પરિપત્ર:

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટીની સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે સાયન્સ વિદ્યાશાખા હેઠળનો NEP-૨૦૨૦ અંતર્ગતનો ગણિત વિષયનો (બી.એસ.સી. વિથ ઓનર્સ) નો સેમેસ્ટર-૧ (શિક્ષણ વિભાગની SOP પ્રામાણેની પેપર સ્ટાઈલ સાથે), સેમેસ્ટર-૨ નો અભ્યાસક્રમ આ સાથે સામેલ છે.

માનનીય કુલપતિશ્રીની મંજુરી અનુસાર સદર અભ્યાસક્રમ શૈક્ષણિક વર્ષ જુન,૨૦૨૩થી અમલવારી કરવાની રહે છે. સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજો ધ્વારા તેની અમલવારી કરવા જણાવવામાં આવે છે.

Bhakta Kavi Narsinh Mehta University Junagadh

03/01/2024

ખાસ ફરજ પરના અધિકારી
(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/એકેડેમિક/૪૨/૨૦૨૪
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી,
સરકારી પોલીટેકનિક કેમ્પસ,
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી રોડ,
ખડીયા, જૂનાગઢ-૩૬૨૨૬૩
તા.૦૩/૦૧/૨૦૨૪

પ્રતિ,

- ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી સંલગ્ન સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમો ચલાવતી તમામ કોલેજોના આચાર્યશ્રીઓ તરફ....

નકલ સાદર રવાનાઃ-

- માન.કુલપતિશ્રી/કુલસચિવશ્રીનાં અંગત સચિવશ્રી.
- પરીક્ષા નિયામકશ્રી, ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી, જુનાગઢ

નકલ રવાના જાણ તથા યોગ્ય કાર્યવાહી અર્થેઃ

- સીસ્ટમ મેનેજરશ્રી, આઇ.ટી.સેલ વિભાગ (વેબસાઇટ ઉપર પ્રસિદ્ધ થવા અર્થે.)

Bhakta Kavi Narsinh Mehta University
Junagadh

BOARD OF MATHEMATICS STUDIES
FACULTY OF SCIENCE
SYLLABUS FOR
BACHELOR OF SCIENCE (HONOURS) PROGRAMME
(SEMESTER- I & II)
EFFECTIVE FROM JUNE, 2023

• Programme:	B.Sc. (Honours)
• Semester:	1
• Subject:	Mathematics
• Course code:	DSC – 101 (Major Paper – 1)
• Title of the course	Matrices and Coordinate Geometry (including practicals)

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation(**CCE**)-Formative- **50 Marks**		Semester End Evaluation(**SEE**)-Summative-**50 Marks**
Theory(25 Marks)	**Practicals(25 Marks)**	
1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours :** 3 Hours/Week (Theory)+ 2 Hours /Batch/Week (Practicals)

DSC – 101(Major Paper – 1)

Matrices and Coordinate Geometry

Course Learning Outcome :

- Student will recollect certain basic matrices.
- Student will be able to obtain inverse of matrix using different methods.
- Student will be able to understand the concept of rank of matrixand will be using it in problem solving.
- Students will have learned the Cayley Hamilton theorem and will be using it to obtain inverse of a square matrix.
- Student will be able to find eigen values and eigen vectors of a square matrix.
- Student will be well equipped to solve a system of simultaneous linear equations several variables.
- Students will have learned about relationship among different systems of point representation like Cartesian, polar, spherical, cylindrical systems.
- Students will have learned the equation of basic geometric structures in polar form.

UNIT 1: Concept of matrix [6 hours]

Some special matrices, adjoint of a matrix, inverse of a matrix and its existence & properties;
determinant of a matrix, its properties and applications;symmetric matrix, skew symmetric matrix, Hermitianmatrix and skew Hermitian matrix.

UNIT 2: Rank of matrix [10 hours]

Elementary row and column operations on a matrix, row and column vectors, linear independence of row(column) matrices, rank of a matrix, row and column rank of a matrix, equivalence of row and column ranks.

UNIT 3: Eigen values and eigen vectors of matrix [15 hours]

Characteristic equation of a matrix, eigen values and eigen vectors of a matrix, Cayley-Hamilton theorem & matrix inversion by using it; Application of matrix to solve a system of simultaneous linear (homogeneous and non-homogeneous both) equations, theorems on consistency of a system of simultaneouslinear equations.

UNIT 4: Coordinate systems [14 hours]

Cartesian, polar, cylindrical and spherical coordinate system, conversion of coordinates of a point from cartesian to polar and vice-versa, conversion of coordinates of a point from cartesian to cylindrical and vice-versa,conversion of coordinates of a point from cartesian to spherical and vice-versa, distance between two points in polar coordinate system, area of triangle in polar coordinates, polar equation of line, polar equation of circle, polar equation of conics with general form, Pedal equation.

Practicals

Practical No.	Title
1.	(A) Draw the graph of parabola, $y^2 = 4ax; a \in \mathbb{R}$.
	(B) Draw the graph of ellipse, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1; a, b \in \mathbb{R}$.
	(C) Draw the graph of hyperbola, $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1; a, b \in \mathbb{R}$.
2.	(A) Draw the graph of cycloid whose parametric equations are $x = r(t - sint);\ y = r(1 - cost),\ t \in \mathbb{R}$.
	(B) Draw the graph of cardioid whose polar equation is given by $r(\theta) = a(1 - \cos(\theta));\ a = 4$.
3.	To obtain inverse of a matrix using adjoint.
4.	To obtain inverse of a matrix using Cayley- Hamilton theorem.

