CMR INSTITUTE OF TECHNOLOGY

USN | | | | | | | | | | |

Improvement Test – III

Sub:	ARM MICROCONTROLLER & EMBEDDED SYSTEM		Sec	A			Code:	15EC62
Date:	22/ 05 / 2018	Duration:	90 mins	Max Marks:	50	Sem: VI	Branch:	TCE

Note: Answer any five full questions.

		Marks	OBE CO	OBE RBT
1	Explain the different characteristics of Embedded System in detail.	10	C602.3	L4
2	Explain the 6 operational quality attributes of an embedded systems.	10	C602.3	L4
3	With a block diagram, mention the components used in the design of a washing machine and also explain its working.	10	C602.4	L4
4	With FSM model, explain the design and operation of automatic tea/coffee vending machine.	10	C602.4	L4
5	Describe preemptive SJF scheduling. Determine average turn around time and average waiting time, if processes P1 P2 and P3 with estimated completion time of 10, 5, 7 milliseconds enter ready queue together and later P4 with a completion time of 2 msec enters ready queue after 2 msec.	10	C602.3	L2
6	Explain the different Embedded firmware design approaches in detail.	10	C602.3	L4
7	Briefly explain the functions of the operating system, with a diagram.	10	C602.3	L4

CMR INSTITUTE OF TECHNOLOGY

USN | | | | | | | | | | |

Internal Assesment Test – III

Sub:	ARM MICROCONTROLLER & EMBEDDED SYSTEM		Sec	A			Code:	15EC62
Date:	22/ 05 / 2018	Duration:	90 mins	Max Marks:	50	Sem: VI	Branch:	TCE

Note: Answer any five full questions.

		Marks	OBE CO	OBE RBT
1	Explain the different characteristics of Embedded System in detail.	10	C602.3	L4
2	Explain the 6 operational quality attributes of an embedded systems.	10	C602.3	L4
3	With a block diagram, mention the components used in the design of a washing machine and also explain its working.	10	C602.4	L4
4	With FSM model, explain the design and operation of automatic tea/coffee vending machine.	10	C602.4	L4
5	Describe preemptive SJF scheduling. Determine average turn around time and average waiting time, if processes P1 P2 and P3 with estimated completion time of 10, 5, 7 milliseconds enter ready queue together and later P4 with a completion time of 2 msec enters ready queue after 2 msec.	10	C602.3	L2
6	Explain the different Embedded firmware design approaches in detail.	10	C602.3	L4
7	Briefly explain the functions of the operating system, with a diagram.	10	C602.3	L4

Name: Preetha.M
USN : 1CR15TE046
Subject: ARM microcontroller & Embedded systems.

Model-Question Paper ⇒ Set II ⇒ Module 4 & 5

7.a Explain the different characteristics of Embedded System in detail

1. Application and domain Specific:

Each embedded system is having certain functions to perform & they are developed in such a manner to do the intended functions only. They cannot be used for any other purpose.

Ex: An embedded control unit of microwave oven cannot be replaced with that of a air Conditioner; because the embedded control units of microwave oven and air conditioner are specifically designed to perform certain specific tasks.

2. Reactive and Real time:

Embedded systems produce change in output in response to change in input. Hence it is Reactive

Real time system operation means the timing behaviour of the system is deterministic; the system should respond to requests or tasks in a known amount of time.

3. Operates in Harsh environment.

The environment in which the embedded system is deployed maybe a dusty one or a high temperature zone or an area subject to vibrations & shock. The design should take care of the operating conditions of the area where the system is going to implement.

4. Distributed:

Embedded systems may be a part of larger Systems. Many numbers of such distributed embedded system form a single large embedded control unit.

5. Small size and Weight

Product aesthetics (size, weight, shape, style, etc) will be one of the deciding factors to choose a product.

In embedded domain, Compactness is a significant deciding factor.

6. Power Concerns:

Embedded Systems should be designed in such a way as to minimize the heat dissipation by the system. Production of high amount of heat demands cooling requirements like cooling fans which in turn occupies additional space and make the system bulky.

What is operational quality attribute? Explain the important non-operational quality attributes to be considered in any Embedded system design.

Operational quality attribute represent the relevant quality attributes related to the embedded system when it is in the operational mode or 'online' mode.

The important non-operational quality attributes:

1. Testability & Debug-ability:

It deals with how easily one can test his/her design, application & by which means he/she can test it.

Debug-ability is a means of debugging the product as such for figuring out the probable sources that create unexpected behaviour in the system.

