INSTITUTEOFAERONAUTICALENGINEERING

(Autonomous)

Dundigal, Hyderabad-500043

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**COMPILER DESIGN**				
Course Code	ACSB11				
Programme	B.Tech				
Semester	V	CSE | IT			
Course Type	Core				
Regulation	**IARE - R18**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	2	1	3	-	-
Chief Coordinator	Mr. N V Krishna Rao, Assistant Professor				

COURSE OBJECTIVES:

The students will try to learn:

I	The process of translating a high-level language to machine code required for compiler construction.
II	The Software tools and techniques used in compiler construction such as lexical analyser and parser generators.
III	The data structures used in compiler construction such as abstract syntax trees, symbol tables, three-address code, and stack machines.
IV	The deeper insights into the syntax and semantic aspects of programming languages, dynamic memory allocation and code generation.

COURSE OUTCOMES :

After successful completion of the course, Students will be able to:

CO 1	**Describe the components of a language processing system for the conversion of high level languages to machine level languages.**
CO 2	**Classify the importance of phases of a compiler for constructing a compiler**
CO 3	**Demonstrate a lexical analyser from a specification of a Language's lexical rules for dividing the programming statements into tokens.**
CO 4	**Construct the derivations , FIRST set , FOLLOW set on the context free grammar for performing the top-down and bottom up parsing methods.**
CO 5	**Distinguish top down and bottom up parsing methods for developing parser with the parse tree representation of the input.**
CO 6	**Construct LEX and YACC tools for developing a scanner and a parser.**
CO 7	**Describe syntax directed definitions & translations for performing Sementic Analysis.**
CO 8	**Classify the different intermediate forms for conversion of syntax translations into Intermediate Code.**
CO 9	**Demonstrate type systems for performing the static and dynamic type checking.**

CO 10	**Describe the run-time memory elements for storage allocation strategies which includes procedure calls, local variable allocation, dynamic memory allocation.**
CO 11	**Apply the code optimization techniques on intermediate code form for improving the performance of a program**
CO 12	**Make use of optimization techniques on basic blocks for reducing utilization of registers in generating the target code.**

TOTAL COUNT OF KEY COMPETENCIES FOR CO – (PO, PSO) MAPPING:

Course Outcome s(COs)	Program Outcomes (POs) / Number of Vital Features												Program Specific Outcomes (PSOs) / Number of Vital Features		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	10	10	11	1	5	3	3	12	5	12	12	1	2	2
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 2	2	-	-	-	1	-	-	-	-	-	-	-	1	-	-
CO 3	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 4	2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO 5	2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO 6	2	2	-	1	-	-	-	-	-	-	-	-	-	2	-
CO 7	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 8	2	-	2	-	1	-	-	-	-	-	-	-	-	-	-
CO 9	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 10	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 11	2	3		-	1	-	-	-	-	1	-	-	-	-	1
CO 12	-	2	2	-	1	-	-	-	-	1	-	-	-	-	1

TUTORIAL QUESTION BANK

MODULE-I

INTRODUCTION TO COMPILERS

PART - A (SHORT ANSWER QUESTIONS)

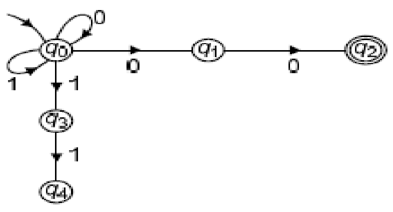
S No	QUESTIONS	Blooms Taxonomy Level		Course Outcomes
1	Name the cousins of compiler?	Remember	---	CO 1
2	Define the two main parts of compilation? What they perform?	Remember	---	CO 1
3	How many phases does analysis phase consists define it?	Remember	---	CO 2
4	Define and explain the Loader?	Remember	---	CO 1

5	Define preprocessor?	Remember	---	CO 1
6	Define the general phases of a compiler?	Remember	---	CO 2
7	Define lexeme and token?	Remember	---	CO 3
8	Write the issues of lexical analyzer?	Remember	---	CO 3
9	List some compiler construction tools?	Remember	---	CO 1
10	Define the term Symbol table?	Remember	---	CO 2
11	Define the term Interpreter?	Remember	---	CO 1
12	Define an error Handler in compiler?	Remember	---	CO 2
13	Explain a translator and types of translator?	Understand	**Recall** components of a language processing system for the **convert** high level languages to machine level languages.	CO 1
14	Define parser and list its types?	Remember	---	CO 2
15	Explain bootstrap?	Understand	This would require the learner to **recall** (knowledge) basic components of a language processing system to **construct** tokens, lexemes, different symbols and their importance and applicability in implementing the lexical analyser	CO 1
16	Define pass?	Remember	---	CO 2
17	Define phase?	Remember	---	CO 2
18	What is cross compiler?	Remember	---	CO1
19	Define multi pass compiler?	Remember	---	CO 2
20	Define DFA,NFA,Regular Expressions.	Remember	---	CO 3
	PART - B (LONG ANSWER QUESTIONS)			
1	Define compiler? State various phases of a compiler and explain them in detail?	Remember	---	CO 2
2	Explain the various phases of a compiler in detail. Also Write down the output for the following expression after each phase x: =a+b*c-d?	Understand	This would require the learner to **recall** the various phases of compiler and **discuss** the output of each phase for given expression.	CO2
3	Explain the cousins of a Compiler? Explain them in detail.	Understand	This would require the learner to **recall** the different phases of compiler, **classify** the cousins of compiler	CO 1
4	Describe how various phases could be combined as a pass in compiler?	Remember	---	CO 2
5	Convert Regular Expression (11+0)*(00+1)* to Finite Automata.	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA to DFA.	CO 3