5. To obtain inverse of a matrix using Gauss-Elimination Method.

6. To obtain inverse of a matrix using Gauss-Jordan Method.

7. To solve the system of simultaneous linear algebraic equations using Gauss Elimination Method. (System of equations involving at least four variables).

8. To solve the given system of simultaneous linear algebraic equations using Gauss-Jordan Method. (System of equations involving at least four variables).

9. To obtain rank of matrix.

10. To obtain eigen values and eigen vectors of matrix.

Reference Books:

(1) University Algebra -N.S. Gopalakrishnan, New Age International(P)Limited,2015.

(2)Matrices – A. R. Vasistha, Krishna Prakashan Mandir, Meerut 2014.

(3) Elements of co-ordinate geometry by S. L. Loney, Mac-Millan& Co.

(4) An elementary treaties on co-ordinate geometry of three dimensions by R. J. T. Bell, Mac-Millan& Co.

(5) A textbook of analytical geometry of three dimensions by P. K. Jain & Khalid Ahmad

(6) A textbook on matrices by Shantinarayan

(7) Analytical Solid Geometry by Shantinarayan& P. K. Mittal, S.Chand& Co.

(8) Solid Geometry, Golden series Krishna Prakashan, Meerut.

• Programme:	B.Sc. (Honours)
• Semester:	1
• Subject:	Mathematics
• Course code:	**DSC – 102 (Major Paper – 2)**
• Title of the course	**Calculus and Solid Geometry (including practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation(**CCE**)-Formative- **50 Marks**		Semester End Evaluation(**SEE**)-Summative-**50 Marks**
Theory(25 Marks)	**Practicals(25 Marks)**	
1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours :** 3 Hours/Week (Theory)+ 2 Hours /Batch/Week (Practicals)

DSC – 102 (Major Paper – 2)

Calculus and Solid Geometry

Course Learning Outcome :

- Student will be able to think geometrically to develop proofs of mean value theorems.
- Student will be able learn the applications of mean value theorems.
- Student will understand various indeterminate forms and hence solve limit examples of such types.
- Student will learn the famous L`Hospital's theorem and use it in problem solving.
- Student will further learn two important geometric shapes namely sphere and cylinder in detail.
- Student will be able to visualize intersection of plane and sphere.
- Student will be able to visualize intersection of two spheres.
- Student will be able to visualize the concept of tangent plane to a sphere and also find equation of such a plane and hence derive condition for tangency of a plane to sphere.
- Student will be able to visualize the construction of cylinder.
- Student will learn the equation of a right circular cylinder with given radius say r.

UNIT 1: **[14 hours]**

Mean Value Theorems:

Rolle's, Lagrange's and Cauchy's mean value theorems and problems related to it.

Taylor's theorem and expansions:

Taylor's theorem (Without proof),Maclaurin'stheorem(Without proof), Taylor's and Maclaurin's infinite series expansions, expansions of***exp(x),*** $\sin x, \cos x, (1+x)^n, \log(1+x)$ under proper conditions.

UNIT 2: Indeterminate Forms **[8 hours]**

Hospital's rules for various indeterminate forms with proof, various indeterminate forms like $\frac{0}{0}$ form, $\frac{\infty}{\infty}$ form, $0 \cdot \infty$ form, $\infty - \infty$ form, 0^0 form, ∞^0 form.

UNIT3: Sphere **[15 hours]**

Equation of a sphere in different forms like standard form, central form, vector form, general equation of sphere with center (α, β, γ) and radius *a*. Plane section of a sphere, intersection of two spheres, equation of sphere having a given diametral extremities, sphere through a given circle, intersection of a sphere and a line, power of a point, equation of a tangent plane and normal to a sphere, condition for the plane $lx + my + nz = p$ to touch the sphere $x^2 + y^2 + z^2 + 2ux + 2vy + 2wz + d = 0$.

UNIT 4: Cylinder **[8 hours]**

Definition of a cylinder, equation of a cylinder with generator parallel to $\frac{x}{l} = \frac{y}{m} = \frac{z}{n}$ and guiding curve $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0; z = 0$.

Equation of right circular cylinder having axis $\frac{x-\alpha}{l} = \frac{y-\beta}{m} = \frac{z-\gamma}{n}$ and radius r.

Practical's

Practical No.	Title
1.	Draw the graphs of $y = \sinh x$, $y = \cosh x$ and $y = \tanh x$.
2.	Draw the graphs of $y = \operatorname{cosech} x$, $y = \operatorname{sech} x$ and $y = \coth x$.
3.	Draw the graphs of $y = \sinh^{-1} x$, $y = \cosh^{-1} x$ and $y = \tanh^{-1} x$.
4.	Draw the graphs of $y = \operatorname{cosech}^{-1} x$, $y = \operatorname{sech}^{-1} x$ and $y = \coth^{-1} x$.

5. Successive differentiation :
Find n^{th}derivative of $y = \frac{x}{x^2+a^2}$ and other similar type of examples.

6. Successive differentiation :
Show that the n^{th} derivative of $y = \tan^{-1}x$ is

$y_n = (-1)^{n-1} .(n-1)![\sin\{n(\frac{\pi}{2} - y)\} \sin^n(\frac{\pi}{2} - y)]$and other similar type of examples.

