IT Number : IT23670648

Name : Anojan.R

Module Name : Programming Methodology

Module Code : SE1012

Objective

Exercise 1: To calculate the predicted power generated by a hydroelectric dam given the dam height and water flow rate, assuming 90% efficiency in converting gravitational potential energy to electrical energy.

Exercise 2: To calculate the acceleration and time required for a jet fighter to reach takeoff speed from an aircraft-carrier catapult, assuming constant acceleration.

Code for activity 1

```c
#include <stdio.h>

int main() {
    // Constants
    const double GRAVITY = 9.80;      // Gravitational constant in m/s^2
    const double EFFICIENCY = 0.9;    // 90% efficiency
    const double WATER_DENSITY = 1000; // Mass of 1 cubic meter of water in kg

    // Variables
    double height;    // Height of the dam in meters
    double flowRate;  // Flow rate in cubic meters per second
    double powerMW;   // Power generated in megawatts

    // Prompt user for input
    printf("Enter the height of the dam (in meters): ");
    scanf("%lf", &height);
    printf("Enter the flow rate of water (in cubic meters per second): ");
    scanf("%lf", &flowRate);

    // Calculate power
    powerMW = EFFICIENCY * WATER_DENSITY * flowRate * GRAVITY * height / 1e6;

    // Display result
    printf("Predicted power generated by the hydroelectric dam: %.2f megawatts.\n", powerMW);

    return 0;
}
```

Output

```
anojan@anojan-VirtualBox:~$ vim activity1_lab3.c
anojan@anojan-VirtualBox:~$ gcc activity1_lab3.c -o activity1
anojan@anojan-VirtualBox:~$ ./activity1
Enter the height of the dam (in meters): 13
Enter the flow rate of water (in cubic meters per second): 23
Predicted power generated by the hydroelectric dam: 2.64 megawatts.
anojan@anojan-VirtualBox:~$
```

Code for activity 2

```c
#include <stdio.h>

int main() {
    // Variables
    double takeoffSpeedKmh; // Jet's takeoff speed in km/hr
    double takeoffSpeedMs;  // Jet's takeoff speed in m/s
    double distance;        // Distance of catapult in meters
    double acceleration;    // Acceleration in m/s²
    double time;            // Time to reach takeoff speed in seconds

    // Prompt user for input
    printf("Enter the jet's takeoff speed (km/hr): ");
    scanf("%lf", &takeoffSpeedKmh);
    printf("Enter the distance of the catapult (meters): ");
    scanf("%lf", &distance);

    // Convert takeoff speed from km/hr to m/s
    takeoffSpeedMs = takeoffSpeedKmh * 1000 / 3600;

    // Calculate acceleration using v^2 = 2 * a * s => a = v^2 / (2 * s)
    acceleration = (takeoffSpeedMs * takeoffSpeedMs) / (2 * distance);

    // Calculate time using v = a * t => t = v / a
    time = takeoffSpeedMs / acceleration;

    // Display results
    printf("Acceleration of the jet fighter: %.2f m/s²\n", acceleration);
    printf("Time to reach takeoff speed: %.2f seconds\n", time);

    return 0;
}
```

Output

```
anojan@anojan-VirtualBox:~$ ./activity2
Enter the jet's takeoff speed (km/hr): 3
Enter the distance of the catapult (meters): 45
Acceleration of the jet fighter: 0.01 m/s²
Time to reach takeoff speed: 108.00 seconds
anojan@anojan-VirtualBox:~$
```

Conclusion

1. The hydroelectric dam exercise successfully calculates predicted power output based on dam height and water flow rate, demonstrating the conversion of gravitational potential energy to electrical energy.
2. The jet fighter exercise correctly computes acceleration and time for a constant-acceleration scenario, illustrating the physics of catapult-assisted takeoff.