A summary report on BOOTATHON event for Virtual Labs Development

(4^{th} – 10^{th} November, 2019 at Rajkiya Engineering College, Banda, Uttar Pradesh)

With the approval of SKIT management, we attended Virtual Lab Development "BOOTATHON" (Bootcamp+Hackathon) event from 4^{th} – 10^{th} November, 2019 at Rajkiya Engineering College, Banda, Uttar Pradesh in coordination with IIT Bombay, IIT Delhi and IIT Kanpur supported by TEQIP-III. Our team consists of following members:

Participating Team: Dr. Om Ji Shukla (Faculty member from ME)
Chirag Patni (B.Tech.-ME 3^{rd} Sem)
Aman Sharma (B.Tech.-ME 3^{rd} Sem)
Hritik Gaur (B.Tech.-ME 3^{rd} Sem)
Mohit Agarwal (B.Tech.-CS 3^{rd} Sem)

"BOOTATHON" was a national event and total 30 teams across India participated in this event. It was very learning experience for us in the field of developing Virtual Labs which is directly handled by MHRD India. During this event, every team had to develop experiments on Virtual Lab. The development process of an experiment consists of four steps:

1. Writing a well-defined pedagogy
2. Writing a detailed storyboard
3. Writing the lab manual
4. Developing the simulator

During this event, sessions for faculty and students were conducted separately from 8 a.m. to 8 p.m. continuously with lunch break and tea. Sessions for faculty members were mentored by experts from Virtual lab community and focused on understanding and completing above mentioned first three steps of respective experiment. Sessions for students were focused on developing the simulator for respective experiment. Our team had performed excellent in every task given by the experts in the event. They applauded our team in front of Director, REC Banda along with other dignitaries. This event is still going on in virtual mode (online) and it is extended to 15^{th} November, 2019.

We are highly thankful to the management of SKIT Jaipur which had permitted to us to attend this BOOTATHON event. Our team has learnt a lot related to Virtual lab development process from this event.

Dr. Om Ji Shukla
Virtual lab Coordinator,
Department of Mechanical Engineering,
SKIT Jaipur

Report on BOOTATHON Event

A team of one faculty (Dr. Om Ji Shukla, Associate Prof., ME) and four students (Chirag Patni, Aman Sharma, Hritik Gaur, Mohit Agarwal) attended Virtual Lab Development "BOOTATHON" (Bootcamp+Hackathon) event from 4th – 10th November, 2019 at Rajkiya Engineering College, Banda, Uttar Pradesh in coordination with IIT Bombay, IIT Delhi and IIT Kanpur supported by TEQIP-III. "BOOTATHON" was a national event and total 30 teams across India participated in this event. During this event, every team had to develop experiments on Virtual Lab. The development process of an experiment consists of four steps: writing a well-defined pedagogy, writing a detailed storyboard, writing the lab manual, developing the simulator. The team had performed excellent in every task given by the experts in the event. The team developed one experiment in virtual lab of Strength of Material during the event.

REF:REC/BOOTATHON/20190042

BOOTATHON

TEQIP III | IEEE #startupindia

Virtual Labs

An MHRD Govt of India Initiative

PARTICIPATION CERTIFICATE

THIS IS TO CERTIFY THAT

Chirag Patni

from **SKIT, Jaipur** participated in the 7 days **BOOTATHON** between Nov. 04-10, 2019 organised by **Rajkiya Engineering College Banda in coordination with IIT Bombay, IIT Kanpur** has developed **01** virtual lab experiment.

PROF. S.P. SHUKLA	DR. ASHUTOSH TIWARI	PROF. KANTESH BALANI	PROF. SANTOSH NORONHA
Director, REC Banda	Vlabs Coordinator, REC Banda	P.I. Vlabs, IIT Kanpur	P.I. Vlabs, IIT Bombay

BOOTATHON

TEQIP III | IEEE #startupindia

REF:REC/BOOTATHON/20190041

Virtual Labs

An MHRD Govt of India Initiative

PARTICIPATION CERTIFICATE

THIS IS TO CERTIFY THAT

Om Ji Shukla

from **SKIT, Jaipur** participated in the 7 days **BOOTATHON** between Nov. 04-10, 2019 organised by **Rajkiya Engineering College Banda in coordination with IIT Bombay, IIT Kanpur** has developed **01** virtual lab experiment.