7. Successive differentiation :
If $y = \sin mx + \cos mx$, then show that

$y_n = m^n\sqrt{1 + (-1)^n \sin 2mx}$and other similar type of examples.

8. Reduction formulae:

Evaluate problems of type $\int \sin^6 x dx$, $\int \cos^7 x dx$ and $\int \sin^4 x \cos^4 x dx$ with integration suitable limits.

9. Reduction formulae: Evaluate $\int_0^{2a} x^2\sqrt{2ax - x^2}dx$, $\int_0^{\infty} \frac{x^2}{(1+x^2)^{9/2}}dx$ and

$\int_0^a x^4(a^2 - x^2)^{3/2}dx$ and other similar problems.

10. Evaluate $\int_0^{\infty} \frac{1}{(1+x^2)^3}dx$, $\int_0^2 \frac{x^4}{\sqrt{4-x^2}}dx$, $\int_0^{\infty} \frac{1}{(a^2+x^2)^4}dx$.

Reference Books:

(1) Differential Calculus by Shanti Narayan.

(2) Differential Calculus by Gorakh Prasad.

(3) Elements of co-ordinate geometry by S. L. Loney, Mac-Millan& Co.

(4) A text book of analytical geometry of three dimensions by P. K. Jain & Khalid Ahmad.

(5) Analytical Solid Geometry by Shanti Narayan & P. K. Mittal, S.Chand.
Solid Geometry, Golden Series Krishna Prakashan , Meerut.

• Programme:	B.Sc. (Honours)
• Semester:	1
• Subject:	Mathematics
• Course code:	**DSM – 101 (Minor Paper)**
• Title of the course	**Matrices and Coordinate Geometry (Including Practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation(**CCE**)-Formative- **50 Marks**		Semester End Evaluation(**SEE**)-Summative-**50 Marks**
Theory(25 Marks) 1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	**Practicals(25 Marks)** 1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours :** 3 Hours/Week (Theory)+ 2 Hours /Batch/Week (Practicals)

DSM – 101 (Minor Paper)

Matrices and Coordinate Geometry

Course Learning Outcome :

- Student will recollect certain basic matrices.
- Student will be able to obtain inverse of matrix using different methods.
- Student will be able to understand the concept of rank of matrixand will be using it in problem solving.
- Students will have learned the Cayley Hamilton theorem and will be using it to obtain inverse of a square matrix.
- Student will be able to find eigen values and eigen vectors of a square matrix.
- Student will be well equipped to solve a system of simultaneous linear equations several variables.
- Students will have learned about relationship among different systems of point representation like Cartesian, polar, spherical, cylindrical systems.
- Students will have learned the equation of basic geometric structures in polar form.

UNIT 1: Concept of matrix [6 hours]

Some special matrices, adjoint of a matrix, inverse of a matrix and its existence & properties;
determinant of a matrix, its properties and applications;symmetric matrix, skew symmetric matrix, Hermitianmatrix and skew Hermitian matrix.

UNIT 2: Rank of matrix [10 hours]

Elementary row and column operations on a matrix, row and column vectors, linear independence of row(column) matrices, rank of a matrix, row and column rank of a matrix, equivalence of row and column ranks.

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Mathematics Practical

Practical No.	Title
1.	(A) Draw the graph of parabola, $y^2 = 4ax; a \in \mathbb{R}$.
	(B) Draw the graph of ellipse, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1; a, b \in \mathbb{R}$.
	(C) Draw the graph of hyperbola, $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1; a, b \in \mathbb{R}$.
2.	(A) Draw the graph of cycloid whose parametric equations are $x = r(t - sint);\ y = r(1 - cost),\ t \in \mathbb{R}$.
	(B) Draw the graph of cardioid whose polar equation is given by $r(\theta) = a(1 - \cos(\theta));\ a = 4$.
3.	To obtain inverse of a matrix using adjoint.
4.	To obtain inverse of a matrix using Cayley- Hamilton theorem.
5.	To obtain inverse of a matrix using Gauss-Elimination Method.

6. To obtain inverse of a matrix using Gauss-Jordan Method.

7. To solve the system of simultaneous linear algebraic equations using Gauss Elimination Method. (System of equations involving at least four variables).

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9. To obtain rank of matrix.

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1. University Algebra -N.S. Gopalakrishnan, New Age International(P)Limited,2015.
2. Matrices – A. R. Vasistha, Krishna Prakashan Mandir, Meerut 2014.
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6. A textbook on matrices by Shantinarayan
7. Analytical Solid Geometry by Shantinarayan & P. K. Mittal, S.Chand & Co.
8. Solid Geometry, Golden series Krishna Prakashan, Meerut.

