Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
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SEVENTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
NOV/DEC 2015
SUBJECT: ADVANCED EMBEDDED SYSTEM DESIGN (ECE - 421)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Assume the features of an embedded system are given in the form of technical tasks *T0, T1, T2, T3, T4* and *T5*. The flow of execution of these tasks is shown in **Fig.1.1**. The execution time(T) and power consumption(P) of each task by various processing elements is given in **Table 1.1**.

i. Explain the concept of co-synthesis in a typical embedded system design flow.
ii. Find suitable application mapping to design the system with power consumption less than 30 mWatts by drawing activity scheduling graph.
iii. Find suitable application mapping to design the system with total processing time less than 20msec by drawing activity scheduling graph.

1B. Write the differences among the following

i. Hard processor and soft processor
ii. Zynq SoC and Discrete FPGA-Processor combination
iii. General Purpose processor and Digital Signal processor

1C. Young engineer is in confusion of selecting proper processing element to implement the following operation:

$$E = A \; X \; B,$$
$$F = C \div D,$$
$$G = E + F$$

[where A,B,C,D,E,F are registers of appropriate size]

If high speed & low cost are his primary objectives then which one you suggest among GPP, FPGA and ZYNQ SoC to get optimum solution. Give reason.

(5+3+2)

2A. With the help of transition diagram, explain the power saving modes of PSoC 4.

2B. List all the clock sources available in PSoC4 and explain the use of them.

2C. Write the special features of digital signal processor over general purpose processors.

(5+3+2)

3A. From the component catalogue of PSoC Creator, assume we have selected one *DigitalIn*, two *DigitalOut* components and named them as **SW**, **LED_GREEN**, **LED_RED** respectively. The two *DigitalOut* pins are configured in '*Strong drive mode'* with initial drive state as '*LOGIC ZERO'* as shown in **Fig.3.1**. When working with CY8CKIT-044, if the code in *main.c* is as shown in **Fig.3.2** write status of **LED_GREEN** and **LED_RED** pins under the following drive conditions of **SW** pin when it is not connected to any digital value externally.

i. Drive mode: *Resistive pull up*, Initial drive: *'0'*.

ii. Drive mode: *Resistive pull down*, Initial drive: *'1'*.
iii. Drive mode: *Strong*, Initial drive: *'0'*.
iv. Drive mode: *Resistive pull up*, Initial drive: *'1'*, SW: connected to '0'
v. Drive mode: *Resistive pull down*, Initial drive: *'0'*, SW: connected to '1'

3B. With neat flow chart, explain the function flow of PSoC Bootloaders.
3C. List out the features of PSoC over traditional data processing elements.

(5+3+2)

4A. Write suitable Linux commands to do each of the following operations (multiple commands with pipe is allowed)
i. To halt the system after 7 mins by broadcasting the message "Scheduled maintenance".
ii. To remove a file named *pipe.c* available in */usr/bin* directory from the home directory of an active user, in interactive mode.
iii. To print all lines in a set of files that match a particular regular expression pattern.
iv. To display information about running processes in a text file named *proc.txt*
v. To compile, link and run a C program file named *first.c*

4B. Draw and explain the architecture of PSoC 4 interrupts.
4C. Explain briefly the universal digital blocks of PSoC.

(5+3+2)

5A. Explain in detail the following system calls or commands of Linux pipe with appropriate syntax and example.
i. popen
ii. pclose
iii. pipe
iv. mkfifo
v. open
5B. Assume the script shown in **Fig.5.1** is saved in a file *script_exam*. Explain how to make it as an executable file and also explain the output at each line of script.
5C. Assume the name of PSoC4 comparator component is "COMP". Explain the use of **COMP_ZeroCal()** & **COMP_LoadTrim()** API routines.

(5+3+2)

6A. Explain the behavior of Linux code if we include following system calls in it
i. **execlp**("ps", "ps", "ax", 0);
ii. new_pid = **fork**();
iii. child_pid = **wait**(&stat_val);
iv. **kill**(getppid(), SIGALRM);
v. res = **pthread_join**(a_thread, &thread_result);
6B. What is signal in Linux, explain the use of it with one example.
6C. What is a Shell in Linux. Explain its role and name few popular shells available to use

(5+3+2)

	GPP	DSP	FPGA	ASIC

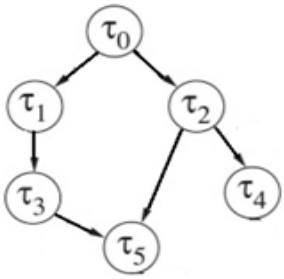

Fig.1.1

Task	T(ms)	P(mw)	T(ms)	P(mw)	T(ms)	P(mw)	T(ms)	P(mw)
T0	24.6	2.1	8.4	9.4	3.2	17.2	1.8	26.2
T1	7.2	9.7	9.7	7.2	17.6	2.8	14.8	7.0
T2	6.4	16.4	7.0	14.8	26.4	1.2	22.7	2.2
T3	26.2	1.8	18.4	2.4	9.4	8.4	8.8	8.8
T4	16.4	6.4	17.2	3.2	2.2	22.7	2.1	24.6
T5	6.4	16.4	1.2	26.4	2.8	17.6	2.4	18.4

T(ms)*-Time taken by each task to execute(in milli seconds).*

P(mw)*- Power consuming by each task (in milli Watts).*

Table 1.1

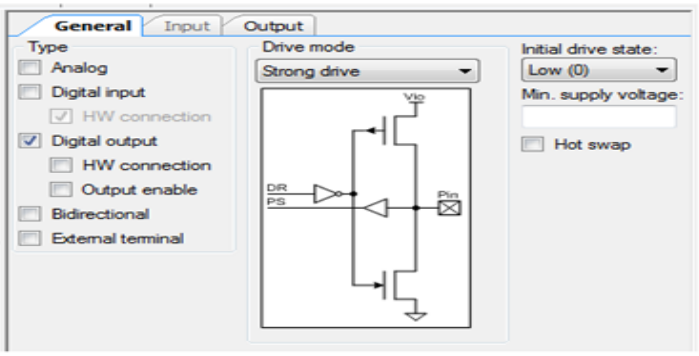

Fig.3.1

```
for(;;)
  {
    if (SW_Read()==1)
      {
      LED_GREEN_Write(~LED_GREEN_Read());
      CyDelay(500);
      }
    else if(SW_Read()==0)
      {
      LED_RED_Write(~LED_RED_Read());
      CyDelay(500);
      }
 }
```

Fig.3.2

```
#!/bin/sh
for file in *
do
if grep -q POSIX $file
then
echo $file
fi
done
exit 0
```

Fig.5.1