PROF. S.P. SHUKLA	DR. ASHUTOSH TIWARI	PROF. KANTESH BALANI	PROF. SANTOSH NORONHA
Director, REC Banda	Vlabs Coordinator, REC Banda	P.I. Vlabs, IIT Kanpur	P.I. Vlabs, IIT Bombay

REF:REC/BOOTATHON/201900043

BOOTATHON

TEQIP III | IEEE #startupindia

Virtual Labs

An MHRD Govt of India Initiative

PARTICIPATION CERTIFICATE

THIS IS TO CERTIFY THAT

Aman Sharma

from **SKIT, Jaipur** participated in the 7 days **BOOTATHON** between Nov. 04-10, 2019 organised by **Rajkiya Engineering College Banda in coordination with IIT Bombay, IIT Kanpur** has developed **01** virtual lab experiment.

PROF. S.P. SHUKLA	DR. ASHUTOSH TIWARI	PROF. KANTESH BALANI	PROF. SANTOSH NORONHA
Director, REC Banda	Vlabs Coordinator, REC Banda	P.I. Vlabs, IIT Kanpur	P.I. Vlabs, IIT Bombay

BOOTATHON

TEQIP III | IEEE #startupindia

REF:REC/BOOTATHON/201900044

Virtual Labs

An MHRD Govt of India Initiative

PARTICIPATION CERTIFICATE

THIS IS TO CERTIFY THAT

Hritik, Gaur

from **SKIT, Jaipur** participated in the 7 days **BOOTATHON** between Nov. 04-10, 2019 organised by **Rajkiya Engineering College Banda in coordination with IIT Bombay, IIT Kanpur** has developed **01** virtual lab experiment.

PROF. S.P. SHUKLA	DR. ASHUTOSH TIWARI	PROF. KANTESH BALANI	PROF. SANTOSH NORONHA
Director, REC Banda	Vlabs Coordinator, REC Banda	P.I. Vlabs, IIT Kanpur	P.I. Vlabs, IIT Bombay

REF:REC/BOOTATHON/20190045

BOOTATHON

TEQIP III | IEEE #startupindia

Virtual Labs

An MHRD Govt of India Initiative

PARTICIPATION CERTIFICATE

THIS IS TO CERTIFY THAT

Mohit Agarwal

from **SKIT, Jaipur** participated in the 7 days **BOOTATHON** between Nov. 04-10, 2019 organised by **Rajkiya Engineering College Banda in coordination with IIT Bombay, IIT Kanpur** has developed **01** virtual lab experiment.

PROF. S.P. SHUKLA	DR. ASHUTOSH TIWARI	PROF. KANTESH BALANI	PROF. SANTOSH NORONHA
Director, REC Banda	Vlabs Coordinator, REC Banda	P.I. Vlabs, IIT Kanpur	P.I. Vlabs, IIT Bombay

Pedagogy(Round 1)

1.1 FOCUS AREA: Reinforce theoretical concept and Experimentation

The student will know the concept of clipper and clamper, recalling concepts of diode and capacitor and to observe AC wave form .They will apprehend about the working of diodes, capacitors and other electrical components. They do the experimentation on the basis of working of diode, trial, error and learn from it and analyze the results.

1.2 About the Experiment:

Experiment is about wave shaping circuits using diode and other components wherein students can design the circuit for different values of components and reference voltage.

