Faculty: Science and Technology Program: B.Sc. (Mathematics)

POs:

At the end of the program, graduates would be able to

1. enhance the knowledge of student in all basic sciences.
2. identify, formulate and develop solutions to computational challenges.
3. develop scientific temper and think in a critical manner.
4. build up progressive and successful career in academics, industry and society.
5. develop student's abilities and aptitudes to apply the mathematical ideas.

PSOs :
Upon completion of the program successfully, students would be able to
1. understand major concepts in all disciplines of Mathematics
2. formulate and develop Mathematical arguments in a logical manner
3. gain good knowledge and understanding in advanced Mathematics
4. create an awareness of the impact of Mathematics on the environment, society and development outside the scientific community.
5. create sensitivity towards environmental concerns and contribute in the development of nation.

<u>Employability Potential of the Program:</u>

Career options for B.Sc. Mathematics students is not just limited to solving complex equation. Apart from the traditional career route of academics and research, there are many careers options offer for B.Sc. Mathematics students that can pick up banking, corporate, accounting and even teaching as their career option on completion of B.Sc. Mathematics, even a career in medicine and law is possible for Mathematics Honors student. Also, a degree with Mathematics is even financially supporting for students because they help in landing placement opportunities by giving an edge over students with B.Sc. physics or other major.

After completing B.Sc. Mathematics, a student can either decide to go for higher studies or apply for jobs. In the case of B.Sc. Mathematics Honors, both the options are very promising. After the B.Sc. Mathematics course, students can purse M.Sc. Mathematics and follow it up with an M. Phil or Ph.D. students can become a mathematician doing research and also become a assistant professor. Also students can pursue a B. Ed. and become a school teacher. Moreover, student can work in related field which required mathematical skills (Machine learning, Data Science etc.). Thus, there exist innumerable B.Sc. Mathematics career options.

The best way to get a prestigious government job is through competitive exams. Examinations like UPSC, Railways, banking and Commission etc. are some important competitive examinations as that one needs to consider as portals for B.Sc. Mathematics career options.

Syllabus Prescribed for the year 2023-24, UG Program

Program: B.Sc. II (Mathematics)

Semester- III

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC-V / Mathematics	Advanced Calculus	9+1* (Including both the papers of Sem-III)

Cos: After completing this course, students would be able to

1. get knowledge of basic principles of limit and continuity, Taylor's theorem.

2. understand Lagrange's multipliers method and Jacobian.

3. understand the concept of improper integral and Beta-Gamma function.
4. learn the definition of sequence and series and Sandwich theorem.

5. learn various tests for convergence and divergence of series.

Unit	Content
Unit I	**Limit and Continuity**: Limit and Continuity of functions of two variables, Algebra of Limit and Continuity, Taylor's theorem of function of two variables. **(12 period)**
Unit II	Maxima and Minima of two variables, Lagrange's multipliers method, Jacobian. **(12 period)**
Unit III	Improper Integral (Definition only), Beta and Gamma functions, Properties of Beta and Gamma functions, Relation between Beta and Gamma functions. **(12 period)**
Unit IV	**Sequence:-** Definition of Sequence, Uniqueness of limit of sequence, Algebra of limit of a sequence, Positivity theorem, Sandwich theorem, Monotonic and Bounded sequence (Definition only), Cauchy Sequence. **(12 period)**
Unit V	**Series:** Series of non-negative terms, Convergence of geometric series, P-Series, Comparison test, Cauchy's integral test, Ratio test, Root test **(12 period)**
***SEM**	
COs:	1. To enhance interest among the students about course. 2. To develop the learning and writing skills. 3. To create mental ability.
**Activities	1. Unit Test 2. Seminar/Group Discussion 3. Quiz/ Study Tour/Project/Assignments/Open Book Test

* For the subject Mathematics, the strength of a batch of tutorials for UG classes shall be 16 (Sixteen) with an addition of 10 percent with the permission of Honorable Vice Chancellor (As amended by Executive Council dated 27/28-4-1979)

Text book :
- V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A. N. Rangari ,Y. S. Solanke: A Text Book of Advanced Calculus, Dnyanpath publication, Amravati, First edition 2023.

