

Activity-based Learning (ABL) of Power Systems-I (PS-I) Course

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Abstract— In this 21st century, radical changes have existed in the teaching-learning system. Only a few students are showing interest in learning information from the teacher rest is purely depending on GOOGLE, Internet resources, etc. In general, many students simply overlook any course if they feel complications in learning it. So for such types of courses as a teacher, we have to create interest among the students through Activity-Based Learning (ABL) which acts as a bridge to cross a typical water pond (Course). Classroom activities will give simultaneous benefits to both students as well as for teachers (students can overcome the difficulty in learning typical course teachers can deliver a topic in a variety of approaches effectively). Collaborative learning among students will create a healthy learning environment and also emphasize student's performance, teamwork. Any student tries to identify a solution for a given problem but, through collaborative learning with a group of people will give an optimized solution to the same problem. Power Systems-I (PS-I) is an essential subject in Electrical Engineering. Along with conventional learning of any course Activity-Based Learning (ABL) will overcome some of the difficulties, I am sharing my teaching experiences in the PS-I course of activities like word search, charts/posters, mindmaps, interdisciplinary lectures, snake and ladder, puzzles, etc.

Index Terms—Activity-Based Learning (ABL), EDMODO tool, Power Systems – I (PS-I).

I. INTRODUCTION

THE basic human needs of man are food, cloth, and shelter as of today power had become a 4th basic need. Humans depend on the environment, with those resources a man had initiated in search of science. In this 21st century, technology has been upgraded a lot with many inventions/discoveries which made our life very much comfortable and convenient too. So to operate any electrical device we need Electric Power. Exactly today scenario is man's life is incomplete without Electric Power. Everyone can utilize the electric power for our needs at the same time have a responsibility to save it for future generations. Power Systems – I (PS-I) is a necessary subject in the discipline of Electrical Engineering. Electric power can generate using both renewable and non-renewable energy resources.

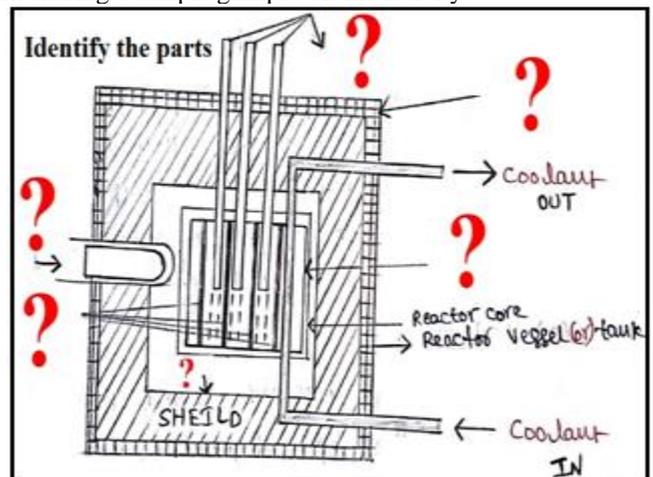
I. LIST OF ACTIVITIES IMPLEMENTED

- IOT (Identification of Topic)
- Posters/Charts
- Word Search
- Business with Temple Run Version 2.0
- Mind Maps
- Case Study PPT's
- Interdisciplinary

- Snake and Ladder
- Mapping/Scratch Cards
- Puzzles

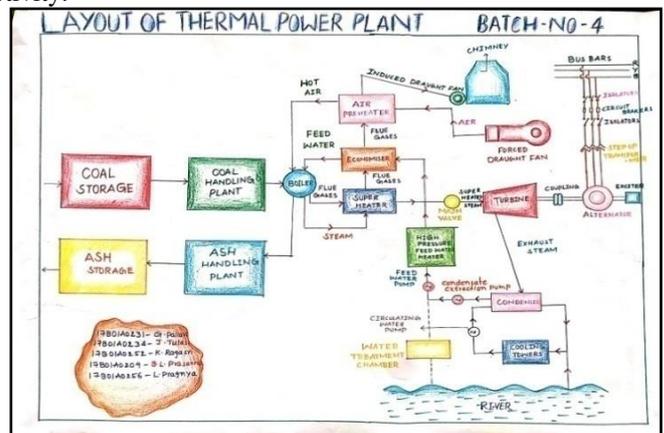
A. Identification of Topic (IOT)

Initially, I had created a variety of images consist of hidden topic names, parts of an apparatus, a mistake in the content. I asked students to identify the hidden topics/parts/mistakes in the image. The objective of this activity is to identify, recollect the technical words in the PS-I course and also help them to perform well in the examinations to get a good score. I am sharing a sample glimpse of this activity.