1.3 Learning Objectives:

S.No.	Learning Objective	Cognitive Level	Action Verb
1	Identify the components required for design of clipper circuits.	Remember	Identify
2	Recall the circuit required for clipper.	Remember	Recall
3	Assemble the circuit for clipper	Apply	Assemble
4	Design a clipper circuit to get an output voltage of +4 Volts.	Evaluate	Design
5	Identify the components required for design of clamper circuit.	Remember	Identify
6	Recall the circuit required for clamper.	Remember	Recall
7	Assemble the circuit for clamper.	Apply	Assemble
8	Design a clamper circuit to get an output voltage of +4 Volts.	Evaluate	Design

2.Instructional Strategy

2.1 Instructional Strategy: Expository and Problem based

2.2 Assessment Method: Formative Assessment

2.3 Description of sections:

1. Students will identify various components as per the arrangement to design setup.
2. Polarity of battery and direction of diode is selected as per the desired output.
3. Diode has to be selected whether ideal or practical diode.
4. Components values and reference voltage are selects as per the desired wave form.

3. Task & Assessment Questions

Sr No.	Learning Objective to be met	Tasks to be performed by the students	Assessment questions aligned to the task
LO1	Identify the components required for design of clipping circuit.	Choose the required components from given set of components.	Identify the components required for a clipper circuit.
LO2	Recall the circuit required for clipper.	Student has to choose the correct circuit from given set of circuits.	What is the circuit of clipper ?
LO3	Assemble the circuit for clipper.	Student will connect the wires to the appropriate terminals to form the clipper circuit.	Same as the task itself.
LO4	Design a clipper circuit to get an output voltage of +4 Volts.	Student will calculate the value of reference voltage for a fixed output voltage and enter the values in the simulator.	Observe a positive clipped waveform of +4 volts output voltage on simulator.
LO5	Identify the components required for design clamping circuit.	Choose the required components from given set of components.	Identify the components required for a clamper circuit.
LO6	Recall the circuit required for clamper.	Student has to choose the correct circuit from given set of circuits.	What is the circuit of clamper ?
LO7	Assemble the circuit for clamper.	Student will connect the wires to the appropriate terminals to form the clamper circuit.	Same as the task itself.
LO8	Design a clamper circuit to get an output voltage of +4 Volts.	Student will calculate the value of reference voltage for a fixed output voltage and enter the values in the simulator.	Observe a positive clamped waveform of +4 volts output voltage on simulator.

What students will do?	What simulator will do?	Purpose of the task
Student will select either he wants to perform clipper or clamper circuit experiment.	Simulator will allow him to select.	To decide whether clipper experiment or clamper experiment is to be performed.
Student will choose the required components from given sets of components.	It will display whether the selected component is correct or not.	To identify the appropriate components required to form wave shaping circuits.

4. Simulator Interactions

Student has to select the correct circuit from given sets of circuits.	It will display a set of circuits to choose the correct one.	To identify the correct circuit of clipper/clamper.
Student will connect the wires to the appropriate terminals to form the clipper/clamper circuit.	Simulator will allow to connect the components.	To form a closed circuit to get a desired waveform.
Student will enter the input parameters and click power on button.	Simulator will give different outputs for different sets of inputs.	To observe the output waveforms of different input parameters.
Student will calculate the input parameters required to get a fixed output voltage using calculator and enter those values in the circuit.	Simulator will calculate the input parameters for a fixed output voltage and display the output waveform with desired output voltage.	To design a clipper/clamper circuit for a fixed output voltage.

Storyboard(Round 2)

Experiment 1: Clipper and Clamper

1. **Story Outline:**

Clippers, limiters or clipping circuits make use of non-linear properties of diode, that is the diode conducts the current in the forward direction and does not conduct in the reverse direction. These circuits are primarily wave shaping circuits. They clip or remove the undesired portion of AC input voltage.

Clamping circuits are used to change DC level (average level) of the signal which adds or subtracts DC value to the signal. In clamping, the shape of waveform remains same only offset value (DC level) will change. Positive clamping adds a positive DC level in the signal while negative clamping adds a negative DC level in the signal. The capacitor is widely used in the clamping circuit.

In this virtual lab experiment, we are first selecting whether we have to perform clipper or clamper circuit experiment, then we have to select the components required for designing a clipper or clamper circuit. We can insert different values for components (R, C), the reference voltage and the type of diode, depending on which the output waveform can be changed. The different tasks can also be performed for given values.

