UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	:	VIRTUAL REALITY
COURSE CODE	:	BIT 3253/BIT 32503
PROGRAMME	:	BACHELOR OF INFORMATION TECHNOLOGY
EXAMINATION DATE	:	JUNE 2012
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS.

THIS QUESTIONS PAPER CONSISTS OF SIX (6) PAGES

Instruction: Answer **ALL** questions.

Q1 Explain each of the following term:

(a) Virtual Environment

(2 marks)

(b) Roll

(2 marks)

(c) Pitch

(2 marks)

(d) Yaw

(2 marks)

(e) XYZ Fixed angles

(2 marks)

(f) XYZ Euler angles

(2 marks)

Q2 Virtual reality (VR) becomes popular when people like to see things change on the screen in response to their commands and become captivated by the simulation.

(a) Define virtual reality in the context of its functionality.

(4 marks)

(b) Differentiate virtual reality from augmented reality and telepresence.

(5 marks)

(c) Explain **TWO (2)** reasons that caused VR systems software is hard to build.

(6 marks)

Q3 The sensation of being immersed within a VE is greatly influenced by the user's integration with the synthetic images.

(a) List **THREE (3)** groups of VR systems.

(3 marks)

(b) Explain each of the group in **Q3(a)**.

(9 marks)

Q4 Tracker is the special-purpose hardware used in VR to measure the real-time change in a 3D object position and orientation. In order to develop the most accurate VR tracker, four types of tracker performance parameters are required. Discuss **TWO (2)** parameters with the help of an appropriate diagram to support the development of your VR tracker.

(8 marks)

Q5 In computer graphics and computer animation the idea of a viewer or camera is used to describe the imaginary observer. It is also called as Virtual Observer (VO).

(a) Explain what do you understand about Virtual Observer?

(2 marks)

(b) State what will happen if the virtual observer (VO) and actual world (W) are aligned. Illustrate the situation and write the matrix transformation.

(5 marks)

(c) Based on **Figure Q5** below, answer the following questions.

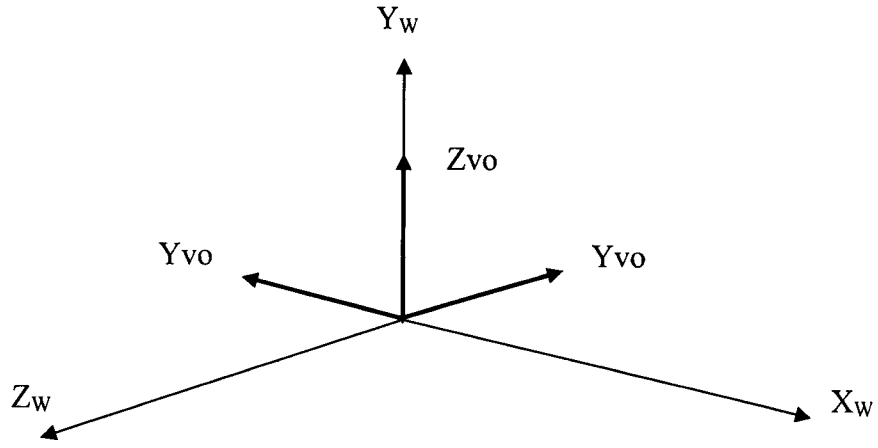

Figure Q5

(i) Calculate the coordinate of, P' if the point P(0,1,1) is given? Show your working.

(3 marks)

(ii) Calculate the coordinate of P', if the VO is offset by $(t_x, t_y, t_z) = (1,5,1)$ and P(0,1,0) is given? Show your working.

(5 marks)

Q6 (a) The actual orientation of both frames of reference is given in **Figure Q6** below. Based on **Figure Q6**, answer the following questions using the XYZ fixed angles method. Show your working step by step.

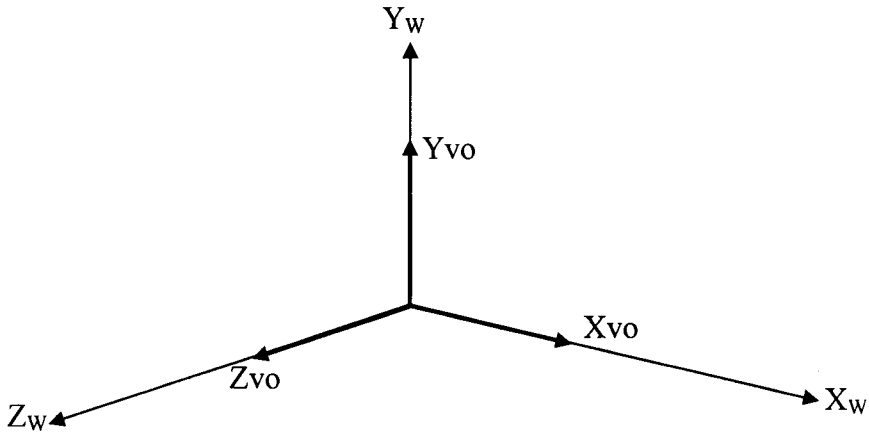

Figure Q6

(i) Draw a box with coordinates (1,1,1), (0,0,1) and (0,1,0). Sketch a new orientation of VO if the following conditions are given:

$\text{roll} = 90^0$, $\text{pitch} = 90^0$, $\text{yaw} = 180^0$

$(t_x, t_y, t_z) = (1,1,5)$

(13 marks)

(ii) Calculate the coordinate for (x',y',z') by substituting the coordinate (1,1,1) in (x,y,z).

(4 marks)

(b) Given the following scenario:

If a VO is oriented in a VE in the sequence roll, pitch and yaw and translate with the following values roll = 90^0 , pitch = 180^0 and yaw = 90^0 ; $(t_x, t_y, t_z) = (2,2,0)$.

Calculate the coordinate for (x',y',z') using XYZ Euler angles method if the coordinate (0,1,0) for (x,y,z) is given. Show your working.

(6 marks)

Q7 (a) Based on **Figure Q7(a)**, answer the following questions using Direct Cosines method.

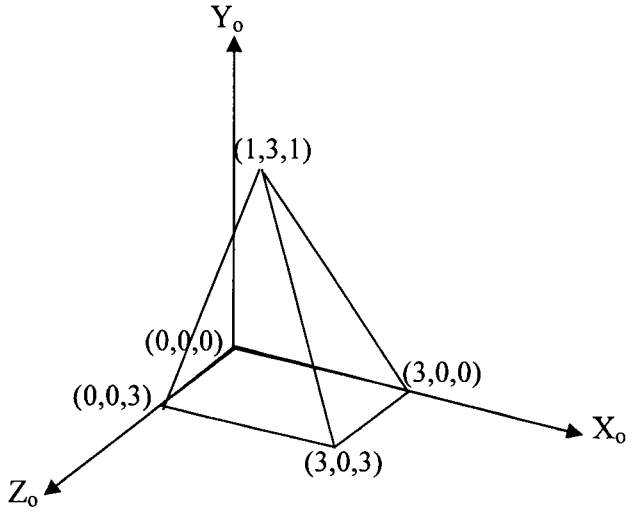

Figure Q7(a)

(i) Rotate the pyramid in **Figure Q7(a)** through a pitch angle of 90^0 about the *x*-axis. Calculate and sketch the new orientation of the pyramid.

(3 marks)

(ii) A compound rotation can be accomplished by subjecting an object to a sequence of matrix operation. Consider the action of rolling the pyramid of **Figure Q7(a)** about the *z*-axis, after performing the 90^0 pitch rotation. Calculate and sketch the new orientation of the pyramid after accomplishing the compound rotation.

(5 marks)

(b) Consider the scenario shown in **Figure Q7(b)**, where an object is located at the origin of the Object Coordinate System (OCS).

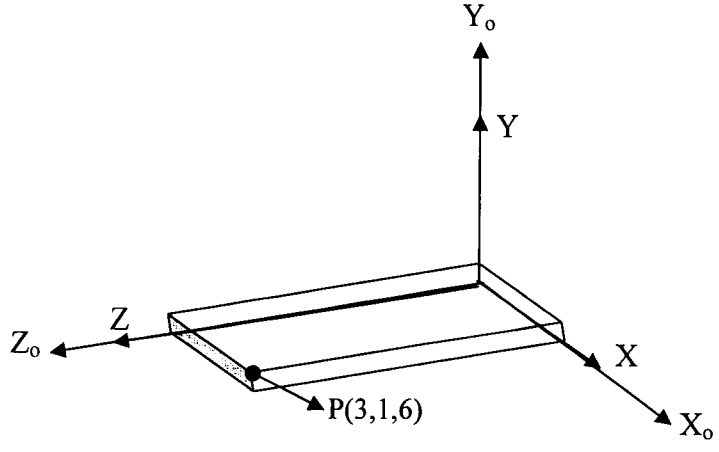

Figure Q7(b)

Consider the activities happened in **Figure Q7(b)**. First, roll the object about the z-axis through an angle of 90^0 rotations, second, 90^0 pitch rotations about the x-axis and the last rotation consist of a 90^0 yaw rotation about the y-axis. Calculate and sketch the final location of the point P' in the OCS.

(7 marks)