B. Posters/Charts

Students have drawn various types of power plants that are exploring their creativity. The purpose of the charts is to improve drawing skills and present diagrams/circuits well in the examination. I am giving out a sample glimpse of this activity.



C. Word Search

Initially, I had placed technical words, components names of PS-I in the 12 x 12 table in various directions (left to right, right to left, top to bottom, bottom to top, diagonally from top to bottom and diagonally bottom to top from both sides (left, right)). The objective of this activity is to search technical words in the PS-I course.

Z	E	K	U	F	F	Y	V	M	L	J	A
H	C	N	D	R	H	T	N	I	L	P	L
G	O	Q	E	E	A	U	T	E	I	J	T
Y	N	S	N	H	Q	N	G	Y	S	L	E
E	O	K	S	Y	F	A	I	D	N	R	R
N	M	G	I	J	S	W	P	U	F	L	N
M	I	Q	M	Q	H	Y	Y	O	M	V	A
I	S	Z	E	W	R	G	I	P	C	J	T
H	E	Q	T	F	F	E	E	D	E	R	O
C	R	H	E	A	T	J	R	B	D	N	R
X	Q	O	R	P	E	D	P	K	W	K	U
G	W	U	Z	X	Q	R	E	L	I	O	B

D. Business with Temple Run Version 2.0

In this PS-I Business activity, a total of 10 Batches had participated. Based on their performance they got profit (or) loss. The procedure for this activity is as follows.

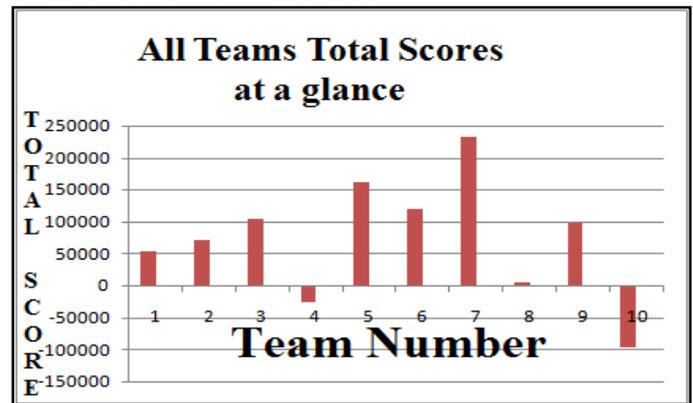
- Purchase of thermal power plant components by playing Temple Run Version 2.0 game treated as temple run score.
- By rolling a die, following general rules of the indoor business game students played for 20 minutes, score at the end of the time is treated as a business game score.

Total Score = Temple Run Score + Business game Score
Out of 10 batches participated in this activity

