,   Value Added Courses - No,

   Exit/ Vocational- Courses – No.

4. Holistic Education - No,   Multidisciplinary - No, Interdisciplinary -No

5. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6. New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8. ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objectives:

1) Upon completing this course students have been introduced the generalization of theory for a single variable to theory for two variables.
2) Students will observe analogue and differences in the concepts for a single variable and multivariable calculus.
3) The course will teach what kinds of care need to deal especially with neighbourhood, limit, continuity, differentiability of a function of two variables.
4) Students will learn applications of Euler's Theorem to evaluate some standard expressions involving partial derivatives or higher order partial derivatives.
5) Students will express a function in terms of an infinite series and also approximate its value at a point along with relative and percentage error.
6) Students will learn various techniques to find maxima or minima of a function of two variables.
7) The course is to equip the student with necessary analytical and technical skills used in the analysis.

Unit No.	Topics	Hours	Marks
I	Functions of two or more variables, Explicit and Implicit functions, The δ −Neighbourhood and deleted δ −Neighbourhood of a point (a, b), Definition of the limit of a function, Examples to find limit using definition, Repeated Limits, Examples of Non-existence of the limits, Algebra of limits (Without Proof).	9	14
II	Definition of the continuity of a function at point (a, b). Examples to check continuity at a point (a, b), Algebra of continuity (Without Proof), Definition of partial derivative, Notations for partial derivative and higher order partial derivative, Examples to find partial derivatives using definition, Geometrical meaning of partial derivative.	9	14

III	Working rules to find partial derivatives and higher order partial derivatives, Examples to find higher order and mixed partial derivatives, The differential of f at (x, y), Change of order of partial derivative, Young's Theorem (Without Proof), Schwarz's Theorem (Without Proof), Differentiation of composite functions (Chain rules), Examples based on chain rules.	**9**	**14**
IV	Homogeneous function, Euler's Theorem on Homogeneous function and its consequences, Problems based on Euler's Theorem and its consequences.	**9**	**14**
V	Taylor's Theorem for two variables, Taylor's series expansion for a function of two variables, Approximate value of $f(x, y)$, Errors in $f(x, y)$ (Relative error, Absolute Error and Percentage error).	**9**	**14**

B.Sc. (Major-Mathematics)
Semester-II
Major-1 Practical

Name of the Course	Applications of Partial Derivatives
Course Credit	**01**
Teaching Hours per Semester	**30**
Total Marks	**50**

Pr.No.	Objective of Practical
1	To find Jacobian of polar coordinates, cylindrical coordinates spherical coordinates.
2	To study properties of Jacobian and problems based on it.
3	To find Jacobian and inverse Jacobian of given relations.
4	To study the concept of extreme values, stationary point, saddle point, etc. and working rules to find maxima and minima for functions of two variables.
5	To find extreme values of given function of two variables. (Consider at least four problems of various types.)
6	To find extreme values of word problems or real life world problems involving two variables.
7	To learn Lagrange's Method of Undetermined Multipliers (LMUM).
8	To find extreme values of given function subject to some function by LMUM. (Consider at least four problems of various types.)
9	To solve word problems or real life world problems by LMUM. (Consider at least four problems of various types.)
10	To solve word problems or real life world problems by LMUM. (Consider at least four problems of various types.)

Reference Books:

1) Mathematical Analysis, S. C. Malik, Savita Arora, New Age International Publishers, Fourth Edition, 2015.
2) Calculus, Thomas and Finney, Pearson Education, 9th or higher edition.
3) A Textbook of Engineering Mathematics, N. P. Bali, Manish Goyal Laxmi Publications(P) Ltd.

