J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)

ACADEMIC YEAR **2015- 16**

http://www.jbiet.edu.in

013-14	COURSE PLAN	2015-16
		Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Asst.Prof
Department:: Information Technology

COURSE DETAILS

Name Of The Programme:: II B.Tech Batch:: 2014 Batch

Year : 2015-16 Semester:II sem
Department:: InformationTechnology
Title of The Subject Design And Analysis of Algorithms Subject Code 54016
No of Students 47

	COURSE PLAN	2015-16
		Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Asst.Prof
Department:: Information Technology

1. TARGET

a) Percentage Pass
100%

b) Percentage I class
100%

2. COURSE PLAN

Lecture No.	**Unit No**	Topic	**Chapter nos. from Text Books and References**
1.	1	Introduction: Algorithm, Pseudo code for expressing algorithms	Hand out –1
2.	1	Analysis-Space complexity, Time complexity.	
3.	1	Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation.	
4.	1	Probabilistic analysis, Amortized analysis	
5.	1	Disjoint Sets- disjoint set operations, union and find algorithms.	
6.	1	Spanning trees	
7.	1	Spanning trees	
8.	1	Spanning trees	
9.	1	Connected components and biconnected components.	
10.	2	Divide and conquer: General method.	Hand out –2
11.	2	Binary search	
12.	2	Quick sort	
13.	2	Merge sort	
14.	2	Strassen's matrix multiplication.	

15.	2	Greedy method: General method	
16.	2	applications-Job sequencing with dead lines	
17.	2	0/1 knapsack problem	
18.	2	Minimum cost spanning trees,	
19.	2	Huffman code	
20.	2	Minimum cost spanning trees,	
21.	2	Single source shortest path problem.	
22.	3	Dynamic Programming: General method	Hand out –3
23.	3	applications-Matrix chain multiplication	
24.	3	Optimal binary search trees	
25.	3	Optimal binary search trees	
26.	3	0/1 knapsack problem	
27.	3	All pairs shortest path problem	
28.	3	All pairs shortest path problem	
29.	3	Travelling sales person problem,	
30.	3	Reliability design.	
31.	4	Backtracking: General method	Hand out –4
32.	4	applications-n-queen problem	
33.	4	n-queen problem	
34.	4	sum of subsets problem	
35.	4	graph coloring	
36.	4	graph coloring	
37.	4	Hamiltonian cycles.	
38.	4	Hamiltonian cycles.	
39.	5	Branch and Bound: General method	Hand out –5
40.	5	applications - Travelling sales person problem	
41.	5	applications - Travelling sales person problem	
42	5	0/1 knapsack problem	
43.	5	0/1 knapsack problem	
44.	5	LC Branch and Bound solution	

45.	5	LC Branch and Bound solution	
46.	5	FIFO Branch and Bound solution	
47.	5	NP-Hard and NP-Complete problems:	
48.	5	Basic concepts	
49.	5	non deterministic algorithms	
50.	5	non deterministic algorithms	
51.	5	NP - Hard and NP Complete	
52.	5	NP - Hard and NP Complete	
53.	5	NP - Hard and NP Complete	
54.	5	Cook's theorem	

References:

Type	**Detail**
Text 1 (T1)	Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia publications pvt. Ltd.
Text2 (T2)	Algorithm Design: Foundations, Analysis and Internet examples, M.T.Goodrich and R.Tomassia, John winey and sons.
Reference (R1)	Data structures and Algorithm Analysis in C++, Allen Weiss, Second edition, Pearson education.
Reference (R2)	Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
Reference (R3)	Introduction to Design and Analysis of Algorithms A strategic approach,R.C.T.Lee, S.S.Tseng,R.C.ChangandT.Tsai,McGraw Hill.

Lesson Plan for Each Class:

Time	**Topic**
5 Minutes	Revision of Previous Chapter
5 Minutes	Outline of the Discussion
30 Minutes	Lecture
5 Minutes	Summary of The Lecture

5 Minutes	Any Queries / Doubts

3. METHOD OF EVALUATION

S no.	**Evaluation Components**	**Nature of Component**	**Duration**	**Weightage**
1	I Mid	Closed Book	90 minutes	10%
2	II Mid	Closed Book	90 minutes	10%
3	Assignments	Open Book	1 week	5 %
4	Final Exam	Closed Book	3 hours.	75 %

