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# Development of e-resource on standard procedure of operation and applications of important electronic devices used by undergraduate science students

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## ABSTRACT

Advancements in information technology today have made a paradigm shift in teaching as well as learning process. Technology supports both teaching and learning and thus infuses classrooms with various learning tools, such as computers and hand held devices and learning materials developed in form of animations, videos, manuals and presentations. Technology has made learning a very easy process which is available to the students for round the clock. Being knowledge partners it is our obligation not only to guide the students to correct resources but also contribute towards evolution & development of such resources. In the present work, an e-learning based model has been developed for effective teaching of basic electronics experiments. The work includes demonstration of various electronics experiments based on digital and analog electronics by developing various e-manuals, power point presentations, descriptive animations and videos shot in the practical laboratories of the college. These resources would act as a handy tool for anyone who wishes to perform these experiments and will be a stepping stone in the realm of practical based learning for forthcoming students of science.

**Key Words**: Animations, E-learning, Electronics, Experiments, Information Technology.

## INTRODUCTION

This paper includes the description of development of various online resources that can be made available to the science and engineering students. The online resources being developed are in form of e-modules including animations, videos and power point presentations of various devices used in electronics practical. These resources definitely build student skills, enhance student involvement, motivate students, increase learning capability and also have the capacity to revolutionize teaching by building a new model which links teachers to their students in a very different and a more effective manner. Studies have shown that when taught through e-learning, students were more engaged and actively involved in their learning process and produced higher quality work [1]. Thus this paper includes various methods of

innovative teaching as well as multimedia aids that can be used in imparting knowledge to the students in a more effective way. This information can be shared by just imparting it verbally or in visual formats like videos, animations and presentations. As observed by various researches [2], the students were able to understand a particular topic being taught by multimedia aids easily and even retained it for longer duration. A comparative analysis [3] shows that the students who learnt by visual means scored much better than the students who were just taught verbally in classroom. There are various multimedia resources available for theoretical study in field of electronics. This paper gives a description of how multimedia applications can be used to develop e-resources for the various experiments performed in laboratory.

## METHODOLOGY

There are various methods being followed across the world to make students learn easily and enjoy while learning like use of an online Student Response System (SRS) in a pre-qualification course for engineering studies in Norway. In this approach, the students answer quizzes using handheld mobile devices like Smart phones, iPADs etc. being developed at Sor-Trondelag University College, Norway [4]. One of the other methods joining the race is making of descriptive animations which actually enhance the learning and retaining capacity of the students [5]. In order to carry out the present work, a systematic approach has been followed.

- First of all the devices to be studied were identified. The devices and components are:
  1. Laboratory Devices: Cathode ray oscilloscope, Digital Storage oscilloscope, Function generator, Regulated DC power supply, Multimeter.
  2. Semiconductor Devices: Diodes, Bipolar junction transistor (BJT), Metal Oxide semiconductor field effect transistor (MOSFET), Integrated circuits, IC tester.
  3. Optical instruments: Spectrometer and Spectrophotometer.
- After exploring the complete literature about these devices/components power point presentations and e-manuals were developed.
- Later on various videos were shot depicting the operation of these devices and step by step procedure to perform various experiments using these electronic devices.
- The next step was the development of innovative animations showing basic experiments of electronics performed by undergraduate science students using these devices and components.
- The entire work is under compilation and some part is already uploaded on the web portal www.emanualz.wordpress.com.

**Technology used**

To design the e-module following open source softwares were used:

- Manuals and power point presentation were made on Libre Office 4.2.
- Circuits and graphs were made using Multisim and QUCS (electronic device simulation software)
- Animated images were created online using GIF maker.
- Animations were designed using blender 2.59/2.71 and an online workshop was conducted in collaboration with IIT Mumbai to have a better understanding of animation software BLENDER.
- Movie maker was used for the video editing.

## RESULTS & DISCUSSION

We have developed the e-manuals, power point presentations, videos and animations of all the major devices. This complete work is under the process of complilation and some part of it has already been uploaded on our web portal www.emanualz.wordpress.com (Screen shot of the website shown in Figure.1). Figure 2, 3 and 4 show the screenshots of various animated images developed using GIFF maker for e-manuals and power point presentations. Screenshot of animation created using BLENDER is also shown in Figure 5. Figure 6 and 7 depict the screen shots of videos of the experiments carried out in the laboratories. Figure 8 shows the screen shot of the Zener diode circuit made by using simulation software "multisim".The developed e-resource is an effective tool for the students to understand various electronic devices and their related experiments.