- 8 Batches got → **PROFIT**
- 2 Batches got → **LOSS**

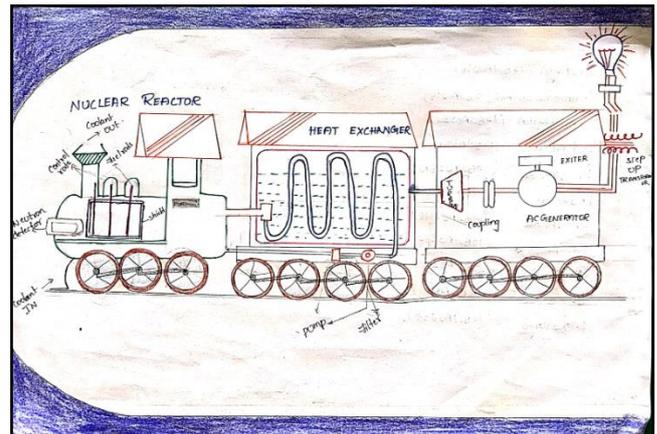
+1,000	STEP-UP TRANSFORMER ₹ 1,10,000/-	AIR PRE-HEATER ₹ 70,000/-	ALTERNATOR ₹ 1,25,000/-	EXCITER ₹ 55,000/-	WATER TREATMENT CHAMBER ₹ 35,000/-	JAIL
ASH HANDLING PLANT ₹ 40,000/-	STEAM POWER PLANT BUSINESS				FORCED DRAUGHT FAN ₹ 45,000/-	BOILER ₹ 1,00,000/-
SUPER HEATER ₹ 90,000/-	ELECTRIC COLOURS	SPARKLE MINDS	ELECTRIC EXPRESS	THE ACHIEVERS	TALANTED TECHIES	POWER PURSUIT
COAL STORAGE ₹ 80,000/-	ANSHVANI	J. TULASI	K. VARSHA	A. KEERTHI	G. BANDHAVI	T. AKANKSHA
TURBINE ₹ 1,00,000/-	L. JYOTHI	BH. PRASANNA	B. MADHURI	D. ANANTHA	R. NAVYA	CHINMAI
COOLING TOWERS ₹ 45,000/-	D. VARSHA	K. RAGA SRI	N. MANISHA	CH. BHARGAVI	R. HARESHITA	J. USHA SRI
	F. RAJITHA	L. PRAGNA	K. SWETHA	G. JAHNAVI	S. KAVYA	B. SIRI VERNNA
	INNOVATIVE MINDS	POWER GENERATORS	ELECTRICAL RIDERS	ELECTRICAL SWAGS	POWER RANGERS	ELECTRIC RACERS
	AKHILA	B. AMULYA	D. KAVYA	A. DIVYA SRI	G. MANASA	G. SHIVANYA
	A. DAKSHAYANI	J. SRI LEKHA	M. CHATURYA	CH. VIRATHI	J. MNHESHWAR	G. LALITHA
	M. NAVYA SRI	A. GAYATRI	G. PRIYANKA	G. DIVYA RAGA	B. MAHIMA	V. KIRANMAI
	LAKSHMI	A. MOONIGA	P. KEERTHI	J. SRI KALA	D. PRATHUSA	K. BINDRU
	J. POOTHIA	B. SUMA	K. VINEETHA	E. DIVYA	B. JYOSHNA	M. SOPRATA
	B. RANI					
	ISOLATORS ₹ 70,000/-	COAL HANDLING PLANT ₹ 60,000/-	ECONOMISER ₹ 80,000/-	CONDENSER ₹ 50,000/-	BUS BARS ₹ 90,000/-	-1,000

The below figure shows the statistical representation of the Team total score Vs Team number.



E. Mind Maps

Students have drawn a variety of mind maps by interfacing PS-I topics with aspects of societal, environment, etc. By these mind maps students elevated PS-I concepts in a different approach, so that they can remember the concepts for a long time. There is quite a difference between Mind maps and posters/Charts. I'm sharing a sample mind map representing the layout of a nuclear power plant that looks like a side view of a train.



F. Case Study PPT's

A case study defines as a *research strategy*, an empirical inquiry that investigates the phenomenon within its real-life context. These case studies formulate learners to direct towards a specific topic in a variety of ways. A Case Study is quite different from a general topic.

Through this activity, students will get to know about problems/issues which are happening/happened in the Power System sector. Initially, I allotted various case study topics to 12 batches in the class (taking references from the daily newspapers/Wikipedia/Google). I have set specific guidelines for preparing PowerPoint presentations (PPT).

Assessment Rubrics of case study PPT's				
S . N o.	Rubrics	Excellent (5)	Good (4)	Average (3)
1	Communication	Very Good Language, Verbal & Non-Verbal	Language, Verbal & Non-Verbal is OK	Language, Verbal & Non-Verbal is to be improved
2	Team Involvement	All Team Members are Involved Much	All Team Members are Involved	Only Few Team Members are Involved
3	PPT Work	Included Much relevant Articles, Glimpse	Included relevant Articles, Glimpses	Have to include better points, Glimpse which suits their topic
4	EDMODO tool Poll Votes	Highest	< Highest	<< Highest
5	Time Management	Utilized almost Given time	completed in a short time but within only	Used more than given time



G. Interdisciplinary faculty lectures with student worksheets

In this activity, three faculty from different engineering disciplines had given individual lectures to II-EEE students.