4. List out any new topic(s) or any innovation you would like to introduce in teaching the subject in this Semester.

Role Play method- Single Source Shortest Path , PPT

Signature of HOD
Date:

Signature of Faculty
Date:

	GUIDELINES TO STUDY THE SUBJECT	2015-16
		Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy

Designation: Assistant Professor

Department:: Information Technology

Guidelines for Preparing the Course:

Course Description:

- This course introduces concepts related to the design and analysis of algorithms. Specifically, it discusses recurrence relations, and illustrates their role in asymptotic and probabilistic analysis of algorithms. It covers in detail greedy strategies divide and conquer techniques, dynamic programming and max flow - min cut theory for designing algorithms, and illustrates them using a number of well-known problems and applications. It also covers popular graph and matching algorithms, and basics of randomized algorithms and computational complexity. However, the depth of coverage of complexity classes and intractability, approximation algorithms, and randomized algorithms, will be as time permits.

Course Objectives:

Upon completion of this course, students will be able to do the following:

1. Write rigorous correctness proofs for algorithms.
2. Demonstrate a familiarity with major algorithms and data structures.
3. Apply important algorithmic design paradigms and methods of analysis.
4. Synthesize efficient algorithms in common engineering design situations.

Learning Outcomes:

Students who complete the course will have demonstrated the ability to do the following:

1. Argue the correctness of algorithms using inductive proofs and invariants.
2. Analyze worst-case running times of algorithms using asymptotic analysis.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.

4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.
5. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize greedy algorithms, and analyze them.
6. 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.
7. Explain the different ways to analyze randomized algorithms (expected running time, probability of error). Recite algorithms that employ randomization. Explain the difference between a randomized algorithm and an algorithm with probabilistic inputs.
8. Analyze randomized algorithms. Employ indicator random variables and linearity of expectation to perform the analyses. Recite analyses of algorithms that employ this method of analysis.
9. Explain what amortized running time is and what it is good for. Describe the different methods of amortized analysis (aggregate analysis, accounting, potential method). Perform amortized analysis.
10. Explain what competitive analysis is and to which situations it applies. Perform competitive analysis.
11. Compare between different data structures. Pick an appropriate data structure for a design situation.
12. Explain what an approximation algorithm is, and the benefit of using approximation algorithms. Analyze the approximation factor of an algorithm.

FACULTY DETAILS:

Name of the Faculty:: Rimpy

Designation: Assistant Professor

Department:: Information Technology

On completion of this Subject / Course the student shall be able to:

S.No.	Objectives	Outcomes
1.	Apply important algorithmic design paradigms and methods of analysis.	1,2,8,9,10
2.	Demonstrate a familiarity with major algorithms and data structures	1,2,3,4
3.	Synthesize efficient algorithms in common engineering design situations.	3,4,5,10
4.	Write rigorous correctness proofs for algorithms.	9,10,11,12

Signature of Faculty

Date:

Note: For each of the OBJECTIVE indicate the appropriate OUTCOMES to be achieved.
Kindly refer Page 16, to know the illustrative verbs that can be used to state the objectives.

	COURSE OUTCOMES	2015-16
		Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy

Designation: Assistant Professor

Department:: Information Technology

The expected outcomes of the Course / Subject are:

S.No.	General Categories of Outcomes	Specific Outcomes of the Course
A.	An ability to apply knowledge of mathematics, science, and engineering	An ability to apply knowledge of mathematics, science, and engineering
B.	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design and conduct experiments, as well as to analyze and interpret data
C.	An ability to design a system, component, or process to meet desired needs within realistic Constraints such as economic, environmental, social, political, ethical, health and safety, Manufacturability and sustainability	An ability to design a system, component, or process to meet desired needs within realistic
D.	An ability to function on multi-disciplinary teams	An ability to function on multi-disciplinary teams
E.	An ability to identify, formulate, and solve engineering problems	An ability to identify, formulate, and solve engineering problems
F.	An ability to identify, formulate, and solve engineering problems	An ability to identify, formulate, and solve engineering problems
G.	An ability to communicate effectively	An ability to communicate effectively
H.	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
I.	A recognition of the need for, and an ability to engage in life-long learning	
J.	A knowledge of contemporary issues	A knowledge of contemporary issues
K.	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Objectives – Outcome Relationship Matrix (Indicate the relationships by mark).

