Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology, Pune

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Department of Instrumentation Engineering

Experiential Learning

Academic Year	**: 2015-16**	**Sem : I**
Pattern	**: F-11 Revised Module : VI**	
Class	**: TY B.Tech Instrumentation & Control**	
Course Name	**: Process Loop Components**	

Course Code : IC30102

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Experiential Learning opportunities planned for Students

Course: Process Loop Components (IC30101)		Class : T.Y.B.Tech.	Div. : R	
Unit No.	Topic	Students Activity	No. of Students	Student's Roll Nos.
1	Process Characteristics	1. Role play –Analogy 2. Quiz / Rapid Fire Quiz 3. Case Study	7	2,3,11, 15,21, 23, 43
	P & ID using ISA S 5.1	1. Presentation 2. Match the Pair 3. Find Differences/ mistakes 4. Quiz / MCQ 5. Case Study	7	6, 7, 14, 16, 22, 27, 40
2	Current to Pressure convertor	1. Poster preparation 2. Model Preparation 3. Demonstration 4. Application Videos	5	1, 25, 29, 37, 42
3	PID Controller	1. Simulation 2. Field Visit – Beta Instruments Pvt. Ltd. 3. Demonstration	5	8, 12, 13, 17, 19
	Alarm Annunciator	1. Field Visit – Minilec / Electronet 2. Demonstration 3. Quiz	4	34, 35, 36, 38
4	Control Valve Applications	1. Field Visit – Forbes Marshall 2. Demonstration 3. Application Videos	5	10, 26, 32, 33, 41
5	Hazardous Area and Intrinsic Safety	1. Chart Preparation 2. Component Collection 3. Demonstration of Intrinsic safe circuit	4	30, 31, 39, 44
		Total No. of Students	37	

Prof. J. A. Gaikwad
Course Teacher

Prof. P. M. Kanjalkar
Head of Department

Group No.: 01

Process Characteristics

Sr. No.	Name of the Student	Roll No.	Contact No.	Signature
1.	Nikita Kumar	2	9930066875	
2.	P. V. Rukmini	3	8308810118	
3.	Shrenik Sanklecha	11	8087220814	
4.	Shaadi Albasayana	15	9975556104	
5.	Sharvari Thokal	21	9766377629	
6.	Tanvi Vaidya	23	8408033833	
7.	Yogesh Pardeshi	43	9420607516	

Topic : Process Characteristics

Objectives :

1. Need of understanding process characteristics.
2. Define and describe various process characteristics.
3. Identification of Process characteristics through quiz.

Activities :

We can start the session with a role-play and the learners can be asked to relate the situation with the topic they are going to study.

1. Role Play :

We need 4 volunteers for the role-play of the scenario given below:
Three customers have come to buy dress in a shop.
Customer **A** has come to buy dress for his daughter.
Customer **B** has come to buy dress for his wife.
Customer **C** has come to buy sari for his old mother as a surprise gift.
The discussion between the customers and the sales man is as follows:
(Customer A): *Excuse me! Show me party dress for a teenage girl who is tall, healthy & has a dark complexion.*
(Sales Man D): *Sir, light colored, salwar kameez with heavy work will definitely suit her. Shall I show you such dress?*
(Customer B): *Hello Excuse me! I am looking for a dress for my wife as a gift for anniversary. I have seen many dresses but I am confused. Please help me to make the selection. My wife is Medium in height, very fair & slim.*
(Sales Man D): *Sir, a bright colored sari will definitely suit her and will be perfect for such an occasion.*
(Customer C): *Hello! Please show me a sari for a 55 years old lady. She is short and has medium fair complexion.*
(Sales Man D): *Will she like a light weight sari having sober color? Since this will suit best for her age and complexion.*

******Purchasing of Laptop : Please see video Group1-Part1***

Let the other learners comment on their observation from the above scene.
What would have happened if the Customer didn't specify the features of the person?
We can conclude by stating that if the dress selection would be wrong, the dress will not suit the person.
Similarly, if type of controller if selected without taking in to account the process characteristics, the performance of the control loop will not be the best.