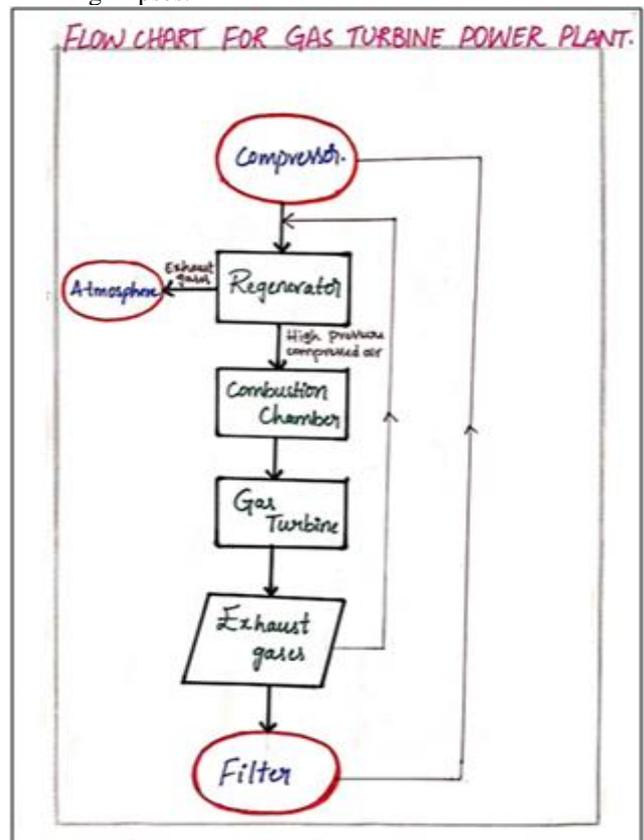
S.No.	Branch of Faculty	Name of the topic
1	Computer Science Engineering (CSE)	<ul style="list-style-type: none"> Algorithms Flowcharts C-Program
2	Mechanical Engineering (ME)	<ul style="list-style-type: none"> Steam Turbines Co-Generation power plants
3	Civil Engineering (CE)	<ul style="list-style-type: none"> Site Selection of power plants Surveying Soil Testing Green Belt

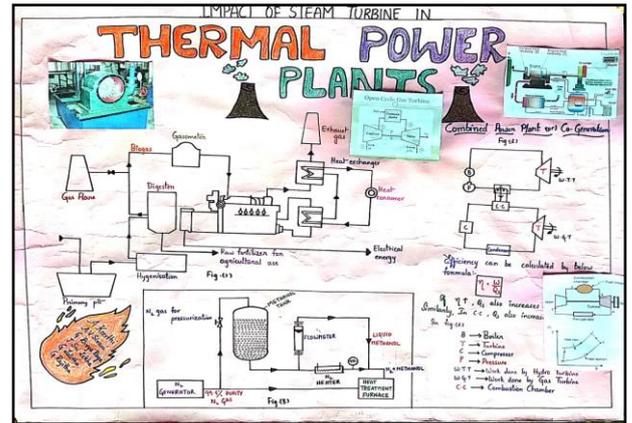
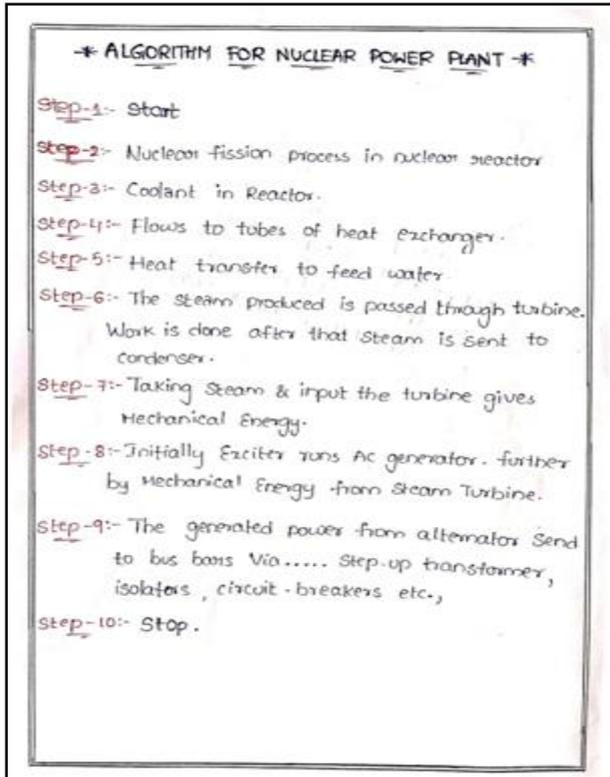
The above lectured acts as prerequisite topics for understanding things behind the layout of thermal/nuclear/gas power plants etc. After completion of the above mentioned interdisciplinary lectures.

- Regarding CSE, some students presented layouts of various power plants in the form of algorithms, flow charts, and c-programs. I am sharing sample glimpses.

