

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: CS404
Course Name: Embedded Systems

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 4 marks.

Marks

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|----|--|-----|
| 1 | What is an embedded computing system? Write two functionalities of an embedded system. | (4) |
| 2 | Explain the problems of hardware software co-design in an embedded system. | (4) |
| 3 | Draw a concurrent program model for Seat Belt Warning System of an automobile. | (4) |
| 4 | Explain the library file in assembly language context. What is the benefit of 'library file'. | (4) |
| 5 | Briefly describe out of circuit programming in Embedded System. | (4) |
| 6 | Differentiate generic IDEs with IDEs used in embedded firmware development with suitable examples. | (4) |
| 7 | Explain hard real-time considerations and soft real-time considerations | (4) |
| 8 | Differentiate monolithic kernel with microkernel | (4) |
| 9 | Explain System on Chip technique (SOC) | (4) |
| 10 | Write any 4 bottlenecks available in the embedded industry. | (4) |

PART B

Answer any two full questions, each carries 9 marks.

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|----|--|-----|
| 11 | a) With a suitable example, explain the specification phase of an embedded system. | (5) |
| | b) Show the UML representation of an object and a class with a suitable example. | (4) |
| 12 | a) Design a coin operated public telephone unit based on FSM model for the following requirements. | (9) |
| | 1. The calling process is initiated by lifting the receiver (off-hook) of the telephone unit. | |
| | 2. After lifting the phone the user needs to insert a 1 rupee coin to make the call. | |

3. If the line is busy, the coin is returned on placing the receiver back on the hook (on-hook).
4. If the line is through, the user is allowed to talk till 60 seconds and at the end of 45th second, prompt for inserting another one rupee coin for continuing the call is initiated.
5. If the user doesn't insert another 1 rupee coin, the call is terminated on completing the 60 seconds time slot.
6. The system is ready to accept new call request when the receiver is placed back on the hook (on-hook).
7. The system goes to the "Out of Order" state when there is a line fault.

(No need to take care of the scenarios like user doesn't insert a coin within the specified time after lifting the receiver, user inserts coins other than a one rupee etc.)

- 13 a) List and explain the non functional requirements in an embedded system. (4)
- b) Draw a class diagram for a basic microwave oven, cooking time should be adjusted from 1 min to 60 min. Include classes for door, front panel and heating elements. (5)

PART C

Answer any two full questions, each carries 9 marks.

- 14 a) With a neat diagram explain the steps in converting assembly language to machine language (9)
- 15 a) Explain the Debuggers used in Embedded System Development Environment (5)
- b) Briefly describe (i) decompiler (4)
- (ii) disassemblers
- 16 a) Is it possible to embed the firmware into the target processor/controller memory at the time of chip fabrication? Justify your answer. (3)
- b) Explain the merits and demerits of assembly language based embedded firmware development . (6)

PART D

Answer any two full questions, each carries 12 marks.

- 17 Explain the different types of Inter Task Communication mechanisms supported by MicroC/OS-II kernel. (12)
- 18 (a) Explain the various steps involved in the development of an embedded system (5)

using Waterfall model.

- (b) Explain the need for product Re-engineering in embedded product development. (4)
- (c) What are the factors that lead to the disposal of an embedded product. (3)
- 19 a) Consider a mobile phone device and look at the main menu. Explain how the events of touching the screen at different points on the screen are handled by an RTOS using two-level ISR handling. (6)
- (b) Explain various types of testing performed in Embedded product development. (6)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
EIGHTH SEMESTER B.TECH DEGREE EXAMINATION(S), OCTOBER 2019

Course Code: CS404
Course Name: EMBEDDED SYSTEMS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 4 marks.

		Marks
1	Mention the challenges in embedded computing system design	(4)
2	What is the use of specification phase in an embedded system design? Mention the components of GPS system specification.	(4)
3	Explain Control Data Flow Graph with an example	(4)
4	Explain the firmware execution flow of super loop based approach.	(4)
5	Describe mixing high level language with Assembly code with an example	(4)
6	Write short notes on (i) Simulator (ii) Emulator	(4)
7	Differentiate General purpose Operating System (GPOS) with Real time Operating system(RTOS)	(4)
8	Explain the memory model of a thread in an operating system	(4)
9	Depict four reasons to build network-based embedded systems.	(4)
10	Discuss the merits and demerits of Waterfall model for embedded system development.	(4)

PART B

Answer any two full questions, each carries 9 marks.

