UPES

Year: II
Semester: III

1. Name of the Faculty: Dr. Shwet Ketu
2. Course : Design and Analysis of Algorithms
3. Program : B.Tech n
4. Target : 45%

Course Code:
L: 3
T: 0
P: 0
C: 3

COURSE PLAN

Target	50% (marks)
Level-1	40% (population)
Level-2	50% (population)
Level-3	60% (population)

1. Method of Evaluation

UG	PG
Quizzes/Tests, Assignments (30%)	Quizzes/Tests, Assignments, seminar (50%)
Mid Examination (20%)	End semester (50%)
End examination (50%)	

2. Passing Criteria

Scale	PG	UG
Out of 10 point scale	SGPA – "6.00" in each semester CGPA – "6.00" Min. Individual Course Grade – "C" Course Grade Point – "4.0"	SGPA – "5.0" in each semester CGPA – "5.0" Min. Individual Course Grade – "C" Course Grade Point – "4.0"

*for PG, passing marks are 40/100 in a paper
*for UG, passing marks are 35/100 in a paper

3. **Pre-requisites:** Basic knowledge of Mathematics and data structure

4. **Course Objectives:**
   1. **Apply mathematical techniques to find the complexity of an algorithm.**
   2. **Analyze algorithms and express asymptotically different case behavior.**
   3. **Demonstrate good principles of algorithm designs.**
   4. **Design appreciate data structures to reduce the complexity of an algorithm.**
   5. **Differentiate among P, NP Hard and NP Complete problems.**

1. Pedagogy
   - Presentations
   - Flipped Classroom sessions
   - Think-Pair-Share Activities
   - Video Lectures

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2. References:

Text Books	1. Thomas H. Cormen (2009) Introduction to Algorithm (Third Edition), The MIT Press. ISBN: 978-0-262- 03384-8 2. John Kleinberg and Eva Tardos (2005), Algorithm Design, ISBN: 0-321-29535-8
Web resources	
Journals	
Reference books	1. Rajesh K. Shukla (2015) Analysis and Design of Algorithms: A Beginner's Approach, Wiley, ISBN10: 8126554770 2. S.Sridhar (2014), Design and Analysis of Algorithms 1st Edition, Publisher: Oxford University Press ISBN: 9780198093695, 0198093691

GUIDELINES TO STUDY THE SUBJECT

Instructions to Students:

1. Go through the 'Syllabus' in the Black Board section of the web-site(https://learn.upes.ac.in) in order to find out the Reading List.
2. Get your schedule and try to pace your studies as close to the timeline as possible.
3. Get your on-line lecture notes (Content, videos) at Lecture Notes section. These are our lecture notes. Make sure you use them during this course.
4. Check your blackboard regularly
5. Go through study material
6. Check mails and announcements on blackboard
7. Keep updated with the posts, assignments and examinations which shall be conducted on the blackboard
8. Be regular, so that you do not suffer in any way
9. **Cell Phones and other Electronic Communication Devices:** Cell phones and other electronic communication devices (such as Blackberries/Laptops) are not permitted in classes during Tests or the Mid/Final Examination. Such devices MUST be turned off in the class room.
10. **E-Mail and online learning tool:** Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments preferably should be uploaded on online learning tool. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.
11. **Attendance:** Students are required to have minimum attendance of 75% in each subject. Students with less than said percentage shall NOT be allowed to appear in the end semester examination.

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This much should be enough to get you organized and on your way to having a great semester! If you need us for anything, send your feedback through e-mail to your concerned faculty. Please use an appropriate subject line to indicate your message details.

There will no doubt be many more activities in the coming weeks. So, to keep up to date with all the latest developments, please keep visiting this website regularly.

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RELATED OUTCOMES

1. The expected outcomes of the Program are:

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
PO9	**Individual and Teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

2. The expected outcomes of the Specific Program are:

PSO1	Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques
PSO2	Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms.
PSO3	Ability to design, develop and manage scalable IT Infrastructure.

3. The expected outcomes of the Course are:

CO 1	Apply mathematical Techniques to find the complexity of algorithm
CO 2	Analyze algorithms and express asymptotically different case behavior
CO 3	Demonstrate good principles of algorithm designs
CO 4	Design appropriate data structures to reduce the complexity of an algorithm.
CO 5	Differentiate among about P, NP-Hard and NP-Complete problems.

