Semester- VI

T.Y.B.Sc. (Mathematics) Semester-VI

Major Course- CC – XIV

COURSE NAME: Real Analysis-II

COURSE CODE: MHMJ-S6P14-2CR26 [CREDITS – 02]

Course learning outcome		
At the end of this course, Students will be able to 1. analyze infinite series, distinguish convergence and divergence, and apply necessary conditions for convergence. 2. use convergence tests (comparison, ratio, root, integral) for series with non-negative terms. 3. study alternating series, and differentiate between absolute and conditional convergence. 4. examine rearrangements and determine convergence of series with non-increasing terms.		
Module 1	**Series of Real Numbers**	**[15L]**
Learning Objective 1. To introduce the concept of infinite series of real numbers and distinguish between convergent and divergent series. 2. To study series with non-negative terms and apply appropriate tests for convergence. 3. To understand alternating series and differentiate between absolute and conditional convergence and to develop analytical skills to apply convergence criteria in problem-solving.		
Learning Outcomes: At the end of this module the learner will be able to 1. determine whether a given infinite series is convergent or divergent using necessary conditions and appropriate convergence tests. 2. apply comparison, ratio, root, and other standard tests to analyze series with non-negative terms. 3. examine alternating series using relevant criteria and distinguish between absolute and conditional convergence.		
1.1	Series of real numbers, Convergent and Divergent Series, Series with non-negative terms	**[7L]**
1.2	Alternating Series, Conditional convergence and absolute convergence.	**[8L]**
Module 2	**Test for Convergence of a Series**	**[15L]**
Learning Objective 1. To understand the concept of rearrangement of infinite series and its effect		

on convergence.
2. To study tests for absolute convergence and distinguish them from non-absolute (conditional) convergence tests.
3. To analyze convergence behavior of series whose terms form a non-increasing sequence.

Learning Outcomes:

At the end of this module the learner will be able to

1. analyze the effect of rearrangement on absolutely and conditionally convergent series and explain the underlying theoretical results.
2. apply appropriate tests to determine absolute convergence and distinguish it from non-absolute convergence.
3. use suitable criteria to test convergence of series whose terms form a non-increasing sequence.

2.1	Re-arrangement of Series, Tests for absolute convergence	**[8L]**
2.2	Tests for non-absolute convergence, Series whose terms form a non-increasing sequence.	**[7L]**

References:

1. R. G. Bartle and D. R. Sherbert: Introduction to Real Analysis, 4/e, Wiley India Edition. New Delhi (2015).
2. R. R. Goldberg: Methods of Real Analysis, Oxford and IBH Publishing Co. (2020).
3. T. M Apostol: Mathematical Analysis, 2/e, Narosa Publishing House, India (1985).
4. W. Rudin: Principles of Mathematical Analysis, 3/e, McGraw-Hill, New York, (2017).
5. H. L. Royden and P.M. Fitzpatrick, Real Analysis, 4/e, Pearson (2010).

Mapping of Cos and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Analyze infinite series, distinguish convergence and divergence, and apply necessary conditions for convergence.	X	X				X
Use convergence tests (comparison, ratio, root, integral) for series with non-negative terms.		X	X		X	X
Study alternating series, and differentiate between absolute and conditional convergence.		X	X	X		X
Examine rearrangements and determine convergence of series with non-increasing terms.		X	X	X		X

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	20%	30%	30%	-	20%	-	100%
II	20%	30%	30%	-	20%	-	100%

T.Y.B.Sc. (Mathematics) Semester-VI

COURSE NAME: LAB COURSE- XII

COURSE CODE: MHMJ-S6PR12-2CR26 [CREDITS- 02]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. understand the concepts of series of real numbers and identify convergence and divergence of series. 2. apply various tests (comparison, ratio, root, and Leibniz test) to determine convergence of series. 3. analyze absolute and conditional convergence, and study the effects of rearrangement of series. 4. develop problem-solving and analytical skills in testing convergence and divergence of different types of series.

