BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: IMSc | **SEMESTER : VI/ADD**
BRANCH: MATHS | **SESSION : SP/2025**

SUBJECT: CS303 OPERATING SYSTEM

TIME: 02 Hours | **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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			CO	BL
Q.1(a)	Compare and contrast between multi-programmed batch systems and time-sharing systems.	[2]	CO1	2
Q.1(b)	What is the role of a long-term scheduler in OS? How does the selection of CPU-bound and I/O-bound processes by the long-term scheduler impact system performance? Provide an example scenario to support your answer.	[3]	CO2	2,3

Q.2(a) Consider the following four processes with arrival times (in ms) and their length of CPU burst (in ms) as shown below: [2] CO2 3

Processes	P1	P2	P3	P4
Arrival Time	0	1	3	4
Burst Time	3	1	3	Z

These processes are run on a single processor using preemptive Shortest Remaining Time First (SRTF) scheduling algorithm. If the average waiting time of the processes is 1 ms, then what is the value of Z?

Q.2(b) Illustrate the five-state process model with a detailed description on each of the process states. [3] CO1 4

Q.3(a) What is the return value of fork() for the child process and the parent process? [2] CO1 3
Consider the following C program is executed on a Linux system:

```
#include<unistd.h>
int main() {
  for (int i =0; i<12; i++) {
    if (i % 3 == 0) {
        fork();
    }
  }
return 0;
}
```

The total number of child processes created is ____________.

Q.3(b) Consider the following set of processes assumed to have arrived at time 0. Consider the CPU scheduling algorithms Shortest Job First (SJF) and Round Robin (RR). For RR assume that the processes are scheduled in the order P1, P2, P3 and P4 respectively. [3] CO2 3

Processes	P1	P2	P3	P4
Burst Time (in ms)	8	7	2	4

If the time quantum for RR is 4 ms, then the absolute value of the difference between the average turnaround times (in ms) of SJF and RR is ___________.

Q.4(a)	Explain the difference between push migration and pull migration in load balancing. How can load balancing negatively impact processor affinity?	[2]	CO2	2
Q.4(b)	Compare and contrast amongst the different relationships that can exist between the user and kernel threads. In what scenario would each model be most suitable?	[3]	CO1	2,4

PTO

Q.5(a)	What is race condition? Explain with the help of an example.	[2]	CO3	2
Q.5(b)	What are the three essential requirements that a solution to the critical-section problem must satisfy? Consider Peterson's algorithm for mutual exclusion between two concurrent processes i and j. The program executed is shown below:	[3]	CO3	4

```
repeat
  flag[i]=true;
  turn=j;
  while (P) do no operation;
  Enter critical section, perform actions, then exit critical section
  flag[i]=false;
  Perform other non-critical section actions.
Until false;
```

For the program to guarantee mutual exclusion, what should be the conditional statement in predicate P in the while loop?

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