6	For the following expression Position:=initial+ rate*60, Show the output after each phase of compiler?	Understand	This would require the learner to **recall** the various phases of compiler and **demonstrate** the output of each phase for given expression.	CO 2
7	Explain the role and issues of Lexical Analyzer?	Understand	This would require the learner to **recall** the different phases of compiler, **classify** the cousins of compiler	CO 3
8	Define Regular Expression and its properties. Give examples for Regular Expressions for given Finite Automatas.	Remember	---	CO 3
9	Explain single pass and multi pass compiler with example?	Understand	This would require the learner to **recall** the different phases of compiler **classify** the cousins of compiler	CO 2
10	Define bootstrapping concept in brief?	Remember	---	CO 1
11	Explain the general format of a LEX program with example?	Understand	This would require the learner to **recall** software tools such LEX to develop a complete compiler and explain with an example.	CO 3
12	Explain and differentiate frontend and backend of a compiler	Understand	This would require the learner to **recall** the different phases of compiler and **discuss** frontend and backend.	CO 2
13	For the following expression a[index]=4+2 , Explain output after each phase of compiler?	Understand	This would require the learner to **recall** the various phases of compiler and **demonstrate** the output of each phase for given expression.	CO 2
14	Convert NFA for (0 + 1)*(00 + 11)(0 + 1)* and Convert to DFA.	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA to DFA.	CO 3
15	Convert Regular Expression 01* + 1 to Finite Automata.	Understand	This would require the learner to **recall** the finite automata, regular expressions and **show** the steps for the conversion of RE to FA.	CO 3
16	Compare compiler and interpreter.	Understand	**Recall** components of a language processing system for the **convert** high level languages to machine level languages.	CO 1
17	Explain the properties of strings and languages.	Understand	This would require the learner to **recall** the finite automata and **write** about strings and languages.	CO 3
18	Compare lexical analyzer and syntax analyzer.	Understand	This would require the learner to **recall** the various phases of compiler and **discuss** the lexical and syntax analyzers.	CO 2
19	Explain the reasons for separating scanner from parser.	Understand	This would require the learner to **recall** the various phases of compiler and **discuss** the scanner, parser	CO 2

20	Compare the pass and phase in compiler construction?	Understand	This would require the learner to **recall** the different phases of compiler **classify** the cousins of compiler	CO 2
PART - C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)				

1	Consider the following fragment of C code:
	float i, j;
	i = i*70+j+2;
	Construct the output at all phases of the compiler for above „C" code?
		Apply	This would require the learner to **recall** the various phases of compiler and **explain** the task of each phase and **apply** the concepts for the conversion of the input of each phase for given expression.	CO 2

2	Describe the languages denoted by the following regular expressions. i. (0+1)*0(0+1)(0+1) ii. 0*10*10*10*	Understand	This would require the learner to **recall** regular expressions and **explain** the languages for given expression.	CO 3
3	Explain how LEX program perform lexical analysis to identify Identifiers, Comments, Numerical constants, Keywords, Arithmetic operators?	Understand	This would require the learner to **recall** software tool such LEX to **demonstrate** a complete compiler.	CO 3
4	For the following expression total = count + rate * 5 Construct the output after each phase of compiler?	Apply	This would require the learner to **recall** the various phases of compiler and **explain** the task of each phase and **apply** the concepts for the conversion of the input of each phase for given expression.	CO 2
5	Convert Regular Expression (b+aa)*a* to Finite Automata.	Understand	This would require the learner to **recall** the finite automata, regular expressions and **show** the steps for the conversion of RE to FA.	CO 3
6	Explain the DFA that will accept those words from ∑= {a, b} where the number of a's is divisible by two and the number of b's is divisible by three. Sketch the transition table of the finite automata	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the writing DFA.	CO 3
7	Convert Regular Expression (11+0)*(00+1)* to NFA.	Understand	This would require the learner to **recall** the finite automata, regular expressions and **show** the steps for the conversion of RE to FA.	CO 3
8	Convert the following NFA to DFA, as shown in fig. below 	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA to DFA.	CO 3
9	Convert NFA with ε to NFA for the following regular expression a*b*.	Understand	This would require the learner to **recall** the finite automata and **show** the steps for the conversion of NFA with ε to NFA.	CO 3