• Programme:	B.Sc. (Honours)
• Semester:	1
• Subject:	Mathematics
• Course code:	**MDC – 101 (MultidisciplinaryCourse – 1)**
• Title of the course	**Matrices and Coordinate Geometry (Including Practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation(**CCE**)-Formative- **50 Marks**		Semester End Evaluation(**SEE**)-Summative-**50 Marks**
Theory(25 Marks)	**Practicals(25 Marks)**	
1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours :** 3 Hours/Week (Theory)+ 2 Hours /Batch/Week (Practicals)

MDC – 101 (Multidisciplinary Course)

Matrices and Coordinate Geometry

Course Learning Outcome :

- Student will recollect certain basic matrices.
- Student will be able to obtain inverse of matrix using different methods.
- Student will be able to understand the concept of rank of matrixand will be using it in problem solving.
- Students will have learned the Cayley Hamilton theorem and will be using it to obtain inverse of a square matrix.
- Student will be able to find eigen values and eigen vectors of a square matrix.
- Student will be well equipped to solve a system of simultaneous linear equations several variables.
- Students will have learned about relationship among different systems of point representation like Cartesian, polar, spherical, cylindrical systems.
- Students will have learned the equation of basic geometric structures in polar form.

UNIT 1: Concept of matrix [6 hours]

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Mathematics Practical

Practical No.	Title
1.	(A) Draw the graph of parabola, $y^2 = 4ax; a \in \mathbb{R}$.
	(B) Draw the graph of ellipse, $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1; a, b \in \mathbb{R}$.
	(C) Draw the graph of hyperbola, $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1; a, b \in \mathbb{R}$.
2.	(A) Draw the graph of cycloid whose parametric equations are $x = r(t - sint);\ y = r(1 - cost),\ t \in \mathbb{R}$.
	(B) Draw the graph of cardioid whose polar equation is given by $r(\theta) = a(1 - \cos(\theta));\ a = 4$.
3.	To obtain inverse of a matrix using adjoint.
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6. To obtain inverse of a matrix using Gauss-Jordan Method.

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(6) A textbook on matrices by Shantinarayan

(7) Analytical Solid Geometry by Shantinarayan & P. K. Mittal, S.Chand & Co.

(8) Solid Geometry, Golden series Krishna Prakashan, Meerut.

• Programme:	B.Sc. (Honours)
• Semester:	1
• Subject:	Mathematics
• Course code:	**SEC – 101**
• Title of the course	**Introduction to SciLab (FOSS)** **(Note: Practical based learning course)**
• Marks of External Examination (SEE) • Marks of Internal Examination: (CCE) • Total Marks:	25 Marks Semester End Evaluation 25 Marks Continuous & Comprehensive Evaluation(CCE) External (SEE) → 25 Marks Internal (CCE) → 25 Marks Total → **50 Marks**
• Credit of the course and teaching hours per week	Course credit – 2 Teaching hours – 4 Hours/Batch/Week

SEC – 101

Introduction to SciLab (FOSS)

Practical based learning course

Course Learning Outcome :

- Student will learn to perform various matrix related operations in SciLab like matrix addition, matrix multiplication, matrix inversion etc.
- Student will learn to solve system of simultaneous linear equations in SciLab.
- Student will be able to plot and analyze conics, graphs of trigonometric functions, hyperbolic trigonometric functions, exponential functions and their inverses using plot command.
- Student will also be equipped with some basic programming skills after finishing this course.
- Student will get self motivated to make use of Free and Open Source Software "SciLab" over MatLab software, for their scientific research and development.

Practical No.	**Objective / Aim of Practical**
1.	Become familiar with the software and its interface: (a) What is *SciLab* ?and Why*SciLab* ? (b) Understanding its general environment and menu bar. (c) The Editor window (*SciNotes*), *Console* and G*raphics* window (d) Some user defined workspace customizations.
2.	To realize *SciLab* as a powerful Calculator : (a) Use of Arithmetic, relational and assignment operators in *SciLab.* (b) Learn and use some predefined constant strings like %e, %pi, %eps. (c) Learn keywords of inbuilt Mathematical functions in *SciLab* like trigonometric & inverse trigonometric functions, exponential & logarithmic functions, hyperbolic trigonometric functions, polynomial functions.
3.	To input matrices (of any order) using console as well as editor window : (a) Input a row vector, a column vector. (b) Input a rectangular array (matrix) and use "*rand*" function to generate matrices with random entries. (c) Learn use of matrix functions: *zeros, ones, eye, rand, det(), inv(), transpose* " ' ".

4. To perform various kinds of operation(s) / procedure(s) on matrices :
(a) To perform arithmetic operations (+, -, *, /) on matrices of suitable dimension and also scalar multiplication of matrix.
(b) Learn to access (*and/or modify*) any (i,j)thentry of given matrix (*or row(s) or column(s)*).
(c) Learn to obtain sub-matrices of given matrix and also delete row(s) / column(s).

5. (a) To find Minors, Cofactors and Adjoint of a matrix and thus get inverse of a matrix by using adjoint method.
(b) To solve system of simultaneous equations by adjoint method (only up to 4 variables).

6. (a) To plot any given set of points or sequences in 2D .
(b) To plot a line segment joining two given points in 2D .
(c) To plot a line in 2D whose equation is known .
(d) To manipulate properties of above plot(s) in terms of colour, thickness, position, label marking, title etc.

7. To draw graph of circle, parabola, ellipse, hyperbola for any general equation of type $ax^2 + by^2 + gx + fy + c = 0$ and describe (plot) centre, focus, directrix, asymptotes etc. (whichever applicable) of given conic.