2. Evolvability:

It is referred as the non-heritable variation. for an embedded system, the quality attribute 'Evolvability' refers to the ease with which the embedded product can be modified to take advantage of new firmware or hardware technologies.

3. Portability:

Portability is the measure of 'System independence'.

A standard embedded product should always be flexible and portable.

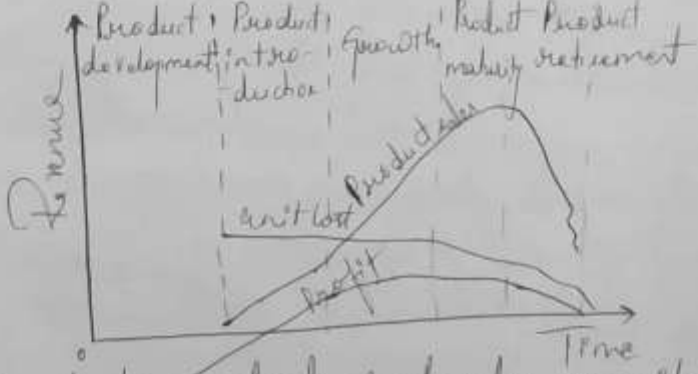
In embedded system, the term 'porting' represents the migration of embedded firmware written for one target processor to a different target processor (Motorola SH3 processor to Intel (or intel) processor)

4. Time-to-prototype and market:

The Embedded product market is highly competitive & time to market the product is a critical factor in the success of a commercial embedded product.

If a prototype is developed faster, the actual estimated development time can be brought down significantly.

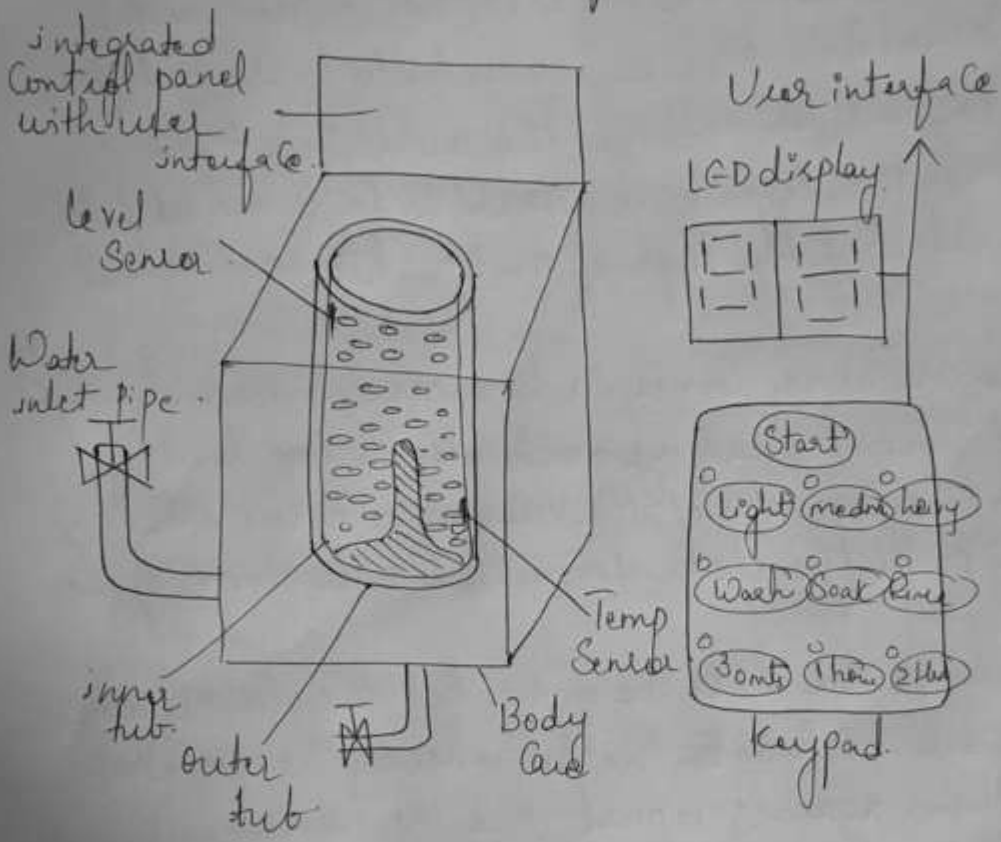
5. Per unit Cost & Revenue:



Cost is a factor which is closely monitored by both end user & product manufacturer.

