

DAVANGERE UNIVERSITY

SHIVAGANGOTHRI – 577 007, DAVANGERE




SYLLABUS FOR

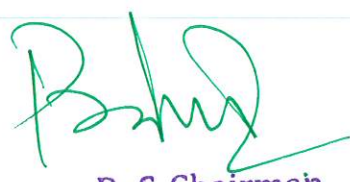
BACHULAR OF SCIENCE (B. SC.) SEMESTER
SCHEME – NEP - 2020

MATHEMATICS


(Major)


BoS-Chairman,
Department of Mathematics
Davangere University
Shivagangotri, Davangere-577007.

SEMESTER - V										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hours)
			IA	SEE	Total	L	T	P		
DSC	MATDSCTS 5.1	Abstract Algebra And Vector Calculus	40	60	100	4	-	-	4	2
	MATDSCPS 5.1	Practical/Lab Work to be performed in Computer Lab (FOSS) Suggested (Practical)	25	25	50	-	-	4	2	3
	MATDSCTS 5.2	Complex Analysis, Line And Multiple Integrals	40	60	100	4	-	-	4	2
	MATDSCPS 5.2	Practical/Lab Work to be performed in Computer Lab (FOSS) Suggested (Practical)	25	25	50	-	-	4	2	3
SEC-4	-	Employability Skills / Cyber security	25	25	50	2	-	2	3	01


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Registrar
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 Professor and Dean,
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SEMESTER - VI										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hours)
			IA	SEE	Total	L	T	P		
DSC	MATDSCTS 6.1	Vector Algebra, Improper Integration, Ordinary Differential Equation-II	40	60	100	4	-	-	4	2
	MATDSCPS 6.1	Practical/Lab Work to be performed in Computer Lab (FOSS) Suggested. (Practical)	25	25	50	-	-	4	2	3
	MATDSCTS 6.2	Numerical Analysis	40	60	100	4	-	-	4	2
	MATDSCPS6.2	Practical/Lab Work to be performed in Computer Lab (FOSS) (Practical)	25	25	50	-	-	4	2	3
SEC-4	-	Internship	-	-	-	-	-	-	2	


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DSC-5.1 PAPER-V

ABSTRACT ALGEBRA AND VECTOR CALCULUS

Unit I: Groups-II

Normal Subgroups – properties, examples and problems, **Quotient group**, **Homomorphism and Isomorphism of groups** – properties examples and problems, Kernel and image of a homomorphism, Normality of the kernel, Fundamental theorem of homomorphism, Properties related to isomorphism, **Permutation group** – Cayley's Theorem. **15 hours**

Unit II: Rings, Integral Domains, Fields

Rings – definition and properties of rings, Rings of integers modulo n , Integral Domain, Fields. examples and standard properties. Subrings, Ideals - Principal, Prime and Maximal ideals in a commutative ring - examples and standard properties **15 hours**

Unit –III: Vector calculus


Geometry of space curve: –Multiple product – scalar triple product, vector triple product, geometrical interpretation, related problems; vector function of a scalar variable interpretation as a space curve, derivative, tangent, normal and binormal vectors to a space curve; Curvature and Torsion of a space curve - definitions, derivation and problems, Serret-Frenet formulae. **15 Hours**

Unit-IV: Vector differential calculus

Gradient of a scalar field, geometrical meaning, directional derivative, unit normal using surfaces - tangent plane and normal to the surface; Vector field - divergence and curl of a vector field, geometrical meaning, solenoidal and irrotational fields; Laplacian of a scalar field; Vector identities. **15 Hours**

Reference Books

1. I N Herstein(1990), Topics in Algebra, 2nd Edition, Wiley Eastern Ltd., New Delhi.
2. Vijay K Khanna and S K Bhambri (1998), A Course in Abstract Algebra, Vikas Publications.
3. Michael Artin (2015), Algebra, 2nd ed., Pearson.
4. Joseph A, Gallian (2021), Contemporary Abstract Algebra, 10th ed., Taylor and Francis Group.
5. M. D. Raisinghania, *Vector Calculus*, S Chand Co. Pvt. Ltd., 2013.
6. M. Spiegel, *Vector Analysis*, 2nd Edition, Schaum's Outline Series, Mc-Graw Hill, Education, 2017.
7. C. E. Weatherburn, *Elementary Vector Analysis*, Alpha edition, 2019.
8. P. N. Wartikar and J. N. Wartikar, *A Textbook of Applied Mathematics*, Vol. II, Pune Vidyarthi Griha Prakashan, Pune, 2009


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University

PRACTICALS

Practical/Lab Work to be performed in Computer Lab (FOSS) Suggested Software:

Maxima/Scilab

Suggested Programs:

1. Examples on different types of rings.
2. Examples on integral domains
3. Examples on fields.
4. Verification of normality of a given subgroup.
5. Illustrating homomorphism of groups
6. Program on multiple product of vectors – Scalar and Cross product.
7. Program on vector differentiation and finding unit tangent.
8. Program to find curvature and torsion of a space curve.
9. Program to find the gradient and Laplacian of a scalar function, divergence and curl of a vector function.
10. Program to demonstrate the physical interpretation of gradient, divergence and curl.