8. To draw graph of trigonometric functions :
`sin(x), cos(x), tan(x), cosec(x), sec(x), cot(x)`

9. To draw graph of inverse-trigonometric functions :
$\sin^{-1}(x), \cos^{-1}(x), \tan^{-1}(x), \text{cosec}^{-1}(x), \sec^{-1}(x), \cot^{-1}(x)$

10. To draw graph of Hyperbolic trigonometric functions :
`sinh(x), cosh(x), tanh(x), cosech(x), sech(x), coth(x)`

11. To draw graph of inverse Hyperbolic trigonometric functions :
$\sinh^{-1}(x), \cosh^{-1}(x), \tanh^{-1}(x), \text{cosech}^{-1}(x), \text{sech}^{-1}(x), \coth^{-1}(x)$

12. To draw graph of logarithmic and exponential functions :
$\log_e(x), \log_{10}(x)$ and `exp(x), 10^x`

Reference Books:

1. Web resource: Getting started by Scilab Enterprises, https://www.scilab.org/tutorials/getting-started
2. E-book: SciLab for very beginners by Scilab Enterprises, https://www.scilab.org/sites/default/files/prg/att/1764/Scilab_beginners_0.pdf
3. E-book: Programming in SciLab by Michael Baudin, https://www.scilab.org/sites/default/files/progscilab-v.0.10_en.pdf

Format of Question Papers for External Theory Examination

(Semester End Evaluation (**SEE**)-Summative-**50 Marks**)

for

DSC – 101, DSC – 103, DSM – 101 and MDC – 101.

(*Effective from Academic Year 2023 – 24 onwards*)

- There will be total FIVE questions.
- One question from every unit comprising of 10 marks each.
  Remaining one question will be asked from all four units of 10 marks

Question No. **1 to 4** (A) Answer any ONE out of TWO. 05 Marks (B) Answer any ONE out of TWO. 05 Marks **TOTAL of each question 1 to 4 10 MARKS**
Question No. **5** (A) Answer any ONE out of TWO 05 Marks (one question each from unit no-1 & 2) (B) Answer any ONE out of TWO 05 Marks (one question each from unit no-3 & 4) **TOTAL 10 MARKS**

Format of Question Paper for External Theory Examination

(Semester End Evaluation (**SEE**)-Summative-**50 Marks**)

for

SEC-101

Evaluation of 50 Marks (2 Credit Paper)

Continuous and Comprehensive Evaluation(**CCE**)-Formative- **25 Marks**	Semester End Evaluation(**SEE**)-Summative-**25 Marks**
Practicals(25 Marks) 1. Performance 15 Marks 2. Viva-voce 10 Marks	**Practicals(25 Marks)** 1. Performance 15 Marks 2. Viva-voce 05 Marks 3. Journal 05 Marks
Total 25 Marks	**Total 25 Marks**

• Programme:	B.Sc. (Honours)
• Semester:	2
• Subject:	Mathematics
• Course code:	**DSC – 201 (Major Paper – 1)**
• Title of the course	**Theory of Ordinary Differential Equations (Including Practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation(**CCE**)-Formative- **50 Marks**		Semester End Evaluation(**SEE**)-Summative-**50 Marks**
Theory(25 Marks)	**Practicals(25 Marks)**	
4. Written Test 15 Marks 5. Assignment 05 Marks 6. Attendance 05 Marks	3. Performance 15 Marks 4. Viva-voce 10 Marks	2. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours :** 3 Hours/Week (Theory)+ 2 Hours /Batch/Week (Practicals)

DSC – 201 (Major Paper – 1)

Theory of Ordinary Differential Equations

Course Learning Outcome :

- Student will recollect the definition of differential equation, its order and degree.
- Student will recollect the meaning of general solution of a differential equation.
- Student will also recollect the previously studied methods of finding general solution of a given differential equation such as variable separable method, linear differential equation of integrating factor type and homogenous differential equation.
- Student will be able to find general solutions of Bernoulli's differential equation and exact differential equation.
- Student will be able to find singular solutions of a differential equation.
- Student will be able to know the geometrical meaning of ordinary differential equation.
- Student will be able to find orthogonal trajectories and also they will get its geometric insight.
- Student will be able to solve a differential equation of first order and higher degree.
- Student will be able to solve homogeneous linear differential equations with constant coefficients and with variable coefficients.

UNIT 1: ODE - First order and first degree [12 hours]

Introduction & review of studied methods to solve first order and first-degree differential equations, Bernoulli`s differential equation, exact differential equation, singular solution of an ordinary differential equation, geometric meaning of an ODE, orthogonal trajectories.

UNIT 2: Differential equations of first order and higher degree [9 hours]

Differential equation of first order solvable for *x*, solvable for *y*, solvable for *p*; Clairaut`s & Lagrange`s form of differential equations.

UNIT 3: Linear differential equations of higher order [12 hours]

Linear differential equation of higher order with constant coefficients, meaning of complimentary function (C.F.) & particular integral (P.I.), operator D, meaning of auxiliary equation, roots of auxiliary equation, real and complex roots of auxiliary equation $f(D)y = 0$.

Operator $\frac{1}{D}$, solution of differential equation of the form $f(D)y = X$, method to find P.I. when $X = e^{ax}, X = \sin(ax + b), X = \cos(ax + b)$, $X = x^m, X = e^{ax}V$.

UNIT 4: Linear differential equations with variable coefficients [12 hours]

Homogeneous linear differential equation, methods for finding complementary function (C.F.), methods for finding particular integral (P.I.), the symbolic operators (θ) & $\frac{1}{f(\theta)}$, particular integral (P.I.) corresponding to a term of the form x^{α}.

