SYLLABUS FOR

THE FOUR-YEAR UNDERGRADUATE PROGRAMME

(FYUP)

B.Sc. Third and Fourth Semester

As per provision of NEP-2020(Central Board)

Implemented fromAcademic Year 2024-25 onwards

Session 2025-26

DEPARTMENT OF MATHEMATICS

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE,

RAJNANDGAON (C.G.)

FOUR YEAR UNDER GRADUATE PROGRAM (2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Diploma/Degree/Honors)		**Semester - III**	**Session:2024-2025**
1	Course Code	**MASC-03**	
2	Course Title	**Differential Equations**	
3	Course Type	**Discipline Specific Course (DSC)**	
4	Pre-requisite(if any)	Knowledge of basic Differential and Integral calculus and differential equation.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Learn various techniques of getting exact solutions of certain solvable first order differential equations and linear differential equations of second order. ➢ Understand the genesis of ordinary as well as partial differential equations. ➢ Learn about solution of first order linear partial differential equations using Lagrange's method. ➢ Know how to solve second order linear partial differential equations with constant coefficients.	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Contributions and Biography of Indian Mathematicians:** Aryabhatta, Varahmihir, Bhaskar-I, Shreedharacharya, Shreepati and Parmeshwar. **First Order and higher degree Differential Equations :** Differential equations of first order and first degree, Equations in which variables are separable, Homogeneous equations, Linear differential equations and equations reducible to linear form, Exact differential equations, Integrating factor, First order higher degree equations solvable for x, y and p, Clairaut's form and singular solutions, orthogonal trajectories.	15
II	**Linear and Ordinary simultaneous differential equations:** Linear differential equations with constant coefficients, Homogeneous linear ordinary differential equations. Linear differential equations of second order.Transformation of the equation by changing the dependent variable/the independent variable.Method of variation of parameters. Ordinary simultaneous differential equations.	15
III	**First order Partial differential equations:** Lagrange's solution, Some special types of equation which can be solved by methods other than general method, Charpit's general method of solution.	15

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IV	**Second and higher order Partial differential equations:** Classification of Linear partial differential equation of second order, Homogeneous and non- homogeneous equation with constant coefficients, Partial differential equation reducible to equation with constant coefficients. Monge's Method.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Dr. M. D. Rajsinghania, Ordinary and partial Differential Equation ,S. Chand and company Pvt.Ltd.
2. A.H. Siddiqi and P. Manchanda , A first course in Differential Equations with Applications, Macmillan India Ltd.

Reference Books Recommended-

3. Erwin Kreyszig (2011). *Advanced Engineering Mathematics* (10th edition). J. Wiley & Sons
4. B. Rai& D. P. Choudhury (2006). *Ordinary Differential Equations - An Introduction*. Narosa Publishing House Pvt. Ltd. New Delhi.
5. Shepley L. Ross (2007). *Differential Equations* (3rd edition). Wiley.
6. George F. Simmons (2017). *Differential Equations with Applications and Historical Notes* (3rd edition). CRC Press. Taylor & Francis.
7. Ian N. Sneddon (2006). *Elements of Partial Differential Equations*. Dover Publications.

E-resources: https://onlinecourses.nptel.ac.in
https://epgp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Examination (ESE): **70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

Dr. Omkar Nath Shivastava

Dr. S. Dash

(Dr. P. K. Sahu)

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Diploma/Degree/Honors)		**Semester - III**	**Session:2024-2025**
1	Course Code	**MASE-01**	
2	Course Title	Advanced Calculus	
3	Course Type	Discipline Specific Elective (DSE)	
4	Pre-requisite (if any)	Basic idea of elementary differential and integral calculus	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Calculate the limit and examine the continuity and understand the concepts of limit , continuity and differentiability of functions of more than one variable with geometrical interpretation. ➢ To Understand the concepts of mean value theorems with their applications . ➢ To understand the concept of maxima and minima for functions of two and three variables with their uses and techniques ➢ Understand conceptual variations while advancing from one variable to severalvariables in calculus. ➢ Understand the concept of integration of functions of two and three variables and their evaluation technique with emphasis on beta and gamma functions .	
6	Credit Value	4 C	1Credit = 15 hours- Learning and observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	Limit and continuity of function of two and three variables. Mean value theorems of function of two variables- First mean value theorem and taylor's theorem. Partial Differentiation and Euler's theorem on homogeneous functions, Change of variables.	15
II	Partial Derivation and differentiability of function of two variables. Schwartz's theorem, Young's theorem, Implicit function theorem. Fourier series, Fourier expansion of piece wise monotonic function.	15
III	Jacobians , Maxima, Minima and saddle points of function of two variables. Lagrange's multipliers method. Envelopes, Evolutes	15
IV	Beta and Gamma function. Double and triple integrals .Dirichelet's integrals. Change of order of integration.	15

Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Text Books Recommended- 1. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd. 2. Mathematical Analysis, S.C. malik and S. Arora, New age international,Delhi		
3. Howard Anton, I. Bivens & Stephan Davis (2016). Calculus (10th edition).Wiley India. 4.Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag. 5.Wieslaw Krawcewicz & Bindhyachal Rai (2003). Calculus with Maple Labs. 6.Principles of Mathematical analysis, W.Rudin,McGraw Hill Publication 7.Jerrold Marsden, Anthony J. Tromba & Alan Weinstein (2009). Basic 8. James Stewart (2012). Multivariable Calculus (7th edition). Brooks/Cole. Cengage.		
E-resources: https://onlinecourses.nptel.ac.in https://epgp.inflibnet.aci.in https://swayam.gov.inhttps://www.mooc.org		
Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Internal Assessment (CIA):** **30 Marks** **End Semester Examination (ESE):** **70 Marks**		
Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Certificate/Diploma/Degree/Honors)		Class: B.Sc. I/III/V Sem	Session:2024-2025
1	Course Code	**MAVAC-1**	
2	Course Title	**Basic Mathematics and Logic**	
3	Course Type	**Value Addition Course**	
4	Course Learning Outcome (CLO)	**This Course will enable the students-** ➢ To orient them towards life-long learning, to develop power of concentration and to overcome the fear of mathematics from their mind. ➢ To cultivate scientific temper through systematic, critical and lateral thinking. ➢ To enhance their logical, analytical and reasoning skills useful for competitive exams. ➢ To make understand the relevance and need of quantitative methods for making business decisions.	
5	Credit Value	2 Credits	*Credit = 15 Hours - learning & Observation*
6	Total Marks	Max. Marks: 50	Min Passing Marks: 20

PART -B: Content of the Course		
Total No. of Teaching–learning Periods (01 Hr. per period) - 30 Periods (30 Hours)		
Unit	Topics (Course contents)	No. of Period
	Basic Mathematics	
I	Brief history of Vedic Mathematics (In Indian Knowledge Tradition), Sanskrit terminology involved in 16 Sutras and 13 Sub-Sutras and their meaning , Addition , Subtraction , Multiplication & Division using different techniques of Vedic Mathematics , Squaring numbers , Square roots of perfect squares , Cube roots of perfect cubes , Methods of quick verification of answers through Digit Sum Method	**8**
II	Problem based on Numbers, Decimal Fractions, Average, Simple Interest , Percentage ,Clocks	**8**
III	Problems on Profit & Loss , Discount, Ages, Speed, Time & Distance, Train , Ratio & Proportion, Mixture	**8**

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FOUR YEAR UNDER GRADUATE PROGRAM(2024-25)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction				
Program: Bachelor in Science (Diploma/Degree/Honors)		**Semester - IV**	**Session:2024-2025**	
1	Course Code	**MASC-04**		
2	Course Title	**Abstract Algebra**		
3	Course Type	**Discipline Specific Course (DSC)**		
4	Pre-requisite(if any)	Knowledge of algebra, vector space and inner product space.		
5	Course Learning Outcome (CLO)	➢ Understand of Homomorphism, Isomorphism of Group ➢ Understand Cyclic and Permutation Groups. ➢ Understand vector spaces, subspaces, basis, dimension and their properties. ➢ Learn about properties of linear transformation and isomorphism theorems. ➢ Understand the concept of linear transformations.		
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and Observation	
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40	