10	Explain Regular Expressions and outline the transition diagrams for different programming constructs like identifier, number, relation operators. .	Understand	This would require the learner to **recall** the finite automata, regular Expressions, recognition of tokens and **write** the RE, transition diagrams for programming constructs.	CO 3
MODULE-II				
SYNTAX ANALYSIS				
PART - A (SHORT ANSWER QUESTIONS)				
1	Define about FIRST and state its rules?	Remember	---	CO 4
2	Define about FOLLOW and state its rules?	Remember	---	CO 4
3	Define LR(0) items in bottom up parsing?	Remember	---	CO 5
4	What LR(k) parsing stands for?	Remember	---	CO 5
5	List types of bottom up parsing techniques?	Remember	---	CO 5
6	Define goto function and closure function in LR parser?	Remember	---	CO 5
7	Why SLR and LALR are more economical to construct Canonical LR?	Remember	---	CO 5
8	Tell about handle pruning?	Remember	---	CO 5
9	What are error recovery types?	Remember	---	CO 5
10	List down the conflicts during shift-reduce parsing.	Remember	---	CO 5
11	List out the types LR(0) and LR(1) parsers?	Remember	---	CO 5
12	Describe about shift reduce parsing?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** basic idea of shift reduce parsing.	CO 5
13	Define YACC parser?	Remember	---	CO 6
14	Compare CLR and LALR?	Understand	This would require the learner to **recall** bottom up parsing technique and **compare** between two bottom up parsing techniques CLR and LALR	CO 5
15	Define an augmented grammar?	Remember	---	CO 4
16	Define shift action?	Remember	---	CO 5
17	Define Reduce action?	Remember	---	CO 5
18	Is left recursion elimination is required in bottom up parsing ?justify.	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the left recursion and then justify whether left recursion elimination is required for bottom up parsing or not.	CO 5
19	List out differences between LL and LR parsers?	Remember	---	CO 5

20	List out the operations of shift reduce parsing?	Remember	---	CO 5
PART - B (LONG ANSWER QUESTIONS)				
1	List the FIRST and FOLLOW sets for following grammar? S → ACB / CbB / Ba A → da / BC B → g / ∈ C → h / ∈	Remember	---	CO 4
2	Explain the common conflicts that can be encountered in a shift-reduce parser?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the common conflicts encountered in shift reduce parser and also explain the conflicts with suitable grammar.	CO 5
3	Explain handle pruning in detail with example?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the term handle pruning with example grammar	CO 5
4	Consider the grammar E → E + E | E *E | (E) | id Show the sequence of moves made by the shift-reduce parser on the input (id1+id2)*id3 and determine whether the given string is accepted by the parser or not?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the acceptance of the string.	CO 5
5	Explain the role of stack in shift reduce parsing method?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** role of stake in shift reduce parsing method.	CO 5
6	Explain YACC-automatic parser generator.	Understand	This would require the learner to **recall** context free grammar and **explain** how CFG is represented in YACC	CO 6
7	State the difference between SLR,CLR and LALR parsers in detail?	Remember	---	CO 5
8	Explain briefly about panic mode and phrase level error recovery techniques?	Remember	---	CO 5
9	Explain how to handle the error in ambiguous grammar with example?	Understand	This would require the learner to **recall** context free grammar and **explain** how to handle error in ambiguous grammar with example grammar.	CO 4
10	Outline the LR Parsing model and write the LR parsing algorithm for constructing the parsing table?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the components in the LR parsing diagram.	CO 5
11	Consider the grammar, P→ E E → E+T E→T T→ id(E) T→id	Remember	---	CO 5

	And, state whether the following grammar is LR(0) or not?			
12	Write shift reduce parsing algorithm and show shift and reduce moves with an example?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the shift reduce parsing method.	CO 5
13	Explain the following terms i) Canonical collection of items ii) Augmented Grammar iii) Closure and go to Operation	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** operations performed on LR parsing techniques such as Augmented grammar, closure and goto operations along with LR(0) items.	CO 5
14	Consider the grammar P→ E E → E+T E→ T T→id (E) T→ id And, State whether the following grammar is SLR(1) or not?	Remember	---	CO 5
15	Outline the CLR Parsing model and write the CLR parsing algorithm for constructing the parsing table?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the steps in algorithm for the construction of CLR parsing table	CO 5
16	Explain the SLR(1) parsing table for the following grammar S→ Aa | bAc|dc|bd A→d	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the steps in algorithm for the construction of SLR parsing table	CO 5
17	Compare LR parsers in detail?	Understand	This would require the learner to **recall** bottom up parsing technique and **compare** the LR parsing methods.	CO 5
18	Consider the grammar S→ AS| b A → SA | a Explain the collection of sets of LR(0) items for this grammar?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the steps in algorithm for writing the LR items	CO 5
19	Show that the following grammar S→ AaAb | BbBa A→∈ B→∈ is SLR(1) or not?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the steps in algorithm for the construction of SLR parsing table and specify is SLR or not.	CO 5
20	Consider the grammar bexpr→bexpr or bterm | btermbterm→bterm and bfactor | bfactor bfactor→notbfactor | (bexpr) |true | false. Explain whether the grammar is CLR or not?	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the procedure to check the grammar is CLR or not.	CO 5
PART - C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)				
1	Consider the grammar given below. E → E+T | T T → T*F | F F→ (E) | id. construct LR parsing table for the above	Apply	This would require the learner to **recall** the LR(0) grammar and LR(1) grammar, and **demonstrate** the rules for	CO 5