******Concluding Remarks : Please see video Group1-Part2***

2. Define and describe various process characteristics.

******Power-point Presentation : Please see Group1-Part3.ppt***

3. Identification of Process characteristics through quiz

******Power-point Presentation : Please see Group1-Part3.ppt***

Group No.: 02

P&ID using ISA S5.1

Sr. No.	Name of the Student	Roll No.	Contact No.	Signature
1.	Siddharth Patil	6	9561493181	
2.	Yogesh Patil	7	9028216075	
3.	Sambhaji Sawant	14	9175711834	
4.	Siddharth Gurav	16	7276822541	
5.	Amar Ukhalkar	22	8237450321	
6.	Vinay Wanare	27	8793237833	
7.	Suyog Khamgaonkar	40	8087405507	

Topic : P & ID using ISA S5.1

Objectives :

1. Need of understanding Piping and Instrumentation Drawings.
2. Understanding P & ID through
   a. Match the pair
   b. Find the differences
   c. Mistakes in given P& ID
   d. Quiz /MCQ
3. Case Study : Boiler controls

Activities :

The standard ISA S 5.1: The purpose of this standard is to establish the uniform method for designating instruments and instrumentation system used for measurement and control. It includes symbols and identification codes.

This ISA S 5.1represent P & ID i.e. Piping and Instrumentation Drawing for chemical, petroleum, power generation, metal, refining, air conditioning, and process industries.

1. Need of understanding Piping and Instrumentation Drawings:

- Design plant sketches
- Teaching examples
- Technical papers, literature, and discussions
- Instrumentation system diagrams, loop diagrams, logic diagrams
- Functional descriptions
- Flow diagrams: Process, Mechanical, Engineering, Systems, Piping (Process) and Instrumentation
- Construction drawings
- Specifications, purchase orders, and other lists Identification (tagging) of instruments and control functions
- Installation, operating and maintenance instructions, drawings and records

After learning the ISA standard S 5.1 we tried to implement small P&ID loops using this standard. For that we first tried to understand the PFDs of small plants. Then we learned how to develop P&ID from PFD. In this we made the control loops for Temperature, Pressure, Level etc.

After implementing small P&IDs we have chosen Boiler as process equipment and tried to chalk out its control schemes. The control schemes are divided in our group. Then in our class we tried to explain each and every loop of this system in front of students. In this we gave the tasks of explaining different loops to our group members.

During this Experiential Learning Process we came to the practical aspects of developing P&ID. How an Instrumentation Engineer develops P&ID from PFD. It benefited us a lot.

2. Understanding P & ID through

a. Match the pair
b. Find the differences
c. Mistakes in given P& ID
d. Quiz /MCQ

****** Please see Power-point presentation : Group2-Part2.ppt***

Benefits of Experiential Learning Process :

- Help us to understand and analyze the PFD.
- Understand how to develop P&ID for small control loops.
- Develop P&ID of Boiler steam-water system.
- As a case study we have studied the different process control loops of boiler system, identification of loops, tag numbers, different variables involved in process control loop.

Shared Learning Experience in the class room :

*3.***Case Study – Boiler Controls : Please see video Group2-Part1*

Group No.: 03

Current to Pressure Convertor

Sr. No.	Name of the Student	Roll No.	Contact No.	Signature
1.	Akshay Navarkar	1	8446722709	
2.	Vikram Virkar	25	9404578730	
3.	Swapnil Shinde	29	9860975955	
4.	Mahesh Urude	37	9271874881	
5.	Babarao Sonule	42	8605283240	