11	With a neat diagram explain major levels in the embedded system design process	(9)
12	a) Imagine yourself as an Embedded System developer. A client approached your team to make an automated Coffee Vending machine. Develop requirements description of the machine.	(4)
	b) Draw the Finite State Machine diagram for an automated Coffee Vending Machine.	(5)
13	a) Describe the sequence diagram for a mouse click scenario.	(4)
	b) Draw the Use case diagram for Seat Belt Warning System with explanation	(5)

PART C

Answer any two full questions, each carries 9 marks.

- 14 a) Describe the firmware design approaches used in an embedded product. (9)
- 15 a) Explain the different techniques for embedding the firmware into the target board of an embedded system? (9)
- 16 a) What is 'Inline Assembly' ? Explain with an example. (3)
- b) Explain different types of files generated after cross – compilation (6)

PART D

Answer any two full questions, each carries 12 marks.

- 17 Explain the three methods of ISRs handling in the RTOSs with examples (12)
- 18 State the different phases of Embedded Product Development Life Cycle. Explain briefly the function of each phase. (12)
- 19 a) Three processes with process IDs P1, P2, P3 with estimated completion time 6, 8, 2 milliseconds respectively, enters the ready queue together in the order. Process P4 with estimated execution completion time 4 milliseconds enters the ready queue after 1 millisecond. (Assuming there is no I/O waiting for the processes) in non- preemptive SJF scheduling algorithm. Calculate the waiting time for each process and average waiting time? (6)
- (b) Describe I²C bus structure and its transaction process. (6)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Eighth Semester B.Tech. Degree Examinations, September 2020

Course Code: CS404
Course Name: Embedded Systems

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 4 marks.

Marks

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|----|---|-----|
| 1 | What are the building blocks of UML? | (4) |
| 2 | List the pros and cons of assembly language based embedded firmware development | (4) |
| 3 | Which are the different levels of abstraction that have to be analysed to understand the real-time behaviour of an embedded computing system? | (4) |
| 4 | List out the major drawbacks of 'super loop' based embedded system design with suitable examples. | (4) |
| 5 | Differentiate between In System Programming (ISP) and In Application Programming (IAP). | (4) |
| 6 | What is the purpose of 'Reverse engineering' in Embedded Product development? Also explain the tools used for reverse engineering. | (4) |
| 7 | Draw a sequential program model for Seat Belt Warning System of an automobile | (4) |
| 8 | Describe the Interrupt Handling mechanism of MicroC/OSII kernel. | (4) |
| 9 | What are the recent trends in embedded operating systems? | (4) |
| 10 | What are the limitations of standard Java in embedded application development? | (4) |

PART B

Answer any two full questions, each carries 9 marks.

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|----|--|-----|
| 11 | Draw a system architecture diagram for a GPS hand held map and refine it to hardware and software architectural block diagrams with explanation. | (9) |
| 12 | a) Draw a Finite State Machine diagram for modeling the operation of a timer, indicating and explaining all the states, events, transitions and actions. | (5) |
| | b) Compare embedded systems and general purpose computers. | (4) |
| 13 | a) Explain Data Flow Graph/Diagram (DFGs) with an example. | (3) |

- b) Which type of embedded applications is best modeled using DFGs? (1)
- c) Illustrate multiple inheritance in UML with a neat diagram. (5)

PART C

Answer any two full questions, each carries 9 marks.

- 14 Illustrate a typical embedded system development environment with a neat figure and explain each of its components. (9)
- 15 Describe embedded firmware design approaches. (9)
- 16 a) List the advantages of High Level Language Based Development of embedded firmware. (4)
- b) List and explain the advantages and limitations of Simulator Based Debugging. (5)

PART D

Answer any two full questions, each carries 12 marks.

- 17 a) Three processes with process IDs P1, P2, P3 with estimated completion time 10, 5, 7 milliseconds and priorities 0, 3, 2 (0—highest priority, 3—lowest priority) respectively enters the ready queue together. Calculate the waiting time and Turn Around Time (TAT) for each process and the Average waiting time and Turn Around Time (Assuming there is no I/O waiting for the processes) in priority based scheduling algorithm. (6)
- b) What are the important functional and non-functional requirements that need to be analysed in the selection of an RTOS for an embedded design? (6)
- 18 Describe the modelling techniques for modelling the stages involved in the embedded product development life cycle. (12)
- 19 a) State and explain the three primary objectives of Embedded Product Development Life Cycle (EDLC) (6)
- b) Explain the various activities performed during the Deployment phase of an embedded product. (6)