	grammar .Give the moves of LR parser on id * id + id?		given grammar and to **construct** the LR parsing table	
2	Identify whether the following grammar is LR(0) with reasons? S → xAy | xBy | xAz A → as | q B → q	Understand	This would require the learner to **recall** the LR(0) grammar and **demonstrate** the rules for given grammar and find out the grammar is LR(0) or not with specific reasons.	CO 5
3	Construct CLR parsing table for the below grammar? S→ Aa | aAc | Bc |bBa A→d B →d	Apply	This would require the learner to **recall** the CLR parsing method and **demonstrate** the rules for given grammar and to **construct** the CLR parsing table	CO 5
4	Identify whether the following grammar is SLR or not with reasons. S→ L = R S→ R L→ * R L→ id R → L.	Understand	This would require the learner to **recall** the LR(0) grammar and **demonstrate** the rules for given grammar and find out the grammar is SLR or not with specific reasons.	CO 5
5	Identify whether the following grammar is CLR or not with reasons? S→ AA A →aA | b	Understand	This would require the learner to **recall** the LR(1) grammar and **demonstrate** the rules for given grammar and find out the grammar is CLR(1) or not with specific reasons.	CO 5
6	Construct SLR parsing table for the below grammar? E → E+T |T T → T*F | F F→ (E) |id.	Apply	This would require the learner to **recall** the LR(0) grammar and **demonstrate** the rules for given grammar and to **construct** the SLR parsing table.	CO 5
7	The following grammar for if-then-else statements is proposed to remedy the dangling-else ambiguity: Stmt → **if** Expr**then** Stmt | **if** Expr**then** Stmt**else** Stmt | **other** Show that how shift and reduce conflicts can be handled in ambiguous grammar.	Understand	This would require the learner to **recall** bottom up parsing technique and **explain** the procedure to handle the ambiguous grammar.	CO 5
8	Construct LALR (1) Parsing table for following grammar? S → Aa |aAc | Bc | bBa A →d B →d	Apply	This would require the learner to **recall** the LR(1) grammar and **demonstrate** the rules for given grammar and to **construct** the LALR parsing table	CO 4
9	Consider the grammar S→ aSbS | bSaS|∈ a) Construct the corresponding leftmost derivation and rightmost derivation For aba b) Construct the corresponding parse trees for abab and identify whether the grammar is ambiguous or not.	Apply	This would require the learner to **recall** context free grammars and **explain** the procedure to **construct** derivations.	CO 5
10	Construct the FIRST and FOLLOW sets for following grammar? S→ aBDh B → cC C → bC / ∈	Apply	This would require the learner to **recall** the top down parsing methods and **demonstrate** the rules for given grammar	CO 4

	$D \rightarrow EF$ $E \rightarrow g / \in$ $F \rightarrow f / \in$		and to **construct** the FIRST and FOLLOW.	
MODULE-III				
SYNTAX-DIRECTED TRANSLATION AND INTERMEDIATE CODE GENERATION				
PART - A (SHORT ANSWER QUESTIONS)				
1	What is the usage of syntax directed definition?	Remember	---	CO 7
2	Define Attribute Grammar?	Remember	---	CO 7
3	List the types of Attribute Grammar?	Remember	---	CO 7
4	Explain syntax directed translation?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the translations.	CO 7
5	Compare synthesized and inherited attributes?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the synthesized and inherited attributes.	CO 7
6	Define L attributed grammar?	Remember	---	CO 7
7	Define S attribute grammar?	Remember	---	CO 7
8	show the Syntax tree for Expression using functions? (a + b) * (b - c)	Remember	---	CO 7
9	Explain the functions to create nodes of Syntax tree for expression?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the nodes of Syntax tree.	CO 7
10	Define syntax tree? Draw the syntax tree for the assignment statement? a :=b * -c + b * -c.	Remember	---	CO 7
CIE-II				
11	Define Translation schemes?	Remember	---	CO 8
12	Define Annotated Parse Tree?	Remember	---	CO 8
13	Explain the three kinds of intermediate representation?	Understand	This would require the learner to **recall** Intermediate Code Generation and **explain** the intermediate forms	CO 8
14	What are the benefits of using machine-independent intermediate form?	Remember	---	CO 8
15	What is postfix notation?	Remember	---	CO 8
16	How can you generate three-address code?	Remember	---	CO 8
17	Translate x+y-(a*b)+c into three address code?	Understand	This would require the learner to **recall** Intermediate Code Generation and **convert** to the three address code form.	CO 8
18	Discuss back-end and front-end?	Understand	This would require the learner to **recall** phases of a compiler and explain the back-end and front-end.	CO 8