PRACTICAL Major MHMJ-S6PR12-2CR26 (Lab Course - XII)	
1	Practical based on series of real numbers and convergence of series.
2	Practical based on tests for convergence of series with non-negative terms.
3	Practical based on comparison test, ratio test, and root test for series.
4	Practical based on alternating series and Leibniz test.
5	Practical based on conditional convergence and absolute convergence.
6	Practical based on re-arrangement of series and its effects on convergence.
7	Practical based on tests for non-absolute convergence (divergence tests).
8	Practical based on series with non-increasing terms and special convergence tests.

T.Y.B.Sc. (Mathematics) Semester-VI

Major Course- CC - XV

COURSE NAME: Advance Group Theory

COURSE CODE: MHMJ-S6P15-2CR26 [CREDITS – 02]

Course learning outcome
At the end of this course, Students will be able to 1. analyze and apply homomorphisms, isomorphisms, automorphisms and Cayley's theorem using examples, results and theorems. 2. apply the Fundamental Theorem of Homomorphism to determine kernels, images and factor groups and analyze group structures effectively. 3. understand and apply the preservation of group properties under isomorphism and automorphism. 4. define permutation groups, understand orbits and cycles and apply theorems with examples. 5. classify permutations as even or odd and work with alternating groups. 6. apply permutation concepts to analyse group structures and solve related algebraic problems.

Module 1	Homomorphism, Isomorphism and Automorphism	[15L]
Learning Objective 1. To understand homomorphisms, isomorphisms, automorphisms and Cayley's theorem along with their examples, results and theorems. 2. To study the Fundamental Theorem of Homomorphism and analyse group structures using kernels, images and factor groups. 3. To learn how group properties are preserved under isomorphism and automorphism and how any group can be represented as a permutation group.		
Learning Outcomes: At the end of this module the learner will be able to 1. analyze and apply homomorphisms, isomorphisms, automorphisms and Cayley's theorem using examples, results and theorems. 2. apply the Fundamental Theorem of Homomorphism to determine kernels, images, and factor groups and analyze group structures effectively. 3. understand and apply the preservation of group properties under isomorphism and automorphism.		
1.1	Definition of Homomorphism along with their examples, results and theorems	**[3L]**
1.2	Isomorphism with their examples, results and theorems	**[2L]**

1.3	Isomorphic groups	**[2L]**
1.4	Fundamental Theorem of Homomorphism	**[3L]**
1.5	Automorphism with their examples, results and theorems	**[3L]**
1.6	Cayley's theorem	**[2L]**
Module 2	**Permutation Groups**	**[15L]**

Learning Objective

1. To understand permutation groups, including orbits, cycles, even and odd permutations, and alternating groups with examples and theorems.
2. To apply permutation concepts to analyse group structures and solve algebraic problems effectively.

Learning Outcomes:

At the end of this module the learner will be able to

1. define permutation groups, understand orbits and cycles, and apply theorems with examples.
2. classify permutations as even or odd and work with alternating groups.
3. apply permutation concepts to analyse group structures and solve related algebraic problems.

2.1	Definition of Permutation Groups along with their examples and theorems	**[3L]**
2.2	Orbit and Cycles	**[3L]**
2.3	Even and odd permutation with examples and theorems	**[3L]**
2.4	Alternating Group	**[3L]**
2.5	Symmetric Groups and examples	**[3L]**

References:

1. I. N. Herstein, Topics in Algebra, 2/e, Wiley Eastern Limited, New Delhi, 2016.
2. P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul: Basic Abstract Algebra, 2/e, Cambridge University Press,1997 (Reprint).
3. Vijay K. Khanna and S.K. Bhambri, A Course in Abstract Algebra, 5/e, Vikas Publishing House Pvt Limited, 1993.
4. Serge Lang,Algebra,Addition Wesley,1993.
5. N.S.Gopal Krishnan, University Algebra,3/e, New Age International Private Ltd,New Delhi,2023.
6. Shanti Narayan, Modern Algebra,2/e,S.Chand and Co.,New Delhi,1965 (Reprint).
7. I.H.Sheth, Abstract Algebra,2/e, PHI, Delhi,2009.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Analyse and apply homomorphisms, isomorphisms, automorphisms, and Cayley's theorem using examples, results, and theorems.	X	X	X	X	X	
Apply the Fundamental Theorem of Homomorphism to determine kernels, images, and factor groups, and analyse group structures effectively.		X	X	X	X	
Understand and apply the preservation of group properties under isomorphism and automorphism.		X	X	X	X	
Define permutation groups, understand orbits and cycles and apply theorems with examples.	X	X	X		X	
Classify permutations as even or odd and work with alternating groups.	X	X	X	X	X	
Apply permutation concepts to analyse group structures and solve related algebraic problems.	X	X	X	X	X	