B.Sc. (Major-Mathematics)
Semester-II
Major-2

Name of the Course	Real Analysis-I
Course Credit	03
Teaching Hours per Semester	45
Total Marks	100

Course	Outcomes
Mathematics **(Real Analysis-I)**	Students are able to 1) understand the concept of bounded set, unbounded set, least upper bound, greatest lower bound, limit point etc. 2) understand the definitions of limits and convergence in the context of sequences and series of real numbers. 3) to compute limits of sequences and series of real numbers. 4) apply various test to check convergence of sequence and series. 5) prove simple statements involving convergence arguments. 6) know the basic concepts and developments of real analysis which will prepare the students to take up further applications in the relevant fields.
Mathematics Practical **(Rectification, Volume and Surface Area of Revolution.)**	After completing all the practical student will be able to 1) find the length of segment of a given curve. 2) volume of the solid generated by revolving a curve about a line. 3) surface area of the surface obtained on revolving a curve about a line. 4) imagine the shape of solid and surface of revolution of a curve.

1. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? <u>હા</u>

3. Major- Yes, Minor –No, Skill Enhancement Courses -No.

Ability Enhancement Courses - No,   Value Added Courses - No,

Exit/ Vocational- Courses – No.

4. Holistic Education - No,   Multidisciplinary - No,   Interdisciplinary -No

5. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6. New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8. ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objectives:

1) Upon completing this course students have been introduced the concept of sequence and series of real numbers.
2) Students will know terminologies associated with sequence and series like limit, convergence, divergence, absolute convergence, conditional convergence of sequence and series etc.
3) Student will learn various analytical techniques and tests to decide convergence.
4) The course will helps in how to deal with an enumeration process involving infinitely many numbers.
5) The course is designed to equip the student with necessary analytical and technical skills used in analysis.

Unit No.	Topics	Hours	Marks
I	Upper and Lower bounds of a set, Bounded and Unbounded sets, Least upper bound and Greatest lower bound of a set, Archimedean Property (Without proof), Limit point of a set, Bolzano Weierstrass Theorem for set (Without proof), Definition of sequence, Bounds of a sequence, Range of a sequence, Monotonic increasing and Monotonic decreasing sequence, Limit point of a sequence, Convergence of a sequence, Non convergent sequence, Elementary results on convergence of sequence, Bolzano Weierstrass Theorem for sequence.	9	14
II	Algebra of convergent sequence, Cauchy sequence, Cauchy's general principle of convergence, Sandwich Theorem, Cauchy's first Theorem on Linits, Cesaro's Theorem.	9	14
III	Cauchy's second Theorem on Limits, Subsequence, Results and problems on convergence of Monotonic sequences, Nested-Interval Theorem for sequence.	9	14

IV	Definition of infinite series, Sequence of partial sum, Convergence of series, Geometric series, Positive term series, Cauchy's fundamental test for convergence for series, Cauchy's general principle of convergence for series, Convergence of p-series, Comparison test, Cauchy's root test.	9	14
V	D'Alembert's ratio test, Raabe's test (Without Proof), Logarithmic test (Without Proof), Alternating series, Leibnitz test, Absolute convergence, Conditional convergence.	9	14

B.Sc. (Major-Mathematics)
Semester-II
Major-2 Practical

Name of the Course	Rectification, Volume and Surface area of revolution.
Course Credit	**01**
Teaching Hours per Semester	**30**
Total Marks	**50**

Pr. No.	Objective of Practical
1	Derivation of the formula for rectification of the Cartesian curve, Parametric curve, Polar curve.
2	To rectify a piece of given Cartesian curves.
3	To rectify a piece of given Parametric curves.
4	To rectify a piece of given Polar curves.
5	To find volume of revolution of given Cartesian curves.
6	To find volume of revolution of given Parametric curves.
7	To find volume of revolution of given Polar curves.
8	To find surface area of revolution of given Cartesian curves.
9	To find surface area revolution of given Parametric curves.
10	To find surface area revolution of given Polar curves.

Reference Books:

1) Mathematical Analysis, S. C. Malik, Savita Arora, New Age International Publishers, Fourth Edition, 2015.
2) A Basic Course in Analysis, Ajitkumar, S.Kumaresan, CRC Press.
3) Calculus, Thomas and Finney, Pearson Education, 9th or higher edition.
4) A Textbook of Engineering Mathematics, N. P. Bali, Manish Goyal Laxmi Publications(P) Ltd.

