SANKALCHAND PATEL UNIVERSITY, VISNAGAR

Faculty of Science & Humanities

Structure, Teaching Scheme and Syllabus of

B.Sc. (Honours and Honours with Research) Mathematics

Semester -8

as per NEP-2020

Program Code: SC104

With effect from: 2023-24

Faculty of Science and Humanities
B.Sc. (Mathematics) (Semester - VIII)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Complex Analysis-II
Course Code:	18-MAM406-4C
Pre-requisite Course:	

Course Objectives:

- To able to know the index of a close curve.
- To know about Meromorphic functions.
- To understand Comparison of entire functions and polynomials with respect to singularity.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory (Marks)		**Practical (Marks)**		
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total (Marks)**
3	**--**	**2**	**4**	**50**	**25**	**--**	**25**	**100**

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	The index of a close curve, behavior of the index on the components, different versions of Cauchy's theorem and Cauchy's integral formula, Morera's theorem, analogy between entire function and polynomials, open mapping theorem.	15	34%
2	Counting zeroes, Meromorphic functions, the argument principle, Rouche's theorem and its application, maximum principle, Schwarz lemma and its application, convex functions, Hadmard's theorem.	15	33%
3	Spaces of continuous functions $C(G,\omega)$, topology of uniform convergence on compact sets, space of analytic functions, Arzela-Ascoli theorem, Montel's theorem, Hurwitz's theorem, Riemann mapping theorem. Behaviour of the function and Riemann's theorem on removable singularity, Casorati- Weierstrass theorem.	15	33%

Reference Books:

1. J. B. Conway - Functions of one complex variable, Springer Verlag.
2. W. Rudin, Real and Complex Analysis, McGraw Hill, 1967.

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=fSoQxuVdKIs
2. https://www.youtube.com/watch?v=mIEGwMUdjXw
3. https://www.youtube.com/watch?v=4K5WB8ajwa8

Practical

Application of Complex Analysis of Unit-1, Unit-2 and Unit-3.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	**Discuss** The index of a close curve, behavior of the index on the components, different versions of Cauchy's theorem and Cauchy's integral formula.	2 Understanding
CLO2	**Explain** Morera's theorem, analogy between entire function and polynomials, open mapping theorem.	4 Analysing
CLO3	**Describe** Meromorphic functions and Counting zeroes.	1 Remembering
CLO4	**Explain** the argument principle, Rouche's theorem and its application, maximum principle, Schwarz lemma and **solve** its example, convex functions, Hadmard's theorem.	4 Analysing 3 Applying
CLO5	**Discuss** Spaces of continuous functions $C(G, \omega)$, topology of uniform convergence on compact sets, space of analytic functions and **Explain** Arzela-Ascoli theorem, Montel's theorem	2 Understanding 4 Analysing
CLO6	**Explain** Hurwitz's theorem, Riemann mapping theorem. Behavior of the function and Riemann's theorem on removable singularity, Casorati-Weierstrass theorem.	4 Analysing

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes(POs)																Programme SpecificOutcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1	2	2		1	2				1								2	1		
CLO2	3	2	1	1	2	1			1								2	2		
CLO3	1	1			1												1	1		
CLO4	3	2	2	1	2	1			1								2	2	1	
CLO5	2	2		1	2	1			1								2	1		
CLO6	3	2	1	1	2	1			1								2	2	1	

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Mathematics) (Semester - VIII)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Functional Analysis
Course Code:	18-MAM407-4C
Pre-requisite Course:	

Course Objectives:

- To able to know the concept of Inner Product Space.
- To know about different types of operators.
- To understand Projections and Riesz representation theorems.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory (Marks)		**Practical (Marks)**		
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total (Marks)**
3	**--**	**2**	**4**	**50**	**25**	**-**	**25**	**100**

Subject Contents:

Sr. No.	**Topic**	**Total Hours**	**Weightage**
1	Inner product spaces, orthonormal sets. Hilbert spaces.	15	34%
2	Approximation and optimization. Projections and Riesz representation theorems.	15	33%
3	Bounded operators and adjoints. Normal, unitary and self-adjoint operators.	15	33%

Reference Books:

1. Limaye, B.V., Functional Analysis, New Age International Publ. Ltd., New Delhi, 1996.
2. H.L.Royden, Real Analysis (3rd Edition) Mc. Millan, 1998.

