# TPCRA STEM Tinkering Virtual Lab
## School Education
## Grade V - XII
# Technical Proposal

**This Proposal Focuses on the following United Nations Sustainable Development Goals (UNSDG):**

**1. SDG: 4 Quality Education**

**2. SDG: 9 Industry, Innovation and Infrastructure**

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# School Education
## Grade V - XII

**⛺ Tinker**   **🔍 Ideate**   **⚙ Innovate**

## Why STEM?

STEM (Science, Technology, Engineering and Math) a revolution in the Education system worldwide.

- Tinkering is intended towards life and creative skills.
- Helps all the students get the required competency in the subjects of Science and Math by their practical manifestation in Engineering and Technology.
- Empower students with the 21st century core skills like problem solving, innovation, collaboration,
- STEM encourages students to tinker and empowers them with open-ended experimenting, with no single solution.
- EdgeFX STEM kits have a directional curriculum that is not restrictive and provides students with the scope to create and innovate.
- EdgeFX offers a range of STEM kits from Electronics to Arduino coding to Robotics!

## A few Concepts Covered

- Voltage, Current and Resistance
- Series and Parallel Circuits
- Short Circuits
- Good and Bad conductor of electricity
- Open and Closed circuits
- Transistor as a switch
- Use of Fuse
- Polarity in circuits
- Sound, Light and Mechanical energy
- Motors & Electricity
- Amplification of current
- Logic Gates concepts
- Primary and Secondary color generation
- Latching Circuits
- Learning to use IDE for Arduino
- Arduino Programming
- Building Arduino projects in simple steps
- Step by Step Building a Remote/ Robot with different Inputs/ Sensors
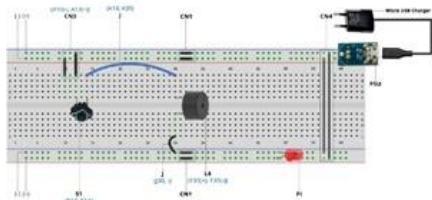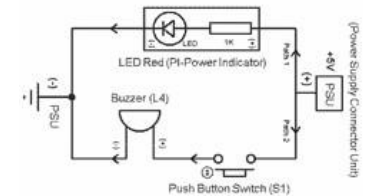
## Learning Outcome

**Learning outcome Level 1:** Physical diagrams provided for each and every project enables the first level of experiential hands on learning and troubleshooting skills for the students providing edutainment and creating enthusiasm amongst them.

**Learning outcome Level 2:** Electronic circuits provided for each and every project enables the student to understand the logic and concept behind each and every project. Experiments and activities supplement additional experiential learning.

**Learning outcome Level 3:** Kindles the spirit of Innovation and Entrepreneurship amongst the students to create new projects based on their learning from the levels 1 & 2.
**This is where the real magic begins!!**

# TPCRA STEM Tinkering Virtual Lab Technical Proposal

**Powered by Free course on Innovation Life cycle & Industry 4.0**

| S.No. | Name of the Product | Grade |
|:---:|:---|:---:|
| 1 | STEM Electronics Design And Prototyping Virtual Lab powered by Real-time Circuit Design and Simulation with 75+ inventions. **This Lab Focuses on SDG4 and SDG9.**<br>(Prerequisite: Nil) | Grade V till Grade XII |
| 2 | STEM Arduino Step By Step Programming, Design And Prototyping Virtual Lab powered by Real-time Circuit Design and Simulation. **This Lab Focuses on SDG4 and SDG9.**<br>(Prerequisite: STEM Electronics) | Grade VIII till Grade XII |
| 3 | STEM Robotics Step By Step Design And Prototyping Virtual Lab  powered by Real-time Circuit Design and Simulation. **This Lab Focuses on SDG4 and SDG9.**<br>(Prerequisite: STEM Electronics) | Grade VIII till Grade XII |

**Note:**
**1. SDG4: Quality Education, SDG9: Industry, Innovation and Infrastructure**
**2. Refer Appendix for list of innovations**