Objectives \ Outcomes	A	B	C	D	E	F	G	H	I	J	K
1.	☐	☐	X ☐	☐	☐	☐	☐	☐	☐	☐	☐
2.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

	COURSE SCHEDULE	2015-16
		Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Asst.Prof
Department:: Information Technology
The Schedule for the whole Course / Subject is::

S. No.	Description	Duration (Date)		Total No. of Periods
		From	To	
1.	Introduction, Disjoint sets	17/12/2015	06/01/2016	13
2.	Divide &Conquer Method, Greedy Method	7/1/2016	29/1/2016	14
3.	Dynamic Programming	1/2/2016	25/2/2016	14
4.	BackTracking	26/2/2016	10/32/2016	10
5.	NP –Hard and NP Complete	11/3/2016	29/3/2016	13

Total No. of Instructional periods available for the course: Hours / Periods : 65 Periods

	SCHEDULE OF INSTRUCTIONS UNIT - I	2015-16 Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology
The Schedule for the whole Course / Subject is::

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
1	17/12/15	1	Introduction to DAA. Aim and scope of the subject		T1
2	18/12/15	1	Rules for Pseudocode ,Perform Analysis		
3	21/12/15	1	Time complexity, Space Complexity		
4	22/12/15	1	Asymptotic Notation: Big oh Notation		
5	23/12/15	1	Omega Notation		
6	28/12/15	1	Disjoint Sets Operations		
7	29/12/15	1	Union and find algorithms		

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
2. ADDITIONAL TOPICS COVERED, IF ANY, MAY ALSO BE SPECIFIED **BOLDLY**.
3. MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - I	2015-16 Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology
The Schedule for the whole Course / Subject is::

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
8		1	Weighting and collapsing rule		T1
9		1	Spanning trees		T1
10		1	Connected Components		T1
11		1	Articulation Point –Biconnected Components		T1
12		1	Articulation Point –Biconnected Components		T1
13		1	Articulation Point –Biconnected Components		T1

Signature of Faculty
Date

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MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - II	2015-16 Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology
The Schedule for the whole Course / Subject is::

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
1		1	Divide and Conquer-General method		
2		1	Binary Search Problem design		
3		1	Binary search Algorithm with Example,Analysis		
4		1	Merge Sort		
5		1	Quick Sort		
6		1	Strassens Matrix Multiplication		
7		1	Greedy Method: Introduction		
8		1	Job sequencing with deadlines		

Signature of Faculty
Date

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2. ADDITIONAL TOPICS COVERED, IF ANY, MAY ALSO BE SPECIFIED **BOLDLY**.
MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT – II	2015-16 Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology
The Schedule for the whole Course / Subject is::

Sl. No.	Date	No. Of Periods	Topics / Sub – Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
7		1	Greedy method –General method		
8		1	applications-Job sequencing with dead lines		
9		1	applications-Job sequencing with dead lines		
10		1	0/1 knapsack problem		
11		1	Minimum cost spanning trees,-Prims		
12		1	Minimum cost spanning trees,-Krushkal		
13		1	Single source shortest path problem.		
14		1	Single source shortest path problem.-Analysis		

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
2. ADDITIONAL TOPICS COVERED, IF ANY, MAY ALSO BE SPECIFIED **BOLDLY**.
MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - III	2015-16 Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology
The Schedule for the whole Course / Subject is::

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
1		1	Dynamic Programming: General Method		
2		1	applications-Matrix chain multiplication		
3		1	Optimal binary search trees		
4		1	Optimal binary search trees		
5		1	0/1 knapsack problem		
6		1	All pairs shortest path problem		
7		1	Travelling sales person problem,		
8		1	Reliability design.		

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
2. ADDITIONAL TOPICS COVERED, IF ANY, MAY ALSO BE SPECIFIED **BOLDLY**.
MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - IV	2015-16 Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology
The Schedule for the whole Course / Subject is::

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
1		1	Backtracking: General method		
2		1	applications-n-queen problem		
3		1	n-queen problem		
4		1	sum of subsets problem		
5		1	graph coloring		
6		1	graph coloring		
7		1	Hamiltonian cycles.		
8		1	Hamiltonian cycles.		

