COURSE HANDOUT

B. Tech (CSE) -6th Semester

Course Title **: LANGUAGE PROCESSORS** Dated: **21.11.17**

Course Code : **CSE 3413** Academic Year: **2017-18**

Course Structure : **3-1-0-4**

Course coordinator : **Dr V Prasad**

Instructor(s) **: Mr Ch Koteswara Rao & Mrs P Someswari**

Course Description:

This course studies the principles of programming languages with an emphasis on programming language implementation and compiler design. This includes various techniques for describing and defining a language, as well as techniques for implementing compilers.

Course Objectives:

The course content enables students to:

1. Learn various translators and phases of compiler.
2. Learn context free grammars, top-down and bottom-up parsing.
3. Learn symbol tables and intermediate code.
4. Learn various code optimization and code generation techniques.

Course Outcomes:

At the end of the course students are able to:

1. Deal with different translators and to acquire the knowledge of compiler and its Phases.
2. Use of formal grammars for specifying the syntax and Semantics of programming languages
3. Build symbol tables and generate intermediate code for a given program.
4. Apply the code optimization techniques to improve the performance of a program in terms of speed and space.
5. Design a compiler for a concise programming language.

SYLLABUS

UNIT - I: **[15]**

Overview of language processing , compiler, assembler , interpreters, linkers & loaders, structure of a compiler, phases of a compiler, Lexical Analysis, Role of Lexical Analysis ,Token, patterns and Lexemes, Lexical Errors, Regular Expressions, Regular definitions for the language constructs, Transition diagram for recognition of tokens, Reserved words and identifiers.

UNIT-II: **[16]**

Syntax Analysis, Top-down parsing, First and Follow, LL(1) Grammars, Non-Recursive predictive parsing , Bottom-up parsing, Shift Reduce Parsing, Model of an LR Parsers, Construction of SLR Tables, construction of CLR (1), LALR Parsing tables, Dangling ELSE Ambiguity.

UNIT-III: **[14]**

Semantic analysis, SDT, Intermediate code, three address code, quadruples, triples, indirect triples, abstract syntax trees, DAG for expressions, symbol tables, Runtime Environment: storage organization, stack allocation, access to non-local data, heap management.

UNIT-IV: **[15]**

Machine independent code optimization, Common sub expression elimination, constant folding, copy propagation, dead code elimination, strength reduction, loop optimization, basic blocks, Flow graph, DAG for basic blocks, Machine dependent code optimization: Peephole optimization, register allocation, instruction scheduling.

Text Books:

1. Compilers, Principles Techniques and Tools- Alfred V Aho, Monical S Lam, Ravi Sethi, Jeffrey D. Ullman, 2nd ed, Pearson,2007.
2. Principles of compiler design, V. Raghavan, 2nd ed, TMH, 2011.

Reference Books:

1. Principles of compiler design, 2nd ed, Nandini Prasad, Elsevier
2. Compiler construction, Principles and Practice, Kenneth C Louden, CENGAGE
3. Implementations of Compiler, A new approach to Compilers including the algebraic methods, Yunlinsu, Springer

COURSE PLAN

Lecture No.	Learning Objectives	Topics to be covered	Reference
		Unit – I	
1	To impart knowledge on the importance of Language Processors	Overview of Language Processors	T1,Chapter 1
2	To impart knowledge on language translators	Compiler, Assembler, Interpreter, Linkers & Loaders	T1,Chapter 1
3	To impart knowledge on structure of compiler	Structure of a Compiler	T1,Chapter 1
4		**TUTORIAL -1**	
5	To impart knowledge on knowledge of compiler phases	Phases of a compiler	T1,Chapter 1
6	To impart knowledge on Lexical analysis	Lexical Analysis, Role of Lexical Analysis	T1,Chapter 3
7	To impart knowledge on understand the key terms token, pattern and lexeme	Token, Patterns and Lexemes	T1,Chapter 3
8		**TUTORIAL -2**	
9	To impart knowledge on Lexical errors	Lexical Errors	T1,Chapter 3
10	To impart knowledge on Regular Expressions	Regular Expressions	T1,Chapter 3
11	To impart knowledge on Regular definitions	Regular Definitions for the Language Constructs	T1,Chapter 3

12	**TUTORIAL -3**		
13	To impart knowledge on diagrams for tokens	Transition Diagram for Recognition of Tokens	T1,Chapter 3
14	To impart knowledge on Reserved words and identifiers	Reserved Words and Identifiers	T1,Chapter 3
15	**TUTORIAL -4**		
UNIT-II			
16	To impart knowledge on syntax analysis	To Learn about Syntax Analysis	T1,Chapter 4
17	To impart knowledge on Top-down parsing	Top-Down Parsing	T1,Chapter 4
18	impart knowledge on first and follow Functions	First and Follow	T1,Chapter 4
19	**TUTORIAL -5**		
20	To impart knowledge on LL(1) grammars	LL(1) Grammars	T1,Chapter 4
21	To impart knowledge on Non-Recursive predictive parser	Non-Recursive Predictive Parsing	T1,Chapter 4
22	impart knowledge on Bottom-up parsing	Bottom-Up Parsing	T1,Chapter 4
23	**TUTORIAL -6**		
24	To impart knowledge on Shift reduce parser	Shift Reduce Parsing	T1,Chapter 4
25	To impart knowledge on LR parsers	Model of an LR Parsers	T1,Chapter 4