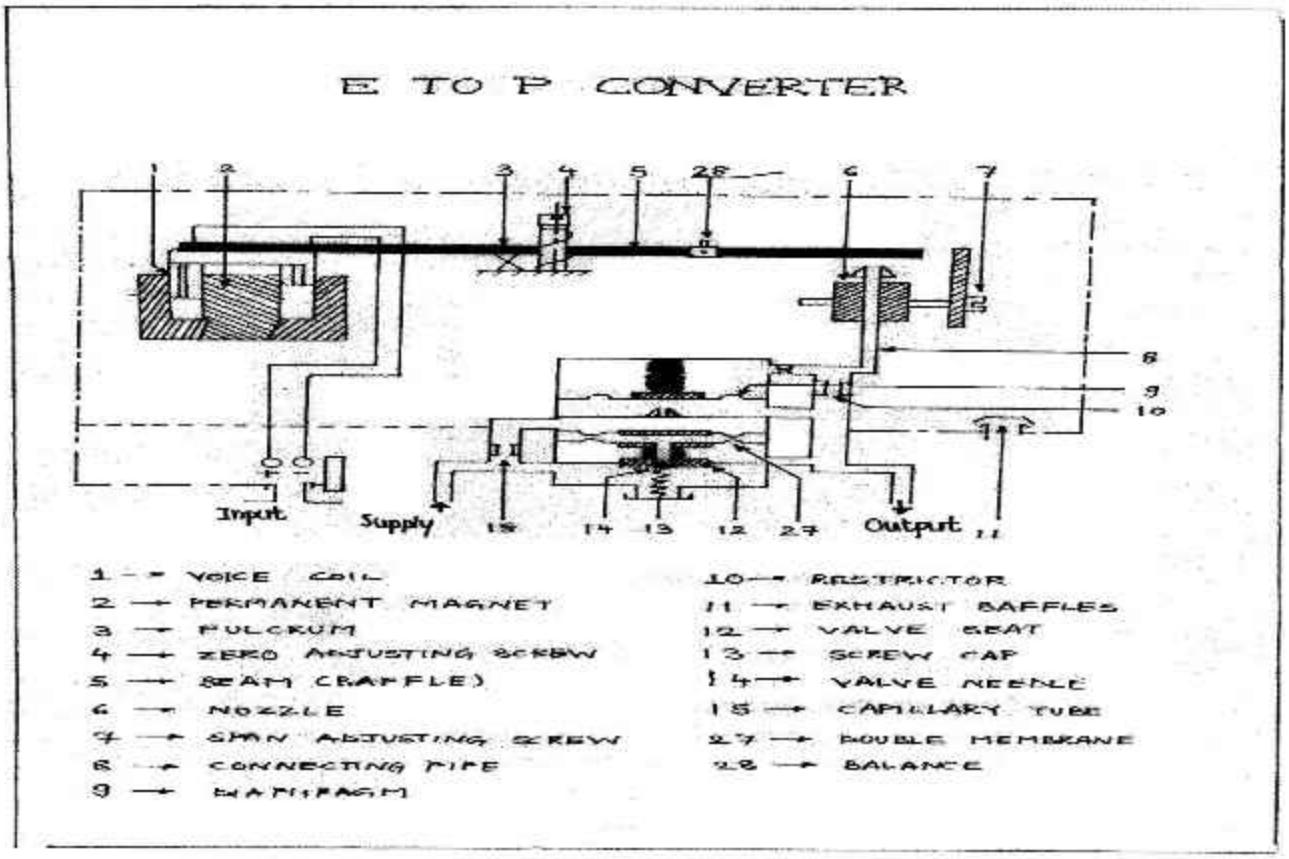
Topic : Current to Pressure Convertor

Objectives :

1. Need of Current to Pressure Convertor
2. Understanding its construction details
3. Model Demonstration
4. Application Videos

Activities :

1. **Need :** A "current to pressure" converter (I/P) converts an analog signal (4 to 20 mA) to a proportional linear pneumatic output (3 to 15 psig). It consists of a current carrying coil, permanent magnet and a flapper nozzle arrangement. Its purpose is to translate the analog output from a control system into a precise, repeatable pressure value to control pneumatic actuators/ operators, pneumatic valves, dampers, vanes, etc.
2. **Construction Details :**



Specifications of Current to Pressure converter :

Input Signal	4-20 mA dc
Input resistance	90 Ω ± 5
Pressure	3-15 psi / 0.2 - 1 kg/cm^2
Characteristics	Linear with input current
Linearity	0.5 %
Sensitivity	0.1 %
Air supply	20 psi / 1.4 kg / cm^2 ± 10 %
Power supply	240 V AC ± 10 % 50 Hz
Consumption	30 L/H typically

3. **Model Demonstration:**

**** Please see video Group3-Part1*





4. **Application Videos :**

**** Please see video Group3-Part2*

Conclusion:

1. Studied the importance of voice coil assembly in I to P converter
2. Learn calibration of I to P converter

3. Studied various technical specifications of Bellofram make I to P converter.

Group No.: 04

PID Controller

Sr. No.	Name of the Student	Roll No.	Contact No.	Signature
1.	Shivraj Pisal	8	9689033489	
2.	Darshana Sapkal	12	8421238486	
3.	Sanket Sapkal	13	9405672096	
4.	Sudarshan Badjatiy	17	9406883059	
5.	Parag Tambalkar	19	8421818982	

Topic : PID Controller

Objectives :

1. Understanding PID Controller basics
2. Simulate PID actions on MATLAB
3. Demonstration
4. Interfacing PID for Temperature Control Loop

Activities :

Some glimpses of our presentation

*** *Please see video Group4-Part1*

*** *Please see Power-point presentation : Group4-Part2*

Group No.: 05

Alarm Annunciator

Sr. No.	Name of the Student	Roll No.	Contact No.	Signature
1.	Akshay Sawant	34	9404351565	
2.	Tushar Gharatkar	35	9764698363	
3.	Shailesh Kamble	36	8149460722	
4.	Dipesh Borole	38	9763117244	

Topic : Alarm Annunciator

Objectives :

1. Need of Alarm Annunciator
2. Demonstration
3. Design Specifications
4. Quiz / Industrial visit

Activities :

Alarm Annunciator is a device which attracts operator attention towards faulty or abnormal process conditions. The annunciator system consists of multiple individual alarm points, each connected to trouble contact (alarm switch) logic module and visual indicator.