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# Appendix

| Session No. | Topic | Session No. | Topic |
|---|---|---|---|
| 1 | Introduction to STEM Electronics | 2 | To demonstrate conductor and insulator of electricity. |
| | To demonstrate the concept of open and closed circuits. | | To demonstrate the use of fuse to make electrical circuits safer. |
| | To demonstrate the Push Button Switch, Buzzer function and how electricity is used to generate sound. | | To demonstrate the function of a Resistor in series with a Buzzer. |
| | To demonstrate the LED function and how electricity is used to light up an LED. | | To demonstrate how a series Resistor is used to protect an LED. |
| | To demonstrate how LED's like one-way valves let electricity flow only in one direction. | | To demonstrate how electric circuits can be build to turn on multiple loads at a time without affecting the performance of the other load. |
| 3 | To demonstrate the use of electronically controlled switches like Transistors using Push Button Switch for Input and Buzzer for Output. | 4 | To demonstrate if human body is a good conductor of electricity using human touch as Input and Buzzer as Output. |
| | To demonstrate how transistor as a switch can control an LED output. | | To demonstrate the amplification of current via darlington Transistor with LED as Output. |
| | Get creative with circuits, demonstration of Push Button Switch in reverse function with Buzzer for Output. | | To demonstrate the function of a DC Motor and how electrical energy is converted into mechanical energy using a DC Motor. |
| | To try and see for your self if the switch is reverse function works for an LED output. | | To demonstrate the use of fuse to make electrical circuits safer with a Motor Output. |
| 5 | To demonstrate how electricity is converted into Sound, Light and Mechanical energy at the same time. | 6 | To demonstrate This OR That logic using Inputs as Push Button Switches and Output as Buzzer. |
| | To demonstrate the characteristics of voltage, current, and resistance in a parallel circuit. | | To demonstrate This OR That logic using Inputs as Push Button Switches and Output as DC Motor. |
| | To demonstrate the characteristics of voltage, current, and resistance in a parallel circuit. | | To demonstrate This OR That logic using Inputs as Push Button Switches and Output as LED. |
| | To demonstrate the use of a free wheeling diode alongside the DC Motor in the DC Motor Block LU4. | | |
| | To demonstrate the use of a capacitor along side the DC Motor in the DC Motor Block LU4. | | |
| 7 | To demonstrate This AND That logic using Inputs as Push Button Switches and Output as Buzzer. | 8 | To demonstrate the Dual LED function. |
| | To demonstrate This AND That logic using Inputs as Push Button Switches and Output as DC Motor. | | To demonstrate the RGB LED function. |
| | To demonstrate This AND That logic using Inputs as Push Button Switches and Output as LED. | | |
| 9 | To demonstrate the concept of open and closed circuits. | 10 | To demonstrate the working of a Reed Sensor with Buzzer Output. |
| | To reiterate the Darlington Transistor concept with DC Motor as Output. | | To demonstrate the working of a Reed Sensor with DC Motor Output. |
| | To demonstrate the amplification of current via darlington Transistor with Flashing LED as Output. | | To demonstrate the working of a Reed Sensor Z9 with an LED Output. |
| | To demonstrate the function of Resistor 1K with a Dual LED Output. | | To demonstrate the working of a Reed Sensor Z9 with a Flashing LED Output. |
| | | | To demonstrate the working of a Reed Sensor Z9 with a Dual LED Output. |
| 11 | To demonstrate the working of an LDR Sensor, Resistor 10K and Transistor BC 557. | 12 | To demonstrate the function of a Slide Switch. |
| | To demonstrate the working of an LDR Sensor with a Fan Output. | | To demonstrate how electric energy is converted into mechanical energy with the use of a another Input Block. |
| | To demonstrate the working of an LDR Sensor with an LED Output. | | To demonstrate how electric energy is converted into sound energy with the use of a another Input Block. |
| | To demonstrate the working of an LDR Sensor with a Flashing LED. | | To study different LED Outputs. |
| | To demonstrate the working of an LDR Sensor with a Dual LED. | | To demonstrate the Output using an Dual LED, when there is a change in the Input. |
| | | | To demonstrate the Output using an RGB LED, when there is a change in the Input. |