Practicals

Practical No.	Title
1.	To obtain solution of linear differential equation of first order.
2.	To obtain singular solution of differential equation of first order and first degree.
3.	To obtain orthogonal trajectories of given family of curves.
4.	To obtain solution of Bernoulli`s differential equation.
5.	To obtain solution of exact differential equation.

6. To obtain solution of differential equation of first order which is solvable for x, y or p .

7. To obtain solution of Clairaut`s differential equation and Lagrange`s differential equation.

8. To obtain solution of differential equation $f(D)y = 0$, where $f(D)$ is a polynomial in D with constant coefficients.

9. To obtain solution of Cauchy Euler homogeneous linear differential equation $f(xD)y = X$, where $f(xD)$ is a polynomial in xD with constant coefficients.

10. To obtain solution of Legendre`s homogeneous linear differential equation.

Reference Books:

1. Differential Calculus by Shanti Narayan.
2. Differential Calculus by Gorakh Prasad.
3. Integral Calculus by Shanti Narayan.
4. Integral Calculus by Gorakh Prasad.
5. Differential Equations by D. A. Murray.
6. Calculus, By G. B. Thomas and R. L. Finney, Pearson Education, 2007.

• Programme:	B.Sc. (Honours)
• Semester:	2
• Subject:	Mathematics
• Course code:	**DSC – 202 (Major Paper – 2)**
• Title of the course	**Partial Derivatives & Differential Geometry (Including Practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation(**CCE**)-Formative- **50 Marks**		Semester End Evaluation(**SEE**)-Summative-**50 Marks**
Theory(25 Marks) 1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	**Practicals(25 Marks)** 1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours :** 3 Hours/Week (Theory)+ 2 Hours /Batch/Week (Practicals)

DSC – 202 (Major Paper – 2)

Partial Derivatives & Differential Geometry

Course Learning Outcome :

- Student will be introduced to functions of several variables, their domain and range.
- Student will be able to realize the differences in the concept of limits and continuity of functions of several variables.
- Student will be able to find partial derivative of functions of several variables.
- Student would have been acquired the important theories governing the existence of continuity, partial derivatives and total derivative.
- Student will be able to compute the approximations using total differentials.
- Student will be knowing the concept of homogeneous functions, implicit functions, composite functions and their partial derivatives.
- Student will come to known the use of Jacobians.
- Student will be able to find the extremum values (local and/or global) of a function of several variables.
- Student will be knowing Lagrange`s method of undetermined multipliers.

UNIT 1: Partial derivatives [15 hours]

Limit and continuity of functions of two variables.
Partial derivatives of first and higher order, partial differentiation of composite functions, partial differentiation of homogeneous functions, Euler`s theorem on homogeneous functions of two and three variables, total differential and chain rule, change of variables, partial differentiation of implicit functions, Young`s and Schwartz`s theorem (without proof).

UNIT 2: Applications of partial derivatives [10 hours]

Errors and approximate values, Jacobians, Taylor`s theorem for functions of two variables, maxima, minima, saddle points of functions of several variables, Lagrange`s method of undetermined multipliers.

UNIT 3: Curvature **[10 hours]**

Definition of curvature, various formulae for curvature (formulae for Cartesian coordinates, parametric equations and polar coordinates only), Newton`s method for finding curvature at origin.

UNIT 4: Asymptotes and multiple points **[10 hours]**

Concavity, convexity and point of inflexion, asymptotes parallel to co-ordinate axes, oblique type, algebraic methods for finding asymptotes, rules for finding asymptotes, multiple points, types of double point.

Practical's

Practical No.	Title
1.	Problems based on limit & continuity of functions of two and three variables.
2.	To obtain partial differentiation using the first principle.
3.	Errors and approximates of functions of several variables using partial derivatives.
4.	To obtain partial differentiation of composite functions.
5.	To obtain Jacobians for functions of two and three variables.
6.	To obtain partial differentiation of implicit functions.
7.	Problems based on partial derivative using Euler`s theorem.
8.	To obtain points of local (and global if exist) maxima and minima of multivariate functions.
9.	To determine local maxima and minima of functions of several variables by the Lagrange`s method of undetermined multipliers.
10.	To obtain series expansion of multivariate functions by Taylor`s theorem.

Reference Books:

1. Differential Calculus by Shanti Narayan.
2. Differential Calculus by Gorakh Prasad.
3. Calculus: Concept and Context, Second edition, By James Stewart Pitamber Publishing Company Ltd. Delhi.
4. Calculus, By G. B. Thomas and R. L. Finney, Pearson Education, 2007.

• Programme:	B.Sc. (Honours)
• Semester:	2
• Subject:	Mathematics
• Course code:	**DSM – 201 (Minor Paper)**
• Title of the course	**Theory of Ordinary Differential Equations (Including Practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation(**CCE**)-Formative- **50 Marks**		Semester End Evaluation(**SEE**)-Summative-**50 Marks**
Theory(25 Marks) 1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	**Practicals(25 Marks)** 1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours :** 3 Hours/Week (Theory)+ 2 Hours /Batch/Week (Practicals)

DSM – 201 (Minor Paper)

Theory of Ordinary Differential Equations

Course Learning Outcome:

- Student will recollect the definition of differential equation, its order and degree.
- Student will recollect the meaning of general solution of a differential equation.
- Student will also recollect the previously studied methods of finding general solution of a given differential equation such as variable separable method, linear differential equation of integrating factor type and homogenous differential equation.
- Student will be able to find general solutions of Bernoulli's differential equation and exact differential equation.
- Student will be able to find singular solutions of a differential equation.
- Student will be able to know the geometrical meaning of ordinary differential equation.
- Student will be able to find orthogonal trajectories and also, they will get its geometric insight.
- Student will be able to solve a differential equation of first order and higher degree.
- Student will be able to solve homogeneous linear differential equations with constant coefficients and with variable coefficients.

