

**King Fahd University of Petroleum and Minerals**  
**Electrical Engineering Department**

**Software Lab # 1**  
**VECTOR REPRESENTATION AND COORDINATE SYSTEMS**  
**USING SOFTWARE PACKAGE: 'CAEME'**

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**Objective:**

To become familiar with basic coordinate systems, vector and scalar quantities using the software “CAEME”.

**Equipment Required:**

‘CAEME’ software. These are licensed software’s and cannot be copied.

**Introduction:**

The software ‘Computer Applications in Electromagnetics Education (CAEME)’, is a well known software for understanding and simulating basic EM problems. In this demonstration laboratory, CAEME software will be used to introduce the basic concept of coordinate systems, vector and scalar quantities. Ask your instructor to clarify all your conceptual problems. If required view the 1<sup>st</sup> part of the software, titled “Vectors and Coordinate systems” several times before you take the class test.

Software navigation techniques: To see the pop-up navigation menu, scroll down the mouse pointer to the bottom of the CAEME screen.

**Procedure:**

- (1) Execute the software “CAEME”.
- (2) Click the top rectangle with title “Vectors and Coordinate systems”.
- (3) Then Click on the icon to enter the lesson.
- (4) Click on the “Introduction” icon
- (5) Click on the icon titled “Basic Concept on Coordinate Systems”. This part of the software will explain the basics or advantages of all the coordinate systems.

- (6) Next click on the “Scalar and vector” icon to learn about vector and scalar quantities.
- (7) Take the interactive practice quizzes.

**Trial quiz:** Answer the following questions based on the DEMO. Before you take the quiz, ask your instructor to clarify any confusion regarding any of the explained subjects.

- (1) Name three 3D coordinate systems and the independent variables use by the coordinate systems:
  - (a) \_\_\_\_\_
  - (b) \_\_\_\_\_
  - (c) \_\_\_\_\_
- (2) A Scalar quantity needs \_\_\_\_\_ to be specified
- (3) A Vector quantity needs \_\_\_\_\_ to be specified

**For the following questions find the correct answer:**

- (4) Outline the steps involved in defining a coordinate system.
  - (a) An origin and a vector are required in general
  - (b) Three points in the space are required
  - (c) An origin and three independent variables are required
  - (d) None of these
- (5) How do we define the base vectors?
  - (a) Perpendicular to the reference surfaces
  - (b) Parallel to the reference surfaces
  - (c) The base vectors are different for every coordinate system
  - (d) The vase vectors are always three.

- (6) How do we define the origin of a coordinate system?
- (a) It is where two vectors intersect
  - (b) It is the point where the three reference surfaces intersect
  - (c) All the vectors point to it
  - (d) All the other answers are true.
- (7) How do we define the reference surfaces?
- (a) As three planes
  - (b) As a sphere, a plane and a cone
  - (c) As a cylinder, a plane and a sphere
  - (d) As surfaces at constant values of the independent variables.
- (8) How do we define a vector in a coordinate system?
- (a) An origin and a vector are required in general
  - (b) Three points in the space are required
  - (c) An origin and three independent variables are required
  - (d) None of these
- (9) Why is it necessary to define an origin to completely specify a vector?
- (a) It is not necessary
  - (b) Well, everything has to have an origin
  - (c) Because the color of the vector is closely related to its origin
  - (d) Because the components along the base vectors only define a magnitude and a direction.