UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	: REAL TIME SYSTEM APPLICATION
COURSE CODE	: BIE 33303
PROGRAMME	: 3 BIT
EXAMINATION DATE	: JUNE 2014
DURATION	: 3 HOURS
INSTRUCTION	: ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Explain the important of real-time system design process.

(2 marks)

(b) Specify **SIX (6)** requirements involved in real-time system design process.

(6 marks)

(c) Ali is building a real time system to monitor his farm. He already develop a real time application that is ready to be embedded into a raspberry pie platform.

Outline in **THREE (3)** step on how to integrate the hardware and software.

(6 marks)

(d) Design a basic model of a real time system for any application domain.

(4 marks)

(e) Explain characteristics of the diagram you have designed in **Q1(d)**.

(2 marks)

Q2 (a) *Temporal data* is a common term in the contact of real time database. Explain the term with **TWO (2)** examples.

(4 marks)

(b) Discuss why deadline time is important when designing real time system.

(2 marks)

(c) Given :

T1 = (3, 1, 7), T2 = (4, 1), and T3 = (6, 2, 4, 8)

Draw a network-flow graph that we can use to find a preemptive cyclic schedule of the periodic tasks.

(4 marks)

(d) Consider the 3 processes below. Assume that P1 has the highest priority follows by P2 and P3.

```
P1:: begin…lock(S1); lock(S3); unlock(S3); unlock(S1); end;
P2:: begin…lock(S3); lock(S2); unlock(S2); unlock(S3); end;
P3:: begin…lock(S2); lock(S1); unlock(S1); unlock(S2); end;
```

(i) Draw the priority ceiling protocol to prevent deadlock on P1, P2 and P3 execution.

(6 marks)

(ii) Compute the Worst Case Blocking Time for process P1, P2 and P3.

(4 marks)

Q3 Henry Hacker has implemented a real-time application with three critical common resources R1, R2 and R3 protected by mutual exclusion semaphores which can be accessed by three different processes P1, P2 and P3. The critical sections in the three processes are accessed through the following statements as shown in Figure Q3:

P1	P2	P3
Wait(R1);	Wait(R2);	Wait(R3);
Wait(R2);	Wait(R3);	Wait(R1);
// Using R1 and R2	// Using R2 and R3	//Using R1 and R3
Signal(R2);	Signal(R3);	Signal(R1);
Signal(R1);	Signal(R2);	Signal(R3);

Figure Q3

(a) Based on **Figure Q3**, determine if there is any problem in P1, P2 and P3.

(2 marks)

(b) State a possible solution to rectify **Q3(a)** problem (if any).

(2 marks)

(c) Suggest an implementation by rewriting P3 to avoid the problem in **Q3(a)**.

(6 marks)

(d) Outline **FOUR (4)** strategies that can be used to prevent issues in mutual exclusion.

(8 marks)

Q4 (a) Explain **THREE (3)** ways how hardware faults can be tolerated in a Real Time Applications (e.g. processor failures).

(6 marks)

(b) Discuss how fault-tolerance can be achieved in real-time task communication.

(6 marks)

(c) `A new nuclear plant has been constructed at Parit Raja to meet high electricity demand from factories in Johor.`

Provide a scheme to provide software fault-tolerance for the above time safety critical application.

(6 marks)

Q5 (a) Real-time systems have to interact with real world entities. These interactions can get fairly complex. Discuss **TWO (2)** important issues that you would consider in designing real time system.

(10 marks)

(b) Compare **TWO (2)** types of threads which are commonly available for performance measurement in real-time systems.

(10 marks)

(c) Discuss **TWO (2)** applications of commercial real-time systems.

(4 marks)

- END OF QUESTION -