In the first task, we have to identify the correct components of clipper and clamper.

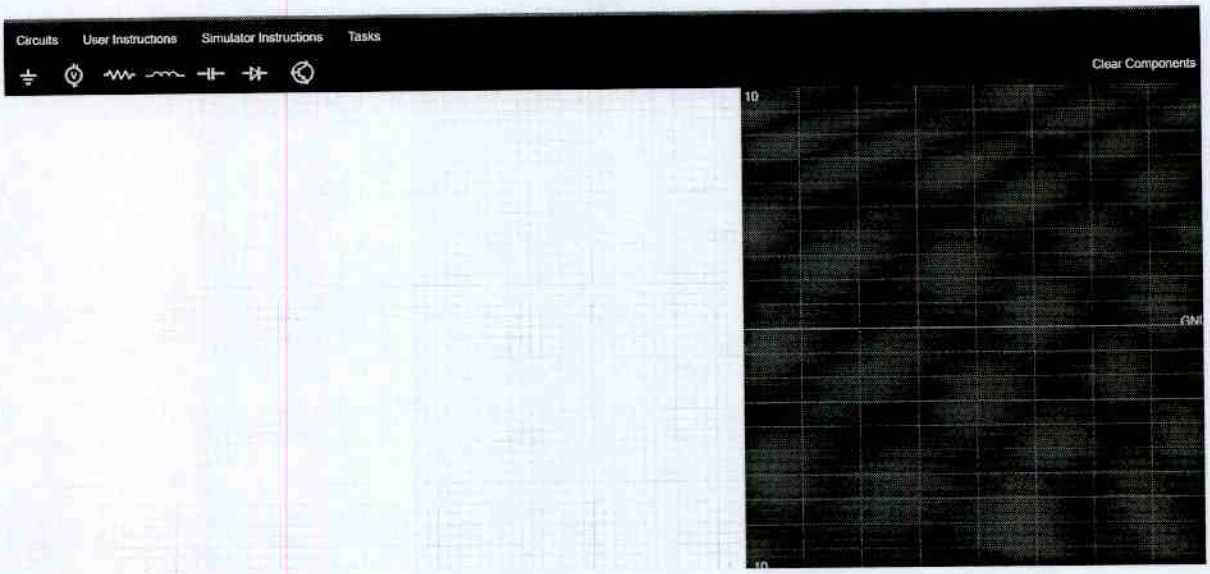
In the second task,we have to identify the correct circuit of clipper and clamper.

In the third task,we have to assemble the circuit by connecting wires at appropriate terminals.

In the fourth task,we have to design the circuit to get the desired output waveform.

2. **Story:**

2.1 Set the Visual Stage Description:



In the beginning, the simulator screen will open with workspace on left side of screen and an oscilloscope on the right side of the screen. There is a navigation bar on the top containing circuits, user instructions, simulator instructions and the tasks. The user have to click on the circuits menu to select whether he wants to perform clipper experiment or clamper experiment. Several tasks can be performed by hovering over the task menu and selecting any task from it. Components bar is just below the navigation bar which can be used by picking and placing them on the workspace.

2.2 Set User Objectives & Goals:

Our objective is to give basic understanding of wave shaping circuits. Another objective is to understand the appropriate connection of circuit elements in the circuit to achieve the required output waveshape.

Goals will be as such that the student will be able to calculate output voltage of clipped waveform and voltage level of clamped waveform depending on given parameters.

2.3 Set the Pathway Activities:

Clipper Circuit

1. Select the clipper button from the circuit menu.
2. Select the components and connect them to draw clipper circuit.
3. Set the desired input voltage value V_i with V_{rms} and frequency values.
4. Select the resistor and set the value.
5. Set the value of reference voltage V.
6. Connect the terminals through wires.
7. Run the simulation and desired output wave will be displayed.

