Reg. No.					

MANIPAL INSTITUTE OF TECHNOLOGY Manipal University

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## SEVENTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - NOV/DEC 2016 SUBJECT: ADVANCED EMBEDDED SYSTEM DESIGN (ECE - 421)

## TIME: 3 HOURS

MAX. MARKS: 50

- Instructions to candidatesAnswer ANY FIVE full questions.
  - Missing data may be suitably assumed.
  - 1A. Explain grep and trap commands of Linux. Write shell script to do the following: Create a file /tmp/aesd\_exam and copy date into it. Use trap command to arrange file /tmp/aesd\_exam deletion when user presses Ctrl+C. Create a while loop to display the message "examination" as long as file /tmp/aesd\_exam exists. Display the message "file deleted" when user presses Ctrl+C.
  - 1B. Explain the function of following environment variables in bash shell scripting
    i). \$0 ii). \$# iii). \$\* iV) \$IFS V). \$@ Vi). \$\$
  - 1C. Write advantages of Command Line Interface over Graphical User Interface of Linux.

(5+3+2)

(5+3+2)

- 2A. Explain the boot modes available in BeagleBone Black. Write the usage of boot switch which is provided to allow switching between the modes.
- 2B. Draw the high level block diagram of BeagleBone Black and explain each block briefly.
- 2C. Write the significance of four user LEDs on BeagleBone Black.
- 3A. Write Linux commands to do the following
  - i). To Reboot BBB
  - ii). To know the type and version of Linux distribution on BBB
  - iii). To make script file /tmp/script.sh executable
  - iV). To install gedit
  - V). To clone a repository *ee402* from *github.com/derekmolloy*
- 3B. Write the three main ways to connect to and communicate with the BBB over the network, explain them briefly.
- 3C. Write the default:
  - i). IP address of Cloud9 IDE on BBB webserver
  - ii). Internet-over-USB address of bone101 script on BBB
  - iii). Linux distribution on BBB
  - iv). Webserver on BBB

(5+3+2)

- 4A. Using Table Q4A, configure pru\_pins in the device tree overlay fragment shown in Fig. Q4A for the following modes
  - i). P9\_27  $\rightarrow$  pr1\_pru0\_pru\_r30\_5, output, pullup & pulldown disable, fast slew
  - ii). P9\_28  $\rightarrow$  pr1\_pru0\_pru\_r31\_3, input, pullup & pulldown disable, fast slew
  - iii). P9\_29  $\rightarrow$  pr1\_pru0\_pru\_r30\_1, output, pullup enable, fast slew
  - iv). P9\_30  $\rightarrow$  pr1\_pru0\_pru\_r30\_2, output, pulldown enable, slow slew
  - v). P8\_46 $\rightarrow$  pr1\_pru1\_pru\_r30\_1, input, pullup & pulldown disable, slow slew
- 4B. Write BBB's PRU program to flash the LED connected to *pr1\_pru0\_pru\_r30\_5* until a button that is connected to *pr1\_pru0\_pru\_r31\_3* is pressed.
- 4C. Write the default port number & location on BBB webserver to access *.html* files from web client. List out the files which need to be modified to change the default port number.

(5+3+2)

5A. Write syntax and explain in detail the following system calls of Linux socket

i). socket ii). connect iii). bind iv). accept v). listen

- 5B. With neat diagram, explain the steps involved in deploying a PRU-ICSS program from Linux host
- 5C. Write the series of commands need to be executed to replace the gadget serial service of BBB with custom application service.

(5+3+2)

- 6A. Write C++ application for BBB that reads analogue input. Structure it in such a way that analogue value from any of the AIN pins of BBB can be read by passing the pin number (0-6) to the *readAnalog()* function. Display the result on console.
- 6B. What is device tree overlay? Explain how it is different from flattened device tree. Write the locations in Linux file system used to load device tree overlay and flattened device tree.
- 6C. Write the significance of following Linux I2C-tool commands i). i2cdetect ii). i2cdump iii). i2cget iv). i2cset

(5+3+2)

fragment@0 {
 target = <&am33xx\_pinmux>;
 \_\_overlay\_\_ {
 pru\_pru\_pins: pinmux\_pru\_pru\_pins {
 pinctrl-single,pins = <
 // PRU PIN MODES NEED TOBE CONFIGURED HERE//
 >; }; };
 Fig.Q4A

Table Q4A										
\$PINS	ADDR	MODE7	MODE6	MODE5						
P9_27	0x184	Gpio3[19]	pr1_pru0_pru_r31_5	pr1_pru0_pru_r30_5						
P9_28	0x19c	Gpio3[17]	pr1_pru0_pru_r31_3	pr1_pru0_pru_r30_5						
P9_29	0x194	Gpio3[15]	pr1_pru0_pru_r31_1	pr1_pru0_pru_r30_5						
P9_30	0x198	Gpio3[16]	pr1_pru0_pru_r31_2	pr1_pru0_pru_r30_5						
P8_46	0x0a4	Gpio2[7]	pr1_pru1_pru_r31_1	pr1_pru0_pru_r30_5						