Reference Books:
1]T .M. Karade, J. N. Salunke, Maya S. Bendre, D .T. Solanke, C .S. Khodre, S. P. Gaikwad, N.B.Nawale: Advanced Calculus, SONU-NILU, Nagpur, 2023
2] Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
3] Gorakh Prasad: Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
4] Murray R. Spiegel: Theory and Problems of Advanced Calculus, Schaum Outline Series.
5] S. C. Malik and Arora: Mathematical Analysis, Wiley Estern Ltd., New Delhi.
6] O. E. Stanaitis : An Introduction to Sequences, Series and improper Integrals, Holden-Dey , Inc. San Francisco, California.
7] Earl D. Rainville : Infinite series, The Macmillan Co., New York.
8] N. Piskunov : Differential a nd Integral Calculus, Peace publishers, Noscow.
9] Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.
10] D. Somasundaram and B. Choudhary: A First course in Mathematical Analysis, Narosa Publ. House.

Program: B.Sc.-II (Semester-III), Mathematics

Syllabus Prescribed for the Year 2023-24, UG Program

Program: B.Sc.-II

Semester- III

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC-VI / Mathematics	Partial Differential Equations	9+1*(Including both the papers of Sem-III)

Cos: After completing this course, students would be able to

1. study partial derivatives, differential equation, real valued functions of two variables and solve the system of homogeneous functions.
2. learn to evaluate partial differential equations, solution of some special type of equations
3. learn to solve methods of partial differential equation of second and higher order.
4. students will be familiar with techniques of Calculus of variations.
5. recognize various methods of separation of variables.

Unit	Content
Unit I	Partial Derivatives and Differentiations of real valued functions of two variables, Homogeneous function, Euler's theorems on homogeneous function. **(12 period)**
Unit II	Formation of PDE, Partial Differential equation of the first order, Total Differential equation (Pfaffian), Lagrange's method, Some special type of equations. **(12 period)**
Unit III	Compatible Differential equation, Charpit's general method of solutions, Partial Differential equation of second and higher order, Homogeneous and non-homogenous equation with constant coefficients.**(12 period)**
Unit IV	Calculus of Variation: Functional, Continuity of functional, variational problems with fixed boundaries, Extremum of a functional. **(12 period)**
Unit V	Method of Separation of variables, Method of separation of variables for wave equations and heat equations in one dimension. **(13 period)**

*SEM	
COs: 1.To enhances interest among the students about course. 2. To develop the learning and writing skills. 3. 3. To create mental ability.	
**Activities	1. Unit Test 2. Seminar/Group Discussion 3. Quiz/ Study Tour/Project/Assignments/Open Book Test

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Text Books:
- V. A. Sharma, S. R. Bhoyar, V. R. Patil, G. U. Khapekar, S. R. Kumbhare, T. D. Nakade, Salim H. Shaikh: A Text Book of Partial Differential Equation, Dnyanpath publication, Amravati, First edition 2023.

Reference Books:
1] T. M. Karade , J. N. Salunke, Smita V. Nahatkar, S. N. Bayaskar, I. D. Pawade, S. A. Salve, A. F. Gotharkar : Partial Differential Equations , SONU-NILU, Nagpur, 2023
2] Murray D.A.: Introductory course in Differential Equations, Orient Longman (India), 1967.
3] Erwin, Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 1999.
4] Piaggio HTS: Differential Equations, CBS Publishers &Distributors, Delhi, 1985.
5] Siminons G.F. : Differential Equations, Tata McGraw Hill, 1972.
6] A.R. Forsyth. A Treatise on Differential Equations. Macmillan and Co. Ltd. London.
7] Ian N., Sneddon, Elements of Partial Differential Equations. McGraw-Hill Book Company, 1988.
8] Jane Cronin. Differential equations, Marcel Dekker, 1994.
9] Frnak Ayres. Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
10] Richard Bronson, Theory and Problems of Differential Equations, McGraw Hill Inc, 1973.
11] A. S. Gupta: Calculus of Variations with Applications, Prentice-Hall of India, 1997.
12] I. M. Gelfand and S. V. Fomin: Calculus of Variations, Prentice-Hill Englewood Cliffs (New Jersey), 1963.
13] A. S. Gupta: Calculus of Variations with Applications, Prentice-Hall of India, 1997.
14] I. M. Gelfand and S. V. Fomin: Calculus of Variations, Prentice-Hill Englewood Cliffs (New Jersey), 1963.

