COURSE CODE	COURSE TITLE	L	T	P	C
1152CS205	COMPETITIVE PROGRAMMING	2	0	4	4

Course Category: Program Elective

A. Preamble :

This course provides comprehensive introduction to modern competitive programming, Number theory and to design the programming techniques for performing searching, sorting. This course also used to learn the methodology of dynamic programming, Graph algorithms and to develop algorithms for Parallel, Tree problems,string algorithms and Optimization techniques.

B. Prerequisite Courses:

Sl No	Course Code	Course Name
1	1150CS201	Problem Solving using C
2	1151CS102	Data Structures
3	1151CS106	Design and Analysis of Algorithm
4	1151CS119	Introduction to Design and Analysis of Algorithms

C. Related Courses:

S. No	Course Code	Course Name
1	1151CS103	Programming in Java
2	1151CS117	Java Programming
3	1151CS202	Internet Programming

D. Course Educational Objectives :

Learners are exposed to

- To understand the general concepts of programming and Number theory
- To understand the programming techniques and method of performing searching, sorting.
- To learn the methodology of dynamic programming, Graph algorithms.
- Develop algorithms for Parallel and Tree problems
- To learn string algorithms and Optimization techniques.

E. Course Outcomes :

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
CO1	Demonstrate the basics of programming and mathematical fundamentals.	K2, S3
CO2	Explain theefficient programs for sorting, searching arrays and structures with time complexity.	K2, S3
CO3	Utilize the Methodology of Dynamic Programming for solving the Graph Algorithms.	K3, S3
CO4	Develop algorithms for Bit Parallel, Trees and Geometry problems.	K3, S3
CO5	Solve the arrays, String algorithms, Square Root Techniques for Dynamic Programming Optimization.	K3, S3

F. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1.	**H**	**M**	**L**	**L**	**L**		**L**	**L**			**L**	**L**	**M**		
CO2.	**M**	**L**	**L**	**L**	**M**		**L**	**L**			**M**	**L**	**L**	**M**	
CO3	**M**	**L**	**M**	**L**	**M**		**M**	**L**			**L**	**L**		**M**	
CO4	**H**	**L**	**L**	**L**	**L**		**L**	**L**			**L**	**L**	**M**	**M**	
CO5	**H**	**L**	**L**	**L**	M		**L**	**L**			**L**	**L**	**M**	**M**	

H- High; M-Medium; L-Low

G. Course Contents:

Unit I 6 Hrs

Competitive Programming – Programming Contests and Tips for Practicing, CSES Problem Set and Other Resources

Review of Mathematics- Number Theory, Combinatorics, Matrices, Probability and Game Theory

Unit II 6 Hrs

Programming Techniques- Language Features, Recursive Algorithms and Bit Manipulation

Efficiency – Time Complexity and Examples

Sorting and Searching – Sorting Algorithms, Solving Problems by Sorting, Binary Search

Data Structures – Dynamic Arrays, Set Structures and Experiments

Unit III 6 Hrs

Dynamic Programming – Basic Concepts and Examples

Graph Algorithms –Basics of Graphs, Graph Traversal, Shortest Paths, Directed Acyclic Graphs, Successor Graphs, Minimum Spanning Trees, Strong Connectivity, Complete Paths, Maximum Flows and Depth First Trees

Unit IV 6 Hrs

Algorithm Design Topics – Bit-Parallel Algorithms, Amortized Analysis and Finding Minimum Values

Range Queries- Queries on Static Arrays and Tree Structures

Tree Algorithms – Basic Techniques, Tree Queries and Advanced Techniques, Geometry – Geometric Techniques and Sweep Line Algorithms

Unit V 6 Hrs

String Algorithms – Basic Concepts, String Hashing, Z-algorithm, and suffix Arrays

Additional Topics – Square Root Techniques, Segment Tress Revisited, Treaps, Dynamic Programming Optimization and Miscellaneous.

Total : 30 Hours

Practical:60 Hours

Text Book

1. Antti Laaksonen, Guide to Competitive Programming : Learning and Improving Algorithms Through Contests, Springer,ISBN: 978-3-319-72546-8, 2017

Reference Books:

1. Antti Laaksonen, Competitive Programmer's Handbook, Draft December, 2017, https://cses.fi/book/book.pdf.
2. Steven Halim and Felix Halim, Competitive Programming, Third Edition, National University of Singapore, 2013, https://www.comp.nus.edu.sg/~stevenha/myteaching/competitive_programming/cp1.pdf
3. Thomas H. Coremen et al., Introduction to Algorithms, MIT, Third Edition,ISBN-13: 978-0262533058 &ISBN-10: 0262533057,2009
4. SartajSahni, Data Structures, Algorithms, and Applications in C++, Silicon Press, Second Edition, 2004
5. SartajSahni, Data Structures, Algorithms, and Applications in Java Silicon Press, Second Edition, 2004