8. Observe the output wave and verify the result with the hand written calculations.

Clamper Circuit

1. Select the clamper button from the circuit menu.
2. Selct the components and connect them to draw clamper circuit.
3. Set the desired input voltage value. V_i with V_{rms} and frequency values.
4. Select the capacitor and set the value.
5. Set the value of reference voltage V_1.
6. Connect the terminals through wires.
7. Run the simulation and desired output wave will be displayed.
8. Observe the output wave and verify the result of the clamped wave form as per the task.

2.4 Set Challenges and Questions/Complexity/Variations in Questions:

We will set the formative questions during simulation which will pose challenges to the user. The challenges will help in meeting higher cognitive levels through numerical and questions related to formula. Complex questions that reveal the fundamentals of the wave shaping circuits are posed to the student in the form of tasks.

Question 1: What will be the effect on output waveform when reference voltage is higher than the peak input voltage?

Question 2: What will be the effect on output waveform when reference voltage is negative?

2.5 Allow pitfalls:

1. For proper functioning of voltage source, values should be entered in the following sequence: (frequency, minimum voltage, maximum voltage) by double clicking on the voltage source.
2. Connecting ground terminal to the voltage source is mandatory in order to get the output.

2.6 Conclusion:

We will be designing a clipper and clamper circuit. The output wave form will be clipped depending on values of R and reference voltage. Similarly, in the clamper circuit the level of output waveform will be changed as per the value of C and reference voltage.Real time preview is shown on the oscilloscope so that the user can analyse the effect of each component and can make changes to the circuit accordingly.

2.7 Equations/formulas:

For clipper

For Si diode V_D=0.7V, V_O=4V, V_I=5 V (as given in aim)

Where: V_D=Cut in voltage of the diode

V_o=output voltage

V_I=input voltage

V=Battery voltage

Apply Kirchhoff's voltage law to get the equation

V_0-V_D-V=0 and solve it.

For clamper

Input voltage: 10 Volt (peak) to (peak) or 5 sin 2πt

Required output voltage: 2 V (peak) to -8V (peak)

Apply the KVL in Circuit:

V_{in}-V_c-V_1=0

The maximum voltage is V_m then equation is

V_m-V_c-V_1=0

Apply the KVL in output circuit

V_{in}-V_c-V_o=0

Put equation (1) to equation (2)