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4. Co-Relationship Matrix

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	1	2									3	1	
CO 2	3	3	2	2									3	1	
CO 3	2	2	2	1									3	1	
CO 4	2	3	2	1									3	1	
CO 5	3	2	1	3									3	1	
Average	2.6	2.6	1.6	1.8									3	1	

5. Course outcomes assessment plan:

components / Course Outcomes	Assignment	Test/Quiz	Mid Semester	End Semester	Any other
CO 1	☐	☐	☐	☐	☐
CO 2	☐	☐	☐	☐	☐
CO 3	☐	☐	☐	☐	☐
CO 4					
CO 5					

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BROAD PLAN OF COURSE COVERAGE

Course Activities:

Unit	Description	Planned			Remarks
		From	To	No. of Sessions	
1	**Algorithm, Psuedo code, Performance Analysis- Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation with numerical, different algorithm design techniques, recurrence relation, solving methods: substitution, recursion tree, master theorem with numerical.**				CO1
2	**Binary search, Quick sort: best case & worst case analysis, Merge sort, Strassen's matrix multiplication**				CO2
3	**Activity selection problem, knapsack problem, Minimum cost spanning trees: Prims and kruskal, Single source shortest path problem: Bellman ford, dijkstra's, Huffman codes.**				CO3
4	**Lower Bounds For Sorting, Counting Sort, Radix Sort, bucket sort** **Backtracking: N-queen problem, sum of subsets problem**				CO4

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5	**Travelling salesman problem** **NP-Hard and NP-Complete problem and concepts**				CO5

Sessions: Total No. of Instructional periods available for the course

SESSION PLAN

UNIT-I

Lecture No.	Topics to be Covered	CO Mapped
1,2	Algorithm, Pseudo code, Performance Analysis- Space complexity, Time complexity	CO1
3	Asymptotic Notation- Big oh notation, Omega notation, Theta notation	CO1
4	Asymptotic Notation- Big oh notation, Omega notation, Theta notation with numerical,	CO1
5	different algorithm design techniques, recurrence relation	CO1
6,7	solving methods: substitution	CO1
8,9	solving methods: recursion tree	CO1
10	Master theorem with numerical	CO1
11	master theorem with numerical	CO1

SESSION PLAN

UNIT-II

Lecture No.	Topics to be Covered	CO Mapped

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12,13	Divide and conquer: Binary search and case analysis	CO2
16,17	Merge sort & Analysis	CO2
18	Strassen's matrix multiplication	CO2

SESSION PLAN

UNIT-III

Lecture No.	Topics to be Covered	CO Mapped
19	Greedy method: activity selection problem	CO3
20,21	knapsack problem(fractional)	CO3
22,23	Minimum cost spanning trees: Prims, kruskal.	CO3
24	Minimum cost spanning trees: Applications	CO3
25	Single source shortest path problem: dijkstra's	CO3
26	Single source shortest path problem: Bellman ford	CO3
27	Huffman codes.	CO3

SESSION PLAN

UNIT-IV

Lecture No.	Topics to be Covered	CO Mapped
28	Dynamic Programming: Matrix chain multiplication	CO4

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29	Dynamic Programming: Matrix chain multiplication	CO4
30	0/1 knapsack problem	CO4
31	0/1 knapsack problem	CO4
31	All pairs shortest path problem	CO4
31	All pairs shortest path problem examples	CO4
32	largest common subsequence	CO4
32	largest common subsequence examples	CO4

SESSION PLAN

UNIT-V

Lecture No.	Topics to be Covered	CO Mapped
33	Sorting in linear time: lower bounds for sorting, counting sort, radix sort	CO4
33	bucket sort	CO4
33	N-queen problem	CO4
34	sum of subsets problem	CO4
34	sum of subsets problem, example	CO4

SESSION PLAN

UNIT-VI

Lecture No.	Topics to be Covered	CO Mapped
35	Branch and Bound method knapsack problem	CO5

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35	Branch and Bound method : knapsack problem	CO5
35	NP-Hard and NP-Complete problem and concepts	CO5
36	NP-Hard and NP-Complete problem example	CO5
37	Doubt discussion	CO5