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DSC-5.2 PAPER-VI

COMPLEX ANALYSIS, LINE AND MULTIPLE INTEGRALS

Unit – I: Complex numbers and functions of complex variables:

Complex numbers-Cartesian and polar form-geometrical representation-complex-Plane,Euler's formula- $e^{i\theta} = \cos \theta + i \sin \theta$. Functions of a complex variable-limit, continuity and differentiability of a complex function. Analytic function, Cauchy-Riemann equations in Cartesian (Cartesian form only)- Harmonic function-standard properties of analytic functions-construction of analytic function when real or imaginary part is given-Milne Thomson method.

15 Hours

Unit –II: Bilinear Transformations

Linear transformation- Definitions-Bilinear transformations- Cross-ratio of four points- Cross-ratio preserving property- Preservation of the family of straight lines and circles- Conformal mappings- Discussion of the transformations $w = z^2$, $w = \sin z$, $w = e^z$, $w = \frac{1}{2} \left(z + \frac{1}{z} \right)$.

15 Hours

Unit-III: Complex integration

definition, Line integral, properties and problems. Cauchy's Integral theorem-proof using Green's theorem-direct consequences. Cauchy's Integral formula with proof-Cauchy's generalized formula for the derivatives with proof and applications for evaluation of simple line integrals. Cauchy's integral problems

15 Hours

Unit-IV: Line and Multiple Integrals

Definition of line integral and basic properties examples evaluation of line integrals. Definition of double integral, Evaluation of double integrals by change of variables – Definition of triple integral and evaluation – change of variables

15 hours

Reference Books:

1. L. V. Ahlfors, *Complex Analysis*, 3rd Edition, McGraw Hill Education
2. Bruce P. Palka, *Introduction to the Theory of Function of a Complex Variable*, Springer
3. Serge Lang, *Complex Analysis*, Springer
4. Shanthinarayan, *Theory of Functions of a Complex Variable*, S. Chand Publishers.
5. S. Ponnuswamy, *Foundations of Complex Analysis*, 2nd Edition, Alpha Science International Limited.
6. R.V. Churchill & J.W. Brown, *Complex Variables and Applications*, 5th ed, McGraw Hill Companies
7. B. S. Grewal, *Higher Engineering mathematics*, Khanna Publications.
8. H. K. Das, *Higher Engineering Mathematics*, S. Chand publishers.
9. N.P Bali Integral calculus Golden series


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PRACTICALS

Practical/Lab Work to be performed in Computer Lab (FOSS) Suggested Software:

Maxima/Scilab

1. Program on verification of Cauchy – Riemann equations (Cartesian form) or test for analyticity.
2. Program to check whether a function is harmonic or not.
3. Program to construct analytic functions (through Milne–Thompson method)
4. Program to find Cross ratio of points and related aspects.
5. Program to find fixed points of bilinear transformations.
6. Evaluation of the line integral with constant limits.
7. Evaluation of the double integral with constant limits.
8. Evaluation of the triple integral with constant limits.
9. Evaluation of the line integral with variable limits.
10. Evaluation of the double integral with variable limits.
11. Evaluation of the triple integral with variable limits.



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DSC-6.1 PAPER-VII

VECTOR ALGEBRA, IMPROPER INTEGRATION, ORDINARY DIFFERENTIAL EQUATION-II

Unit – I: Vector spaces

Vector spaces - Definition, examples and properties; **Subspaces** - Examples, criterion for a sub-set to be a subspace and some properties; **Linear Combination** - Linear span, Linear dependence and Linear independence, basic properties of linear dependence and independence, techniques of determining linear dependence and independence in various vector spaces and related problems; **Basis and dimension** - Coordinates, ordered basis, some basic properties of basis and dimension and subspace spanned by given set of vectors;

15 Hours

Unit – II: Linear Transformations

Linear transformation - Definition, examples, equivalent criteria, some basic properties and matrix representation and change of basis and effect on associated matrix, similar matrices; **Rank - Nullity theorem** - Null space, Range space, proof of rank nullity theorem and related problems.

15 Hours

Unit – III: Improper Integrals

Definitions, Properties and examples, relations between beta and gamma functions, standard theorems, applications of evaluations of definite integrals, duplication formula and applications.

15 Hours

Unit-4. DIFFERENTIAL EQUATIONS –II

Solutions of second order ordinary linear differential equations with variable coefficients by the following methods.

- When a part of complementary function is given
- Changing the independent variable
- Changing the dependent variable
- Variation of parameters (variable coefficient only)
- Conditions for exactness and the solution when the equation is exact.

