Duration:3 hours **Total Marks: 80**

N.B: (1) Question No. 1 is compulsory.
(2) Attempt any three questions out of remaining five questions.
(3) Make suitable assumptions wherever necessary.

Q.1. **a)** Define "System Programming". Differentiate between system software & application software. **[05]**

b) Explain in brief "forward reference problem". Explain how TII handles forward reference problem in single pass assembler. **[05]**

c) Explain conditional macro with suitable example. **[05]**

d) Compute FIRST and FOLLOW for the following grammar: **[05]**

$S \rightarrow Aa$
$A \rightarrow BD$
$B \rightarrow b|\varepsilon$
$D \rightarrow d|\varepsilon$

Q.2. **a)** Draw the flowchart of pass1 of assembler and explain its working with the databases. **[10]**

b) What are the different ways of Intermediate code representation? Explain with example. **[10]**

Q.3. **a)** Construct the necessary data structures after compiling the following code by Pass1 of two-pass macro processor: **[10]**

```
1.  MACRO
2.  COMPUTE   &x, &a, &p
3.  MOVER     &a, &x
4.  MULT      &a, ='4'
5.  MOVEM     &a, &p
6.  MEND
7.  MACRO     &g, &k, &r
8.  MOVER     &r, &k
9.  SUB       &r, ='4'
10. MEND
```

b) Construct LR(0) parsing table for the following grammar and Analyze the contents of stack and input buffer and action taken after each step while parsing the input string "abbcbcde": **[10]**

$S \rightarrow aCDe$
$C \rightarrow Cbc$
$C \rightarrow b$
$D \rightarrow d$

Q.4. **a)** State and explain the types of assembly language statements with examples. **[10]**

b) Discuss the databases used in direct linking loader. **[10]**

Q.5. **a)** Generate 3-address code for the following C program and construct flow graph with the help of basic blocks : **[10]**

```
i=1; j=1;x=5;
while(i<3)
{
    switch(i)   {
      case 1:   a[j++]=i+x;
                break;
      case 2:   a[j++]=i-x;
                break;     }
i++;
                }
```

b) What are the phases of compiler? Give working of each phase for the following statement: **[10]**

$$P = Q + R - S * 3$$

Q.6. **a)** Explain Dynamic Linking Loader in Detail. **[10]**

b) Explain different Code Optimization Techniques in detail. **[10]**

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