Department of Computer Applications
National Institute of Technology Tiruchirappalli

1.Course Outline			
Course Title	Data Structures and Algorithms		
Course Code	CAS 765		
Department	CA	**No. of Credits**	3
Pre-requisites Course Code	NIL	**Faculty Name**	Dr. A. V. Reddy
PAC Chairman	Dr. S. Sangeetha		
E-mail	reddy@nitt.edu	**Telephone No.**	+91-431-2503734
Course Type	Core Course		

2. Course Overview

The purpose of this course is to provide the students with solid foundations in the basic concepts of data structures and algorithms. This course teaches the students how to select and design data structures and algorithms that are appropriate for problems that they might encounter. This course is also about showing the correctness of algorithms and studying their computational complexities.

3. Course Objectives

- To design and implement various basic and advanced data structures.
- To introduce various techniques for representation of the data in the real world.
- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

4. Course Outcomes (CO)

Student will be able to:

- Analyze worst-case running times of algorithms using asymptotic analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
- Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
- Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
- Synthesize dynamic-programming algorithms, and analyze them.
- Describe the greedy paradigm and explain when an algorithmic design situation calls

for it.

- Synthesize greedy algorithms, and analyze them.
- Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate.
- Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them.
- Explain the different ways to analyze randomized algorithms (expected running time, probability of error).
- Explain the difference between a randomized algorithm and an algorithm with probabilistic inputs.
- Compare between different data structures. Pick an appropriate data structure for a design situation.

5. Course Outcome (CO)	Aligned Programme Outcome (PO)											
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
Understand common data structures and algorithms, implement them.		L	H					M				
Describe different paradigms of algorithm, explain when an algorithmic design situation calls for it and synthesize algorithms based on the paradigm.	L			M		H						
Explain and analyse randomized and probabilistic algorithms.		H			L				M			
Compare between different data structures. Pick an appropriate data structure for a design situation.		M		H						L		

L-Low M-Medium H-High

6. Course Teaching and Learning Activities			
Week	**No. of Classes**	**Topic Covered**	**Mode of Delivery**
1	Class-I	Introduction – Arrays	Chalk and Talk , Power Point Presentation
	Class-II	Stack: Definition and examples, Representing Stacks	Chalk and Talk , Power Point Presentation
	Class-III	Queue and its Representation	Chalk and Talk , Power Point Presentation
2	Class-I	Lists and their Representation	Chalk and Talk , Power Point Presentation

	Class-II	Linked Lists: Singly linked lists, Doubly linked lists, Circular Linked lists	Chalk and Talk , Power Point Presentation
	Class-III	Applications of Stacks, Queues and Linked lists	Chalk and Talk , Power Point Presentation
3	Class-I	Binary Trees – Representation	Chalk and Talk , Power Point Presentation
	Class-II	Operations on binary trees	Chalk and Talk , Power Point Presentation
	Class-III	Binary Search Trees – Introduction	Chalk and Talk , Power Point Presentation
4	Class-I	Binary Search Tree traversals	Chalk and Talk , Power Point Presentation
	Class-II	Operations on Binary Search Trees	Chalk and Talk , Power Point Presentation
	Class-III	Representing Lists as binary trees, Search trees	Chalk and Talk , Power Point Presentation
5	Class-I	Analysing algorithms	Chalk and Talk , Power Point Presentation
	Class-II	Design paradigms of algorithms	Chalk and Talk , Power Point Presentation
	Class-III	Asymptotic notations	Chalk and Talk , Power Point Presentation
6	Class-I	Methods to solve recurrences	Chalk and Talk , Power Point Presentation
	Class-II	Basic sorting techniques	Chalk and Talk , Power Point Presentation
	Class-III	Basic search techniques	Chalk and Talk , Power Point Presentation
7	Class-I	Analysing time complexity of operations on data structures	Chalk and Talk , Power Point Presentation
	Class-II	Design and analysis of Heap sort	Chalk and Talk , Power Point Presentation
	Class-III	Design and analysis of Quick sort	Chalk and Talk , Power Point Presentation
8	Class-I	Radix sort and Bucket sort	Chalk and Talk , Power Point Presentation
	Class-II	Selection in linear time	Chalk and Talk , Power Point Presentation
	Class-III	Shell sort and analyzing other sorting techniques	Chalk and Talk , Power Point Presentation
9	Class-I	Recursion	Chalk and Talk , Power Point Presentation
	Class-II	Divide and conquer - Multiplication of large integers	Chalk and Talk , Power Point Presentation
	Class-III	Strassen's matrix multiplication	Chalk and Talk , Power Point Presentation
10	Class-I	Greedy method – Prim's and Kruskal's algorithm	Chalk and Talk , Power Point Presentation
	Class-II	Huffman codes, Dynamic Programming	Chalk and Talk , Power Point Presentation
	Class-III	Backtracking and Branch & Bound methods	Chalk and Talk , Power Point Presentation

7. Course Assessment Methods – Theorey				
Sl. No.	Mode of Assessment	Week/Date	Duration	Weightage(%)
1.	Cycle Test –1	6th week	60 mins	20
2.	Cycle Test –2	12th week	60 mins	20
3.	Assignment	7thand 10thweek	7 days	10
4.	End Semester Exam	-	180 mins	50
			Total	100

8. Essential Readings (Textbooks, Reference books, Websites, Journals, etc.)

REFERENCES:

1. T.H.Cormen, C.E.Leiserson, R.L.Rivest and C. Stein, "Introduction to algorithms", 3rd edition, MIT Press, 2009.
2. P. H. Dave and H. B.Dave, "Design and Analysis of Algorithms", Pearson Education India. 2009.
3. S. Lipschutz and G.A.V. Pai, "Data Structures", Tata McGraw-Hill, 2010.
4. Clifford A. Shaffer, "Practical Introduction to Data Structures and Algorithm Analysis", 2nd edition, Prentice Hall, 2000.
5. P. Brass, "Advanced Data Structures", Cambridge University Press, 2008.

9. Course Exit Survey (mention the ways by which the feedback about the course is assessed and indicate the attainment level)

1. The students through the class rep may give their feedback at any time to the course co-ordinator which will be duly addressed.
2. The students may also give their feedback during Class Committee meeting.
3. 'Course Outcome Survey' form will be distributed on the last working day to all the students and the feedback on various rubrics will be analyzed.
4. The COs will be computed after arriving at the final marks.

10. Course Policy (including plagiarism, academic honesty, attendance, etc.)

- **Plagiarism**
  The students are expected to come out with their original code for problems given assignments during the class work, and tests/examinations. If found to copy from internet/other students, zero marks will be assigned and action will be taken.

- **Attendance**
  100% is a must. However, relaxation will be given for leave on emergency requirements (medical, death, etc.) and representing institute events. Minimum 75% is required.

- **Academic Honesty**
  i. Possession of any electronic device, if any, found during the test or exam, the

student will be debarred for 3 years from appearing for the exam and this will be printed in the Grade statement/Transcript.

ii. Tampering of MIS records, if any, found, then the results of the student will be with held and the student will not be allowed to appear for the Placement interviews conducted by the Office of Training & Placement, besides (i).

11. Additional Course Information

- The students can get their doubts clarified at any time with their faculty member with prior appointment.

For Senate's Consideration

Dr. A. V. Reddy	Dr. S. Sangeetha	Dr. S.R.Balasundaram
Course Faculty	Class Committee Chairperson	HOD