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Isomorphism Theorems , Cyclic and Permutation Groups :** Group homomorphism and isomorphism with properties; First, second and third isomorphism theorems for groups, Cyclic groups and properties, Classifications of subgroup of cyclic groups, Permutation group and properties, Even and odd permutations, Cayley's theorem.	15
II	**Ring, Field and Integral Domain, Ideals:** Definition and properties of a ring, example of rings, Subrings, Integral domain and fields, characteristic of ring and field. Ring Homomorphism, Ideals and Quotient Rings. Field of Quotients of an Integral Domain, Euclidean Rings, Polynomial Rings, Polynomials over the Rational Field. The Eisenstein Criterion, Polynomial Rings over Commutative Rings, Unique factorization domain. R unique factorization domain implies so is R [x1, x2 ….. xn].	15
III	**Vector Spaces:** Definition and examples of vector spaces. Subspaces. Sum and direct sum of subspaces, Linear span. Linear dependence, independence and their basic properties. Basis. Finite dimensional vector spaces. Existence theorem for bases. Invariance of the number of elements of a basis set. Dimension. Existence of complementary subspace of a subspace of a finite dimensional vector space. Dimension of sums of subspaces. Quotient space and its dimension.	15

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IV	**Linear Transformation:** Linear transformations and their representation as matrices. The Algebra of linear transformations. The rank nullity theorem. Change of basis. Dual space. Bi-dual space and natural isomorphism. Adjoint of a linear transformation.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Nathan Jacobson (2009). *Basic Algebra* I (2nd edition). Dover Publications.
2. Nathan Jacobson (2009). *Basic Algebra* II (2nd edition). Dover Publications.

Reference Books Recommended-

3. I. M. Gel'fand (1989). *Lectures on Linear Algebra*. Dover Publications.
4. Kenneth Hoffman & Ray Kunze (2015). *Linear Algebra* (2nd edition). Prentice-Hall.
5. Serge Lang (2005). *Introduction to Linear Algebra* (2nd edition). Springer India.
6. Gilbert Strang (2014). *Linear Algebra and its Applications* (2nd edition). Elsevier

E-resources: https://onlinecourses.nptel.ac.in
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https://swayam.gov.in
https://www.mooc.org

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DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Diploma/Degree/Honors)		**Semester - IV**	**Session:2024-2025**
1	Course Code	**MASE-02**	
2	Course Title	**MECHANICS**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre-requisite(if any)	Basic idea of Statics and Dynamics	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ The object of the paper is to give students knowledge of basic mechanics such as simple harmonic motion, motion under other laws and forces. ➢ Learn about a nul point, a nul line, and a nul plane with respect to a system of forces acting on a rigid body together with the idea of central axis. ➢ Understand necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body. Determine the centre of gravity of some materialistic systems and discuss the equilibrium of a uniform cable hanging freely under its own weight. ➢ Deal with the kinematics and kinetics of the rectilinear and planar motions of a particle including the constrained oscillatory motions of particles. Learn that a particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions, which were deduced by him long before the mathematical theory given by Newton. ➢ Understand the reduction of force system in three dimensions to a resultant force acting at a base point and a resultant couple, which is independent of the choice of base of reduction.	
6	Credit Value	**4 C**	1Credit =15 hours-Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	Analytical conditions of equilibrium of Coplanar Forces. Forces in three dimensions, Poinsot's central axis, Wrenches, Null lines and planes.	**15**
II	Virtual work, Stable and Unstable equilibrium, Catenary.	**15**
III	Velocities and accelerations along and transverse directions, and along tangential and normal directions, Simple harmonic motion, Motion under other law of forces. Elastic strings.	**15**

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IV	Motion in resisting medium, Constrained motion, Motion on smooth and rough plane curves. Motion of particles of varying mass, Central orbit, Keplers laws of motion, Rocket motion, Motion of particle in three dimensions.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. R.S. Verma (1962). a text books of statics Pothishala Pvt. Ltd.
2. P.L. Shrivastava (1964). Elementary dynamics. Ram Narayan Lal, Beni Prasad Publishers Allahabad

Reference Books Recommended-

3. A.S. Ramsey (2009), Statics, Cambridge University Press
4. A.S. Ramsey (2009), Dynamics, Cambridge University Press
5. S.L. Loney (2006) , An Elementary Treatise on the dynamics of a partical and of rigid bodies. .
6. J.L. Synge an Griffith (1949). Principal of Mechanics, McGraw-Hill.

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