15 Hours


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Reference Books:

1. I N. Herstein, *Topics in Algebra*, 2nd Edition, Wiley.
2. Stephen H. Friedberg, Arnold J. Insel & Lawrence E. Spence (2003), *Linear Algebra* (4th Edition), Printice-Hall of India Pvt. Ltd.
3. F. M. Stewart, *Introduction to Linear Algebra*, Dover Publications.
4. S. Kumaresan, *Linear Algebra*, Prentice Hall India Learning Private Limited.
5. Kenneth Hoffman & Ray Kunze (2015), *Linear Algebra*, (2nd Edition), Prentice Hall India Learning Private Limited.
6. Gilbert. Strang (2015), *Linear Algebra and its applications*, (2nd Edition), Elsevier.
7. Vivek Sahai & Vikas Bist (2013), *Linear Algebra* (2nd Edition) Narosa Publishing.
8. Serge Lang (2005), *Introduction to Linear Algebra* (2nd Edition), Springer India.
9. T. K. Manicavasagam Pillai and K S Narayanan, *Modern Algebra Volume 2*.
10. B. S. Grewal, *Higher Engineering mathematics*, Khanna Publications.
11. H. K. Das, *Higher Engineering Mathematics*, S. Chand publishers.

PRACTICALS

Practical/Lab Work to be performed in Computer Lab (FOSS) Suggested Software's:
Maxima/Scilab /Python/R.

Suggested Programs:

1. Program on linear combination of vectors.
2. Program to verify linear dependence and independence.
3. Program to find basis and dimension of the subspaces.
4. Program to verify if a function is linear transformation or not.
5. Program to find the matrix of linear transformation.
6. Program to find the Eigenvalues and Eigenvectors of a given linear transformation.
7. Program on Rank – nullity theorem.
8. Evaluation of the integrals using gamma function.
9. Evaluation of the integrals using Beta function.
10. solving second order differential equation with variable coefficient(all methods)

DSC-6.2 PAPER-VIII
NUMERICAL ANALYSIS

Unit – I: Algebraic and Transcendental Equations

Solutions to algebraic and transcendental equations - Bisection method, Regula-Falsi method, iterative method Newton-Raphson method and secant methods

15 Hours

Unit – II: Finite Differences

Finite differences. Forward, backward and central differences and shift operators: definitions, properties and problems; Polynomial interpolation - Newton-Gregory forward and backward interpolation formulas, Gauss's Forward and backward interpolation formulas, Lagrange interpolation polynomial, Newton's divided differences and Newton's general interpolation formula

15 Hours

Unit-III: Numerical Differentiation and Integration

Formula for derivatives (till second order) based on Newton-Gregory forward and backward interpolations (Derivations and problems based on them). Numerical Integration - General quadrature formula, Trapezoidal rule, Simpson's $1/3$ rule, Simpson's $3/8$ rule and Weddell's rule (derivations for only general quadrature formula, trapezoidal rule and Simpson's $1/3^{\text{rd}}$ rule and problems on the applications of all formulas).

15 Hours


Unit – IV: Solution of initial value problems

Solution of initial value problems for ordinary linear first order differential equation by Taylor's series, Euler's and Euler's modified method, Picard's methods and Runge-Kutta's fourth order method

15 Hours

Reference Books :

1. E. Isaacson and H. B. Keller, *Analysis of Numerical methods*, Dover Publications.
2. S. S. Sastry, *Introductory methods of Numerical Analysis*, 5th Edition, PHI Learning Private Limited.
3. E Kreyszig, *Advanced Engineering Mathematics*, Wiley India Pvt. Limited
4. B. S. Grewal, *Numerical Methods for Scientists and Engineers*, Khanna Publishers.
5. M. K. Jain, S. R. K. Iyengar and R. K. Jain, *Numerical Methods for Scientific and Engineering computation*, 4th Edition, New Age International
6. H. C. Saxena, *Finite Difference and Numerical Analysis*, S. Chand Publishers
7. B. D. Gupta, *Numerical Analysis*, Konark Publishers Pvt. Ltd.


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PRACTICALS

Practical/Lab Work to be performed in Computer Lab (FOSS)

Suggested Software's: Maxima/Scilab

Suggested Programs:

1. Program to find root of an equation using bisection
2. Program on Regula-Falsi methods
3. . Program on newton Rapson methods
4. Newton forward and backward interpolation
5. Program to evaluate integral using Simpson's $1/3$ and $3/8$ rules.
6. Program to evaluate integral using Trapezoidal
7. Program on Weddle rules
8. Program to find the missing value of table using Lagrange method.
9. Program on Modified Euler's method
10. Program on Runge-Kutta method


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DEAN

Vth and VIth Semester B.Sc. Examination
(NEP Scheme)

MATHEMATICS

DSC-5.1 , DSC-5.2, DSC-6.1, DSC-6.2 :

Time: 2 Hours

Max. Marks: 60

Note: All the sections are compulsory is compulsory.

SECTION – A

1. Answer any FIVE questions of the following:

(5x2 = 10)

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)

SECTION – B

Answer any FIVE questions of the following:

(5x4 = 20)

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

SECTION – C


Answer any THREE full questions of the following:

(3x10 = 30)

10. a)
b)
11. a)
b)
12. a)
b)
13. a)
b)
14. a)
b)
15. a)
b)


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Registrar
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Dr. RAMALINGAPPA
Professor and Dean,
Faculty of Science & Technology
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