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
2. ADDITIONAL TOPICS COVERED, IF ANY, MAY ALSO BE SPECIFIED **BOLDLY**.
MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - V	2015-16 Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology
The Schedule for the whole Course / Subject is::

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal...) Page No___ to ___
1		1	Branch and Bound: General method	1,2,3 4& 5,6	
2		1	applications - Travelling sales person Problem		
3		1	applications - Travelling sales person Problem		
4		1	0/1 knapsack problem		
5		1	LC Branch and Bound solution		
6		1	FIFO Branch and Bound solution		

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
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MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - V	2015-16 Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology
The Schedule for the whole Course / Subject is::

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
7		1	NP-Hard and NP-Complete problems:		
8		1	Basic concepts		
9		1	non deterministic algorithms		
10		1	NP - Hard and NP Complete		
11		1	Cook's theorem		
12		1	Cook's theorem		

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
2. ADDITIONAL TOPICS COVERED, IF ANY, MAY ALSO BE SPECIFIED **BOLDLY**.
MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	COURSE COMPLETION STATUS	2015-16
		Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy

Subject:: Design and Analysis of Algorithms Subject Code 54016

Department:: Information Technology

Actual Date of Completion & Remarks, if any

Units	Remarks	Nos. of Objectives Achieved
Unit 1	completed	5
Unit 2	completed	4
Unit 3	ongoing	2
Unit 4	ongoing	
Unit 5	ongoing	

Signature of Dean of School
Date:

Signature of Faculty
Date:

NOTE: AFTER THE COMPLETION OF EACH UNIT MENTION THE NUMBER OF OBJECTIVES ACHIEVED.

2013-14	TUTORIAL SHEETS - I	2015-16
		Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology
The Schedule for the whole Course / Subject is::

Date:

This Tutorial corresponds to Unit No.1 Time:

1. What do you mean an algorithm. Explain the different design for algorithm.
2. What are the parameters for considering the time complexity of an algorithm.
3. Analyze the problem and justify your answer. If we apply insertion sort on super computer & Quick sort on PC the array of one million numbers in super computer which executes 100 million instrumentation/ second. While the PC executes only one million / second.
4. Give an optimal solution for the problem if (x and y) then a = b;
   Else if (not x) and y) then a = c;

   Else if (x and not y) then a = d;

   Else a = e;

5. Write the Trade off between Time complexity & Space complexity.
6. What are the basic steps for writing a good algorithm / program.
7. Define the asymptotic notation.
8. Explain how a Binary search tree has a height of [lgn].
9. Write the following algorithm in an improved way.
   For (I = 1 to n)

   If (I < j) then Sum = Sum + nums[i];

10. What is Randomized Algorithm?
11. Write the general method for Divide & Conguer. Explain through an example.
12. Order the following functions in their growth rate; N, $\sqrt{N}$, $N^{1.5}$, N^2, N_{logN}, N^2_{log}, 2/N, 2^N, 37, N^3.
13. If $T_1(N) = O(f(N))$, $T_2(N) = O(2f(n))$ then which one is True.
    i) $T_1 + T_2 = O(f(N))$ ii) $T_1 + T_2 = O(3f(N))$ iii) $T_1 + T_2 = O(f(3N))$ iv) $T_2 = 2T_1$
14. What is the worst –case running time of Algorithm?
15. How much time is required to compute $f(x) = \Sigma^N_{z=0} x_i$
16. How much time is required to compute a matrix multiplication?
17. What are the factors for analyzing an algorithm?
18. Compare & contrast between all the design of algorithm

Signature of Dean of School
Date:

Signature of Faculty
Date:

	TUTORIAL SHEETS - II	2015-16
		Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology
The Schedule for the whole Course / Subject is::

Date:

This Tutorial corresponds to Unit No. 2 Time:

1. Write the algorithm for Quick Sort & Explain through an example.
2. Analyze all cases of quick sort.
3. Explain & analyze the Marge sort algorithm.
4. Discuss the problem of selection & compare the time complexity of all type.
5. Explain the idea of strassen's matrix multiplication & write its's complexity.
6. Write the algorithm for binary search & analyze it.
7. Derive mathematically the time complexity of binary search tree.
8. Illustrate the divide and conquer strategy for finding maximum and minimum from a set of element.
9. Analyze all cases of time complexity for finding maximum and minimum from a set of element.
10. Two sets A and B each. Assume that each element is an integer in the range $[0,n^{100}]$. These sets are not necessarily sorted. Show how to check whether these two sets are disjoint in O(n) time. Your algorithm should use O(n) space.
11. Sort the follwing list in decending order using quick sort technique and argue upon its running time.
    a. L=<1,3,5,6,8,10,13,15>
12. What do you mean Greedy Method. How it is useful to solve the algorithm.
13. Write algorithm for job sequencing problem so that all jobs are completed in deadline.
14. Devise an algorithm to a given amount for purchasing a particular item from the shop using least number of coins. Assume that the available coin set is C={1,2,5,20,50,100,200} what is the total number of coins for purchasing the item of total cost 5.96.
15. Let G(V,E) be any weighted connected graph. If C is any cycle of G, then show that the heaviest edge of C cannot belong to a minimum-cost spanning tree of G.
16. What is an MST? Write an algorithm for MST? Analyze it's Time Complexity.
17. Write Kruskal's algorithm & analyze it.

a.