Bachelor of Science (B.Sc.)
Semester-II
Minor (Mathematics)

Name of the Course	Calculus-II
Course Credit	**03**
Teaching Hours per Semester	**45**
Total Marks	**100**

Course	Outcomes
Mathematics **(Advanced Calculus)**	Students are able to 1) understand the concept of neighborhood of a point, limit at a point and continuity at a point for a function of two variables. 2) compute first ordered, higher ordered partial derivatives by both definition and working rules. 3) understand the importance and difference of order of variables in evaluation of partial derivatives of a function. 4) apply various chai rules to calculate partial derivatives. 5) prove and apply Euler's Theorem for homogeneous function. 6) find the Taylor's series expansion of a function of two variables. 7) find approximate value of a function along with relative error and percentage error in it.
Mathematics Practical **(Applications of Partial Derivatives)**	After completing all the practical student will be able to 1) find the Jacobian of a given set of relations. 2) apply the concepts and techniques of partial derivative in to finding maxima and minima of a function of two variables. 3) apply Lagrange's Method of Undetermined Coefficient in order to find extreme values of a function of two variables. 4) solve some physical real life problems with the help of theory of partial derivative.

B.Sc. Mathematics (Honours) & B.Sc. Mathematics (Honours With Research)

1. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? હા

3. Major- No,   Minor –Yes,   Skill Enhancement Courses -No.

   Ability Enhancement Courses - No,   Value Added Courses - No,

   Exit/ Vocational- Courses – No.

4. Holistic Education - No,   Multidisciplinary - No, Interdisciplinary -No

5. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6. New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8. ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objective:
1) Upon completing this course students have been introduced the generalization of theory for a single variable to theory for two variables.
2) Students will observe analogue and differences in the concepts for a single variable and multivariable calculus.
3) The course will teach what kinds of care need to deal especially with neighbourhood, limit, continuity, differentiability of a function of two variables.
4) Students will learn applications of Euler's Theorem to evaluate some standard expressions involving partial derivatives or higher order partial derivatives.
5) Students will express a function in terms of an infinite series and also approximate its value at a point along with relative and percentage error.
6) Students will learn various techniques to find maxima or minima of a function of two variables.
7) The course is to equip the student with necessary analytical and technical skills used in the analysis.

Unit No.	Topics	Hours	Marks
I	Functions of two or more variables, Explicit and Implicit functions, The δ−Neighbourhood and deleted δ−Neighbourhood of a point (a,b), Definition of the limit of a function, Examples to find limit using definition, Repeated Limits, Examples of Non-existence of the limits, Algebra of limits (Without Proof).	9	14
II	Definition of the continuity of a function at point (a,b). Examples to check continuity at a point (a,b), Algebra of continuity (Without Proof), Definition of partial derivative, Notations for partial derivative and higher order partial derivative, Examples to find partial derivatives using definition, Geometrical meaning of partial derivative.	9	14

III	Working rules to find partial derivatives and higher order partial derivatives, Examples to find higher order and mixed partial derivatives, The differential of f at (x, y), Change of order of partial derivative, Young's Theorem (Without Proof), Schwarz's Theorem (Without Proof), Differentiation of composite functions (Chain rules), Examples based on chain rules.	9	14
IV	Homogeneous function, Euler's Theorem on Homogeneous function and its consequences, Problems based on Euler's Theorem and its consequences.	9	14
V	Taylor's Theorem for two variables (Without Proof), Taylor's series expansion for a function of two variables, Approximate value of $f(x, y)$, Errors in $f(x, y)$ (Relative error and Percentage error).	9	14

Bachelor of Science (B.Sc.)
Semester-II
Minor (Mathematics Practical)

Name of the Course	Applications of Partial Derivatives
Course Credit	**01**
Teaching Hours per Semester	**30**
Total Marks	**50**