Need-work activities of Alarm Annunciator:

The operator controls the process or plant from control room. If any abnormal condition occurred, alarm annunciator attracts the attention of operator towards the abnormal condition.

First we studied the theory and practical aspects of alarm annunciator. After learning the alarm annunciator, we visited website of MINILEC (one of the manufacturer of alarm annunciator). From there, we got detail information about their products e.g. input-output features, construction details, block diagram, etc.

After learning alarm annunciator, we present one demonstration and quiz on alarm annunciator.

During this Experiential Learning Process we came to the practical aspects alarm annunciator. How an alarm annunciator can be used for different applications e.g. process industries, airplane, etc.

Sequences of Alarm Annunicator are,

1B: Flashing sequence: The alert condition of an alarm point result in flashing visual condition and an audible signal. The visual indicator turns off automatically when monitored process returns to normal.

1D: Dim sequence: Same as 1B, but visual indicator is dim rather than off, so a dimmer unit is required, because all visual indicators are turned on for DIM (normal) flashing (alert) or steady (acknowledge) the feature for detecting lamp is unnecessary.

2A: Ringback sequence: The difference from 1B is that following acknowledge the return to normal condition produces a dim flashing and an audible signal. An additional momentary contact, 'reset' pushbutton is required for this sequence. Pushing the reset button after monitor variable has returned to normal turn off the dim flashing.

2C: Manual Reset sequence: - This sequence is same as 1B except that the systems must be reset manually after operation has returned to normal in order to turn OFF visual indicator ON even though the trouble contact has returned to normal.

4A: First Out sequence: - It is designated to identify the first of a no. of interrelated variable that have exceeded normal operating limits. An Off normal condition is only one of a group of process variable will cause some or all the remaining condition in the group to become abnormal. The first alarm causes flashing and all the subsequent point in the group turns the steady light only. This sequence monitors interrelated variable. The visual indication is turned off automatically when condition returns to normal after acknowledgement.

****** Please see video Group5-Part1***

OPERATING SEQUENCE CHART:

1B (A) 2C (M) 4A (F) 2A (R)

FAULT CONDITION	MANUAL ACTION	AUTO RESET		MANUAL RESET (1)		MANUAL RESET (2)		FIRST UP		RING BACK ALARM		
		AUDIO	VISUAL	AUDIO	VISUAL	AUDIO	VISUAL	AUDIO	VISUAL	AUDIO	VISUAL	RING BACK ALARM
NORMAL		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
ABNORMAL		ON	FLASH	ON	FLASH	ON	FLASH	ON	FLASH (I) STEADY (S)	ON	FAST FLASH	OFF
NORMAL BEFORE ACCEPT		ON	FLASH	ON	FLASH	ON	FLASH	ON	FLASH (I) STEADY (S)	ON	FAST FLASH	OFF
NORMAL	ACCEPT	OFF	OFF	OFF	STEADY	OFF	STEADY	OFF	STEADY (I) STEADY (S)	ON	SLOW FLASH	OFF
ABNORMAL	ACCEPT	OFF	STEADY	OFF	STEADY	OFF	STEADY	OFF	STEADY (I) STEADY (S)	OFF	STEADY	OFF
ABNORMAL	RESET			OFF	STEADY	ON	FLASH					OFF
NORMAL BEFORE RESET		OFF	OFF	OFF	STEADY	ON	FLASH	OFF	STEADY (I) STEADY (S)	ON	SLOW FLASH	OFF
NORMAL	RESET			OFF	OFF	ON	FLASH	OFF	OFF	OFF	OFF	OFF
ABNORMAL	RESET			ON	FLASH	ON	FLASH	OFF	STEADY	ON	FAST FLASH	OFF
NORMAL	TEST			ON	FLASH	ON	FLASH	ON	FLASH	ON	FAST FLASH	OFF