List of Open Source Software/learning website:

1. https://youtu.be/g-eNeXlZKAQ
2. https://youtu.be/rKiy6wEiQIk

Practical

Application of Functional Analysis of Unit-1, Unit-2 and Unit-3.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	**Describe** Inner product spaces.	1 Remembering
CLO2	**Discuss** orthonormal sets.	2 Understanding
CLO3	**Explain** Hilbert spaces	4 Analyzing
CLO4	**Use** Approximation and optimization and **Discuss** Projections and Riesz representation theorems.	2 Understanding 3 Applying
CLO5	**Explain** Bounded operators and adjoints.	4 Analyzing
CLO6	**Explain** Normal, unitary and self-adjoint operators	4 Analyzing

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CLO1	1	1			1												1	1		
CLO2	2	2		1	2				1								2	1		
CLO3	3	2	1	1	2	1			1								2	2		
CLO4	3	2	1	1	2	1			1								2	2	1	
CLO5	3	2		1	2	1			1								2	2	1	
CLO6	3	2		1	2	1			1								2	2	1	

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Mathematics) (Semester - VIII)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Methods of Partial Differential Equations
Course Code:	18-MAM408-4C
Pre-requisite Course:	Basic concept of Ordinary Differential Equations

Course Objectives:

- To able to know fundamental concept of partial differential equations.
- To know about Monge's method for solving non-linear partial differential equations.
- To understand Second order partial differential equations with variable coefficients.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory (Marks)		**Practical (Marks)**		
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total (Marks)**
3	**--**	**2**	**4**	**50**	**25**	**-**	**25**	**100**

Subject Contents:

Sr. No.	**Topic**	**Total Hours**	**Weightage (%)**
1	Origin of second order partial differential equations, linear second order partial differential equations with constant coefficients, solutions for f(x; y) to be polynomial, exponential, sin/cos functions, general method for homogeneous equations.	15	34%
2	Classification of second ordered partial differential equations and canonical form. Non-linear second order partial differential equations: solution by Monge's method, special case and general case.	15	33%
3	Second order partial differential equations with variable coefficients, method of changing variables for special type of equations. Separation of variable Method: solution of three special equations –Laplace, Wave and diffusion equation, Solution of these equations in different coordinate systems.	15	33%

Reference Books:

1. Amarnath, T., Elementary Course in Partial Differential Equations, Narosa Publ. House, New Delhi,1997.
2. Sneddon, I. N., Elements of Partial Differential Equations, McGraw- Hill Publ. Co., 1957..
3. Grewal, B. S. and Grewal, J. S., Higher Engineering Mathematics, (36th Edition), Khanna Publ.,New Delhi, 2000.
4. Raisinghania, M. D. Advanced Differential Equations, S. Chand \& Co., 1995.

Phoolan Prasad and Ravindran, R., Partial Differential Equations, Wiley Eastern

List of Open Source Software/learning website:

1. https://youtu.be/O3ahEHAX-KU
2. https://youtu.be/gHCZOcTv4d0

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom'sTaxonomyLevel
CLO1	**Discuss** the basic concept of partial differential equations and using it **Solve** linear second orderpartial differential equations with constant coefficients, solutions for f(x; y) to be polynomial, exponential, sin/cos functions, general method for homogeneous equations.	2 Understanding 3 Applying
CLO2	**Use** Monge's method and **solve** non-linear second order partial differential equations.	3 Applying
CLO3	**Explain** Second order partial differential equations with variable coefficients and **solve** example of its.	3 Applying, 4 Analysing
CLO4	**Explain** method of changing variables for special type of equations.	4 Analysing
CLO5	**Discuss** sin/cos functions, general method for homogeneous equations and **solve** example of its.	2 Understanding 3 Applying
CLO6	**Explain** Separation of variable Method: solution of three special equations –Laplace, Wave and diffusionequation, Solution of these equations in different coordinate systems.	4 Analysing

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1	3	2	1	1	2	1			1								2	2	1	
CLO2	3	2			2	1			1								2	2		
CLO3	3	2	1	1	2	1			1								2	2	1	
CLO4	2	2	1		2	1			1								2	1		
CLO5	3	2	1	1	2				1								2	2		
CLO6	3	2	1	1	2	1			1								2	2	1	

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Mathematics) (Semester - VIII)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Programming in "C" language and application.
Course Code:	18-MAE402-4C
Pre-requisite Course:	Basic knowledge of computer.

Course Objectives:

- To be able to know Arrays, logical expression, control statements etc...
- To understand Some mathematical C- programs.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory (Marks)		**Practical (Marks)**		
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total (Marks)**
3	**--**	**2**	**4**	**50**	**25**	**--**	**25**	**100**

Subject Contents:

Sr. No.	**Topic**	**Total Hours**	**Weightage (%)**
1	Defining and manipulating Arrays, Logical expression and more control statements, handling of character strings.	15	33%
2	User-defined functions, Some mathematical C- programs.	15	33%
3	Practical: • Evaluation of factorial of a positive integer and evaluation of binomial coefficients. • Evaluation of Prime and Armstrong numbers, Generation of twin primes, automorphic numbers	15	34%

Reference Books:

1. "Programming in ANSI C" by E. Balagurusamy, The McGraw-Hill Pub. Co. Ltd., 1992.
2. **"C**omputer programming in C", V Rajaraman, PHI-2002
3. "The C Programming Language" by B. W. Kernighan and B. M. Ritchie. Prentice-Hall, 1977.
4. "The C Primer" by L. Hancock and M. Krieger, McGraw-Hill, 1987.