V_{in}-V_m+V_1=V_o

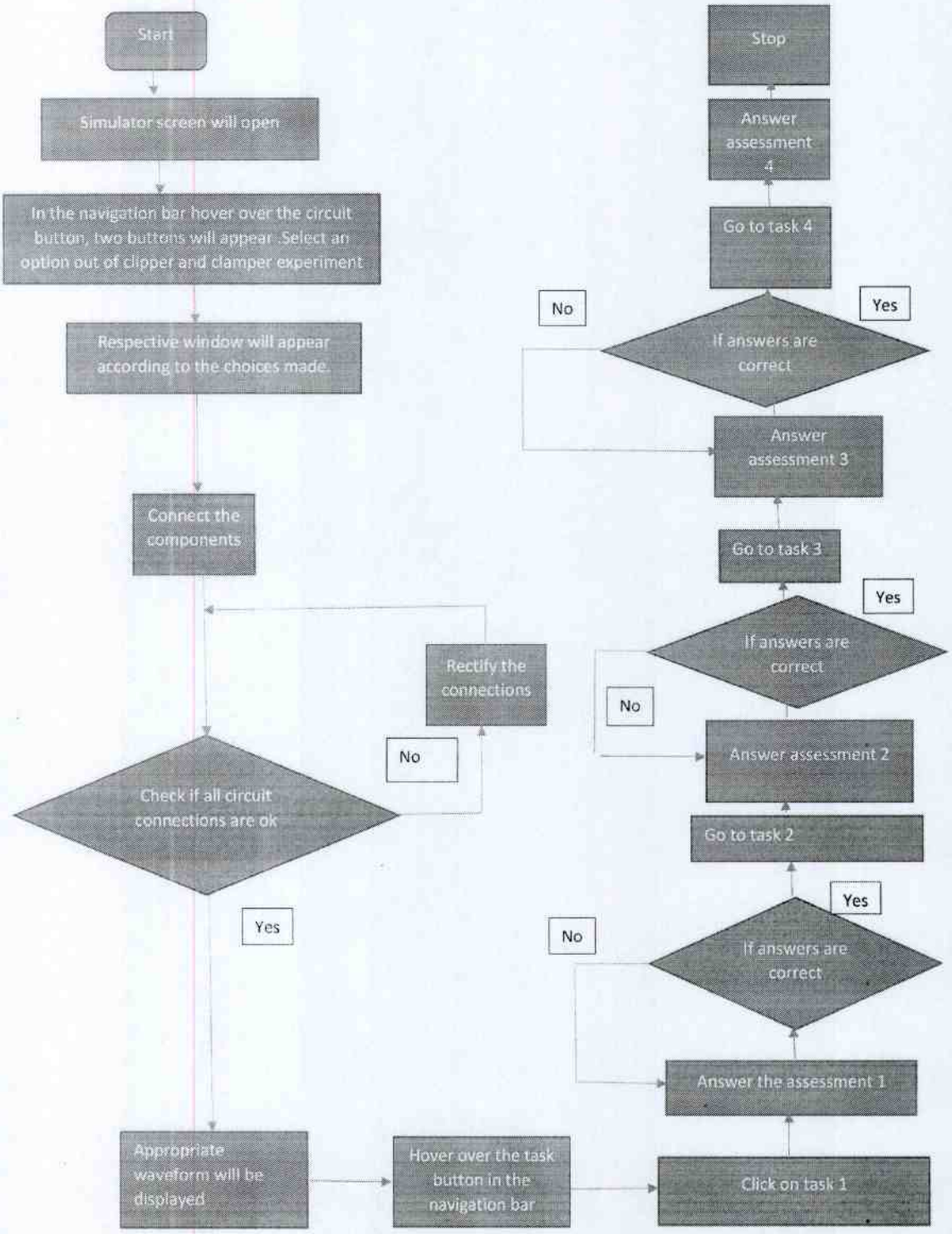
If V_{in}=0 then V_o=-V_m+V_1

If V_{in}= V_m then V_o=V_1

If V_{in}=-V_m then V_o=-2V_m+V_1

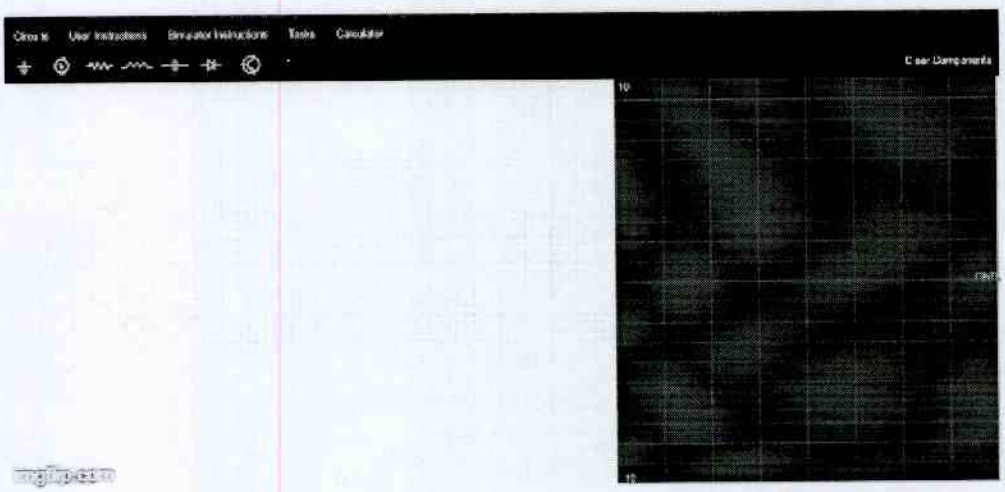
Now calculate the required parameters accordingly.