UNIT 1: ODE - First Order and First Degree [12 hours]

Introduction & review of studied methods to solve first order and first-degree differential equations, Bernoulli`s differential equation, exact differential equation, singular solution of an ordinary differential equation, geometric meaning of an ODE, orthogonal trajectories.

UNIT 2: Differential equations of first order and higher degree [9 hours]

Differential equation of first order solvable for *x*, solvable for *y*, solvable for *p*; Clairaut`s & Lagrange`s form of differential equations.

UNIT 3: Linear differential equations of higher order [12 hours]

Linear differential equation of higher order with constant coefficients, meaning of complimentary function (C.F.) & particular integral (P.I.), operator D, meaning of auxiliary equation, roots of auxiliary equation, real and complex roots of auxiliary equation $f(D)y = 0$,.

Operator $\frac{1}{D}$, solution of differential equation of the form $f(D)y = X$, method to find P.I. when $X = e^{ax}, X = \sin(ax + b)$, $X = \cos(ax + b)$, $X = x^m, X = e^{ax}V$.

UNIT 4: Linear differential equations with variable coefficients [12 hours]

Homogeneous linear differential equation, methods for finding complementary function (C.F.), methods for finding particular integral (P.I.), the symbolic operators (θ) & $\frac{1}{f(\theta)}$, particular integral (P.I.) corresponding to a term of the form x^{α}.

Practical's

Practical No.	Title
1.	To obtain solution of linear differential equation of first order.
2.	To obtain singular solution of differential equation of first order and first degree.
3.	To obtain orthogonal trajectories of given family of curves.
4.	To obtain solution of Bernoulli`s differential equation.
5.	To obtain solution of exact differential equation.

6. To obtain solution of differential equation of first order which is solvable for x, y or p .

7. To obtain solution of Clairaut`s differential equation and Lagrange`s differential equation.

8. To obtain solution of differential equation $f(D)y = 0$, where $f(D)$ is a polynomial in D with constant coefficients.

9. To obtain solution of Cauchy Euler homogeneous linear differential equation $f(xD)y = X$, where $f(xD)$ is a polynomial in xD with constant coefficients.

10. To obtain solution of Legendre`s homogeneous linear differential equation.

Reference Books:

1. Differential Calculus by Shanti Narayan.
2. Differential Calculus by Gorakh Prasad.
3. Integral Calculus by Shanti Narayan.
4. Integral Calculus by Gorakh Prasad.
5. Differential Equations by D. A. Murray.
6. Calculus, By G. B. Thomas and R. L. Finney, Pearson Education, 2007.

• Programme:	B.Sc. (Honours)
• Semester:	2
• Subject:	Mathematics
• Course code:	**MDC – 201 (Multidisciplinary Course – 1)**
• Title of the course	**Theory of Ordinary Differential Equations (Including Practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation (**CCE**)-Formative- **50 Marks**		Semester End Evaluation(**SEE**)-Summative-**50 Marks**
Theory(25 Marks) 1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	**Practicals(25 Marks)** 1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours:** 3 Hours/Week (Theory)+ 2 Hours /Batch/Week (Practical's)

MDC – 201 (Multidisciplinary Course)

Theory of Ordinary Differential Equations

Course Learning Outcome :

- Student will recollect the definition of differential equation, its order and degree.
- Student will recollect the meaning of general solution of a differential equation.
- Student will also recollect the previously studied methods of finding general solution of a given differential equation such as variable separable method, linear differential equation of integrating factor type and homogenous differential equation.
- Student will be able to find general solutions of Bernoulli's differential equation and exact differential equation.
- Student will be able to find singular solutions of a differential equation.
- Student will be able to know the geometrical meaning of ordinary differential equation.
- Student will be able to find orthogonal trajectories and also they will get its geometric insight.
- Student will be able to solve a differential equation of first order and higher degree.
- Student will be able to solve homogeneous linear differential equations with constant coefficients and with variable coefficients.

UNIT 1: ODE - First Order and First Degree [12 hours]

Introduction & review of studied methods to solve first order and first degree differential equations, Bernoulli`s differential equation, exact differential equation, singular solution of an ordinary differential equation, geometric meaning of an ODE, orthogonal trajectories.

UNIT 2: Differential equations of first order and higher degree [9 hours]

Differential equation of first order solvable for *x*, solvable for y, solvable for p; Clairaut`s & Lagrange`s form of differential equations.

UNIT 3: Linear differential equations of higher order [12 hours]

Linear differential equation of higher order with constant coefficients, meaning of complimentary function (C.F.) & particular integral (P.I.), operator D, meaning of auxiliary equation, roots of auxiliary equation, real and complex roots of auxiliary equation $f(D)y = 0$.