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	10%	40%	40%	-	10%	-	100%
II	10%	40%	30%	-	20%	-	100%

T.Y.B.Sc. (Mathematics) Semester-VI

COURSE TITLE: LAB COURSE- XIII

COURSE CODE: MHMJ-S6PR13-2CR26 [CREDITS- 02]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. apply mathematical theories and formulas to solve practical and computational problems. 2. correlate theoretical mathematical concepts with practical experiments and graphical interpretations. 3. analyze and interpret mathematical data using appropriate methods and tools. 4. develop logical reasoning and problem-solving skills through mathematical investigations and practical applications.

PRACTICAL Major MHMJ-S6PR13-2CR26 (Lab Course - XIII)	
1	Practical based on Homomorphism.
2	Practical based on Isomorphism.
3	Practical based on Automorphism.
4	Practical based on Cayley's theorem.
5	Practical based on Permutation Groups.
6	Practical based on Properties of Permutation Groups.
7	Practical based on special types of Permutation.
8	Practical based on Alternating Group.

T.Y.B.Sc. (Mathematics) Semester-VI

Major Course- CC - XVI

COURSE TITLE: Graph Theory

COURSE CODE: MHMJ-S6P16-2CR26 [CREDITS – 02]

Course learning outcome		
At the end of this course, Students will be able to 1. understand the basic concepts of graph theory, including types of graphs, degree of vertices, subgraphs, and graph operations. 2. analyze graph properties such as connectivity, paths, circuits, Euler and Hamiltonian graphs, and planarity. 3. apply graph theory concepts to solve real-life problems like the Konigsberg Bridge Problem, travelling salesman problem, and utility networks. 4. develop skills in working with trees, spanning trees, and related properties such as distance, radius, and diameter. 5. build the ability to model and solve complex problems using graph-based methods in mathematics and computer science.		
Module 1	**Introduction, Paths and Circuits**	**[15L]**
Learning Objective 1. Understand fundamental concepts and structures in graph theory. 2. Apply graph theory to solve real-world problems.		
Learning Outcomes: At the end of this module the learner will be able to 1. classify graphs based on their structure and properties, including connectedness, degree, and the presence of Eulerian or Hamiltonian circuits. 2. perform operations on graphs and determine isomorphism between two graphs using incidence, degree, and subgraph analysis. 3. model and solve real-life problems using graph theory concepts such as paths, circuits, and graph traversal techniques.		
1.1	Graphs, Various type of graphs, Incidence and Degree, Isolated and pendent vertices, Subgraphs, Isomorphism between two graphs, Operations on graphs, Walks, Paths, Circuits, connected graphs, Disconnected graphs, Components of graphs	**[8L]**
1.2	Euler graphs, Arbitrary traceable graph, Hamiltonian Graphs, Hamiltonian Circuits	**[3L]**
1.3	Applications of graphs: Konigsberg Bridge Problem, Seating Arrangement Problem, Utility Problem, The Travelling Salesman Problem	**[3L]**

Module 2	Trees and fundamental Circuits	[15L]

Learning Objective

1. Understand the structural properties and classifications of trees and planar graphs.
2. Apply graph-theoretic techniques to analyze and construct spanning trees and detect planarity.

Learning Outcomes:

At the end of this module the learner will be able to

1. compute tree properties such as pendent vertices, distance between vertices, centre, radius, and diameter, and classify trees as rooted or binary.
2. construct and enumerate spanning trees of a graph, including in weighted graphs, and identify fundamental circuits.
3. analyse the planarity of graphs using Kuratowski's Theorem and recognize different graphical representations and their implications.

