7. (a) What is the need of SYMTAB and Location Counter (LC) in an assembly process? (4)

(b) Consider the following context free grammar :

$S \rightarrow daAe$

$A \rightarrow daA \mid E$

$E \rightarrow EbP \mid P$

$P \rightarrow d \mid pAp$

Is the grammar SLR(1)? Justify your answer? (6)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1094 **C**

Unique Paper Code : 32347501

Name of the Paper : System Programming

Name of the Course : **B.Sc. (H) Computer Science**

Semester : V

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **four** questions from **Section B**.
4. Make and state necessary assumptions wherever applicable.

SECTION A

1. (a) Which phase of a compiler will generate error if a semicolon is missing in a C program. (1)

(b) Differentiate between pseudo opcodes "DB" and "RESB". (2)

(c) What is the purpose of "yytext" and "yyleng" variables in a Lex program? (2)

(d) Explain the structure of a Pseudo-opcode table in a two pass assembler. (2)

(e) Write regular expressions for the following languages:

(i) All strings of x's and y's where number of y's is a multiple of three and there can be any number of x's.

(ii) All Strings of letters that contain the five vowels in the order. (2+1)

(f) Write a Lex program to count the number of vowels and consonants in an input string. (3)

(g) Show whether the given grammar is ambiguous or not by parsing the string w = abababb

$E \rightarrow a \mid abEb \mid aFb$

$F \rightarrow bE \mid aFFb$ (3)

(h) Write three address-code for the following arithmetic expression :

$-(x * y) + (p + q) - (x + y)$ (3)

(b) Write a regular expression for a C language identifier and also draw its transition diagram. (5)

6. (a) Generate machine code for the following three address sequence :

```
if x < y goto L1
   z = 0
goto L2
L1: z = 1
```

Assuming that x, y, and z are in memory locations. (6)

(b) What is bottom-up parsing? Consider the following grammar:

$E \rightarrow E + T|T$

$T \rightarrow T * F|F$

$F \rightarrow (E)|id$

Draw the sequence of tree for the bottom-up parser of token stream

id * id + id (4)

(b) Consider the following Syntax Directed Definition:

Production	Semantic Rules
$D \rightarrow TL$	L.attr := T.type
$T \rightarrow int$	T.type := integer
$T \rightarrow float$	T.type := float
$L \rightarrow L_1, id$	L_1.attr := L.attr; addtype(id. entry, L.in)
$L \rightarrow id$	Addtye(id. entry, L.in)

Identify and write terminal and non-terminal symbols. List down the attributes associated with the grammar symbols and also classify them as synthesized and inherited. (5)

5. (a) Find the First and Follow set of all non-terminal for the following grammar : (5)

$S \rightarrow ES'$

$S' \rightarrow +ES' | \varepsilon$

$E \rightarrow AE'$

$E' \rightarrow * AE' | \varepsilon$

$A \rightarrow (S) | id$

(i) Identify and list the possible lexemes, tokens and their attribute values that would be identified by the lexical analyzer while scanning the code fragment.

```
if (x ≤ 20) then
    mid = 10;
else
    last = mid + gap;
```
(4)

(j) Translate the following arithmetic expression into Quadruples :

a[i] = b[i] + c[j] (4)

(k) Consider the following Syntax Directed Definition :

Production	Semantic Rules
$L \rightarrow En$	L.val = E. val
$E \rightarrow E_1 + T$	E.val = E_1. val + T.val
$E \rightarrow T$	E.val = T.val
$T \rightarrow T_1 * F$	T.val = Ti.val * F.val
$T \rightarrow F$	T.val = F. val
$F \rightarrow (E)$	F.val = E.val
$F \rightarrow digit$	F.val = digit, lexval

Construct the annotated parse tree for (1 + 2 * (3 + 4) + 5) * 6n. (4)

P.T.O.

(l) Determine and write the costs of the following instruction sequences :

LD R0, i

MUL R0, R0, 8

LD R1, a(R0)

ST b, R1 (4)

SECTION B

2. (a) Consider the following grammar :

$S \rightarrow aS|Ab$

$A \rightarrow XYZ|\varepsilon$

$X \rightarrow cS|\varepsilon$

$Y \rightarrow dS|\varepsilon$

$Z \rightarrow eS$ (4)

Give leftmost derivation of the string"aebb".

(b) Following are the section tables and symbol tables for two object files namely, filel.obj and file2.obj.

Using Pass 1 of linking process, populate the Combined Section Table and Public Definition Table.

Section Table of file1.obj

Name	Size	Align
.sec A	120	4
.sec B	50	16
.sec C	60	4

Symbol Table of file1.obj

Name	Location	Section-ID
L1	20	1
L2	35	3

Section Table of file2.obj

Name	Size	Align
.sec B	50	4
.sec C	70	16
.sec D	110	4

Symbol Table of file2.obj

Name	Location	Section-ID
L1	15	1
L2	85	3

(6)

3. (a) Consider the following grammar :

$E \rightarrow Ea|Ec|c$

Is the grammar LR(1)? Justify your answer. (7)

(b) What is the use of Machine Opcode Table (MOT) in an assembly process? Explain its structure. (3)

4. (a) Construct the Directed Acyclic Graph for the expression (5)

$$\Big((x+y)-\big((x+y)*(x-y)\big)\Big)+((x+y)*(x-y))$$