Operator $\frac{1}{D}$, solution of differential equation of the form $f(D)y = X$, method to find P.I. when $X = e^{ax}, X = \sin(ax + b)$, $X = \cos(ax + b)$, $X = x^m, X = e^{ax}V$.

UNIT 4: Linear differential equations with variable coefficients [12 hours]

Homogeneous linear differential equation, methods for finding complementary function (C.F.), methods for finding particular integral (P.I.), the symbolic operators (θ) & $\frac{1}{f(\theta)}$, particular integral (P.I.) corresponding to a term of the form x^{α}.

Practicals

Practical No.	Title
1.	To obtain solution of linear differential equation of first order.
2.	To obtain singular solution of differential equation of first order and first degree.
3.	To obtain orthogonal trajectories of given family of curves.
4.	To obtain solution of Bernoulli`s differential equation.
5.	To obtain solution of exact differential equation.

6. To obtain solution of differential equation of first order which is solvable for x, y or p .

7. To obtain solution of Clairaut`s differential equation and Lagrange`s differential equation.

8. To obtain solution of differential equation $f(D)y = 0$, where $f(D)$ is a polynomial in D with constant coefficients.

9. To obtain solution of Cauchy Euler homogeneous linear differential equation $f(xD)y = X$, where $f(xD)$ is a polynomial in xD with constant coefficients.

10. To obtain solution of Legendre`s homogeneous linear differential equation.

Reference Books:

1. Differential Calculus by Shanti Narayan.
2. Differential Calculus by Gorakh Prasad.
3. Integral Calculus by Shanti Narayan.
4. Integral Calculus by Gorakh Prasad.
5. Differential Equations by D. A. Murray.
6. Calculus, By G. B. Thomas and R. L. Finney, Pearson Education, 2007.

• Programme:	B.Sc. (Honours)
• Semester:	2
• Subject:	Mathematics
• Course code:	**SEC – 201**
• Title of the course	**Introduction to GeoGebra (FOSS)** **Note: Practical based learning course**
• Marks of External Examination (SEE) • Marks of Internal Examination: (CCE) • Total Marks:	25 Marks Semester End Evaluation(SEE) 25 Marks Continuous & Comprehensive Evaluation(CCE) External (SEE) → 25 Marks Internal (CCE) → 25 Marks Total → **50 Marks**
• Credit of the course and teaching hours per week	Course credit – 2 Teaching hours – 4 Hours/Batch/Week

SEC – 201

Introduction to GeoGebra (FOSS)

Practical based learning course

Course Learning Outcome:

- Student will learn to draw various geometric shapes using a variety of tools available in GeoGebra.
- Student will learn to use function inspector tool to analyze the given function.
- Student will be able to use slider functionality of GeoGebra.
- Student will also be able to plot various types of conics and calculate the area of the bounded region.
- Student will be equipped to find optimum solution of given LPP.

Practical No.	Title
1.	Introduction to the interface of GeoGebra.
2.	Use of tools bar to draw various geometric shapes including line, line segment, triangle, polygon, circle and conics.
3.	Drawing of graph of any function of one variable for cartesian equation using menu bar and to analyze the function using function inspector tool from tools menu and find its properties like maximum and minimum values.
4.	Drawing of graph of curve using menu bar, when equation of the curve is given.
5.	Drawing of various types of triangles including equilateral triangle, isosceles triangle, scalene triangle, right angled triangle, acute angled triangle, obtuse angled triangle, and locating concurrent points like centroid, incenter, circumcenter and orthocenter.
6.	Introduction to various circle and compass tools and practicing construction of various geometric shapes including triangles,

polygons, squares, rectangle etc.

7. Verification of some important theorems of geometry, algebra and calculus using GeoGebra.

8. Drawing and measuring various geometric shapes using angle, distance, area and slope tools from tools bar.

9. Use of vector tools for creating reflection, rotation and translation.

10. Use of slider and animation.

Format of Question Papers for External Theory Examination

(Semester End Evaluation(**SEE**)-Summative-**50 Marks**)

for

DSC – 201, DSC – 202, DSM – 201 and MDC – 201.

(*Effective from Academic Year 2023 – 24 onwards*)

- There will be total FIVE questions.
- One question from every unit comprising of 10 marks each.
  Remaining one question will be asked from all four units of 10 marks

Question No. **1 to 4** (A) Answer any ONE out of TWO. 05 Marks (B) Answer any ONE out of TWO. 05 Marks	
TOTAL of each question 1 to 4	**10 MARKS**
Question No. **5** (A) Answer any ONE out of TWO 05 Marks (one question each from unit no-1 & 2) (B) Answer any ONE out of TWO 05 Marks (one question each from unit no-3 & 4)	
TOTAL	**10 MARKS**

Format of Question Paper for External Theory Examination

(Semester End Evaluation(**SEE**)-Summative-**50 Marks**)

for

SEC-201

Evaluation of 50 Marks (2 Credit Paper)

Continuous and Comprehensive Evaluation (**CCE**)-Formative- **25 Marks**	Semester End Evaluation (**SEE**)-Summative-**25 Marks**
Practical's (25 Marks) 1. Performance 15 Marks 2. Viva-voce 10 Marks	**Practical's (25 Marks)** 1. Performance 15 Marks 2. Viva-voce 05 Marks 3. Journal 05 Marks
Total 25 Marks	**Total 25 Marks**