19	Define abstract syntax tree?	Remember	---	CO 8
20	List out types of three address code?	Remember	---	CO 8
PART – B (LONG ANSWER QUESTIONS)				
1	Explain briefly about syntax directed definition and it types?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the types of SDD	CO 7
2	Explain briefly about Synthesized and Inherited attribute in detail?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the attributes.	CO 7
3	Define translation scheme and write for a<b or b>c?	Remember	---	CO 7
4	Explain briefly about S-attributed and L-attributed grammar in detail?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the attributes.	CO 7
5	Explain how declaration is done in a procedure using syntax directed translation?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the SDT for procedure.	CO 7
6	Explain briefly about postfix Translation Scheme?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the postfix Translation Scheme	CO 7
7	Describe the method of generating syntax directed definition for control Statements?	Remember	---	CO 7
8	Show SDT for the simple assignment statement with example?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the SDT for simple assignment statement	CO 7
9	Explain the construction steps and construct the syntax tree for expression using functions? (m * n + p) + (m – n + p)?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the types of three address code.	CO 7
10	Explain briefly syntax directed translation into three address code with suitable example?	Understand	This would require the learner to **recall** Syntax-Directed Translation and **explain** the conversion of SDT to three address code.	CO 7
CIE-II				
11	Explain three address codes and mention its types. How would you implement the three address statements? Explain with suitable examples?	Understand	This would require the learner to **recall** Intermediate Code Generation and **explain** the three address code forms.	CO 8
12	Explain with an example to generate the intermediate code for the flow of control statements?	Understand	This would require the learner to **recall** Intermediate Code Generation and **explain** the generation of intermediate code for the flow of control statements.	CO 8
13	Explain about Quadruple and Triple with its structure?	Understand	This would require the learner to **recall** Intermediate Code Generation and **explain** the quadruple and triple.	CO 8

14	Define and represent the Triple, indirect triple and quadruple for the assignment statement? x:= -b + d * -b+d	Remember	---	CO 8
15	Translate the arithmetic expression a* -(b+c) into a) A syntax tree b) Postfix notation	Understand	This would require the learner to **recall** Intermediate Code Generation and **explain** the arithmetic expression translation into syntax tree & Postfix notation .	CO 8
16	Translate the expression – (a + b) * (c + d) + (a + b +c) into a) quadruples b) triples	Understand	This would require the learner to **recall** Intermediate Code Generation and **explain** the arithmetic expression translation into triple, indirect triple and quadruple.	CO 8
17	Show translation scheme for Boolean Expressions with example?	Understand	This would require the learner to **recall** Intermediate Code Generation and **explain** the Boolean Expression translation scheme.	CO 8
18	Show translation scheme for Control Flow with example?	Understand	This would require the learner to **recall** Intermediate Code Generation and **explain** the Control Flow.	CO 8
19	Translate the expression – (a + b) * (c + d) + (a + b +c) into a) triples b) indirect triples.	Understand	This would require the learner to **recall** Intermediate Code Generation and **explain** the arithmetic expression translation into triple, indirect triple.	CO 8
20	Explain the three address code and draw the abstract tree for the following expressions? (a-b)*c+m-n	Understand	This would require the **recall** Intermediate Code Generation and **explain** the three address code.	CO 8
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)				
1	Construct production rules and semantic actions for S-attributed grammar for the following grammar along with syntax tree and annotated parse tree for the given string a*b-c/d+e? L→E E→ E+T | E-T | T T→ T*F | T/F |F F→ P-F | P P→(E) P→ID	Apply	This would require the learner to **recall** Syntax-Directed Translation and **explain** the rules for the conversions and **Construct** the S-attributed grammar.	CO 7
2	Construct production rules and semantic actions for the following grammar along with annotated parse tree for the string 9-5+4? expr→ expr + term | expr – term | term term→0|1|2|3|4|5|6|7|8|9	Apply	This would require the learner to **recall** Syntax-Directed Translation and **explain** the rules for the conversions and **Construct** the parse tree.	CO 7
3	Construct production rules and semantic actions for the following grammar along with annotated parse tree for the expression: “int a, b, c”? D →T L T →int T → float; L→ L1,id L → id	Apply	This would require the learner to **recall** Syntax-Directed Translation and **explain** the rules for the conversions and **Construct** the parse tree.	CO 7

4	Construct production rules and semantic actions for the following grammar along with annotated parse tree for the string (3+4)*(5+6)? L→E E→ T E→E1+T T→ F T→ T1*F F→ (E) F→ digit	Apply	This would require the learner to **recall** Syntax-Directed Translation and **explain** the rules for the conversions and **Construct** the parse tree.	CO 7
5	Construct production rules and semantic actions for the following grammar along with annotated parse tree for the string a-4+c? E→E1+T E→E1-T E→T T→(E) T→id T→ num	Apply	This would require the learner to **recall** Syntax-Directed Translation and **explain** the rules for the conversions and **Construct** the parse treeo-.	CO 7
CIE-II				
6	Construct the three address code and draw the abstract tree for the following expressions? a) (x-y)*z+m-n b) a+(b-c)+(b+c)*(a*e)	Apply	This would require the **recall** Intermediate Code Generation and **explain** the concepts to **construct** the three address code.	CO 8

