INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date .... FN / AN *Time:* 2/3 Hrs. *Full Marks* .... *No. of Students* ....
Autumn / Spring Semester, 20 .... Deptt. .... Sub No. ....
...... Yr. B. Tech.(Hons.) / B. Arch. / M. Sc. Sub. Name ....

Instructions : **Answer All (9) Questions.**

1. Name the Linux application program interfaces (APIs) for (i) process creation, (ii) to set an offset in a file for read/write, (iii) to duplicate a file descriptor, (iv) to load and execute an executable file, (v) to create a kernel thread, (vi) to send a signal to a process. [**3**]

2. Briefly explain a software interrupt. Linux on Pentium uses `int 0x80` to implement all its APIs. The command to `read()` from the STDIN, assigns three (3) to `%eax` and zero (0) to `%ebx`. Write assembly language code to read 80 bytes from the STDIN to a global array `n[80]`. [**5**]

3. Explain briefly why a global variable '`n`' cannot be used as a shared data between a parent process and its child process, but can be used as a shared data between two execution *threads* of a process. [**3**]

4. How does the memory image of one process can be protected from another process using the *base* and the *bound* (*limit*) registers? [**2**]

5. Explain briefly how a context-switching takes place on a timer interrupt. [**3**]

6. The Linux `sbrk(0)` call shows the current location of the program break. If it is `0x8049538`, what is the highest data memory address that can be accessed without any memory violation? There is no other sbrk() or brk() call. Give a brief explanation of your answer. [**2**]

7. How can a machine instruction like *exchange* ('`xchg`' in Pentium) be used to ensure mutual exclusion of critical sections of processes? [**3**]

8. Peterson's algorithm for mutual exclusion of critical sections for two processes starts as follows: `int flag[2] = {0, 0}, turn;`

```
/* Process0 */          /* Process 1 */
flag[0] = 1 ;           flag[1] = 1 ;
turn = 0 ;              turn = 1 ;
...............         ................
```

   What can be the problem if the first two statements are exchanged (in both the processes)? [**3**]

9. Write C program to implement Peterson's algorithm on Linux. The prototypes for shared memory APIs are the following [**6**]

```
int shmget(key_t key, int size, int shmflg);
void *shmat(int shmid, const void *shmaddr, int shmflg);
int shmdt(const void *shmaddr);
int shmctl(int shmid, int cmd, struct shmid_ds *buf);
```

Sig.of the Paper-Setter ....