Pr.No.	Objective of Practical
1	To find Jacobian of polar coordinates, cylindrical coordinates spherical coordinates.
2	To study properties of Jacobian and problems based on it.
3	To find Jacobian and inverse Jacobian of given relations.
4	To study the concept of extreme values, stationary point, saddle point, etc. and working rules to find maxima and minima for functions of two variables.
5	To find extreme values of given function of two variables. (Consider at least four problems of various types.)
6	To find extreme values of word problems or real life world problems involving two variables.
7	To learn Lagrange's Method of Undetermined Multipliers (LMUM).
8	To find extreme values of given function subject to some function by LMUM. (Consider at least four problems of various types.)
9	To solve word problems or real life world problems by LMUM. (Consider at least four problems of various types.)
10	To solve word problems or real life world problems by LMUM. (Consider at least four problems of various types.)

Reference Books:

1) Mathematical Analysis, S. C. Malik, Savita Arora, New Age International Publishers, Fourth Edition, 2015.
2) Calculus, Thomas and Finney, Pearson Education, 9th or higher edition.
3) A Textbook of Engineering Mathematics, N. P. Bali, Manish Goyal Laxmi Publications(P) Ltd.

Bachelor of Science (B.Sc.)
Semester-II
MDC-A (Mathematics)

Name of the Course	Basic Mathematics for Physics and Chemistry-II
Course Credit	03
Teaching Hours per Semester	45
Total Marks	100

Course	Outcomes
Mathematics (Basic Mathematics for Physics and Chemistry-II)	Students are able to 1) compute first ordered, higher ordered partial derivatives using working rules. 2) compute various types of products of vectors and could evaluate gradient, divergence and curl. 3) classify periodic and non-periodic function and could find period of a given function in the case of periodic function. 4) Find Fourier series of a given periodic piecewise continuous function. 5) know various techniques to find the Laplace transform of a given function and could solve a differential equation using it. 6) know some important Mathematical tools which are used in the subjects Physics and Chemistry.
Mathematics Practical (Applications of Partial Derivatives)	After completing all the practical student will be able to 1) find the Jacobian of a given set of relations. 2) apply the concepts and techniques of partial derivative in to finding maxima and minima of a function of two variables. 3) solve real world problems based on extreme values involving two variables. 4) understand the geometry of Gradiant, Divergence, Curl and could also solve problems based on it in their respective subjects.

1. Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2. Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? હા

3. Major- No,   Minor –No,   Skill Enhancement Courses -No.

    Ability Enhancement Courses - No,   Value Added Courses - No,

    Exit/ Vocational- Courses – No.

4. Holistic Education - No,   Multidisciplinary - Yes, Interdisciplinary - No

5. દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6. New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7. Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8. ઇન્ડિયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objective:

1) Upon completing this course student have been introduced the how to find partial derivative and higher ordered partial derivatives of multivariable function using working rules.
2) Students will learn how to deal with vectors and will know the geometry of terms like Gradient, Divergence and Curl along with its applications.
3) Student will learn Fourier series expansion of a periodic function and associated Mathematical manipulation for it.
4) Students will know various methods to find Laplace transform and inverse Laplace transform of a function and its application to solve differential equation.
5) The course is to equip the student with necessary technical skills used in application of Mathematics in their respective subjects.

Unit No.	Topics	Hours	Marks
I	Partial differentiation using working rules only (Don't explain by limit approach), Partial derivatives of first order, Partial derivative of composite functions (Chain rule), Higher order partial derivatives, Total derivative, Derivative of implicit functions.	9	14
II	Vectors in R^2 and R^3, Unit vector, Product of two vectors, Product of three vectors, Scalar function and Vector function, Differentiation of vector function with respect to scalar variable, Geometric interpretation of $\frac{d\bar{r}}{dt}$, Gradient, Divergence, Curl and its properties.	9	14
III	Period of a function, Periodic function, Fourier series for a piecewise continuous function in an interval of length 2π, Fourier series for a piecewise continuous function in interval of any arbitrary length.	9	14