2.1	Trees, Properties of trees, Pendent vertices in a tree, Distance between two vertices, Centre, Radius and Diameter of a Tree, Rooted & Binary trees, on counting trees, spanning trees	**[07L]**
2.2	Fundamental circuits, finding all Spanning Trees of a Graph, Spanning Trees in a Weighted Graph, Planar Graphs, Kuratowski's Two Graphs, Different presentations of a Graph, Detection of Planarity	**[08L]**

References:

1. Narsingh Deo: Graph Theory with Applications to Engineering & Computer Science, Dover Publications, Inc., New York, 2016.
2. R. J. Wilson: Introduction to Graph Theory, 4/e, Academic Press, New York, 1996.
3. J. A. Bondy and U. S. R. Murty: Graph Theory, Springer Publishing Company, 2008.
4. Frank Harary: Graph Theory, Addison-Wesley Pub. Co., 1969.
5. Claude Berge: The Theory of Graphs, Dover Publications, Inc., New York, 2001.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
understand the basic concepts of graph theory, including types of graphs, degree of vertices, subgraphs, and graph operations.	X				X	
analyze graph properties such as connectivity, paths, circuits, Euler and Hamiltonian graphs, and planarity.	X	X		X		
apply graph theory concepts to solve real-life problems like the Konigsberg Bridge Problem, travelling salesman problem, and utility networks.		X	X		X	
develop skills in working with trees, spanning trees, and related properties such as distance, radius, and diameter.		X	X	X		
build the ability to model and solve complex problems using graph-based methods in mathematics and computer science.			X	X	X	X

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	20%	30%	30%	-	-	20%	100%
II	20%	30%	30%	-	-	20%	100%

T.Y.B.Sc. (Mathematics) Semester-VI

COURSE NAME: LAB COURSE- XIV

COURSE CODE: MHMJ-S6PR14-2CR26 [CREDITS- 02]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. understand basic graph concepts, types, and representations, and analyze structural properties like subgraphs and isomorphism. 2. construct trees (binary trees) and implement algorithms to find spanning trees. 3. apply graph algorithms to solve real-life problems and verify properties of planar, Euler, and Hamiltonian graphs through practical work.
PRACTICAL Major MHMJ-S6PR14-2CR26 (Lab Course - XIV)
1 Practical based on Fundamentals of Graph Theory. 2 Practical based on Structure and Relationships in Graphs. 3 Practical based on Traversals and Connectivity. 4 Practical based on Advanced Graphs and Applications. 5 Practical based on Introduction to Trees. 6 Practical based on Rooted and Binary Trees. 7 Practical based on Spanning Trees and Circuits. 8 Practical based on Planar Graphs and Representations.

T.Y.B.Sc. (Mathematics) Semester-VI

Minor Course- VI

COURSE TITLE: Linear Programming

COURSE CODE: MHMN-S6P6-2CR26 [CREDITS – 02]

Course learning outcome		
At the end of this course, Students will be able to 1. Formulate real-life problems as LPP and solve simple cases using graphical methods in various standard forms. 2. Apply Simplex, Big-M, and Two-Phase methods to obtain and interpret optimal solutions. 3. Understand duality, construct dual problems, and analyze primal-dual relationships. 4. Solve transportation problems using NWCM, LCM, VAM, and optimize using MODI method. 5. Formulate and solve assignment problems using the Hungarian method for optimal allocation.		
Module 1	**Linear Programming Problem**	**[15L]**
Learning Objective 1. To introduce the concept of Linear Programming Problem (LPP) and develop the ability to formulate real-life optimization problem mathematically. 2. To understand different representations of LPP including matrix form, general form, canonical form and standard form. 3. To study graphical and Simplex method for solving LPP. 4. To apply advanced solution techniques such as Big-M (Penalty) method and Two-Phase method for solving linear programming problem.		
Learning Outcomes: At the end of this module the learner will be able to 1. formulate linear programming problem in general, canonical, and standard forms, and represent them using matrix notation. 2. solve LPPs using graphical methods and apply the Simplex, Big-M, and Two-Phase methods to find optimal solutions. 3. explain the basic properties of convex and concave functions and sets and their significance in ensuring feasible and optimal solutions in LPP.		
1.1	The linear programming problem, Formulation of LPP, Matrix form of the LPP, general form, Canonical form, Standard form of the LPP, Graphical method to solve LPP, Basic definitions to use Simplex method, Simplex method	**[7L]**