7	Construct the three-address code for the following C program fragment?
	while(a > b)
	{
	if (c < d) x = y +z;
	else
	x = y -z;
	}
		Apply	This would require the **recall** Intermediate Code Generation and **explain** the concepts to **construct** the three address code.	CO 8

8	Construct triples, Indirect and quadruples of an expression: a = b * - c + b * - c?	Apply	This would require the **recall** Intermediate Code Generation and **explain** the concepts to **construct** the .triples, Indirect and quadruples.	CO 8
9	Construct triples, Indirect and quadruples of an expression : x = (a + b)* - c/d?	Apply	This would require the **recall** Intermediate Code Generation and **explain** the concepts to **construct** triples, Indirect and quadruples.	CO 8
10	Why are quadruples preferred over triples in an optimizing compiler with example?	Remember	---	CO 8
MODULE-IV				
TYPE CHECKING AND RUN TIME ENVIRONMENT				
PART – A (SHORT ANSWER QUESTIONS)				
1	List different data structures used for symbol table?	Remember	---	CO 10
2	Define Type checking?	Remember	---	CO 9
3	List the different types of type checking?	Remember	---	CO 9
4	Define Type Expression?	Remember	---	CO 9
5	Explain about the type systems?	Understand	This would require the learner to **recall** type checking and **explain** the type systems	CO 9

6	Show the Translation scheme for checking the type of Assignment statement S→id:=E	Remember	---	CO 9
7	Explain Dynamic type checking?	Understand	This would require the learner to **recall** type checking and **explain** the Dynamic type checking	CO 9
8	Define Structural Equivalence?	Remember	---	CO 9
9	What is the Strongly typed language?	Remember	---	CO 9
10	Define Type error?	Remember	---	CO 9
11	Write a short note on static type checking?	Understand	This would require the learner to **recall** type checking and **explain** the static type checking	
12	Show the Translation scheme for checking the type of Conditional statement - S→if E then S1	Remember	---	CO 9
13	Show the Translation scheme for checking the type of while statement - S→While E do S1	Remember	---	CO 9
14	Define Type conversion?	Remember	---	CO 9
15	List the types of type conversion?	Remember	---	CO 9
16	Write about general activation record?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the general activation record.	CO 10
17	Define Symbol table?	Remember	---	CO 10
18	Define Dynamic storage allocation?	Remember	---	CO 10
19	Write short note on procedures?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the procedures	CO 10
20	Define Activation tree?	Remember	---	CO 10
21	Define stack storage allocation?	Remember	---	CO 10
22	Define static storage allocation?	Remember	---	CO 10
23	Define heap storage allocation?	Remember	---	CO 10
24	Write a short note on parameter passing?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the parameter passing	CO 10
25	Define Control stack?	Remember	---	CO 10
PART – B (LONG ANSWER QUESTIONS)				
1	Explain the specification of a simple type checker	Understand	This would require the learner to **recall** type checking and **explain** the specification of a simple type checker	CO 9
2	Define a type expression? Explain the equivalence of type expressions with an appropriate example?	Remember	---	CO 9
3	Explain about reusing the storage space for names?	Understand	This would require the learner to **recall** Run Time	CO 10

			Environment and **explain** the procedure for using storage space efficiently.	
4	Discuss about all allocation strategies in run-time storage environment?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the allocation strategies.	CO 10
5	Explain the data structures used for implementing Symbol Table?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the Symbol Table implementation	CO 10
6	Explain Static and Dynamic Checking of types with examples?	Understand	This would require the learner to **recall** type checking and **explain** the Static and Dynamic Checking	CO 9
7	Compare the call by value and call by name with examples?	Understand	This would require the learner to **recall** Run Time Environment and **compare** the call by value and by name	CO 10
8	Distinguish between static and dynamic storage allocation?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the Static and Dynamic storage allocation	CO 10
9	Explain the type checking of expressions?	Understand	This would require the learner to **recall** type checking and **explain** the procedure for expressions	CO 9
10	Explain storage organization in runtime environment?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the storage organization	CO 10
11	Explain the types of storage allocations?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the storage allocations types	CO 10
12	Describe the name and structure equivalence in type expressions?	Understand	This would require the learner to **recall** type checking and **explain** the name and structure equivalence in type expressions	CO 9
13	Explain the type checking of control flow statements?	Understand	This would require the learner to **recall** type checking and **explain** the steps for control flow statements	CO 9
14	Explain briefly about storage allocation strategies?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the storage allocations strategies	CO 10
15	Describe the basic implementation techniques for symbol table?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the symbol table implementation	CO 10
16	Explain the calling sequences of activation record?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the calling sequences.	CO 10