IV	Definition of Laplace transform, Laplace transform of standard functions, Change of scale, First shifting Theorem, Second shifting Theorem, Multiplication by t, Division by t, Laplace transform of Derivative.	**9**	**14**
V	Inverse Laplace transform of standard functions, Inverse Laplace transform by Partial fraction, Derivative of $F(s)$, and Convolution Theorem (Without Proof), Solution of differential equations using Laplace transform.	**9**	**14**

Bachelor of Science (B.Sc.)
Semester-II
MDC-A (Mathematics Practical)

Name of the Course	Applications of Basic Mathematics to Physics and Chemistry-I
Course Credit	**01**
Teaching Hours per Semester	**30**
Total Marks	**50**

Pr. No.	Objective of Practical
1	To find Jacobian of polar coordinates, cylindrical coordinates spherical coordinates.
2	To study properties of Jacobian and problems based on it.
3	To find Jacobian and inverse Jacobian of given relations.
4	To study the concept of extreme values, stationary point, saddle point, etc. and working rules to find maxima and minima for functions of two variables.
5	To find extreme values of given function of two variables. (Consider at least four problems of various types.)
6	To find extreme values of word problems or real life world problems involving two variables.
7	To study the geometry of gradient and problems based on it.
8	To find directional derivative of a scalar function at a given point.
9	To study the geometry of divergence and problems based on it.
10	To study the geometry of curl and problems based on it.

Reference Books:

1) Mathematical Analysis, S. C. Malik, Savita Arora, New Age International Publishers, Fourth Edition, 2015.
2) Calculus, Thomas and Finney, Pearson Education, 9th or higher edition.
3) A Textbook of Engineering Mathematics, N. P. Bali, Manish Goyal Laxmi Publications(P) Ltd.
4) The Laplace Transform Theory and Applications, Joel L. Schiff, Springer.

Bachelor of Science (B.Sc.)
Semester-II
MDC-B (Mathematics)

Name of the Course	**Basic Bioinformatics -II**
Course Credit	**03**
Teaching Hours per Semester	**45**
Total Marks	**100**

Course	Outcomes
Basic Bioinformatics-II	Students are able to 1) apply Fundamental Principle of Counting to count all possible ways of various phenomena. 2) count all possible combinations of selection in the case of procedure involving selection of things. 3) Find probability of event associated with a random exprement. 4) understand rules and techniques to deal with theory of probability and could find conditional probability, apply Byes' Theorem to find conditional probability. 5) know the applications of testing of hypothesis. 6) Apply t-tests, F-test and χ^2-test on data of their respective fields.
Mathematics Practical **(Derivative and its Applications)**	After completing all the practical student will be able to 1) find the derivative of standard and basic functions. 2) algebra of differentiation of functions. 3) find amount of rate of change in one quantity due to change if other quantity. 4) solve variable separable and linear differential equations of first order 5) solve real world problems occurs in their subjects and associated with differential equation.

1) Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2) Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? હા

3) Major- No   Minor –No   Skill Enhancement Courses -No

Ability Enhancement Courses -No, Value Added Courses-No Exit/ Vocational-No Courses

4) Holistic Education -No   Multidisciplinary -Yes   Interdisciplinary -No

5) દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6) New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7) Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8) ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objective:

1) Upon completing this course, students have been introduced the concepts of permutation and combination followed by probability.
2) Students will learn concept of testing of hypothesis.
3) Students will learn how to deal with the theory of probability and will know how to find conditional probability and application of Bayes' Theorem to evaluate inverse probability.
4) The course will help to check the authenticity of the data received from various sources in terms of applications of testing of hypothesis.
5) Students will learn various student t-tests, F-test and χ^2-tests for testing of hypothesis.
6) The course is to equip the student with necessary Mathematical and Statistical technical skills used in application of their respective subjects.