1.2	Big-M method (Penalty method), Two phase method to solve LPP (without alternative solution and unbounded solution)	**[8L]**
Module 2	**Transportation and Assignment Problem**	**[15L]**

Learning Objective

1. To understand the principle of duality in Linear Programming Problem (LPP) and learn the method of constructing the dual of a given primal problem.
2. To formulate and solve Transportation Problem (TP) using appropriate initial and optimal solution methods.
3. To introduce the Assignment Problem (AP) and apply the Hungarian method for obtaining optimal assignments.

Learning Outcomes:

At the end of this module the learner will be able to

1. explain the principle of duality, construct the dual of a given primal LPP, and solve simple primal-dual problems.
2. formulate Transportation Problems in mathematical and matrix form and obtain initial basic feasible solutions using NWCM, LCM, and VAM methods.
3. determine the optimal solution of balanced and unbalanced Transportation Problems using the MODI (u–v) method (excluding degeneracy cases).
4. formulate Assignment Problems in mathematical and matrix form and solve them using the Hungarian method to obtain optimal allocation.

2.1	Principle of duality in LPP, Primal LPP and method to find its dual LPP (Simple problems of above articles).	**[4L]**
2.2	The transportation problem: Mathematical and matrix form of TP. Initial solution of TP by NWCM, LCM and VAM, Optimum solution of TP by Modi method (u-v method) (except degenerate solution), Balanced and unbalanced TP (Simple problem)	**[7L]**
2.3	Assignment problem: Mathematical and matrix form of AP, Hungarian method to solve method (simple method).	**[4L]**

References:

1. J. K. Sharma: Operation Research Theory and Applications, 2/e, McMillan India Ltd.
2. Hillier F. S. and Lieberman G. J.: Introduction to Operations Research, 9/e, Tata McGraw Hill, Singapore, 2009.
3. G. Hadley: Linear Programming, Reprint edition, Narosa Publishing House, New Delhi, 2002.
4. Handy A. Taha: Operations Research, 10/e, Pearson Education, India, 2019.
5. P. M. Karak: Linear Programming, 2/e, New Central Book Agency Pvt. Ltd., Calcutta, 2015.
6. K. V. Mittal & L. Mohan: Optimization methods in O.R. and System Analysis, New Age International Publications.
7. Goel & Mittal: Operations Research, Pragati Prakashan, Meerut

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Formulate real-life problems as LPP and solve simple cases using graphical methods in various standard forms.	X				X	
Apply Simplex, Big-M, and Two-Phase methods to obtain and interpret optimal solutions.		X	X		X	X
Understand duality, construct dual problems, and analyze primal-dual relationships.		X	X	X		X
Solve transportation problems using NWCM, LCM, VAM, and optimize using MODI method.		X			X	X
Formulate and solve assignment problems using the Hungarian method for optimal allocation.		X			X	X

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	10%	-	50%	-	40%	-	100%
II	10%	-	50%	-	40%	-	100%

T.Y.B.Sc. (Mathematics) Semester-VI

COURSE TITLE: LAB COURSE-VI

COURSE CODE: MHMN-S6PR6-2CR26 [CREDITS- 02]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. understand the fundamentals of Operations Research and formulate real-life problems into Linear Programming Problems (LPPs), and solve them using graphical methods. 2. apply simplex methods (maximization and minimization) along with advanced techniques like Big-M and Two-Phase methods to obtain optimal solutions. 3. analyze duality in Linear Programming and solve transportation problems using initial and optimal solution methods. 4. apply assignment problem techniques and develop analytical and decision-making skills for real-world optimization problems.