26	To impart knowledge on SLR parsing table	Construction of SLR Tables	T1,Chapter 4
27	**TUTORIAL -7**		
28	To impart knowledge on CLR parser	Construction of CLR (1)	T1,Chapter 4
29	To impart knowledge on LALR parser	LALR Parsing Tables	T1,Chapter 4
30	To impart knowledge on Dangling ELSE Ambiguity	Dangling ELSE Ambiguity	T1,Chapter 4
31	**TUTORIAL -8**		
UNIT-III			
32	To impart knowledge on semantic analysis	Semantic analysis	T1,Chapter 5
33	To impart knowledge on SDT	SDT	T1,Chapter 5
34	To impart knowledge on Intermediate code	Intermediate Code	T1,Chapter 5
35	**TUTORIAL -9**		
36	To impart knowledge on three address code	Three address code	T1,Chapter 5
37	To impart knowledge on quadruples, triples, indirect triples	Quadruples, Triples, Indirect Triples	T1,Chapter 5
38	To impart knowledge on abstract syntax trees	Abstract Syntax Trees	T1,Chapter 5
39	**TUTORIAL -10**		

40	To impart knowledge on DAG for expressions	DAG for Expressions	T1,Chapter 5
41	impart knowledge on symbol table	Symbol tables	T1,Chapter 7
42	To impart knowledge on Runtime Environment	Runtime Environment: Storage Organization, Stack allocation	T1,Chapter 7
43	**TUTORIAL -11**		
44	To impart knowledge on access to non-local data	Access to Non-Local Data	T1,Chapter 7
45	To impart knowledge on access to heap management	Heap Management	T1,Chapter 7
46	**TUTORIAL -12**		
UNIT-IV			
47	To impart knowledge on machine independent code optimization techniques	Machine Independent Code Optimization	T1,Chapter 10
48	To impart knowledge on machine independent code optimization techniques	Common Sub Expression Elimination, Constant Folding	T1,Chapter10
49	To impart knowledge on machine independent code optimization techniques	Copy Propagation, Dead Code Elimination, Strength Reduction	T1,Chapter 10
50	**TUTORIAL -13**		
51	To impart knowledge on loop optimization	Loop Optimization	T1,Chapter 10
52	To impart knowledge on basic blocks	Basic Blocks	T1,Chapter 10

53	To impart knowledge on Flow graph	Flow Graph	T1,Chapter 10
54	**TUTORIAL -14**		
55	To impart knowledge on DAG for blocks	DAG for Basic Blocks	T1,Chapter 10
56	To impart knowledge on machine dependent code optimization techniques	Machine Dependent Code Optimization: Peephole optimization	T1,Chapter 10
57	To impart knowledge on register allocation	Register Allocation	T1,Chapter 9
58	**TUTORIAL -15**		
59	To impart knowledge on instruction scheduling	Instruction Scheduling	T1,Chapter 9
60	To impart knowledge on Optimization	Optimization	T1,Chapter 9 & 10

TUTORIALS:

Tutorial No.	Topic(s) to be covered
1	Tutorial on fundamentals of LP
2	Problems on writing the output of each phase
3	Problems on Regular Expressions and identification of lexical errors
4	Problems on design of transition diagrams
5	Problems on top-down parsing
6	Problems on LL(1) and predictive parser
7	Problems on SLR parser and shift reduce parser
8	Problems on LR parsers
9	Problems on intermediate code representations
10	Problems on construction of DAGs
11	Identifying of on symbol table entries
12	Applying of minimization techniques
13	Applying of minimization techniques
14	Problems on DAG
15	Problems on assignment and allocation of registers

EVALUATION SCHEME:

Component	Duration (minutes)	Marks	% of weightage	Date & Time	Venue
Sessional Test – 1	90	20	20 (Best 2 tests average)	01-01-2018 to 06-01-2018 9:00 AM – 10.30 AM	Block-5
Sessional Test – 2	90	20		19-02-2018 to 24-02-2018 9:00 AM – 10.30 AM	Block-5
Sessional Test – 3	90	20		02-04-2018 to 07-04-2018 9:00 AM – 10.30 AM	Block-5
Comprehensive Quiz	20	10	10	02-04-2018 to 07-04-2018 11:00 AM – 12.30 AM	Block-5
Semester End Examination	180	70	70	16-04-2018 to 28-04-2018	Exam Section

Chamber Consultation Hour:

Venue: CSE Staff Room

Notices: CSE Main notice board

Signature of the Instructor(s)

Mr Ch Koteswara Rao & Mrs P Someswari

Signature of the course-coordinator

Dr V Prasad