Unit No.	Topics	Hours	Marks
I	Definition of factorial and its computation, Fundamental Principal of Counting, Permutation, Formula to find permutations in various cases (All distinct Objects, Some objects repeated), Circular permutations, Word problems based on permutations, Combination, Basic properties of combination, Word problems based on permutations.	9	14
II	Random excrement, Sample space, Event, Sure event, Impossible event, Elementary event, Compound event, Complementary event, Algebra of events, Mutually exclusive events, Exhaustive events, Classical definition of probability with examples, Theorems on probability (Without Proof), Word problems to find probability, Conditional probability, Basic properties of conditional probability (without proof), Multiplication rule of probability (Without Proof), Independent events, Theorem of total probability (Without proof), Bayes' Theorem(Without Proof), Examples based on it.	9	14

III	Test of Hypothesis, Some Related Terms and Concepts like Parameters, Statistic, Hypothesis, Statistical Hypothesis, Sampling Distribution, Standard Error of a Statistic, Null Hypothesis, Alternative Hypothesis, Testing of Hypothesis, Types of Errors in Test of Hypothesis, Level of Significance, Critical region, One Tailed test and Two Tailed test, Degree of Freedom.	9	14
IV	Student's t-test, Conditions for applying t-tests, One sample t-test or t-test for one mean, t-test concerning difference between two means, Paired sample t-test, t-test for testing the significance of correlation coefficient, Unpaired sample t-test, Fisher's F-test for equality of two variances or Variance Ratio Test,	9	14
V	Chi-Square test, Definition of statistic χ^2, Conditions for the application of χ^2-test, Applications of χ^2-test, Examples of χ^2-test, Contingency Table, Procedure to make 2×2 Contigency Table. Examples based on 2×2 Contigency Table.	9	14

Bachelor of Science (B.Sc.)
Semester-II
MDC-B (Mathematics Practical)

Name of the Course	**Derivative and its Applications**
Course Credit	**01**
Teaching Hours per Semester	**30**
Total Marks	**50**

Pr. No.	Objective of Practical
1	To study basic functions and functions occurs in field of biology.
2	To learn concept of derivative as a change in variable and to learn derivative of standard functions.
3	To learn algebra of derivative and to evaluate derivative of a given function.
4	To study integration as an inverse process of derivative and to find integration of standard functions.
5	To learn algebra of integration and to learn elementary techniques of integration.
6	To study rate of change using derivative.
7	To study method to solve variable separable first order differential equation and its examples.
8	To study method to solve first orders linear differential equation and its examples.
9	To study real word applications of variable separable first order differential equation.
10	To study real word applications of first order linear differential equation.

Reference Books:

1) S.C. Gupta and V. K. Kapoor, Fundamental of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2) G upta S. C. & Kapoor V. K. : Fundamental of Applied Statistics, Sultan Chand & Sons, New Delhi.

Bachelor of Science (B.Sc.)
Semester-II
SEC (Mathematics)

Name of the Course	**Scientific Writing using LaTeX**
Course Credit	**02**
Teaching Hours per Semester	**60**
Total Marks	**50**

Course	Outcomes
Scientific Writing using LaTeX	Students will be able to 1) install MikTeX (compiler) in their own computer/laptop. 2) download editor winedit/Texmaker/TeXstudio and install it in their own computer. 3) create and view a document using LaTeX. 4) format text, input border and page number, text in header/footer. 5) input mathematical text and symbols, equations and matrix. 6) input tables and design rows and columns according to their requirement. 7) input figures and resize it according to requirement. 8) input title of the document, author, section, subsection. 9) prepare different file for each different chapter and include it to make complete document. 10) include table of contents, index, references.

1) Employability/Entrepreneurship/Skill Development પર કેન્દ્રિત થયેલ છે કે નહિ ? <u>હા</u>

2) Value added Courses Imparting Transferable and Life Skills ના ગુણો ધરાવે છે ? હા

3) Major- No   Minor –No   Skill Enhancement Courses - Yes

   Ability Enhancement Courses -No,   Value Added Courses-No

   Exit/ Vocational Courses -No

4) Holistic Education -No   Multidisciplinary -No   Interdisciplinary -No

5) દિવ્યાંગ માટે વિષય અંતર્ગત આનુસાંગિક જોગવાઈ કરાયેલ છે ? ના

6) New India Literacy Programme (NILP) મુજબનો વિષય છે ? ના

7) Swayam પ્લેટફોર્મ પરના MOOC વિષય પર આધારિત આ વિષય છે ? ના

8) ઇન્ડીયન નોલેજ સીસ્ટમ (IKS) પર આધારિત વિષય છે ? ના

Objectives:

1) Students will learn globally accepted editing software LaTeX.
2) Students will learn the basics of technical writing.
3) Students will communicate their ideas effectively in the form of technical reports, journal papers etc., by using the technical writing tool LaTeX.
4) Students will get expertise in drafting technical documents which is an indispensable skill for all professionals helping them to share their knowledge of technical subjects effectively in all domains of society and thus makes them competent in their professional careers.
5) Students will know importance of this software for publishing research articles, papers, project reports and books.

Unit No.	Topics
I	Set up and Installation, Document class, \usepackage, output file (dvi, pdf), Preparing a document, Typing text, Compile and view document, Types of document, Writing text in bold, italic, underline, SMALLCAPS, Spacing using \indent, \quad, \hspace, \vspace, Aligning text (Left, Center, Right, Justify), Toogle text, Bullets and numbering, Line spacing, Two column format, Input header and footer, Different styles of header and footer, Page border, \pagestyle.
II	Input mathematical text, symbols, use of \multicols command, \ldots, \cdots, Input Equations using \begin{equation}...\end{equation}, \begin{eqnarray}…\end{eqnarray}, Labels to equations, Input matrix using \begin{matrix}…\end{matrix}, Use of \begin{array}...\end{array}.
III	Input table, formatting rows and columns of table, Insert figure, Scaling the figure, Assign caption to table and figure using \caption command. Input title using \title, \author, \maketitle commands, Include chapters, section, subsection, table of contents, indexing, references, Presentation using Beamer.

Reference Books:

1) LaTeX 2e: An Unofficial Reference Manual, Karl Berry, Stephen Gilmore and Torsten Martinsen.
2) LaTeX Beginner's Guide: Create visually appealing texts, articles, and books for business and science using LaTeX
3) The Not So Short Introduction to LaTeX, by Hubert Partel, Irene Hyna and Elisabeth Schlegl, Tobias Oetiker,1999.
4) Digital platform: https://www.latex-project.org.

NEP-Level 4.5: B.Sc. Semester I & II

B.Sc. Mathematics semester I & II (1ST YEAR) (UG certificate course) NEP-Level 4.5
Modes of Learning in semester I & II: Flexibility to switch to alternative modes of learning [offline, ODL (Open and distance learning), and Online learning, and hybrid modes of learning.] (CCFUP-3.1)
• **Semester duration:** 15 week / 90 working days. • **1 Theory Credit** = 15 hours of academic activity engagement in 15 weeks of a semester. **(Per week 1 hours).** • **1 Credit of (Practical/Internship/Workshop-based activity/ Self-Learning-Online/Offline)** = 30 hours of engagement in 15 weeks of a semester. **(Per week 2 hours)**. • **1 Credit of Experiential learning (field visit/industry visit)/Assignments** = 40-45 hours of engagement in a semester.

Semester – I							
Sr. No	**Course Category**	**Course Title**	**Credit**		**Exam Marks**		
			Th	**Pr**	**Int**	**Ext**	**Total**
1	Major 1	Calculus-I	**3**	**-**	**30**	**70**	**100**
2	Major 1 (Practical)	Graphs and Properties of some Standard Functions	**-**	**1**	**15**	**35**	**50**
3	Major 2	Matrix Algebra	**3**	**-**	**30**	**70**	**100**
4	Major 2 (Practical)	Curve Tracing	**-**	**1**	**15**	**35**	**50**
5	Minor	Calculus-I	**3**		**30**	**70**	**100**
6	Minor (Practical)	Graphs and Properties of some Standard Functions	**-**	**1**	**15**	**35**	**50**
7	MDC-A	Basic Mathematics for Physics and Chemistry-I	**3**	**-**	**30**	**70**	**100**
		Applications of Basic Mathematics to Physics and Chemistry-I	**-**	**1**	**15**	**35**	**50**
	OR						
	MDC-B	Basic Bioinformatics-I	**3**	**-**	**30**	**70**	**100**
		Data Analysis	**-**	**1**	**15**	**35**	**50**
8	AEC	English Language and Communication Skill-1	**2**	**-**	**0**	**50**	**50**
9	SEC	How to Write and Read Mathematics?	**-**	**2**	**50**	**0**	**50**
10	IKS	Vedic Mathematics		**2**	**50**	**0**	**50**
Total Credits and Marks (Semester-I)			**14**	**8**	**280**	**470**	**750**

