CO-PO attainment
in
Outcome Based Education

Semester VI
CC13,CC14,DSE3

Department of Mathematics,

Government General Degree College, Kalna-I

Program Outcome (PO)

- PO1: Disciplinary knowledge
- PO2: Communication Skills
- PO3: Critical thinking
- PO4 : Problem solving
- PO5: Self-directed learning
- PO6: Research-related skills
- PO7: Analytical reasoning
- PO8: Information/digital literacy
- PO9: Lifelong learning

Program Specific Outcome (PSO): UG Mathematics

- **PSO1: Foundation of mathematical concepts:** To use mathematical methodologies to crack problems using suitable mathematical analysis and suitable techniques.

- **PSO2: Foundation of mathematical system:** The ability to interpret the fundamental concept and methodologies of mathematical systems like group theory, mechanics, metric space and other real and abstract mathematical structures and spaces. Students can understand the functionality of analytical part and analysis of fundamental mathematical structures.

- **PSO3: Foundation of mathematical development:**The ability to grasp the mathematical development lifecycle and methodologies of mathematical systems. Familiarity and practical proficiency with broad area of real life applications and provide new ideas and innovations towards research.

Course Content

Course code : BMH6CC13

Course name : Metric Spaces and Complex Analysis (Marks : 75)

Total Lecture Hours: 60

- Unit 1 : Metric spaces: Sequences in Metric Spaces, Cauchy sequences. Complete Metric Spaces, Cantor's theorem. 5L
- Unit 2 : Continuous mappings, sequential criterion and other characterizations of continuity, Uniform continuity, Connectedness, connected subsets of R.
- Compactness: Sequential compactness, Heine-Borel property, Totally bounded spaces, finite intersection property, 27 and continuous functions on compact sets.
- Homeomorphism, Contraction mappings, Banach Fixed point Theorem and its application to ordinary differential equation. 25L
- Unit 3 : Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings.Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability. 7L
- Unit 4 : Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, and definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals.Cauchy-Goursat theorem, Cauchy integral formula. 13L
- Unit 5 :Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples. 6L
- Unit 6 : Laurent series and its examples, absolute and uniform convergence of power series. 4L

Course Outcome (CO) Paper: CC-13

Sl. No.	Course Outcome (CO)	Knowledge Level (Bloom's Level)	POs	PSOs
1	**Explain** concepts of Metric Spaces, Sequences in Metric Spaces, Complete Metric Spaces	L2: Understand	**1, 2, 3, 4, 5, 7, 9**	**1,2,3**
2	**Illustrate** Continuous mappings, Uniform continuity, Compactness of Metric Space	L4: Analyze	**1, 2, 3, 4, 5, 7, 9**	**1,2,3**
3	**Summarize** Homeomorphism, Contraction mappings, Banach Fixed point Theorem with application	L5: Evaluate	**1, 2, 3, 4, 5, 6, 7, 9**	**1,2,3**
4	**Describe** properties of complex numbers in Complex plane	L1: Remember	**1, 2, 3, 4, 7, 9**	**1,2,3**
5	**Compute** analytic functions, derivative of a function, Contour integration.	L3: Applying	**1, 2, 3, 4, 5, 7, 9**	**1,2,3**
6	**Explain** Liouville's theorem, The fundamental theorem of algebra, Laurent series with examples.	L2: Understand	**1, 2, 3, 4, 5, 6, 7, 9**	**1,2,3**

Course Content

Course code : BMH6CC14
Course name : Ring Theory and Linear Algebra II

Course Outcome (CO) — Paper: CC-14

Sl. No.	Course Outcome (CO)	Knowledge Level (Bloom's Level)	POs	PSOs
1	Describe polynomial rings, principal ideal domain, Euclidean domain and unique factorization domain, and their relationships.	L1: Remember	1, 2, 3, 4, 7, 9	1,2,3
2	Judge reducible and irreducible polynomial.	L5: Evaluate	1, 2, 3, 4, 5, 7, 9	1,2,3
3	Relate between dual basis and linear transformations.	L4: Analyze	1, 2, 3, 4, 5, 7, 9	1,2,3
4	Explain the concept of minimal polynomial.	L2: Understand	1, 2, 3, 5, 7, 9	1,2,3
5	Define an idea about inner product space and proceed to normed linear spaces.	L1: Remember	1, 2, 3, 4, 7, 9	1,2,3
6	Use Gram-Schmidt process to find orthogonal set of non-null vectors from any arbitrary set of vectors.	L3: Apply	1, 2, 3, 4, 5, 7, 9	1,2,3

Course Content

Course code : BMH6DSE33
Course name : Group Theory II

Course : BMH6DSE33

Group Theory II (Marks : 75)

Total Lecture Hours: 60

Unit 1: Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinitecyclic groups, applications of factor groups to automorphism groups, Characteristic subgroups, Commutatorsubgroup and its properties. 15L

Unit 2: Properties of external direct products, the group of units modulo n as an external direct product, internaldirect products, Fundamental Theorem of finite abelian groups. 10L

Unit 3: Group actions, stabilizers and kernels, permutation representation associated with a given group action.Applications of group actions. Generalized Cayley's theorem. Index theorem. 15L

Unit 4 : Groups acting on themselves by conjugation, class equation and consequences, conjugacy in Sn, p-groups,Sylow's theorems and consequences, Cauchy's theorem, Simplicity of An for n ≥ 5, non-simplicity tests.20L

Course Outcome (CO) — Paper: DSE-33

Sl. No.	Course Outcome (CO)	Knowledge Level (Bloom's Level)	POs	PSOs
1	Define Automorphism, Inner Automorphism, Automorphism groups, Automorphism groups of finite and infinite cyclic groups.	**L1: Remember**	1, 3, 4, 6, 9	**1,2,3**
2	Illustrate the properties of external direct products, internal direct products.	**L4: Analyze**	1, 2, 3, 4, 6, 9	**1,2,3**
3	Explain Group actions, stabilizers and kernels.	**L2: Understand**	1,3, 4, 6,9	**1,2,3**
4	Solve the existence or non-existence of normal subgroup in a group by using Generalized Cayley's Theorem.	**L3: Apply**	1, 4, 5, 7, 9	**1,2,3**
5	Construct Conjugacy Class Equations of some finite groups.	**L6: Create**	1, 4, 7, 9	**1,2,3**
6	Decide the Simple property of a Group with Sylow's Theorems.	**L5: Evaluate**	1, 3, 4, 5, 9	**1,2,3**