Signature of Dean of School
Date:

Signature of Faculty
Date:

	TUTORIAL SHEETS - III	2015-16 Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology

Date:

This Tutorial corresponds to Unit No. 3 Time:

1. Write the general method for Dynamic programming.
2. State the all pairs shortest path problem & analyze its Time & Space complexity.
3. Solve the all pairs shortest problem for the diagraph with the weight matrix

i. | 0 2 ∞ 1 8 |
ii. | 6 0 3 2 ∞ |
iii. | ∞ ∞ 0 4 ∞ |
iv. | ∞ ∞ 2 0 3 |
v. | 3 ∞ ∞ ∞ 0 |

4. Taking the Traveling saleman problem as case study, suggest an algorithm for this & analyze its time complexity.
5. State the 8-queens problem. Explain a back tracking algorithm for solving it.
6. State and solve 8-puzzle using backtracking.
7. Write an algorithm for sum of subsets & analyze it.
8. Suppose you are given n men and n women and two nxn arrays P and Q such that P(i,j) is the preference of man i for woman j and Q(i, j) is the preference of woman I for man j. Devise an algorithm that finds a pairing of men and women such that the sum of the product of the preference maximized.
9. Prove that the size of the set of all subsets of n elements is 2^n
10. Let w={5,7,10,12,15,18,10} and m=35. Find all possible subsets of w that sum to m. Draw the state space tree for it.
11. Show that the computing time for optimal binary search tree is $O(n^2)$.
12. Write Dynamic programming method to solve 0/1 knapsack problem.
13. Consider the following instance of the knapsack problem:
    a. N=6, (p1,p2, p3, p4, p5, p6)=(w1, w2, w3, w4, w5, w6)=(100, 50, 20, 10, 7, 3) and M=165. Solve the above problem using dynamic programming approarch.

Signature of Dean of School
Date:

Signature of Faculty
Date:

	TUTORIAL SHEETS - IV	2015-16
		Regulation: R14

FACULTY DETAILS:

Name of the Faculty:: Rimpy
Designation: Assistant Professor
Department:: Information Technology

Date:

This Tutorial corresponds to Unit Nos. 4&5 Time:

1) What do you mean by Branch & Bound & how it is differ from other method.
2) Write difference between FIFO branch and bound and LC branch and bound algorithms.
3) Devise algorithm for the knapsack problem using Branch and Bound Technique.
4) Devise algorithm for the traveling salesman problem using Branch and Bound Technique.
5) Consider the following traveling salesman instance defined by the cost matrix

a.	∞	7	3	12	8
b.	3	∞	6	14	9
c.	5	8	∞	6	18
d.	9	3	5	∞	11
e.	18	14	9	8	∞

   b. Obtain the reduced cost matrix.

6) Draw the state space tree generated by LCBB for the following knapsack instances:
   a. n=5, (p1,p2,……..,p5)=(10,15, 6, 8, 4), (w1, w2,……..,w5)=(4, 6, 3, 4, 2), and m=12
   b. n=5, (p1,p2,……..,p5)=(w1, w2,……..,w5)=(4, 4, 5, 8, 9), and m=15
7) Explain the concept of NP. Explain NP – completeness & satisfiability.
8) Write an algorithm for Random Number Generations & write at least two application of Random Number.
9) State cook's theorem.

	ILLUSTRATIVE VERBS FOR STATING INSTRUCTIONAL OBJECTIVES	2015-16
		Regulation: R14

These verbs can also be used while framing questions for Continuous Assessment Examinations as well as for End – Semester (final) Examinations.