17	Differentiate ordered, unordered and binary search tree in symbol table?	Understand	This would require the learner to the **recall** Run Time Environment and **explain** binary search tree in symbol table	CO 10
18	Explain briefly about static storage allocation with block diagram?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the static storage allocation	CO 10
19	Differentiate explicit and implicit allocation of memory to variables?	Understand	This would require the learner to **recall** Run Time Environment and **compare** the allocation types of memory to variables	CO 10
20	Differentiate stack and heap storage allocation strategies?	Understand	This would require the learner to **recall** Run Time Environment and **explain** the stack and heap storage allocation strategies.	CO 10
PART – C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)				
1	Suppose that the type of each identifier is a sub range of integers, for expressions with operators +, -, *, div and mod, as in Pascal. Explain type- checking rules that assign to each sub expression the sub range its value must lie in?	Understand	This would require the learner to **recall** type checking **explain** how type checking rules implemented for each type of identifier	CO 9
2	Explain briefly about Source language issues?	Understand	This would require the learner to **recall** type checking **explain** about Source language issues	CO 9
3	Explain briefly about Activation record with block diagram?	Understand	This would require the learner to **recall** run time environment **explain** the Activation record with block diagram	CO 10
4	Discuss about variable length data on stack with neat diagram?	Understand	This would require the learner to **recall** run time environment **explain** the variable length data on stack	CO 10
5	Explain briefly about heap storage allocation with block diagram?	Understand	This would require the learner to **recall** run time environment **explain** the heap storage allocation	CO 10
6	Explain briefly about stack storage allocation with block diagram?	Understand	This would require the learner to **recall** run time environment **explain** the stack storage allocation	CO 10
7	Explain briefly about language facilities for dynamic storage allocation?	Understand	This would require the learner to **recall** run time environment **explain** the language facilities for dynamic storage allocation	CO 10
8	Describe the parameter passing methods with examples?	Understand	This would require the learner to **recall** run time environment **explain** the various parameter passing methods.	CO 10

9	Explain Over loading of Operators & Functions with examples?	Understand	This would require the learner to **recall** run time environment **explain** the Over loading of Operators & Functions	CO 10
10	Differentiate the call by reference and call by copy restore with examples?	Understand	This would require the learner to **recall** run time environment **explain** the call by reference and call by copy restore.	CO 10
MODULE-V				
CODE OPTIMIZATION AND CODE GENERATION				
PART - A (SHORT ANSWER QUESTIONS)				
1	List the principle sources of optimization?	Remember	---	CO 11
2	Define the 3 areas of code optimization?	Remember	---	CO 11
3	Explain the techniques used for loop optimization and Reduction in strength?	Understand	This would require the learner to **recall** code optimization and **Explain** the loop optimization methods.	CO 11
4	Define constant folding?	Remember	---	CO 11
5	Define Common Sub expressions?	Remember	---	CO 11
6	Explain Dead Code?	Understand	This would require the learner to **recall** code optimization and **Explain** the concept of dead code.	CO 11
7	Define local optimization?	Remember	---	CO 11
8	What is Register allocation and assignment?	Remember	---	CO 12
9	Define flow graph and basic block?	Remember	---	CO 11
10	Explain about inner loops?	Understand	This would require the learner to **recall** code optimization and **Explain** the flow graph representation to find the inner loops.	CO 11
11	Define a DAG? Mention its Remember?	Remember	---	CO 12
12	Define peephole optimization?	Remember	---	CO 12
13	Define the machine instructions for operations and copy statement?	Remember	---	CO 11
14	Explain global data flow?	Understand	This would require the learner to **recall** code optimization and **Explain** the global data flow.	CO 12
15	Explain about live variable analysis?	Understand	This would require the learner to **recall** code optimization and **Explain** the live variable analysis.	CO 11
16	Define the term copy propagation?	Remember	---	CO 11
17	Define the term Code motion?	Remember	---	CO 11
18	What is induction variable?	Remember	---	CO 11

19	How do you calculate the cost of an instruction?	Remember	---	CO 11
20	What is the Unreachable Code?	Remember	---	CO 11
PART - B (LONG ANSWER QUESTIONS)				
1	Explain the concept of Function-Preserving Transformations?	Understand	This would require the learner to **recall** code optimization and **Explain** the transformations.	CO 11
2	Explain Machine dependent code optimization in detail with an example?	Understand	This would require the learner to **recall** code optimization and **Explain** the Machine dependent code optimization.	CO 12
3	Write about target code forms and Explain how the instruction forms effect the computation time?	Understand	This would require the learner to **recall** code optimization and **Explain** the how the instruction forms effect the computation time	CO 11
4	Explain about machine dependent and machine independent optimization?	Understand	This would require the learner to **recall** code optimization and **Explain** the machine dependent and machine independent optimization	CO 11
5	Explain the role of code generator in a compiler?	Understand	This would require the learner to **recall** code generation and **explain** the code generator in a compiler.	CO 12
6	Explain in detail the issues in the design of code generator?	Understand	This would require the learner to **recall** code generation and **explain** the issues in the design of code generator	CO 12
7	Explain the instructions and address modes of the target machine?	Understand	This would require the learner to **recall** code generation and **explain** the instructions and address modes of the target machine	CO 12
8	Explain the principle sources of code optimization in detail?	Understand	This would require the learner to **recall** code optimization and **Explain** the sources of code optimization	CO 11
9	Explain the primary structure preserving transformations on basic blocks?	Understand	This would require the learner to **recall** code optimization and **Explain** the structure preserving transformations	CO 11
10	Explain peephole optimization in detail?	Understand	This would require the learner to **recall** code optimization and **Explain** the peephole optimization	CO 12
11	Define the following i. Copy propagation **ii.** Dead code elimination	Remember	---	CO 11
12	Explain in the DAG representation of the basic block with example?	Understand	This would require the learner to **recall** DAG and **Explain** the representation of the basic blocks	CO 12
13	Explain loop optimization in detail with example?	Understand	This would require the learner to **recall** code optimization and **Explain** the loop optimizations	CO 11

