(3 Hours) **[Total Marks: 80]**

N.B.: (1) Question No. 1 is **Compulsory**.
(2) Attempt any **three** questions out of the remaining **five**.
(3) Each question carries 20 marks and sub-question carry equal marks.
(4) Assume suitable data if required.

1. (a) Examine Thumb-2 instructions in CORTEX M3 Architecture. **(5)**
   (b) Analyze the role of TCB IN RTOS Kernel. **(5)**
   (c) Describe RR-Round Robin task scheduling algorithm. **(5)**
   (d) Explain any one "On Chip Debugging Technique" **(5)**
2. (a) Explain briefly NVIC: interrupt and exception handling in Cortex-M3 architecture. **(10)**
   (b) Explain CAN bus Protocol in detail w.r.t features and Applications **(10)**
3. (a) The three tasks with the IDS T1, T2, T3 with the estimated completion time 6, 5, 8 milliseconds respectively arrives a ready queue together. Calculate the average Turn Around Time (TAT) and average waiting time using Round Robin task scheduling algorithm with 2ms time slice. Assume that there is no input/output waiting for the tasks. **(10)**
   (b) Explain functions related to any four RTOS Kernel objects available in FREE RTOS **(10)**
4. (a) Draw CDFG, control data flow graph to calculate the roots of quadratic equation. **(10)**
   (b) Explain task state diagram outlining the significance of each state. **(10)**
5. (a) Explain the necessary and sufficient condition of task schedulability.
   Decide whether the tasks are schedulable by Necessary and sufficient condition in an embedded system with 4 different tasks with task IDs T1, T2, T3, T4 and estimated completion time 12, 8,10,5 mS respectively. T1, T2, T3 and T4 have their cycle duration as 30, 40, 50 and 60 ms respectively. **(10)**
   (b) Explain the important features of real time operating system, FREERTOS **(10)**
6. (a) Discuss various issues involved in TASKs SYNCHRONIZATION in an embedded system. **(10)**
   (b) Design an embedded System: Automatic Teller Machine, Design should include
   1) Requirement analysis 2) System Model and block diagram 3) Selection of Hardware 4) Software algorithm 5) Real time Issues and Challenges. **(10)**