Program: B.Sc.- II (Semester- IV), Mathematics

Syllabus Prescribed for the year 2023-24, UG Program

Program: B.Sc.-II

Semester IV

Code of the Course/Subject	**Title of the Course/Subject**	**(Total Number of Periods/week)**
DSC-VII / Mathematics	Elements of Algebra	9+1* **(Including both the papers of Sem-IV)**

COs: After completing this course, students would be able to
1 . learn the concept of Group, Subgroup and Cosets.
2. explain the significance of the notations of Cosets, Normal subgroups and Quotient group.
3. learn the concept of Homomorphism & Isomorphism and its Theorem.
4. study the properties of Ring and Ideals and Integral domain.
5.familiar with Fundamental concepts of Number theory.

Unit	Content
Unit I	Group: Definition of a group with examples, Properties of group, Subgroup, Cyclic group, Order of a generator of a cyclic group, Permutation groups, Even and Odd permutations. **(12 period)**
Unit II	Cosets and Normal subgroups: Cosets, Lagrange's theorem, Normal subgroups, Different Characterization of normal subgroups, Quotient group. **(12 period)**
Unit III	Homomorphism and Isomorphism: Homomorphism, Homomorphic image, Kernal of Homomorphism, Isomorphism of a group, Fundamental theorem on homomorphism of a group, second isomorphism theorem, third Isomorphism theorem. **(12 period)**
Unit IV	Ring: Definition, Examples and Properties of a ring (Commutative ring, ring with unity, zero divisor, without zero divisor), Subring, Characterization of ring, Integral domain, field, subfield, prime field(Definition Only). **(14 period)**
Unit V	Fundamental Concept of Number theory: Well ordering Principle, Principle of Mathematical induction, Division Algorithm, Greatest common divisor, Least common multiple, Euclidean Algorithm, Prime, fundamental theorem of arithmetic, Congruence and its properties, **(15 period)**
*SEM	
COs: 1.To enhances interest among the students about course. 2. To develop the learning and writing skills. 3. To create mental ability.	
**Activities	1.Unit Test 2. Seminar/Group Discussion 3. Quiz/ Study Tour/Project/Assignments/Open Book Test

* For the subject Mathematics, the strength of a batch of tutorials for UG classes shall be 16 (Sixteen) with an addition of 10 percent with the permission of Honorable Vice Chancellor (As amended by Executive Council dated 27/28-4-1979)

Text book :

✦ V. A. Sharma , S. R. Bhoyar, V. R. Patil, G. U. Khapekar , A. N. Rangari, N. S. Bayaskar, R. V. Kene, P. B. Deshmukh, M. C. Dhabe: A Text Book of Elements Algebra, Dnyanpath publication, Amravati, First edition 2023

Reference Books:
1] T .M. Karade, J. N. Salunke , Smita V.Nahatkar, Rekha Rani, Vidya N.Mahalle, K.M.Patil, V.D.Bokey, S.M.Munde: Elements of Algebra, SONU-NILU, Nagpur, 2023
2] I.N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
3] N. Jocobson : Basic Algebra ,Vol. I and II W.H.Freeman,1980(Hindustan Publishing Co.
4] Shanti Narayan :A Text Book Of Modern Abstract Algebra, S. Chand and Co. ,New Delhi
5] K.B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd.New Delhi,2000
6] P.B.Bhattacharya, S.K.Jain and S.R.Nagpal : Basic Abstract Algebra (IInd Edition) Cambridge University Press Indian Edition, 1997
7] K.Hoffman and R.Kunze :Linear Algebra ,II nd Edition Prentice Hall, Englewood Cliffs, New Jersey,1971.
8] S.K.Jain, A Gunawardhana and P.B.Bhattacharya : Basic Linear algebra with MATLAB, Key College Publishing (Springer-Verlag)2001
9] S. Kumaresan : Linear Algebra, A Geometric Approach, P Prentice Hall of India Pvt. Ltd. New Delhi,2000
10] Vivek Sahai and Vikas Bisht: Algebra, Narosa Publishing House, 1997.
11] D.S.Malik,J.N.Mordeson and M.K.Sen: Fundamentals of Abstract Algebra, McGraw Hill International Edition 1997
12] D. M. Burton: Elementary Number Theory, Universal Book Stall, New Delhi, Second Edition 2003.
13] C.Y. Hsiung: Elementary Theory of Numbers, Allied Publishers Ltd.1992.
14] I. Niven, H. S. Zuckerman and H. L. Montgomery: An introduction to the Theory of Numbers, Wiley Student Edition, Fifth edition 2004.
15] K. H. Rosen: Elementary Number Theory and its Applications, Addison-Wesley, 1986.
16] T. M. Karade, J. N. Salunke, K. D. Thengane, M. S. Bendre: Lectures on Elementary Number Theory, Sonu-Nilu publication 2005.
17] K. Irland and M. Rosen: A Classical Introduction to Modern Number Theory, GTM Volume 84, Springer-Verlag 1972
18] G. A. Jones and I. M. Jones: Elementary Number Theory, Springer, 1998

