Exam No: _____

GANPAT UNIVERSITY

M. TECH SEM-III(COMPUTER ENGINEERING/INFORMATION TECHNOLOGY)

REGULAR EXAMINATION NOV-DEC 2016

3CE302/3IT302: COMPILER DESIGN

MAX. TIME: 3 HRS **MAX. MARKS: 60**

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.

SECTION: I

Q.1

A Discuss the action taken by every phase of compiler on the following instruction of source program while compilation. 6

position = initial + rate * 60

B Remove left recursion from the following grammar: 4

1. $A \rightarrow Ba \mid Bg \mid g$
   $B \rightarrow Ag$
2. $S \rightarrow ABC$
   $A \rightarrow Aa \mid d$
   $B \rightarrow Bb \mid e$
   $C \rightarrow Cc \mid f$

OR

Q. 1

A Answer the following: 6

1. Generate RE for the strings accept only strings which ends with either 00 or 11 over Σ {0, 1}.
2. Write a CFG for the R.E. 0*1(0+1)*.
3. Consider the following grammar and identify the type of grammar:
   $S \rightarrow abc \mid aAbc$
   $Ab \rightarrow bA$
   $Ac \rightarrow Bbcc$
   $bB \rightarrow Bb$
   $aB \rightarrow aa \mid aaA$

B Do as directed: 4

1. Eliminate useless symbol from the following grammar:
   $X \rightarrow YT \mid XZ$
   $Y \rightarrow zYXt \mid y$
   $Z \rightarrow yXZ \mid zZT$
   $T \rightarrow Zt \mid yx$
2. Eliminate Null production from the given grammar:
   $A \rightarrow 0B \mid 1E$
   $B \rightarrow 0A \mid 1F \mid \epsilon$
   $C \rightarrow 0C \mid 1A$
   $D \rightarrow 0A \mid 1D \mid \epsilon$
   $E \rightarrow 0C1A$
   $F \rightarrow 0A \mid 1B \mid \epsilon$

Q.2

A Answer the following: 4

1. Write the regular expression for the language of all the strings contains either ab or bbb over Σ {a, b}.
2. Design the CFG for the regular expression r = (a + b)* bb (a + b)*

B Define: Ambiguous grammar. Consider the following grammar: 3

bExp → bExp or bExp | bExp and bExp | not bExp | true | false

Check whether the given grammar is ambiguous or not? If grammar is ambiguous remove ambiguity.

C Consider the following grammar: 3

$S \rightarrow AB$
$A \rightarrow aAb \mid ab$
$B \rightarrow Bc \mid c$

Construct left most derivation, right most derivation and generate parse tree for the string "aabbcc".

OR

Q.2

A Do as directed: 6

a. Perform left factoring on following grammar:

1. $E \rightarrow eTt \mid eTtEs \mid e$
   $T \rightarrow t$
2. $S \rightarrow ccA \mid ccB \mid cc$
   $A \rightarrow cA \mid c$
   $B \rightarrow ccB \mid d$

b. Identify and eliminate unit production from given grammar:

$I \rightarrow a \mid b \mid Ia \mid Ib \mid I0 \mid I1$
$F \rightarrow I \mid (E)$
$T \rightarrow F \mid T * F$
$E \rightarrow T \mid E + T$

B Consider the following grammar: 4

$S \rightarrow ABe$
$A \rightarrow dB \mid aS \mid c$

1. Find FIRST and FOLLOW
2. Construct predictive parsing table
3. Check grammar is LL (1) or not?

Q.3

A 6

$S \rightarrow iEtSS' \mid a$
$S' \rightarrow eS \mid \epsilon$
$E \rightarrow b$

For the above grammar:

1. Find FIRST, FOLLOW and SELECT
2. Construct M-Table
3. Parse the string "ibtibtaea"

B 4

expr → term rest
rest → + term rest | - term rest | ϵ
term → 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

For the above grammar:

1. Find FIRST, FOLLOW and SELECT
2. Check given grammar is LL (1) or not?

SECTION: II

Q.4

A Consider the following grammar: 7

$R \rightarrow R + R \mid RR \mid R^* \mid (R) \mid a \mid b$

1. Construct LR (0) parsing table
2. Construct SLR (1) parsing table and check given grammar is SLR (1) or not? Justify your answer

B Define: Handle. Show the handle for the each step of paring a string "xyyzyzwv" 3

$X \rightarrow xYZv$

$Y \rightarrow Yyz \mid y$

$Z \rightarrow w$

OR

Q.4

A Construct the SLR (1) parsing table for the following grammar and parse the string "(v + v) * v #". 7

$S \rightarrow E\#$

$E \rightarrow TE'$

$E' \rightarrow +TE' \mid \epsilon$

$T \rightarrow FT'$

$T' \rightarrow *FT' \mid \epsilon$

$F \rightarrow (E) \mid v$

B Construct CLR (1) parsing table for the following grammar and parse the string "aaaab". 3

$S \rightarrow aAb \mid bB$

$A \rightarrow Aa \mid \epsilon$

$B \rightarrow Bb \mid \epsilon$

Q.5

A Construct CLR (1) parsing table for the following grammar and check whether given grammar is CLR (1) or not? Justify your answer. 6

$S \rightarrow aBc \mid bCc \mid aCd \mid bBd$

$B \rightarrow e$

$C \rightarrow e$

B Explain R-R conflict and S-R conflict for SLR (1) and CLR (1) with example. 4

OR

Q.5

A Construct CLR (1) parsing table for the following grammar and parse the string "(a, ((a, a), (a, a))". 6

$S \rightarrow (L) \mid a$

$L \rightarrow L , S \mid S$

B Explain linear list structure and hash table structure for the symbol table organization in detail with diagram. 4

Q.6

A What is operator grammar? Construct operator precedence paring table for the following grammar and parse the string "id + id * id" 5

$E \rightarrow E + E \mid E * E \mid (E) \mid id$

B Answer the following: 3

1. Generate three address code for the following code:

```
while (a < c and b > d) {
  if (a = 1) { c = c + 1; }
  else  a = a + 3;
```

2. Perform loop invariant on the following code:

```
while ( j < maximum - 1)
{ i = j + ( 4 + a[k] ) * pi + 5; }
```

C Name the error generates by lexical analyzer and syntax analyzer. 2

----------END OF PAPER----------