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**Second Semester M.Tech. Degree Examination, June /July 2016**  
**Real Time Operating Systems**

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions.**

- 1
  - a. Write pseudocode for basic real time service using polling technique and event driven services. Provide necessary description. (08 Marks)
  - b. Describe the time line diagram of real time system. Represent changes in it if hardware acceleration is used. (08 Marks)
  - c. Write any four key features of RTOS. (04 Marks)
- 2
  - a. Describe isochronal, soft real-time, anytime service and soft isochronal real time services with necessary diagrams. (08 Marks)
  - b. With the help of pseudocode, explain thread safe reentrant codes. (08 Marks)
  - c. Discuss two algorithms for the determination of necessary and sufficient feasibility testing with RM policy. (04 Marks)
- 3
  - a. Derive an expression for RMLUB considering two services. (10 Marks)
  - b. Consider four services  $s_1, s_2, s_3$  and  $s_4$  with release time  $T_1 = 2, T_2 = 5, T_3 = 7, T_4 = 13$  ; having execution time  $c_1 = 1, c_2 = 1, c_3 = 1, c_4 = 2$ . Write timing diagram for RM policy and calculate individual service utility. Also draw timing diagram for EDF and LLF policies. (Assume  $\text{prio}(s_1) > \text{prio}(s_2) > \text{prio}(s_3) > \text{prio}(s_4)$  for fixed priority policy). (10 Marks)
- 4
  - a. Write the equations and conditions for WCET and ACET for hard and soft real time systems respectively. Also list five conditions for I/o overlap situations relative to  $S_i$  deadline  $D_i$ . (08 Marks)
  - b. Explain ECC memory design using Hamming code. Let  $(11000100)_2$  be a data byte. Find the encoded bit stream using Hamming code. Assuming a single bit error at position  $do_3$  of encoded bit stream ; detect and correct the error. (12 Marks)
- 5
  - a. Briefly describe the following :
    - i) Pipelining technique
    - ii) Physical memory hierarchy
    - iii) Deadlock and livelock. (12 Marks)
  - b. Describe unbounded priority inversion. Suggest solutions for it. (08 Marks)
- 6
  - a. Write short notes on :
    - i) Different levels of single step debugging (10 Marks)
    - ii) Exceptions and asserts. (06 Marks)
  - b. Describe three firmware components. (06 Marks)
  - c. Explain reentrant application libraries. (04 Marks)
- 7
  - a. Explain drilldown tuning. (08 Marks)
  - b. Explain message queue and heap based message que communication between tasks. (08 Marks)
  - c. List the basic methods for optimizing code segments. (04 Marks)
- 8
  - a. Discuss reliability with an example, compare reliability and availability. (10 Marks)
  - b. Consider an example of RTOS based digital clock and thermometer application using PIC microcontroller. With necessary pseudocode explain how multitasking is achieved in this application? (10 Marks)