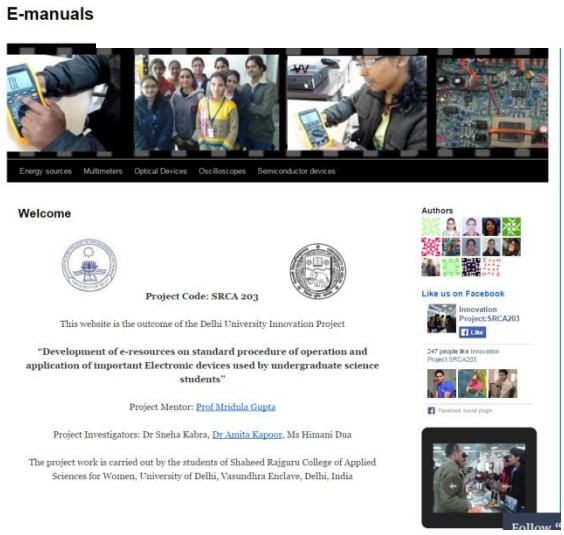


Fig. 1 Screen shot of our website www.emanualz.wordpress.com

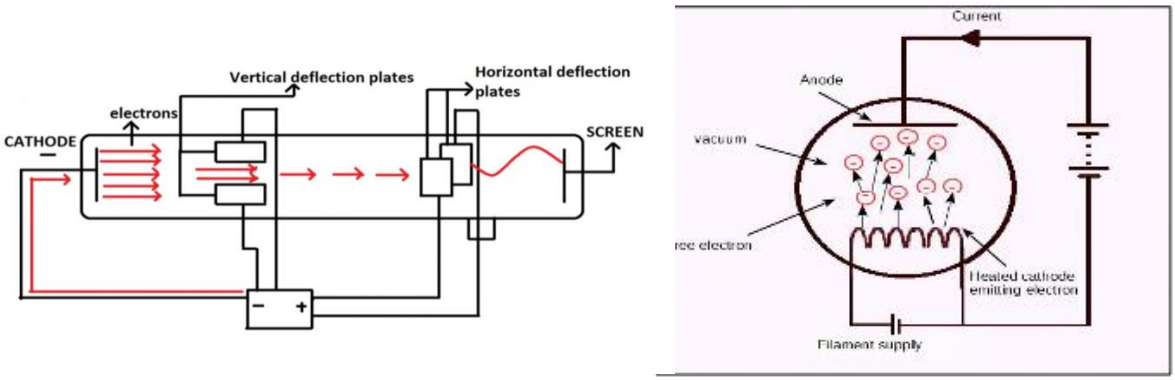


Fig.2 Screenshot of the GIFF images showing internal structure of CRO

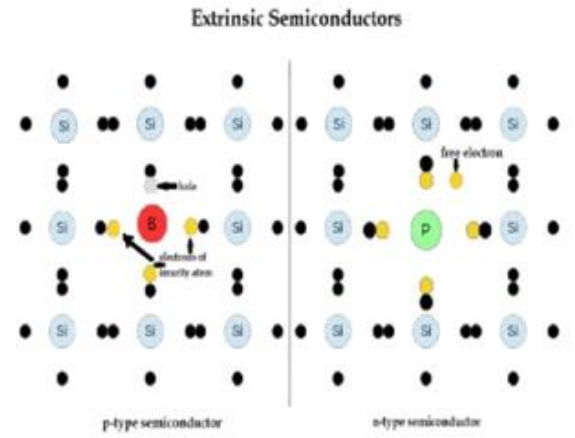


Fig. 3 Screenshot of the image showing extrinsic semiconductor

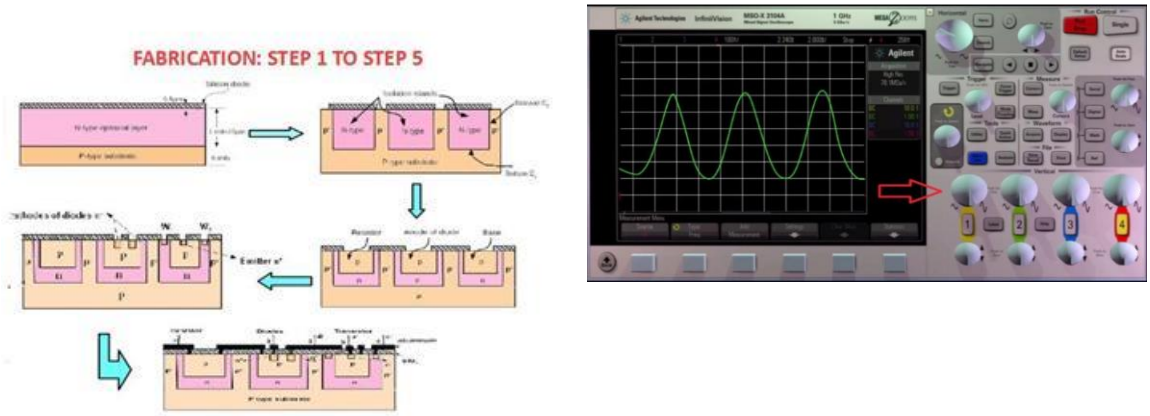


Fig 4 Screenshot of the image showing various steps present in IC fabrication.