PRACTICAL Major MHMN-S6PR6-2CR26 (Lab Course - VI)	
1	Practical based on Graphical Method.
2	Practical based on Simplex Method for Maximization.
3	Practical based on Simplex Method for Minimization.
4	Practical based on Big-M Method for Maximization.
5	Practical based on Big-M Method for Minimization.
6	Practical based on Two-Phase method.
7	Practical based on Duality in Linear Programming.
8	Practical based on Transportation Problem – Initial Solutions.
9	Practical based on Transportation Problem – Optimal Solution for Maximization & Minimization.
10	Practical based on Assignment Problem.

T.Y.B.Sc. (Mathematics) Semester-VI

Minor Course-VII

COURSE NAME: Fourier Series, Integral and Transform

COURSE CODE: MHMN-S6P7-2CR26 [CREDITS – 02]

Course learning outcome
At the end of this course, Students will be able to 1. identify and understand periodic functions and determine Fourier series using Euler's coefficients. 2. understand and apply Fourier series expansions for even, odd, discontinuous functions and functions with arbitrary periods. 3. analyze and understand convergence conditions, half-range expansions, Parseval's theorem and complex exponential Fourier series. 4. understand and identify Fourier integrals and their complex form. 5. understand and apply Fourier transform techniques. 6. identify and understand properties of Fourier transforms and apply Fourier sine, cosine and finite transforms in problem solving.

Module 1	Fourier Series	[15L]
Learning Objective 1. To introduce the concept of periodic functions and Fourier series representation using Euler's formulae. 2. To understand Fourier series expansions of even, odd, discontinuous functions and functions with arbitrary periods. 3. To study convergence properties, half-range expansions, Parseval's theorem, and the complex exponential form of Fourier series.		
Learning Outcomes: At the end of this module the learner will be able to 1. identify and understand periodic functions and determine Fourier series using Euler's coefficients. 2. understand and apply Fourier series expansions for even, odd, discontinuous functions and functions with arbitrary periods. 3. analyze and understand convergence conditions, half-range expansions, Parseval's theorem, and complex exponential Fourier series.		
1.1	Periodic functions and some important results	**[1L]**
1.2	Fourier series and Euler's formulae	**[2L]**
1.3	Even and odd functions	**[2L]**
1.4	Convergence of Fourier series	**[2L]**
1.5	Fourier series of discontinuous functions	**[2L]**

1.6	Functions having arbitrary periods	**[2L]**
1.7	Half range Fourier series, Parseval's theorem on Fourier constants	**[2L]**
1.8	Complex Exponential form for Fourier series	**[2L]**
Module 2	**Fourier Integral and Fourier Transforms**	**[15L]**

Learning Objective

1. To introduce the concept of Fourier integrals and their complex representation.
2. To understand Fourier transforms and inverse Fourier transforms.
3. To study Fourier sine and cosine transforms, their properties and finite Fourier sine and cosine transforms.

Learning Outcomes:

At the end of this module the learner will be able to

1. understand and identify Fourier integrals and their complex form.
2. understand and apply Fourier transform techniques.
3. identify and understand properties of Fourier transforms and apply Fourier sine, cosine, and finite transforms in problem solving.

2.1	Fourier series to Fourier Integral-Fourier cosine and sine integrals	**[3L]**
2.2	Complex form of Fourier integrals	**[2L]**
2.3	Fourier transform-Fourier cosine and sine transform	**[2L]**
2.4	Properties of Fourier's transforms	**[3L]**
2.5	Properties of Fourier cosine and sine transforms	**[3L]**
2.6	Finite Fourier sine and cosine transforms	**[2L]**

References:

1. Lokenath Debnath, Integral Transform and their applications, 3/e, CRC Press Taylor and Francis Group,2015.
2. B. Davies: Integral Transforms and their applications, Springer - Verlag, New York, (Volume 25), 1978.
3. Baidyanath Patra, An Introduction to Integral Transforms,1/e, CRC Press, Taylor Francis Group,2018. https://doi.org/10.1201/9780429503580
4. Kanwal, R.P. and Sneddon, I.N.: Fourier Transforms, Dover publication, 2010.
5. Ian Sneddon: The use of Integral Transform,1/e, McGraw Hill, 1972.
6. A. R. Vasishta and R. K. Gupta, Integral Transforms, Krishna

Publication Media,2016.
7. Boss M. L.: Mathematical Methods in Physical Sciences, John Wiley & Sons, 1983.
8. Andrews, L. G. & Shivamoggi B. K., Integral Transforms for Engineers,1/e, PHI, 2003.
9. E. Kreyszig, Advanced Engineering Mathematics,10/e, John Wiley,New York,2011.2010.

