4. (a) Construct quadruples, triples and Indirect triples for the following expression "a + a* (b – c) + (b – c)* d". (CO4)

   (b) Explain Backpatching with an example. Write Annotated parse tree for a simple Boolean expression. (CO4)

   (c) What is peephole optimization ? Explain machine independent and machine dependent code optimization techniques with an example. (CO4)

5. (a) Explain the various design issues in code generation with a suitable example. (CO5)

   (b) What do you mean by DAG ? Construct DAG for the following three address codes :

   (i) a = b + c
   (ii) t1 = a × a
   (iii) b = t1 + a
   (iv) c = t1 × b
   (v) t2 = c + b
   (vi) a = t2 + t2

   (c) Write a YACC/LEX program for Desk Calculator. (CO5)

H Roll No. .....

TCS-601

B. TECH. (CS) (SIXTH SEMESTER) END SEMESTER EXAMINATION, June, 2023

COMPILER DESIGN

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any ***two*** sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are **twenty**.

(iv) Each sub-question carries 10 marks.

1. (a) What do you understand by the phases of a Compiler ? Explain the action taken by every phase of compiler for the given source code to convert from high level to target code. (CO1)

a = x + y * z;

(b) Explain input buffering. Why do we need two buffer schemes over one buffer scheme ? Justify your answer by taking a suitable example. (CO1)

(c) Illustrate LEX structure. Design a LEX program to recognize the keywords, integer number, floating point number and valid identifier. (CO1)

2. (a) Consider the following grammar : (CO2)

$E \rightarrow E + T/T$

$T \rightarrow T * F/F$

$F \rightarrow (E)/a/b$

Construct the LL(1) parsing table for the above grammar.

(b) Explain the following grammars with an appropriate example by listing the problems associated with the following grammars. (CO2)

(i) Ambiguous grammar

(ii) Left recursive grammar

(iii) Left factoring/Non deterministic grammar

(c) Consider the following grammar : (CO2)

$S \rightarrow BB$

$B \rightarrow aB/b$

To check whether the given grammar is LR(0) or not.

3. (a) Write a short note on the S-attributed and L-attributed SDT with an appropriate example.

(b) What do you mean by SDT ? Consider the following SDT (Syntax-Directed Translation) schemes.

Productions	Semantic rules
$E \rightarrow E_1 + T$	{E. Val= E_1.Val+T.Val;}
$E \rightarrow T$	{E. Val = T. Val; }
$T \rightarrow T_1 * F$	{T. Val= T_1.Val+F.Val;}
$T \rightarrow F$	{T. Val = F. Val; }
$F \rightarrow$ num	{F. Val = num.lexVal; }

Using the above SDT, construct a parse tree for the expression : 2 + 3*4 and also compute the final value.

(c) Explain Control stack and Activation record with a suitable example. (CO3)