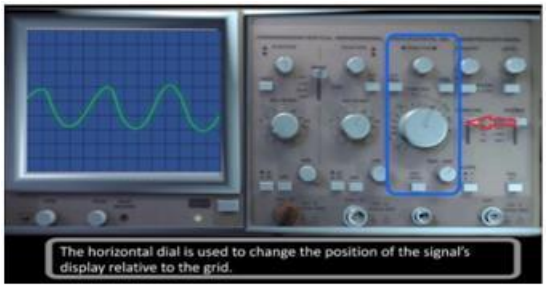


Fig 5 Screenshot of the animation showing description of various knobs present on CRO and DSO

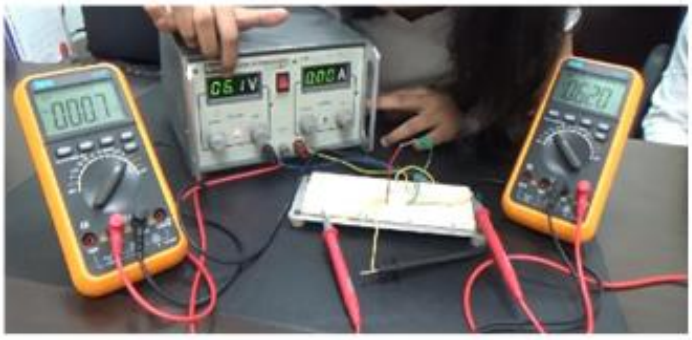

Fig.6 Screenshot of the video showing experiment on pn junction diode

Fig. 7 Screenshot of the video showing experiment on Newton's rings

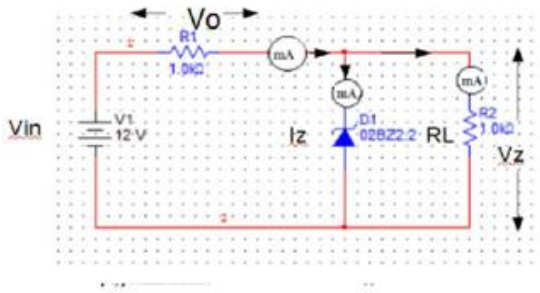


Fig. 8 Screen shot of the Zener diode circuit made by using simulation software multisim

## CONCLUSION

The developed e-resources would facilitate students with a material which is easy to understand. For the beginners, it would help to provide a better exposure of various components and devices in the laboratory which in turn would help in building a better

foundation. The work done in the project would be very helpful for all the undergraduate science students. The module being developed would be very useful as all these devices are used in one or the other science course and even by undergraduate engineering students. Being an interactive process, it encourages active participation of students which helps in their overall growth and a much better understanding of the subject. The study portrays that the using e-resources in classroom is beneficial for both teacher and student. It can definitely help in overall growth of India's education system.

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## REFERENCES

1. Hall, M., Nix, I. and Baker, K., "Student experiences and perceptions of digital literacy skills development: engaging learners by design?", *The Electronic Journal of e-Learning Volume 11, Issue 3, 2013, pp207-225*
2. Manuela Renáta Grosu, Eötvös, , The Role of Innovative Teaching and Learning Methods in Legal Education ,*The future of education conference, 2011*, Loránd University of Sciences (Hungary),
3. MedhaDalal, Impact of Multi-media Tutorials in a Computer Science Laboratory Course – An Empirical Study, *The Electronic Journal of e-Learning, Volume 12, Issue 4, 2014.*
4. Arnesen, K., Sivertsen Korpås, G. S., Hennissen J. E. and Birger Stav, J. "Experiences With use of Various Pedagogical Methods Utilizing a Student Response System – Motivation and Learning Outcome, *The Electronic Journal of e-Learning, Volume 11, Issue 3, 2013, pp169-181.*
5. Hwang I, Tam M, Lam S L and Lam P "Review of use of animation as a supplementary Learning Material of Physiology Content in four academic years*" The Electronic Journal of e-learning, Volume 10, Issue 4, 2012, pp368.*