Program: B.Sc.- II (Semester-IV), Mathematics

Syllabus Prescribed for the year 2023-24 , UG Program

Program: B.Sc.-II Semester- IV

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods/week)
DSC –VIII / Mathematics	Classical Mechanics	**9+1* (Including both the papers of Sem-IV)**

COs:

After completing this course, students would be able to

1. learn radial and transverse component of velocities and acceleration.

2. learn to explain Degree of freedom, Generalized co-ordinates and constraints.

3. learn to expressing the central force motion and areal velocity.

4. explain the significance of coplanar forces, triangle law of forces, parallel forces and equilibrium forces.

5. learn to find work and energy, virtual work and uniform catenary.

Unit	content
Unit I	Velocities and Acceleration along the co-ordinate axes, Radial and Transverse directions, Tangential and Normal directions, Projectiles. **(12 period**)
Unit II	Degree of freedom, Constraints, Generalized Co-ordinates, D'Alembert Principles and Lagrange's equations of motions. **(12 period)**
Unit III	Central force motion, Areal velocity, Equivalent one body problem, Central orbit, Virial theorem, Kepler's laws of motion (statement only). **(12 period)**
Unit IV	Coplanar forces, forces acting at a point, triangle law of forces, Parallel forces, Equilibrium Forces, Lami's Theorem, Analytical condition of equilibrium of Coplanar forces. **(13 period)**
Unit V	Work and Energy, virtual work, Uniform Catenary. **(12 period)**
*SEM	

COs: 1.To enhances interest among the students about course.
        2. To develop the learning and writing skills
        3. To create mental ability.	

**Activities	1. Unit Test 2.Seminar/Group Discussion 3.Quiz/ Study Tour/Project/Assignments/Open Book Test

* For the subject Mathematics, the strength of a batch of tutorials for UG classes shall be 16 (Sixteen) with an addition of 10 percent with the permission of Honorable Vice Chancellor (As amended by Executive Council dated 27/28-4-1979)

Text book:
‑   V. A. Sharma, V. R. Patil, S. R. Bhoyar, G. U. Khapekar, A.P.Wasnik, P. R. Langade, Y. D. Naner A. M. Bagde,
 N. B. Nawale, M. D. Netnaskar: A Text Book of Classical Mechanics, Dnyanpath publication, Amravati, First edition
 2023.

Reference Books:

1] T.M.Karade, J.N.Salunke, Smita V. Nahatkar, Y.D.Patil, Minakshi T. Sarode, S.B. Khobragade, A.M.Bagade: Elements of Classical Mechanics, SONU-NILU, Nagpur, 2023.

2] H. Goldstein: Classical Mechanics (2nd edition) Narosa publishing house, New Delhi, 1998.

3] D. A. Wells: Lagrangian Dynamics, McGraw Hill, 1967.

4] J. L. Synge, B.A. Griffith: Principles of Mechanics, McGraw Hill, 1959.

5] M. R. Spiegel: Theoretical Mechanics, McGraw Hill, 1983.

6] L.D. Landau, E. M. Lifschitz: Mechanics, Pergamon Press, 1976.

7] B. R. Gossick: Hamilton's Principle and Physical Systems, Academic Press, 1967.

8] S. L. Loney : An Elementary Treatise on the Dynamics of a particle and of rigid bodies, Cambridge University Press, 1956.

9] P. K. Mittal: Mathematics for Degree Students, S. Chand & Co Ltd, New Delhi, 2011.