Model Question Set 1 ⇒ Module 4 & 5 paper

With a block diagram, mention the components used in the design of a washing machine & also explain its working.



An embedded System Contains Sensors, actuators, Control unit & application-specific user interfaces like keyboards, display units etc.

The actuator part of the washing machine consists of a motorized agitator, tumble tub, water drawing pumps & inlet valve to Control the flowing water into the unit

The sensor part consists of the water temperature sensor, level sensor, etc. The control part contains microprocessor / controller based board with interfaces to the sensors & actuators.

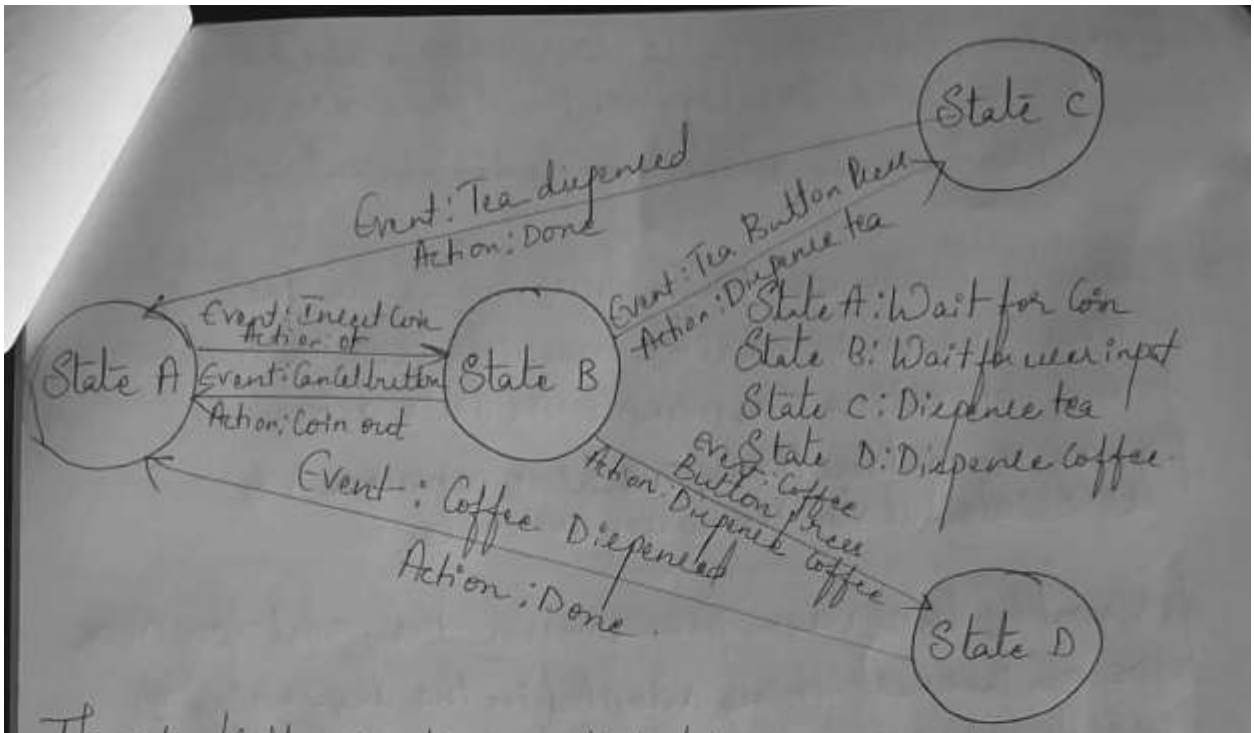
The sensor data is fed back to the control unit & the control unit provides connectivity to user interfaces like keypad for setting the washing time, selecting the type of material to be washed like light, selecting the type of material to be washed

Washing machine comes in two models, namely top loading & front loading machines. In top loading model the agitator of the machine twists back & forth & pulls the cloth down to the bottom of the tub.

On reaching the bottom of the tub the clothes would their way back up by the tub where the agitator grabs them again & repeats the mechanism.

In the front loading machines, the clothes are tumbled & plunged into the water over & over again.

This is the first phase of washing.



The tea/coffee vending is intiated by user inserting a 5 rupee coin. After inserting the coin, the user can either select 'Coffee' or 'Tea' or press 'Cancel' to cancel the order & take back the coin.

It is the simplest representation, it contains four states namely, 'wait for coin', 'wait for user input', 'Dispense tea' & 'Dispense coffee'.