List of Open Source Software/learning website:

1. https://www.youtube.com/watch?v=fu04NXbIeGo
2. https://www.youtube.com/watch?v=6SnxFx9aRps
3. https://www.youtube.com/watch?v=35-gzfKlSBc

Practicals:

- Addition, subtraction and multiplication of matrices, Transpose, determinant…etc
- Writing a given number in words using function, Arranging a set of names in alphabetical order. Operations with strings and sorting. ….etc.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom'sTaxonomyLevel
CLO1	**Decide** Operations with strings and sorting in programe	5 Evaluating
CLO2	**Create** some other program which is related to c programming.	6 creating
CLO3	**Describe** Arrays.	1 Remembering
CLO4	**Explain** Logical expression and more control statements	4 Analysing,
CLO5	**Use** C language programs **Discuss** Various definitions	3 Applying, 2 Understanding
CLO6	**Discuss** handling of character strings.	2 Understanding

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CLO1	3	2	1	1	2				1	2							2	2		
CLO2	3	2	2	1	2				1	2							2	2	1	
CLO3	1				1					1							1	1		
CLO4	2	2	1	1	2				1	2							2	2		
CLO5	3	2	1	1	2				1	2							2	2	1	
CLO6	2	2		1	1				1	2							2	1		

3: High, 2: Medium, 1: Low

Faculty of Science and Humanities
B.Sc. (Mathematics) (Semester - VIII)
In Effect from Academic Year 2023-24

Branch Name:	B.Sc. Mathematics
Program Code:	SC104
Course Name:	Applied Classical Mechanics
Course Code:	18-MAE402-4O
Pre-requisite Course:	

Course Objectives:

- To able to know the equations of motion and first integral.
- To know about Angular momentum and kinetic energy of rotating rigid body.
- To understand the Euler's equation of motion.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
				Theory (Marks)		Practical (Marks)		
Lecture (L)	Tutorial (T)	Practical (P)	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total (Marks)
3	-	2	4	50	25	-	25	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Lagrangian formulation of two body central force problem, Equations of motion and first integral, Kepler problem, Derivation of laws of planetary motions.	15	34
2	Kinematics of rigid bodies, Degrees of freedom, Generalized coordinates for translation, Rotation group of a rigid body, Euler's theorem, Eulerian angles as rotational generalized coordinates, Infinitenisin of rotations.	15	33
3	Dynamics of rigid bodies, Angular momentum and kinetic energy of rotating rigid body, Moment of inertia, Euler's equation of motion, Torque free motion of symmetric top, Precession and nutation.	15	33

Reference Books:

1. "Classical Mechanics with Introduction to Nonlinear Oscillations and Chaos", Bhatia, Narosa Publ.
2. "Classical Mechanics", C. R. Mondal, Prentice Hall of India Pvt. Ltd.
3. "Classical Mechanics", Tai L. Chow, John Wiley and Sons Inc.
4. "Classical Mechanics-System of Particles and Hamiltonian Dynamics", Walter greiner, Springer.
5. "Classical Mechanics", Goldstein, H., Poole, C. and Safko, J., Pearson Education, Inc.

List of Open Source Software/learning website:

1https://youtu.be/X2MoP491umI
2. https://youtu.be/FbvXuXcbccY

Practical

Application of Applied Classical Mechanics from Unit-1,Unit-2 and Unit-3.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom'sTaxonomyLevel
CLO1	**Discuss** Derivation of laws of planetary motions.	2 Understanding
CLO2	**Use** Kinematics of rigid bodies.	3 Applying
CLO3	**Describe** Angular momentum and kinetic energy of rotating rigid body.	1 Remembering
CLO4	**Explain**Euler's equation of motion.	4 Analysing
CLO5	**Explain** Torque free motion of symmetric top.	4 Analysing
CLO6	**Create** an example of Lagrangian formulation of two body central force problem.	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Programme Outcomes (POs)																Programme Specific Outcome (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	PSO1	PSO2	PSO3	PSO4
CLO1	3	2			2												2	1		
CLO2	3	2			2												2	2		
CLO3	2	1			1												2	1		
CLO4	3	3			2												2	2		
CLO5	3	2			2												2	2		
CLO6	3	3	3		2	1			1								2	2	1	1

3: High, 2: Medium, 1: Low