(I) – Initial fault, (S) – Subsequent Fault S6 All off S5 S7 S8

Power-point Presentation : Please see Group5-Part2.ppt

Group No.: 06

Control Valve and its applications

Sr. No.	Name of the Student	Roll No.	Contact No.	Signature
1.	Sonam Raut	10	9730662910	
2.	Poonam Waghere	26	9881191633	
3.	Mohini Sawant	32	8237149726	
4.	Vaishnavi Girolkar	33	9552188935	
5.	Pratiksha Kadam	41	8446905831	

Topic : Control valve and its Applications

Objectives :

1. Demonstration of Control valves
2. Control valve Application Videos
3. Specifications
4. Industrial visit

Activities :

Control valve applications:-

1. **Butterfly valve**: In the pharmaceutical, chemical and food industry a butterfly valve is used to interrupt product flow (solid, liquid, gas) within the process. The valves used in these industries are usually manufactured according CGMP guidelines (current good manufacturing practice)

2. **Ball valve**: Pulp & paper industry uses ball valve. It is also used as shut-off valve. ball valve includes a wide selection of solutions for dependable isolation in power mining, refining, silica and petrochemical applications.

3. **Globe valve**: They are used to control flow rates when mixed fluids are there or in batching operations where fluid flow is continuously adjusted. It is used oil and gas industries and for regulating flow.

4. **Gate valve**: They are used when straight line flow of fluid and minimum restrictions are needed. It is also used paper and pulp industry, slurry handling, water and sewage, high temperature.

5. **Pneumatic valve**: it is used in transportation industry in the suspension and engine of transportation. Also used in utility equipment.

6. **Diaphragm valve**: These valves are used on shut-off and throttling service for liquids. Used for slurries, vacuum, gases and to isolate or block flow.

7. **Plug valve**: these are used for On-off control on flow. For moderate flow throttling and for flow diversion using multiport valves.

8. **Needle Valve** : Generally used for air / gas service and also for very accurate flow control applications.

Specifications :

Make :Dembla
Type : Globe valve two way
Size : 15mm
Body : cast steel
Trim : SS 316
Packing: PTFE(Teflon)+ABS (Asbestos)
Plug Characteristics : Equal Percentage
Cv : 0.5 gpm
Stroke length : 18mm
Actuator : Pneumatic Spring and diaphragm type
Action : Air to open
Valve : Direct, Push down to close
Fail safe : Air failure to close
Spring Range : 0.2 to 1 Kg/cm^2
Max. change in pressure : 3.5 Kg/cm^2

Process connection Rating : ANSI 150 Leakage Class : III

*** *Please see video Group6-Part1*

*** *Please see video Group6-Part2*

*** *Please see video Group6-Part3*

*** *Please see video Group6-Part4*

****Power-point Presentation : Please see Group6-Part5.ppt*

Group No.: 07

Hazardous Area Classification and Intrinsic Safety

Sr. No.	Name of the Student	Roll No.	Contact No.	Signature
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2.	Suresh Shelake	31	9764698363	
3.	Rupali Ghanghav	39	8149460722	
4.	Mohini Mangate	44	9763117244	

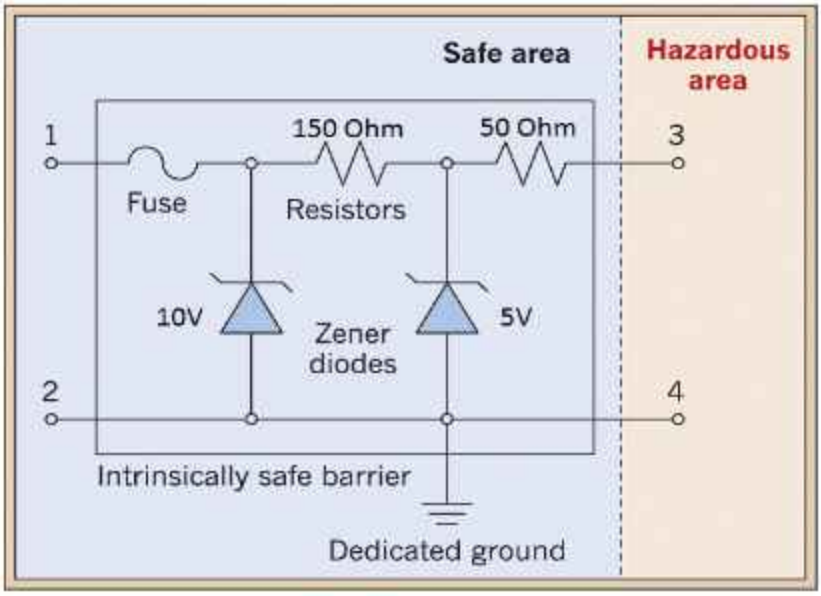
Topic : Hazardous Area Classification and Intrinsic Safety