ILLUSTRATIVE VERBS FOR STATING **GENERAL OBJECTIVES**

Know Comprehend	Understand Apply	Analyze Design	Generate Evaluate

ILLUSTRATIVE VERBS FOR STATING **SPECIFIC OBJECTIVES:**

A. Cognitive Domain

1	2	3	4	5	6
Knowledge	**Comprehension Understanding**	**Application** of knowledge & comprehension	**Analysis** of whole w.r.t. its constituents	**Synthesis** combination of ideas/constituents	**Evaluation** judgement
Define	Convert	Change	Breakdown	Categorize	Appraise
Identify	Defend	Compute	Differentiate	Combine	Compare
Label	Describe (a	Demonstrate	Discriminate	Compile	Conclude
List	procedure)	Deduce	Distinguish	Compose	Contrast
Match	Distinguish	Manipulate	Separate	Create	Criticize
Reproduce	Estimate	Modify	Subdivide	Devise	Justify
Select	Explain why/how	Predict		Design	Interpret
State	Extend	Prepare		Generate	Support
	Generalize	Relate		Organize	
	Give examples	Show		Plan	
	Illustrate	Solve		Rearrange	
	Infer			Reconstruct	
	Summarize			Reorganize	
				Revise	

B. Affective Domain		**C. Psychomotor Domain (skill development)**				
Adhere	Resolve	Bend	Dissect	Insert	Perform	Straighten
Assist	Select	Calibrate	Draw	Keep	Prepare	Strengthen
Attend	Serve	Compress	Extend	Elongate	Remove	Time
Change	Share	Conduct	Feed	Limit	Replace	Transfer
Develop		Connect	File	Manipulate	Report	Type
Help		Convert	Grow	Move precisely	Reset	Weigh
Influence		Decrease	Handle	Operate	Run	
Initiate		Demonstrate	Increase	Paint	Set	

	LESSON PLAN Unit-1	2015-16 Regulation: R14

Name of the Faculty: Rimpy

Subject Design and Analysis of Algorithms Subject Code 54016

Unit 1

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
1	**Introduction: Algorithm, Pseudo code for expressing algorithms**	**50min**	**T1**	Lecture method – Board & Chalk
2	**Analysis-Space complexity, Time complexity.**	**50min**	**T1**	Lecture method – Board & Chalk
3	**Asymptotic Notation- Big oh notation.**	**1.30 hr**	**T1**	PPT
4	**Omega notation, Theta notation and Little oh notation.**	**50min**	**T1**	PPT
5	**Probabilistic analysis**	**50min**	**T1**	Lecture method – Board & Chalk
6	**Amortized analysis**	**50min**	**T1**	Lecture method – Board & Chalk
7	**Disjoint Sets- disjoint set operations, union and find algorithms**	**50 min**	**T1**	Lecture method – Board & Chalk
8	**union and find algorithms.-Weighted union by rank**	**50 min**	**T1**	Lecture method – Board & Chalk
9	**Find alg- Collapsing rule**	**50 min**	**T1**	Lecture method – Board & Chalk
10	Spanning trees	**50 min**	**T1**	Lecture method – Board & Chalk
11	**Connected Components**	**50 min**	**T1**	Lecture method – Board & Chalk
12	**biconnected components.- Articulation Point**	**50 min**	**T1**	Lecture method – Board & Chalk

On completion of this lesson the student shall be able to(Outcomes)

- Explain the different ways to analyze randomized algorithms (expected running time, probability of error). Recite algorithms that employ randomization. Explain the difference between a randomized algorithm and an algorithm with probabilistic inputs.
- Analyze randomized algorithms. Employ indicator random variables and linearity of expectation to perform the analyses. Recite analyses of algorithms that employ this method of analysis.
- Explain what amortized running time is and what it is good for. Describe the different methods of amortized analysis (aggregate analysis, accounting, potential method). Perform amortized analysis.
- Explain what competitive analysis is and to which situations it applies. Perform competitive analysis.
- Compare between different data structures. Pick an appropriate data structure for a design situation.
- Explain what an approximation algorithm is, and the benefit of using approximation algorithms.. Analyze the approximation factor of an algorithm.