3. Flowchart


Start
Simulator screen will open
In the navigation bar hover over the circuit button, two buttons will appear .Select an option out of clipper and clamper experiment
Respective window will appear according to the choices made
Connect the components
Check if all circuit connections are ok
No
Rectify the connections
Yes
Appropriate waveform will be displayed
Hover over the task button in the navigation bar
Click on task 1
Answer the assessment 1
If answers are correct
No
Yes
Go to task 2
Answer assessment 2
If answers are correct
No
Yes
Go to task 3
Answer assessment 3
If answers are correct
No
Yes
Go to task 4
Answer assessment 4
Stop

4. Mindmap

5. Storyboard



Clipper and Clamper

Aim

To design the clipper and clamper circuit.

Developed by :
Harshal Nigam | SKIT M&G, Jaipur

A summary report on "BOOTATHON" event attended at Rajkiya Engineering College, Banda for Virtual Labs Development in coordination with IIT Bombay, IIT Delhi and IIT Kanpur supported by TEQIP-III from 4th – 10th November, 2019

Bootathon is a combination of Bootcamp & Hackathon. The event is organized to develop virtual Labs. They have specialized training program with a team of expert mentors and reviewers.

Our team submitted an initial proposal to develop a virtual lab on the design of "Clipper and Clamper" circuits. The proposal was accepted and our team was called to attend Bootathon event from 4th – 10th November, 2019 at Rajkiya Engineering College, Banda, after that with the approval of SKIT Management our team proceeded to attend the virtual Lab development program (Bootathon 2019)

Participating team details:

Team Members:

Harshal Nigam (Faculty from ECE Department)

Udyan Srivastava (B.Tech.-ECE 3rd Sem)
Ashwani Malav (B.Tech.-ECE 3rd Sem)
Aaditya Priya Gautam (B.Tech.-ECE 3rd Sem)
Vipul Gupta (B.Tech.-ECE 3rd Sem)

Lab Experiment: Design of Clipper and Clamper circuits

Discipline: Electronics and Communication Engineering

"Bootathon" was a national event and total 30 teams across India participated in this event. It was a very great experience to learn how to develop a virtual lab.

There are different rounds to clear before developing a perfect virtual lab which are as follows

Round 1 (Pedagogy)- In this stage learning objectives and pedagogy for experiments needs to be clearly defined.

Round 2 (Storyboard)- After completing the pedagogy the designing of story, mindmap, flowchart and storyboard is started.

Round 3 (Lab Manual)- In round 3, the developer designs the lab manual and the programmers code for the virtual lab simulator.

Round 4 (Code Development)- In this stage integration of different components should be done and it must be submitted for approval.

Round 5- This is the final stage where review and approval would is done by the virtual labs team.

The day to day activities done were as follows:

Day-1 (4 Nov 2019):

The students and faculty were separated. The students were taught coding languages to design the simulator and the faculties were given training to design Round 1 (Pedagogy) for their experiment.

Day-2 (5 Nov 2019):

The students training continued and they were given some tasks to perform regarding the simulator design. The faculties were given time to complete pedagogy for their experiment along with the assigned mentor.

Day-3 (6 Nov 2019):

The faculties were given training regarding Round 2 (Storyboard) and also to finalise Round 1 with mentor.

Day-4 (7 Nov 2019):

The faculties were given time to complete Round 2 (Storyboard) for their experiment and finalise the Rounds 1 and 2 for respective experiments.

Day-5 (8 Nov 2019):

The faculties of each team were told to sit with student team members and design the simulator according to what discussed in Rounds 1 and 2 and work on Round 3.

Day-6 (9 Nov 2019):

Due to Ayodhya issue we were told that the event is still continuing but in virtual mode (online) and the program extended to 15 November 2019.

The timings for each day was from 8 AM to 8 PM and our team worked very hard to complete all the rounds. We were appreciated by Director, REC Banda and the reviewers over there as we presented the progress of our work.

The scores for each team are being updated by the reviewers and they are continuously monitoring our work and guiding us to update the same.

We are highly thankful to the management of SKIT Jaipur for permitting to us to attend this BOOTATHON event. We have learnt a lot related to Virtual lab development process from this event.

Mr. Harshal Nigam

Assistant Professor

ECE Department

SKIT M & G Jaipur