Topic Name	Newspaper/Website	Date
Indian coal allocation scam	Wikipedia/Google	2004-2009
'Water scarcity may hit thermal power'	The Hindu	JANUARY 16, 2018
Coal shortage begins to hit power generation	The Hindu	18-Oct-2018
Andhra Pradesh to set up two mega super critical thermal power plants	DECCAN CHRONICLE	16-Dec-2015
Bhopal gas tragedy	Wikipedia/Google	2-3 December 1984
Coal shortage hits production at Vijayawada thermal power plant	Times of India	Nov-28,2017
Severe shortage of coal stares NTPS	The Hindu	14-Jun-2014
Power producers urge centre to speed up the revival of gas-based power plants	The Hindu	30-Sep-2018
Andhra Pradesh to get another nuclear plant	DECCAN CHRONICLE	22-Sep-2018
Coal Ash In Telangana and Andhra Pradesh Sparks Concern	DECCAN CHRONICLE	7-Apr-2015

Sample glimpses of case study PPT's

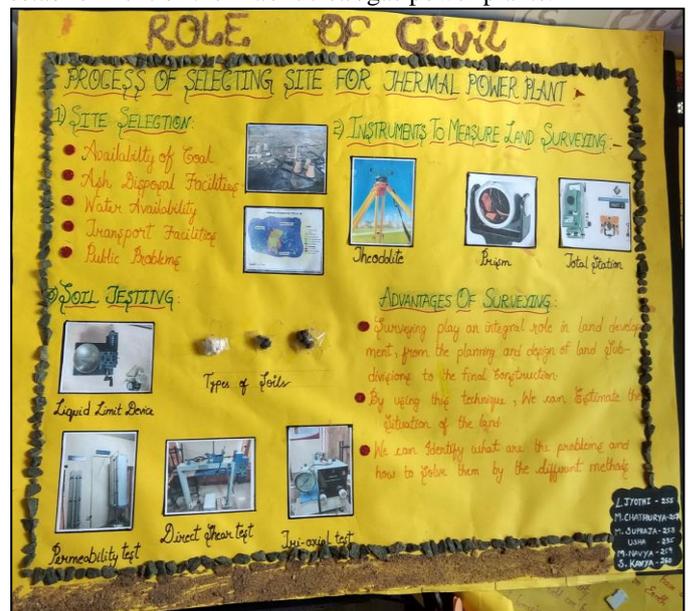




- Regarding ME, some students presented a poster on the co-generation concept, which improves the overall efficiency of the power plant. The below poster explained the role of ME components like steam turbines in the working of thermal/nuclear/gas power plants.
- Regarding CE, some students presented a poster consist of the below CE discipline topics.

S. No.	Name of process	Tools/Methods
1	Soil Testing	<ul style="list-style-type: none"> • Liquid Limit Test • Permeability Test • Direct Shear Test • Tri- Axial Test
2	Surveying	<ul style="list-style-type: none"> • Theodolite • Prism • Total Station

The below poster will shows the role of CE topics (soil testing methods, surveying tools) behind the establishment of thermal/nuclear/gas power plants.



C-Programme

Coal and Ash Handling Plant

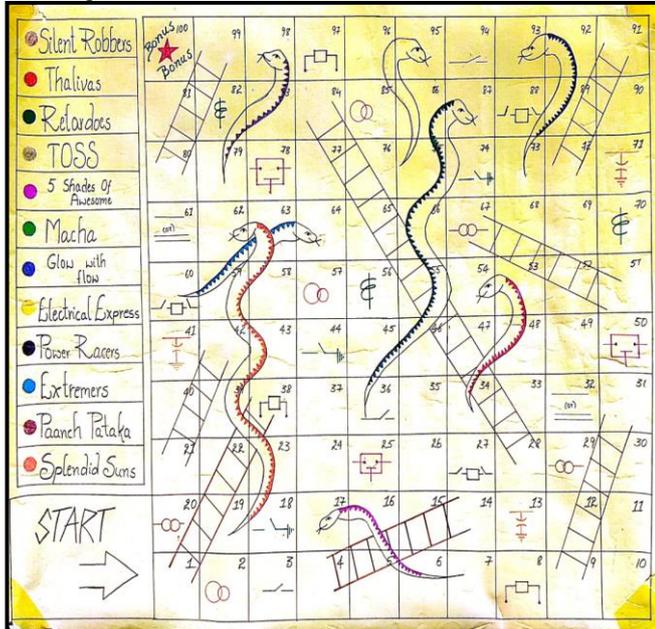
```

#include <stdio.h>
int main ( )
{
    int coal ;
    while (coal > 0)
    {
        printf ("Send to coal storage unit ");
        printf ("Send to Crusher");
        if (coal storage % crusher == 0)
        {
            printf ("Send to pulverisation");
            printf ("Send to boiler");
        }
        else
        {
            printf ("Send to crusher");
        }
        if (Boiler output == ash) {
            printf ("Send to Ash handling plant");
        }
        else
        {
            printf ("Send to Super heater");
        }
    }
}
    
```