	ASSIGNMENT Unit-I	2015-16
		Regulation: R14

Assignment / Questions

1) What do you mean an algorithm. Explain the different design for algorithm.
2) What are the parameters for considering the time complexity of an algorithm.
3) Analyze the problem and justify your answer. If we apply insertion sort on super computer & Quick sort on PC the array of one million numbers in super computer which executes 100 million instrumentation/ second. While the PC executes only one million / second.
4) Give an optimal solution for the problem if (x and y) then a = b;
    a. Else if (not x) and y) then a = c;
    b. Else if (x and not y) then a = d;
    c. Else a = e;
5) Write the Tradeoff between Time complexity & Space complexity.
6) What are the basic steps for writing a good algorithm / program.
7) Define the asymptotic notation.
8) Write the following algorithm in an improved way.
    a. For (I = 1 to n)
    b. If (I < j) then Sum = Sum + nums[i];
9) What is Randomized Algorithm?

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN Unit-II	2015-16
		Regulation: R14

Name of the Faculty: Rimpy

Subject Design and Analysis of Algorithms Subject Code54016

Unit II

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
1	**Divide and conquer: General method.**	50 min	T1	Lecture method – Board & Chalk
2,3	**Binary search**	1hr.40 min	T1	Lecture method – Board & Chalk
4,5	**Quick sort**	1hr.40 min	T1	PPT,Lecture Method
6,7	Merge sort	1hr.40 min	T1	PPT,Lecture Method
8	**Greedy method: General method**	50 min	T1	Lecture method – Board & Chalk
9	**applications-Job sequencing with dead lines**	1hr.40 min	T1	Lecture method – Board & Chalk
10	**0/1 knapsack problem**	1hr.40 min	T1	PPT,Lecture Method
11	Minimum cost spanning trees,	1hr.40 min	T1	PPT,Lecture Method
12	**Single source shortest path**	1hr.40 min	T1	PPT,Lecture Method

On completion of this lesson the student shall be able to(Outcomes)

1. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
2. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms.
3. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
4. Describe the greedy paradigm and explain when an algorithmic design situation calls for it.

	ASSIGNMENT Unit-II	2015-16
		Regulation: R14

Assignment / Questions

1. Write the algorithm for Quick Sort & Explain through an example.
2. Analyze all cases of quick sort.
3. Explain & analyze the Marge sort algorithm.
4. Discuss the problem of selection & compare the time complexity of all type.
5. Explain the idea of strassen's matrix multiplication & write its's complexity.
6. Write the algorithm for binary search & analyze it.
7. Derive mathematically the time complexity of binary search tree.
8. Illustrate the divide and conquer strategy for finding maximum and minimum from a set of element.
9. Analyze all cases of time complexity for finding maximum and minimum from a set of element.
10. Two sets A and B each. Assume that each element is an integer in the range $[0,n^{100}]$. These sets are not necessarily sorted. Show how to check whether these two sets are disjoint in O(n) time. Your algorithm should use O(n) space.
11. Sort the follwing list in decending order using quick sort technique and argue upon its running time.
    a. L=<1,3,5,6,8,10,13,15>
12. What do you mean Greedy Method. How it is useful to solve the algorithm.
13. Write algorithm for job sequencing problem so that all jobs are completed in deadline.
14. Let G(V,E) be any weighted connected graph. If C is any cycle of G, then show that the heaviest edge of C cannot belong to a minimum-cost spanning tree of G.
15. What is an MST? Write an algorithm for MST? Analyze it's Time Complexity.
16. Write Kruskal's algorithm & analyze it.

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Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN Unit-III	2015-16
		Regulation: R14

Name of the Faculty: Rimpy

Subject Design and Analysis of Algorithms

SubjectDesign and Analysis of Algorithms

Unit III

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
1	**Dynamic Programming: General method**	50 min	T1	PPT ,Lecture method
2,3	**applications-Matrix chain multiplication**	1hr 40 min	T1	PPT ,Lecture method
4,5	**Optimal binary search trees**	1hr 40 min	T1	PPT ,Lecture method
6	0/1 knapsack problem	50 min	T1	PPT ,Lecture method
7	**All pairs shortest path problem**	50 min	T1	PPT ,Lecture method
8	**Travelling sales person problem,**	50 min	T1	PPT ,Lecture method
9	**Reliability design.**	50 min	T1	PPT ,Lecture method

On completion of this lesson the student shall be able to (Outcomes)

1) Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
2) Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them

	ASSIGNMENT **Unit-III**	2015-16 Regulation: R14

Assignment / Questions

1. Write the general method for Dynamic programming.
2. State the all pairs shortest path problem & analyze its Time & Space complexity.
3. Solve the all pairs shortest problem for the diagraph with the weight matrix

i. | 0 2 ∞ 1 8 |
ii. | 6 0 3 2 ∞ |
iii. | ∞ ∞ 0 4 ∞ |
iv. | ∞ ∞ 2 0 3 |
v. | 3 ∞ ∞ ∞ 0 |