Mapping of COs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Identify and understand periodic functions and determine Fourier series using Euler's Formulae.	X	X	X	X		
Understand and apply Fourier series expansions for even, odd, discontinuous functions and functions with arbitrary periods.	X	X	X	X	X	
Analyze and understand convergence conditions, half-range expansions, Parseval's theorem, and complex exponential Fourier series.	X	X	X	X	X	
Understand and identify Fourier integrals and their complex form.	X	X	X	X	X	
Understand and apply Fourier transform techniques.	X	X	X	X	X	
Identify and understand properties of Fourier transforms and apply Fourier sine, cosine, and finite transforms in problem solving.	X	X	X	X	X	

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	10%	10%	40%	-	40%	-	100%
II	10%	10%	40%	-	40%	-	100%

T.Y.B.Sc. (Mathematics) Semester-VI

COURSE NAME: LAB COURSE-VII

COURSE CODE: MHMN-S6PR7-2CR26 [CREDITS- 02]

Course Learning Outcome
After the successful completion of the Course, the learner will be able to: 1. apply mathematical theories and formulas to solve practical and computational problems. 2. correlate theoretical mathematical concepts with practical experiments and graphical interpretations. 3. analyses and interpret mathematical data using appropriate methods and tools. 4. develop logical reasoning and problem-solving skills through mathematical investigations and practical applications.

PRACTICAL Major MHMN-S6PR7-2CR26 (Lab Course - VII)	
1	Practical based on Fourier series, Euler's formulae and even and odd functions
2	Practical based on the convergence of the Fourier series and Fourier series of discontinuous functions
3	Practical based on functions having arbitrary periods and half-range Fourier series
4	Practical based on and Parseval's theorem on Fourier constants and the complex exponential form for the Fourier series
5	Practical based on the Fourier cosine and sine integrals
6	Practical based on the Fourier cosine and sine transform
7	Practical based on based on the properties of Fourier transforms and the properties of Fourier cosine and sine transforms
8	Practical based on Finite Fourier sine and cosine transforms

T.Y.B.Sc. (Mathematics) Semester-VI

Minor Course – VI (Statistics)

COURSE NAME: Statistical Quality Control

COURSE CODE: STMN-S6P6-2CR26 [CREDITS - 02]

Course learning outcome		
At the end of this course, Students will be able to 1. explain the fundamental concepts and objectives of Statistical Quality Control (SQC). 2. differentiate between types of control charts and select appropriate charts for variable and attribute data 3. construct and interpret control charts to monitor and improve quality in manufacturing and service processes. 4. understand and apply the concepts of acceptance sampling, including OC curves, risks, AQL, and LTPD. 5. design and evaluate single and double sampling plans for quality inspection in industrial applications.		
Module 1	**Statistical Techniques in quality control**	**[15L]**
Learning Objective 1. Understand the concept, objectives, and importance of Statistical Quality Control (SQC) in quality management. 2. Identify types and causes of variation in processes and learn the fundamentals of control charts. 3. Construct and interpret variable control charts using 3σ limits and apply the theory of runs to detect non-random patterns.		
Learning Outcomes: At the end of this module the learner will be able to 1. define Statistical Quality Control and explain its objectives and significance in quality improvement. 2. identify and differentiate between common and assignable causes of process variation. 3. construct and interpret control charts for variables and attributes using 3σ limits and apply the theory of runs for process analysis.		
1.1	• Introduction of Statistical Quality Control (SQC), Objectives of SQC • Causes of variations • Types of Quality Control charts • Advantages of a control chart	**[6L]**

	• 3σ limits • Theory of runs	

1.2	• Construction of Control chart for variables:
	  ○ R Chart
	  ○ σ Chart and
	  ○ $\bar{x}$ Chart
	• Problems of above topics
		[4L]