Objectives :

1. Chart Preparation for Hazardous Area Classification
2. Intrinsic Safety and its Components
3. Intrinsic Safety Circuit Design

Activities :

We are assigned topic hazardous area and intrinsic safety in which we are preparing chart of different hazardous areas and implementing intrinsic safe circuit on the breadboard. We have prepared chart. In chart we have given classification of hazardous areas. Hazardous areas are classified based on different classes which include different divisions, in which there are groups. Also we have given zones for dust and gases. We have learned about sources of hazard or explosion or ignition and hazardous areas in industry. Till, we have done chart of classification hazardous areas. Also we have done calculations of intrinsic safe-circuit. safe circuit – Intrinsic safe circuit protects safe area from hazardous area i.e. low power circuit from high power circuit. It includes protection component like zener diode, fuse, resistor etc.



Loop I: By using KVL,

$$-10 - 150i1 - 5 = 0 ,$$

$i1 = -15/150 ,$

$i1 = -100mA.$

Loop II: By using KVL,

$$-5 - 50i2 - 5 = 0 ,$$

$i1 = -5/50 ,$

$i1 = -100mA.$

In both loops Actual current direction is opposite to assumed current direction. So, calculated currents are negative.

We have demonstrated the intrinsic safe circuit. The fuse used is of 200mA, condition given is such that, if the current exceeds 200mA then the fuse will blow and connection will be broken that means instrument will be safe.

We have used 150ohm and 50ohm resistors. Zener diode of 5V and 10V and the supply is varied according to circuit requirement. We have varied the supply from 50mA to 300mA and finally we got expected result.

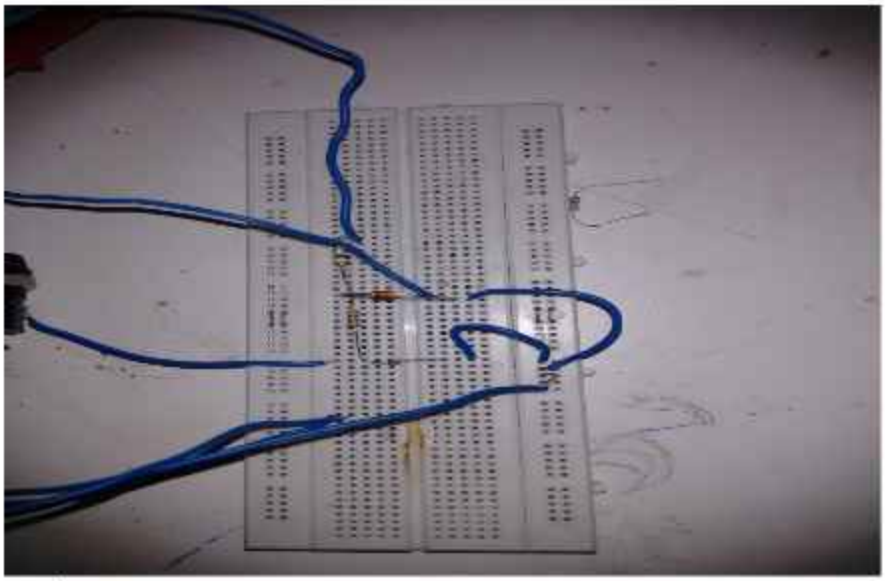
The circuit is divided into two parts – 1) Hazardous area 2) Safe area

1) Hazardous area:-

We have used DMM for output voltage indication before and after fuse blown. The output voltage before fuse blown is 10V and after fuse blown is 0V. That indicates circuit is broken before any damage.

2) Safe area:-

We have used power source i.e. current source (upto 2A), fuse (200mA), zener circuit in safe area.



****** Please see video : Group7-Part1***

****** Please see Chart : Group7-Part2***

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Experiential Learning Activity

FEEDBACK

Please rate this course on the scale of 1 to 5:
5=Excellent, 4=Very Good, 3=Good, 2= Above Average, 1=Average

1. Did you find Experiential Learning Activities useful.....[ ]
2. Effectiveness of this activity in understanding fundamentals .....[ ]
3. Methodology of conducting this activity .....[ ]
4. Did you like this activity in general and be continued in next semester ....[ ]

Any suggestions / comments :

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Name and Signature : .....