14	Explain various Global optimization techniques in detail?	Understand	This would require the learner to **recall** code optimization and **Explain** the global optimizations	CO 11
15	Explain Loops in flow graph in detail with example?	Understand	This would require the learner to **recall** code optimization and **Explain** the flow graphs	CO 11
16	Explain Local optimization in detail with example?	Understand	This would require the learner to **recall** code optimization and **Explain** the local optimization	CO 11
17	Explain Redundant-instructions elimination and Flow-of-control Optimizations?	Understand	This would require the learner to **recall** code optimization and **Explain** optimizations.	CO 11
18	Explain the simple code generator with a suitable example?	Understand	This would require the learner to **recall** code generation and **explain** the simple example for code generator.	CO 12
19	Explain the procedure to detect induction variable and dead code elimination with example?	Understand	This would require the learner to **recall** code optimization and **Explain** optimizations.	CO 11
20	Explain briefly about register allocation and assignment?	Understand	This would require the learner to **recall** code generation and **explain** the register allocation.	CO 12
PART – C (PROBLEM SOLVING AND CRITICAL THINKING)				
1	Construct the code sequence generated by the simple code generation algorithm for x*y+(m-k)-(g+b)	Apply	This would require the learner to **recall** code generation and **explain** the procedure to **Construct** the code sequence.	CO 12

2	Construct target code for the given program segments:
	main()
	{
	int i=4,j; j = i + 5;
	}
		Apply	This would require the learner to **recall** code generation and **explain** the procedure to **Construct** the target code.	CO 12

3	Consider the following basic block of 3-address instructions .Construct target code for the source language statement and finds its cost. a := b + c x := a + b b := a – d c := b + c d := a –d y := a – d	Apply	This would require the learner to **recall** code generation and **explain** the procedure to **Construct** the target code.	CO 12
4	Identify the register descriptor target code for the source language Statement and its cost. (a-b) + (a-c) + (a-c)	Apply	This would require the learner to **recall** code generation and **explain** the procedure to **Construct** the target code.	CO 12

5	Consider the following part of code.
	int main()
	{
	intn,k=0; scanf("%d",&n);
	for(i=2;i<n;i++)
	{
	if(n%I),==0)break;
	} k=1;
	if(i==n)
	printf("number is prime");
		Apply	This would require the learner to **recall** code generation and **explain** the procedure to **Construct** the basic blocks.	CO 12

	else
	printf("number is not printed");
	}
	Identify the basic block in the given program			

6	Construct the DAG for the following basic block.
	D:=B*C
	E:=A+B
	B:=B+C
	A:=E-D
		Apply	This would require the learner to **recall** code generation and **explain** the procedure to **Construct** the DAG.	CO 12

7	Construct basic block for following code
	void quicksort(m, n)
	int m, n;
	{
	int i, j;
	if (n <= m)
	return; /* fragment begins here */
	i = m-1;
	j = n;
	v = a[n]; while(1)
	{
	do
	i = i+1;
	while(a[i] < v);
	do
	j = j-1;
	while(a[j] > v); if(i >= j)
	break;
	x = a[i];
	a[i] = a[j]; a[j] =x;
	}
	x = a[i]; a[i] = a[n];
	a[n]= x; /* fragment ends here */
	quicksort(m, j);
	quicksort(i+1, n);
	}.
		Apply	This would require the learner to **recall** code generation and **explain** the procedure to **Construct** the basic blocks.	CO 12

8	Construct DAG and explain the procedure for the conversion. a+b*(a+b)+c+d	Apply	This would require the learner to **recall** code generation and **explain** the procedure to **Construct** the DAG.	CO 12
9	Explain role of DAG representation in optimization with example?	Understand	This would require the learner to **recall** code generation and **explain** the DAG and its role in optimization.	CO 12

10	Construct the basic block and flow graph for the following code
	begin
	prod :=0; i:=1;
	do begin
	prod :=prod+ a[i] * b[i];
	i :=i+1;
	end
	while i <= 20 end
		Apply	This would require the learner to **recall** code generation and **explain** the procedure to **Construct** the basic blocks.	CO 12

11	Construct optimal machine code for the following C program. main()
	{
	inti,a[10]; while(i<=10)
	a[i]=0;
	}
		Apply	This would require the learner to **recall** code generation and **explain** the procedure to **Construct** the optimal machine code.	CO 12

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