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| 13 | To demonstrate the use of electronically controlled switches like Transistors using Push Button Switch for Input and Flashing LED for Output. | 14 | To demonstrate This OR That logic using Inputs as Push Button Switches and Output as Flashing LED. |
|---|---|---|---|
| | To demonstrate the use of electronically controlled switches like Transistors using Slide Switch for Input and Buzzer for Output. | | To demonstrate This OR That logic using Inputs as Slide Switches and Output as Buzzer. |
| | To demonstrate the use of electronically controlled switches like Transistors using Slide Switch for Input and DC Motor for Output. | | To demonstrate This OR That logic using Inputs as Slide Switches and Output as DC Motor. |
| | To demonstrate the use of electronically controlled switches like Transistors using Slide Switch for Input and LED for Output. | | To demonstrate This OR That logic using Inputs as Slide Switches and Output as LED. |
| | To demonstrate the use of electronically controlled switches like Transistors using Slide Switch for Input and Flashing LED for Output. | | To demonstrate This OR That logic using Inputs as Slide Switches and Output as Flashing LED. |
| | Demonstration of Push Button Switch in reverse function with Flashing LED for Output. | | To demonstrate This OR That logic using Inputs as Push Button Switch and Slide Switch and Output as Flashing LED. |
| | Demonstration of Slide Switch in reverse function with Buzzer for Output. | | To demonstrate This AND That logic using Inputs as Push Button Switches and Output as Flashing LED. |
| | Demonstration of Slide Switch in reverse function with DC Motor for Output. | | To demonstrate This AND That logic using Inputs as Slide Switches and Output as Buzzer. |
| | Demonstration of Slide Switch in reverse function with LED for Output. | | To demonstrate This AND That logic using Inputs as Slide Switches and Output as DC Motor. |
| | Demonstration of Slide Switch in reverse function with Flashing LED for Output. | | To demonstrate This AND That logic using Inputs as Slide Switches and Output as LED. |
| | | | To demonstrate This AND That logic using Inputs as Slide Switches and Output as Flashing LED. |
| | | | To demonstrate This AND That logic using Inputs as Push Button Switch and Slide Switch and Output as Flashing LED. |
| 15 | To demonstrate a Latching circuit with Buzzer as the Output. | | |
| | To demonstrate a Latching Circuit with DC Motor as the Output. | | |
| | To demonstrate a Latching Circuit with LED as the Output. | | |

| STEM Arduino Step By Step Programming, Design And Prototyping Virtual Lab powered by Real-time Circuit Design and Simulation. | | | |
|---|---|---|---|
| Session No. | Topic | Session No. | Topic |
| 1 | Introduction to the STEM Arduino | 2 | How to use Arduino IDE Part-1 |
| 3 | How to use Arduino IDE Part-2 | 4 | Basic Troubleshooting Part-1 |
| 5 | Basic Troubleshooting Part-2 | 6 | Power the Arduino Nano |
| 7 | To demonstrate the Push Button Switch, Buzzer and generate sound with Arduino Sketch | 8 | To generate Red flashing light |
| 9 | To generate Green flashing light | 10 | To generate Blue flashing light |
| 11 | To generate secondary color Yellow with the sum of two primary colors Red and Green | 12 | To generate secondary color Magenta with the sum of two primary colors Red and Blue |
| 13 | To generate secondary color Cyan with the sum of two primary colors Green and Blue | 14 | To generate White light with the sum of three primary colors Red, Green and Blue |
| 15 | To generate the final output. i.e. To generate a rainbow of colors, each with a unique Buzzer Sound. | | |

| STEM Robotics Step By Step Design And Prototyping Virtual Lab powered by Real-time Circuit Design and Simulation | | | |
|---|---|---|---|
| Session No. | Topic | Session No. | Topic |
| 1 | Introduction to the STEM Electronics | 2 | How to design robotics electronic circuit and Battery |
| 3 | How to design robotics mechanical part and procurement | 4 | Assembly the Transmitter and Receiver |
| 5 | To build a bot which moves in the Left direction on pressing the Push Button Switch | 6 | To build a bot which moves in the Left and Right directions on pressing the respective Push Button Switches. |
| 7 | To build a bot which moves in the Left, Right and Forward directions on pressing the respective Push Button Switches. | 8 | To build a bot which moves in the Left, Right, Forward and Reverse directions on pressing the respective Push Button Switches. |
| 9 | To build a bot which moves in the Left, Right, Forward and Reverse directions on activating the respective Slide Switches, by moving the slider to your right. | 10 | To build a bot which moves in the Left, Right, Forward and Reverse directions on activating the respective Reed Switches with a magnet. |
| 11 | To build a bot which moves in the Left direction using human touch as input | 12 | To build a bot which moves in the Left and Right directions on holding the respective Touch points |
| 13 | To build a bot which moves in the Left, Right and Forward directions on holding the respective Touch Points | 14 | To build a bot which moves in the Left, Right, Forward and Reverse directions on holding the respective Touch Points. |
| 15 | To build a bot which moves in the Left, Right, Forward and Reverse directions on activating four different inputs Reed Switch, Touch Point, Push Button Switch and Slide Switch respectively. | | |