4. Taking the Traveling saleman problem as case study, suggest an algorithm for this & analyze its time complexity.

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Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN Unit-IV	2015-16
		Regulation: R14

Name of the Faculty: Rimpy

Subject Design and Analysis of Algorithms

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Unit IV

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
1	**Backtracking: General method**	50 min	T1	PPT ,Lecture method
2,3	**applications-n-queen problem**	1 hr 40 min	T1	PPT ,Lecture method
4	**sum of subsets problem**	50 min	T1	PPT ,Lecture method
5	graph coloring	50 min	T1	PPT ,Lecture method
6	**Hamiltonian cycles**	50 min	T1	PPT ,Lecture method

On completion of this lesson the student shall be able to (Outcomes)

1. Explain the major graph algorithms and their analyses.
2. Employ graphs to model engineering problems, when appropriate.
3. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them.

	ASSIGNMENT **Unit-IV**	2015-16 Regulation: R14

Assignment / Questions

1. State the 8-queens problem. Explain a back tracking algorithm for solving it.
2. State and solve 8-puzzle using backtracking.
3. Write an algorithm for sum of subsets & analyze it.
4. Suppose you are given n men and n women and two nxn arrays P and Q such that P(i,j) is the preference of man i for woman j and Q(i, j) is the preference of woman I for man j. Devise an algorithm that finds a pairing of men and women such that the sum of the product of the preference maximized.
5. Prove that the size of the set of all subsets of n elements is 2^n
6. Let w={5,7,10,12,15,18,10} and m=35. Find all possible subsets of w that sum to m. Draw the state space tree for it.

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Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN Unit-V	2015-16 Regulation: R14

Name of the Faculty: Rimpy

Subject Design and Analysis of Algorithms Subject Code54016

Unit V

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
1	**Branch and Bound: General method**	**50 min**	**T1**	PPT ,Lecture method
2,3	**applications - Travelling sales person problem**	**1hr 40 min**	**T1**	PPT ,Lecture method
4	**0/1 knapsack problem**	**50 min**	**T1**	PPT ,Lecture method
5	LC Branch and Bound solution	**50 min**	**T1**	PPT ,Lecture method
6	**FIFO Branch and Bound solution**	**50 min**	**T1**	PPT ,Lecture method
7	**NP-Hard and NP-Complete problems**	**50 min**	**T1**	PPT ,Lecture method
8	**Basic concepts**	**50 min**	**T1**	PPT ,Lecture method
9	**non deterministic algorithms**	**50 min**	**T1**	PPT ,Lecture method
10	NP - Hard and NP Complete	**1 hr 40 min**	**T1**	,Lecture method
11	**Cook's theorem**	**50 min**	**T1**	,Lecture method

On completion of this lesson the student shall be able to

1. Compare between different data structures. Pick an appropriate data structure for a design situation.
2. Explain what an approximation algorithm is, and the benefit of using pproximation algorithms.. Analyze the approximation factor of an algorithm.

	ASSIGNMENT Unit-V	2015-16
		Regulation: R14

Assignment / Questions

1) Explain the concept of NP. Explain NP – completeness & satisfiability.
2) Write an algorithm for Random Number Generations & write at least two application of Random Number.
3) State cook's theorem.
4) What do you mean by Branch & Bound & how it is differ from other method.
5) Write difference between FIFO branch and bound and LC branch and bound algorithms.
6) Devise algorithm for the knapsack problem using Branch and Bound Technique.
7) Devise algorithm for the traveling salesman problem using Branch and Bound Technique.
8) Consider the following traveling salesman instance defined by the cost matrix

a.	∞	7	3	12	8
b.	3	∞	6	14	9
c.	5	8	∞	6	18
d.	9	3	5	∞	11
e.	18	14	9	8	∞

   b. Obtain the reduced cost matrix.

6) Draw the state space tree generated by LCBB for the following knapsack instances:
   a. n=5, (p1,p2,……..,p5)=(10,15, 6, 8, 4), (w1, w2,……..,w5)=(4, 6, 3, 4, 2), and m=12
   b. n=5, (p1,p2,……..,p5)=(w1, w2,……..,w5)=(4, 4, 5, 8, 9), and m=15

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.