**Round 1 (R1) Pedagogy**

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| **Name of Faculty:** Mr. Praveen Goyal  **Institute:**  Rajkiya Engineering College, Banda  **Email ID :**  praveen\_soit@yahoo.com  **Discipline to which the Lab belongs: Information Technology**  **Name of the Lab: Data Structure**  **Name of experiment : Tower of Hanoi**  **Kindly Refer these documents before filling the worksheet**  **1. Coursework (MOOC ) on Pedagogy , Storyboard , Lab Manual :**  [**http://bit.ly/Vlabs-MOOC**](http://bit.ly/Vlabs-MOOC) **2. Additional Documentation booklet for reference.** [**http://vlabs.iitb.ac.in/vlabs-dev/document.php**](http://vlabs.iitb.ac.in/vlabs-dev/document.php)  **3. Sample Git Repository. : https://github.com/BootTeam11/Boot2k19.git** |

* 1. **FOCUS AREA:**

Make the student understand and code the problem of Tower of Hanoi using recursion for n disks.

* 1. **About the Experiment:**

The Tower of Hanoi is a mathematical game or puzzle. It consists of three rods, and a number of disks of different sizes which can slide onto any rod. The puzzle starts with the disks in a neat stack in ascending order of size on one rod, the smallest at the top, thus making a conical shape. The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules: • Only one disk can be moved at a time.

• Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e. a disk can only be moved if it is the uppermost disk on a stack.

• No disk may be placed on top of a smaller disk. With three disks, the puzzle can be solved in seven moves.

The minimum number of moves required to solve a Tower of Hanoi puzzle is 2^n - 1, where n is the number of disks.

**1.3 Learning Objectives:**

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| --- | --- | --- |
| **S.No.** | **Learning Objective** | **Cognitive Level** |
| 1.Students will be able to : | Move 3 disks from first rod to the last rod using spare rod. | Understand |
| 2.Students will be able to : | Move n disks from first rod to the last rod using spare rod. | Understand |
| 3.Students will be able to : | Observe the pattern and derive the expression for minimum number of moves to solve the puzzle. | Analyze |
| 4. Students will be able to : | Calculate the minimum number of moves for solving the puzzle with n disks. | Evaluate |
| 5.Students will be able to : | Analyze the pattern and come up with an algorithm to solve the puzzle. | Analyze |
| 6.Students will be able to : | Understand the concept of recursion and use it for solving the puzzle as its application. | Apply |
| 7. Students will be able to : | Write the code for the puzzle using recursion. | Apply |

# Instructional Strategy

**2.1 Instructional Strategy:**

* Make the student play the puzzle consisting of 3 disks.
* Make the student play the puzzle consisting of 7 disks.
* Make the student understand mathematical expression for minimum number of moves required for solving the puzzle.
* Make the student understand the concept of recursion.
* Write the code for solving the puzzle of Tower of Hanoi.

**2.2 Assessment Method:**

* Successfully transferring the stack of 3 disks from first tower to last tower using the spare tower.
* Successfully transferring the stack of 7 disks from first tower to last tower using the spare tower.
* Answering quiz questions based on the puzzle.

**2.3 Description of sections:**

* **A Glimpse at the Puzzle**

The student is made aware of the importance of the puzzle through mentioned history.

* **Game Play of 3 disks**

The student is supposed to solve the puzzle consisting of three disks following the instructions.

* **Game Play of 7 disks**

The student is supposed to solve the puzzle consisting of seven disks following the instructions.

* **Coding the Solution**

The student is supposed to understand the approach to solution of the puzzle ad comprehend the code.

* **Quiz**

The student is supposed to answer the questions after playing the games and comprehending the code.

# Task & Assessment Questions

Complete the following table with details of the various tasks and assessment questions you will give to the students.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sr No**  **.** | **Learning Objective to be met** | **Tasks to students** | **be** | **performed** | **by** | **th e** | **Assessment questions aligne**  **to the task** |
| **1** | Observe the pattern | Move 3 disks from first rod to the last rod using spare rod. |  |  |  |  |  |
| **2** | Observe the pattern | Move n disks from first rod to the last rod using spare rod. |  |  |  |  |  |
| **3** | Comprehend the mathematical expression for min moves given n number of disks | Evaluate minimum number of moves for n number of disks. |  |  |  |  |  |
| **4** | Understand the code of solution to the problem | Read the code and answer the quiz later. |  |  |  |  | A sequence of questions followed based on gameplay and solution to the code. |

# 4.Simulator Interactions

**Complete the following table giving the details of the Simulator interactions.**

What Simulator will do? What students will do? Purpose of the task

Write your content in the table below.

|  |  |  |
| --- | --- | --- |
| **What students will do?** | **What simulator will do?** | **Purpose of the task** |
| Play the game where tower is made up of 3 disks. | Calculate the number of moves. | Student observes the pattern. |
| Play the game where tower is made up of n disks. | Calculate the number of moves. | Student observes the pattern and think about the algorithm. |
| Answer questions. | Ask Questions | Comprehension check. |