The event 'insert coin' (5 rupee coin insertion), transitions the state to 'wait for user input'. The system stays in this state until a user input is received from the buttons 'Cancel', 'Tea' or 'Coffee'

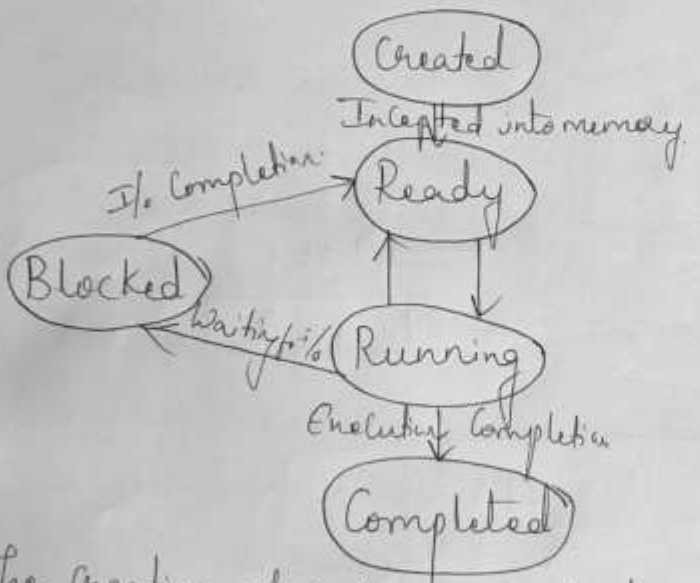
Once the coffee/tea vending is over, the respective states transitions back to the 'wait for coin' state.

Average waiting time = $\frac{14+7+3+0}{4}$ = 6ms

Avg Turn around = $\frac{24ms+5ms+14ms+7ms}{4}$

= 12.5ms

9. c With a State transition diagram, structure & memory organization of a process, describe the Process state transitions.



The creation of a process to its termination is not a single step operation. The process traverses through a series of states during its transition from the newly created state to the terminated state. The cycle through which a process changes its state from 'newly created' to 'execution completed' is known as process life cycle.

Explain the different Embedded firmware design approaches in detail.

The two basic approaches used for Embedded firmware design

1. Conventional procedural based firmware design (Super-loop model)
2. Embedded operating system based design

The Super-loop based approach:

a. Adopted for applications that are not time critical
b. Code is executed task by task

The firm-ware execution flow:

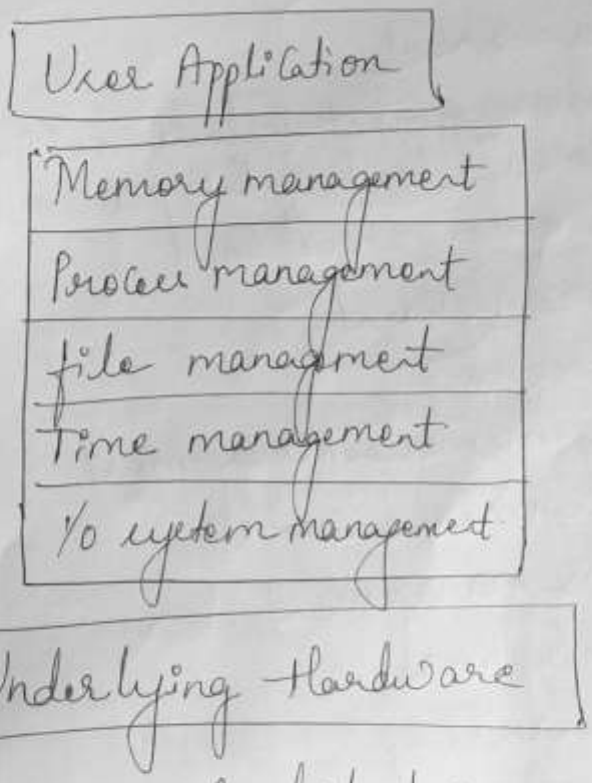
1. Configure the common parameters, perform initialization for memory, registers etc.
2. Start the first task & execute it
3. Execute the second task
4. Execute the next task
5. .
6. .
7. Execute the last defined task
8. Jump back to first task and follow the same flow

```
Void main()
{
  Configurations();
  Initializations();
  while(1)
  {  Task1(), Task2(); ... Taskn();
  }
}
```

2 Briefly explain the functions of the operating system, with a diagram.

The primary function of OS is

1. Makes the system convenient to use.
2. Organize & manage the system resources efficiently & correctly.



The OS Architecture