DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	**M.Tech Computer Science and Engineering**		
Course Title	**ADVANCED DATA STRUCTURES AND ALGORITHMS**		
Course Code	**CS603**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**July 2020**	**Section (if, applicable)**	**~~A / B~~**
Name of Faculty	**Rajeswari Sridhar**	**Department**	**Computer Science and Engineering**
Email	**srajeswari@nitt.edu**	**Telephone No.**	
Name of Course Coordinator(s) (if, applicable)	**----**		
E-mail		**Telephone No.**	
Course Type	√ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

2019

Unit I Analysis Of Algorithms Review of order of growth of functions, recurrences, probability distributions, Average case analysis of algorithms, Randomized Algorithms – Analysis - NP – Complete and NP – Hard Problems – Amortized Analysis

Unit II Heaps Min Heap – Min-max Heaps – Deaps – Leftist heaps – Skew leftist heaps – Binomial Heaps – Lazy binomial heaps – Fibonacci Heaps.

Unit III Trees AVL Trees – Red-Black Trees – Splay Trees - B trees - Multi-way search trees –Tries

Unit IV Advanced Tree Structures Point – trees – Quad trees - K-d trees – TV-trees – Segment trees – Static and Dynamic

Unit V Geometric algorithms – line segment intersection – Map overlay detection – Voronoi diagram

COURSE OBJECTIVES

- To introduce and practice advanced algorithms and programming techniques necessary for developing sophisticated computer application programs
- To get accustomed with various programming constructs such as divide-and-conquer, backtracking, and dynamic programming.

• To understand and use various data structures in applications • To learn new techniques for solving specific problems more efficiently and for analyzing space and time requirements.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
1. Familiarize with algorithmic techniques such as brute force, greedy, and divide and conquer	PO_1, PO_3, PO_5, PO_6
2. Apply advanced abstract data type (ADT) and data structures in solving real world problems.	PO_1, PO_3, PO_4, PO_5,PO_6
3. Analyze and apply graph data structure to real-life problems	PO_1, PO_3, PO_5, PO_6
4. Effectively combine fundamental data structures and algorithmic techniques in building a complete algorithmic solution to a given problem	PO_1, PO_2, PO_3, PO_5

COURSE PLAN – PART II

COURSE OVERVIEW

This course covers the advanced topics in Data structures including advanced heaps, advanced trees, tree structures that are used for Multimedia data and for geometric algorithms. Multimedia datastructures will have a different perspective to search algorithms. Geometric algorithms will cover the problems related to finding line intersectins, map intersections, etc., Algorithms strategies, algorithms analysis, asymptotic notations, randomized algorithms will also be discussed.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery Online through MS Teams
1	15/9/2020 to 18/9/2020 2 hours	Unit1: Introduction to Algorithms, Need for Analysis, design strategies, Asymptotic notations	**Lecture** *Pen and Talk and Power point presentation*
2	21/9/2020 to 25/9/2020 3 hours	Asymptotic notations, problems, solving recurrences, Tree, iterative, substitution method and masters method	**Lecture** *Pen and Talk and Power point presentation*
3	28/9/2020 to 02/10/2020 3 hours	Algebraic method, Randomized algorithms, amortized analysis	**Lecture** *Pen and Talk and Power point presentation*
4	05/10/2020 to 09/10/2020	NP problems – NP complete and NP hard, Unit 2: BST, AVL Trees – Insert, Delete, Search,	**Lecture** *Pen and Talk and Power*

	3 hours	Red Black trees – Insert	*point presentation*
5	12/10/2020 to 16/10/2020 3 hours	Red Black trees – Delete, search, analysis, Splay Trees – Insert, delete, traverse, B Trees	**Lecture** *Pen and Talk and Power point presentation*
6	19/10/2020 to 23/10/2020 3 hours	B Trees – Insert, Delete, Analysis, applications, Multiway Search Trees, Tries – Binary and non-binary, analysis	**Lecture** *Pen and Talk and Power point presentation*
7	26/10/2020 to 30/10/2020 3 hours	Cycle Test 1 Unit 3: Heaps, Min heaps, Min-max heaps,	**Lecture** *Pen and Talk and Power point presentation*
8	02/11/2020 to 06/11/2020 3 hours	deaps, Insert, Delete, operations, analysis Leftist heaps, Skew leftist heaps - insert, delete, traverse, analysis	**Lecture** *Pen and Talk and Power point presentation*
9	09/11/2020 to 13/11/2020 3 hours	Binomial heaps, Fibonacci Heaps, proof – Insert, Delete, traverse. Unit 4: Point trees, Quad trees – Insert, Delete, traverse	**Lecture** *Pen and Talk and Power point presentation*
10	16/11/2020 to 20/11/2020 3 hours	K-D trees, insert, delete, search, TV trees – insert, delete, range query, Segment trees	**Lecture** *Pen and Talk and Power point presentation*
11	23/11/2020 to 27/11/2020 3 hours	Segment trees – range query, traverse, applications Unit 5: Geometric algorithms	**Lecture** *Pen and Talk and Power point presentation*
12	30/11/2020 to 04/12/2020 2 hours	Line segment intersection	**Lecture** *Pen and Talk and Power point presentation*
12	07/12/2020 to 11/12/2020 3 hours	Map overlay identification, voronoi diagram.	**Lecture** *Pen and Talk and Power point presentation*
13	14/12/2020 to 18/12/2020 3 hours	Voronoi diagram, construction	**Lecture** *Pen and Talk and Power point presentation*

Text Books

1. H. S. Wilf, Algorithms and complexity, Prentice hall.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, Introduction to Algorithms, Prentice hall.

Reference books

1. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, "Computational Geometry Algorithms and Applications", Third Edition, Springer, 2011
2. V. Subrahmanyam, "Principles of Multimedia Database systems", Elsevier, 2008
3. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2008

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test 1	26/10/2020 to 30/10/2020	1 hour	15
2	Weekly assessments – Class surprise quizzes		3 hours	15
3	Programming Assessment		2 hours	20
4	Assignment Problems	Periodically	4 hours	20
CPA	Compensation Assessment*	After completion of Weekly assessments	1 hour	15
5	Final Assessment *	As per academic schedule	As per institute norms	30

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. **Students' feedback through class committee meetings**
2. **Feedbacks are collected before final examination through MIS or any other standard format followed by the institute**
3. **Students, through their Class Representatives, may give their feedback at any time to the course faculty which will be duly addressed.**

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)

Email

COMPENSATION ASSESSMENT POLICY

1. One compensation assessment will be given towards the end of the semester for the students those who are absent for Cycle Test 1 due to genuine reason.

2. Surprise Tests will have extra components to compensate for the missed surprise tests.
3. Compensatory assessments would cover the syllabus of 4 units.
4. The prior permission and required document must be submitted for absence.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION

1. The Course Coordinator is available for consultation during the time intimated to the students then and there.
2. Relative grading adhering to the instructions from the office of the Dean (Academic) will be adopted for the course.

FOR APPROVAL

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____