H. Snake and Ladder

Firstly, before the day of the activity, I divided total class students into batches and instructed them to prepare various types of bus-bar arrangements for snake and ladder activity. I had designed a snake and ladder chart, which consists of various Power system components like bus bars, circuit breakers, Sectionalization switch, Current Transformer

(CT), Potential Transformer (PT), etc. in the blocks of different numbers. On the activity day, the activity gets started just by following the general rules of the snake and ladder game by rolling the die. I instructed all batches to play the game and collect various power system components using them to design any type of bus bar arrangement before reaching of 100th block.



		1	6		7		8		
					2				
3	5								
									4

I. Mapping/Scratch Cards

Initially, I had prepared various quiz questions cards, answers cards, and scratch cards. I had separated, question cards on the left side, answer cards on the right side and asked batch-wise to map question cards with answer cards.

$\frac{\text{Plant capacity factor}}{\text{Load Factor}} =$	Utilization Factor	 You've won 2 Points
${}_{90}^{232}\text{Th}, {}_{92}^{238}\text{U}$ _____ materials	Belted Cables	
		 Better luck next time!

J. Puzzles

Initially, I had prepared various short answer questions in both vertical and horizontal positions combined to form a puzzle.

Horizontal Questions

- 1) It is a device which heats the feed water on its way to boiler by deriving heat from flue gases in thermal (or) steam power plant
- 2) The process of achieving uniform distribution in dielectric stress is called _____ of cables.
- 3) ${}_{92}^{235}\text{U}, {}_{92}^{233}\text{U}, {}_{94}^{239}\text{Pu}$ \Rightarrow _____ materials
- 4) Mixing Indian rubber with mineral material such as sulphur, zinc oxide, red lead etc gives _____ Indian Rubber which is an insulating material of underground cables.

Vertical Questions

- 5) If fission rate of chain reaction is to be _____ control rods are moved out slightly.
- 6) Exhaust Steam is collected at _____ of thermal (or) steam power plant.
- 7) Which gas is used in Gas-filled cables having pressure of 1400 kN/m²?
- 8) Jet type condenser is also known as _____ type condenser.

II. CONCLUSION

Activity-Based Learning (ABL), made students learn various topics of PS-I in different ways also to know the importance of the course. These classroom activities motivate and create interest in learning power systems-I (PS-I) course.

III. ACKNOWLEDGMENT

I am thankful to II EEE 2017 batch Students, Our college principal, Vice-principal, HOD, EEE department faculty, entire college management, and Vishnu Educational Development Innovation Center (VEDIC), Hyderabad for valuable support.

IV. REFERENCES

- [1] EDMODO tool for conducting quiz, student polls, assignments, course material sharing etc.
- [2] Youtube animation videos of thermal/nuclear/gas power plants operation and working in 3-D view.
- [3] Google/Wikipedia for information about various power systems – I (PS-I) topics.
- [4] Google forms to collect student feedback about impact of Activity Based Learning (ABL) in learning Power Systems-I (PS-I).



Author J.Venkatesh completed my Bachelor's Degree in Electrical and Electronics Engineering, PVP Siddhartha Institute of Technology (A), Vijayawada. I did my Master's degree in Power Systems & Automation, SRKR Engineering College (A), Bhimavaram.

Since 9th September 2014, I work as Assistant Professor in Electrical and Electronics Engineering (EEE), Shri Vishnu Engineering College for Women (Autonomous), Bhimavaram, West Godavari District, Andhra Pradesh. My area of interest is education research in engineering. Regarding the Electromagnetic Fields (EMF) course, I had received a certificate for "Outstanding Teaching Practices" as demonstrated at faculty colloquium held during the 13th and 14th December 2018 at Vishnu Educational Development Innovation Center (VEDIC), Aziz Nagar, Hyderabad.