1.3	• Construction of Control chart for attributes:
	  ○ p Chart
	  ○ np Chart and
	  ○ c Chart and its uses
	• Problems of above topics
	• Difference between variable charts and attribute charts
		[5L]

Module 2	**Acceptance sampling plan for attributes**	**[15L]**
Learning Objective 1. Understand the concept and need for acceptance sampling in quality control. 2. Learn the differences between 100% inspection and sample inspection. 3. Understand key terms like Producer's Risk, Consumer's Risk, AQL, LTPD, and OC curves. 4. Understand the procedure for designing and implementing a Single and Double Sampling Plan. 5. Learn the key performance measures: OC curve, ASN, AOQ, AQQL, and ATI. 6. Develop problem-solving skills related to single and double sampling plans.		
Learning Outcomes: At the end of this module the learner will be able to 1. understand acceptance sampling plans (Single, Double, and Multiple Sampling). 2. use and analyze OC curve, AOQ curve, ASN curve and ATI curve (Single sampling plan, double sampling plan).		

2.1	• Introduction:
	  ○ Role of Acceptance sampling
	  ○ Explain: 100% inspection and Sample inspection, Producer's risk and Consumer's risk, Good and bad lots, AQL, LTPD
	  ○ OC curve, Ideal OC curve
		[3L]

2.2	• Single Sampling Plan: ○ Procedure	**[5L]**

	○ OC curve, ASN, AOQ and AOQL, ATI ○ Problems of above topics	
2.3	• Double Sampling Plan: ○ Procedure ○ OC curve, ASN, AOQ and AOQL, ATI ○ Problems of above topics	**[7L]**

References:

1. Mukhopadhyay P.: Applied Statistics, Revised 2/e New Central Book Agency (1999).
2. Gupta SC, Kapoor V.K.: Fundamentals of Applied Statistics, Revised 4/e Sultan Chand & Sons (2007).
3. Montgomery D.C. (2001): Introduction to Statistical Quality Control, 4/e Wiley & Sons.
4. Grant E.L. (2000): Statistical Quality Control, 7/e., Tata Mcgraw Hill
5. Ott E.R. (1975): Process Quality Control, McGraw Hill.
6. Wetherill G.B. (1977): Sampling Inspection and Quality Control, 2/e Halsted Press, USA.
7. Wetherill G.B. and Brown D.W. (1991): Statistical Process Control, Theory and Practice, 3/e Chapman and Hall.

Course Learning Outcomes	**Programme Outcomes**					
	1	**2**	**3**	**4**	**5**	**6**
Explain the fundamental concepts and objectives of Statistical Quality Control (SQC).	X					X
Differentiate between types of control charts and select appropriate charts for variable and attribute data		X			X	
Construct and interpret control charts to monitor and improve quality in manufacturing and service processes.		X	X		X	
Understand and apply the concepts of acceptance sampling, including OC curves, risks, AQL, and LTPD.		X		X		
Design and evaluate single and double sampling plans for quality inspection in industrial applications			X	X	X	

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	20%	60%	-	-	20%	-	100%
II	20%	60%	-	-	20%	-	100%

T.Y.B.Sc. (Mathematics) Semester-VI

COURSE NAME: Statistics Minor Lab Course VI
COURSE CODE: STMN-S6PR6-2CRC26 Credit- 02

Course Learning Outcomes
After the successful completion of the Course, the learner will be able to: 1. construct and interpret control charts for variables to monitor process stability. 2. construct and interpret control charts for attributes to evaluate product quality. 3. apply statistical methods to develop and evaluate acceptance sampling plans.

PRACTICAL VI	STMN-S6PR6-2CRC26	[60 Hr]

1	Construction and interpretation of $\bar{x}$ and R chart.
2	Construction and interpretation of Revised $\bar{x}$ and R chart.
3	Construction and interpretation of p chart.
4	Construction and interpretation of Revised p chart.
5	Construction and interpretation of np chart.
6	Construction and interpretation of Revised np chart.
7	Construction and interpretation of c chart.
8	Construction and interpretation of Revised c chart.
9	Examples of Single sampling plan.
10	Examples of Double sampling plan.

Minimum number of experiments: 8

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