	B.Sc. Mathematics semester I & II (1 ST YEAR) (UG certificate course) NEP-Level 4.5						
Modes of Learning in semester I & II: Flexibility to switch to alternative modes of learning [offline, ODL (Open and distance learning), and Online learning, and hybrid modes of learning.] (CCFUP-3.1)						

• **Semester duration:** 15 week / 90 working days.
• **1 Theory Credit** = 15 hours of academic activity engagement in 15 weeks of a semester. **(Per week 1 hours).**
• **1 Credit of (Practical/Internship/Workshop-based activity/ Self-Learning-Online/Offline)** = 30 hours of engagement in 15 weeks of a semester. **(Per week 2 hours)**.
• **1 Credit of Experiential learning (field visit/industry visit)/Assignments** = 40-45 hours of engagement in a semester.

		Semester – II					
			Credit		**Exam Marks**		
Sr. No	**Course Category**	**Course Title**	**Th**	**Pr**	**Int**	**Ext**	**Total**
1	Major 1	Calculus-II	3	-	30	70	100
2	Major 1 (Practical)	Applications of Partial Derivatives	-	1	15	35	50
3	Major 2	Real Analysis-I	3	-	30	70	100
4	Major 2 (Practical)	Rectification, Volume and Surface area of revolution.	-	1	15	35	50
5	Minor	Advanced Calculus	3		30	70	100
6	Minor (Practical)	Applications of Partial Derivatives	-	1	15	35	50
7	MDC-A	Basic Mathematics for Physics and Chemistry-II	3	-	30	70	100
8		Applications of Basic Mathematics to Physics and Chemistry-II	-	1	15	35	50
OR							
7	MDC-B	Basic Bioinformatics-II	3	-	30	70	100
8		Derivative and Its Applications	-	1	15	35	50
9	AEC	English Language and Communication Skill-2	2	-	0	50	50
10	SEC	Scientific Writing using LaTeX	-	2	50	0	50
11	VAC	Select any 1 from **VAC Basket***		2	50	0	50
Total and Marks (Semester-II)			**14**	**8**	**280**	**470**	**750**
Total Credit and Marks (semester-I + semester-II)			**28**	**16**	**560**	**940**	**1500**
12	**For Exit-1** Summer Internship / Apprenticeship	**--**		**04**			

Exit 1: Award of UG certificate in Major course with **44 credits** with additional **4 credits of Summer Internship / Apprenticeship.**

VAC Basket*: (1) Yoga & Pranayam (2) Environmental Science (3) Indian Constitution (4) History of Indian Science & Technology (5) Digital Technological Solution (6) Vedic Mathematics (7) Any MOOC course related to VAC on SWAYAM platform (www.swayam.gov.in).

Abbreviations: AEC (Ability Enhancement Course); **MDC** (Multi/Inter disciplinaries course); **IKS** (Indian Knowledge System); **NCrF** (National Credit Framework); **NSS** (National Service Scheme); **NCC** (National Cadet Corps); **NSQF** (National Skills Qualification Framework); **OJT** (On-the-Job Training); **SEC** (Skills Enhancement Course); **RP** (Research Project); **VAC** (Value Added Course), **ODL** (Open and Distance Learning), CCFUP (Curriculum and credit framework for undergraduate programme), **O. Ge. B. Sc**. (Ordinance general B. Sc.)