Criteria 1.3.3: Curriculum Enrichment
Ph.D -Electronics Engineering

1.3.3 Percentage of students undertaking project work/ field work/ internships (Data for the latest completed academic year) -2021-22

- **Number of students undertaking Research Project Work in Ph.D=3**
- **Total No.of Students enrolled in 2021-22 in Ph.D = 3**

Formula:

$$\frac{\text{Number of students undertaking project work /field work / internships}}{\text{Total number of students}} \times 100$$

- **Percentage of Students Undertaking Project Work/Field Work/Internships = 100 %**

Academic Year 2021-22

Ph.D. Programme of the Faculty of Technology in Electronics Engineering

Year of Enrolment	Brach	Name	Title of the Project
2014-15	Electronics	Mrs. Asma Siddavatam	New Methods to Improve Performance of High Resolution Nuclear Pulse Spectroscopy System
2015-16	Electronics	Mrs. Kanchan Chavan	Time Interval Measurement with High Resolution over Wide Dynamic Range for Nuclear Timing Spectroscopy Applications
2019-20	Electronics	Ms.Tejashree Phatak	Evaluation of Neutron Reaction Cross Section Data

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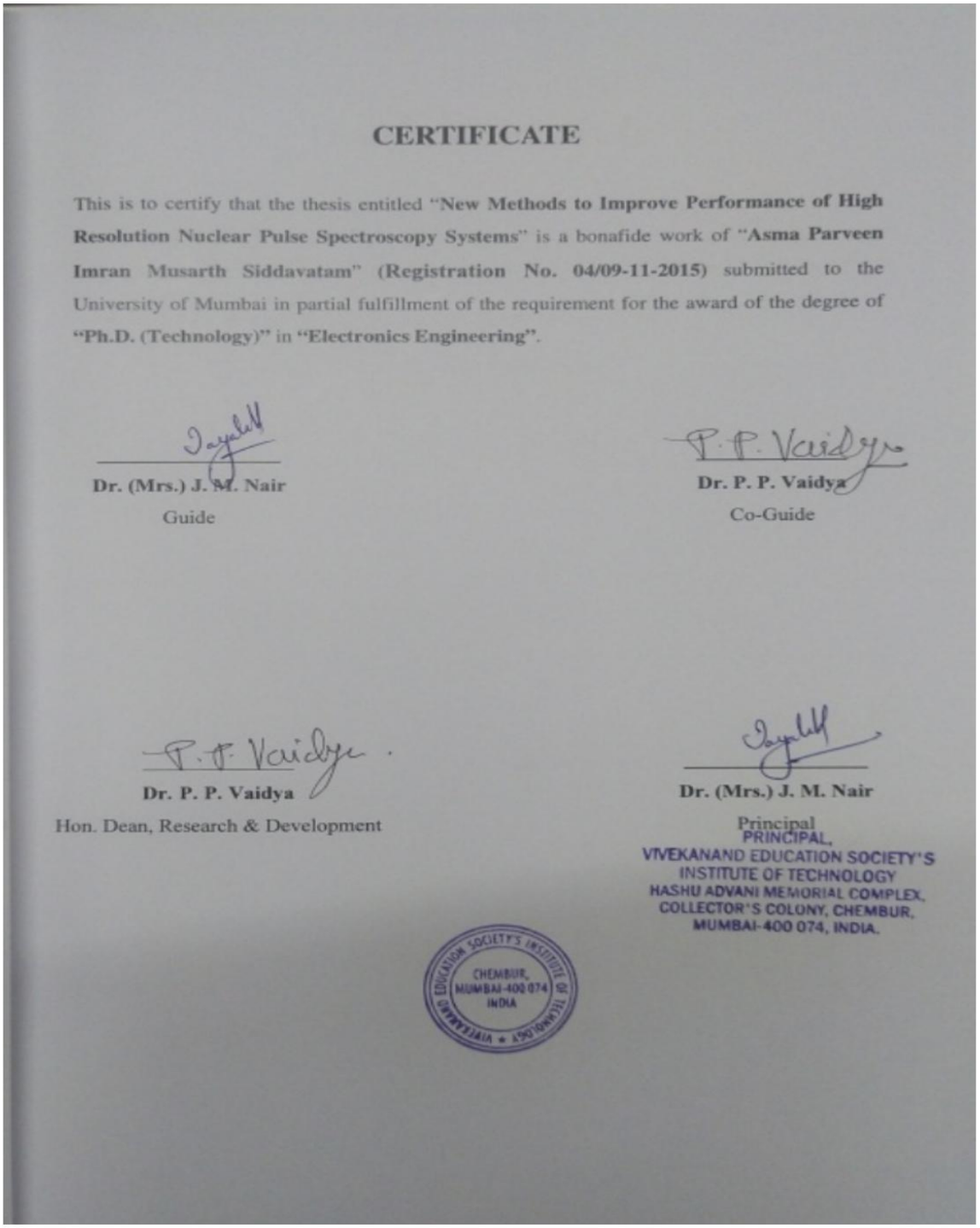
Vivekanand Education Society's
Institute of Technology
(Affiliated to University of Mumbai, Approved by AICTE & Recognized by Govt. of Maharashtra)

Name of the Ph.D Researcher :Mrs. Asma Siddavatam

Title: New methods to improve Performance of High Resolution Nuclear Pulse Spectroscopy Systems



CERTIFICATE

This is to certify that the thesis entitled "**New Methods to Improve Performance of High Resolution Nuclear Pulse Spectroscopy Systems**" is a bonafide work of "**Asma Parveen Imran Musarth Siddavatam**" (**Registration No. 04/09-11-2015**) submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of "**Ph.D. (Technology)**" in "**Electronics Engineering**".

Dr. (Mrs.) J. M. Nair
Guide

Dr. P. P. Vaidya
Co-Guide

Dr. P. P. Vaidya
Hon. Dean, Research & Development

Dr. (Mrs.) J. M. Nair
Principal

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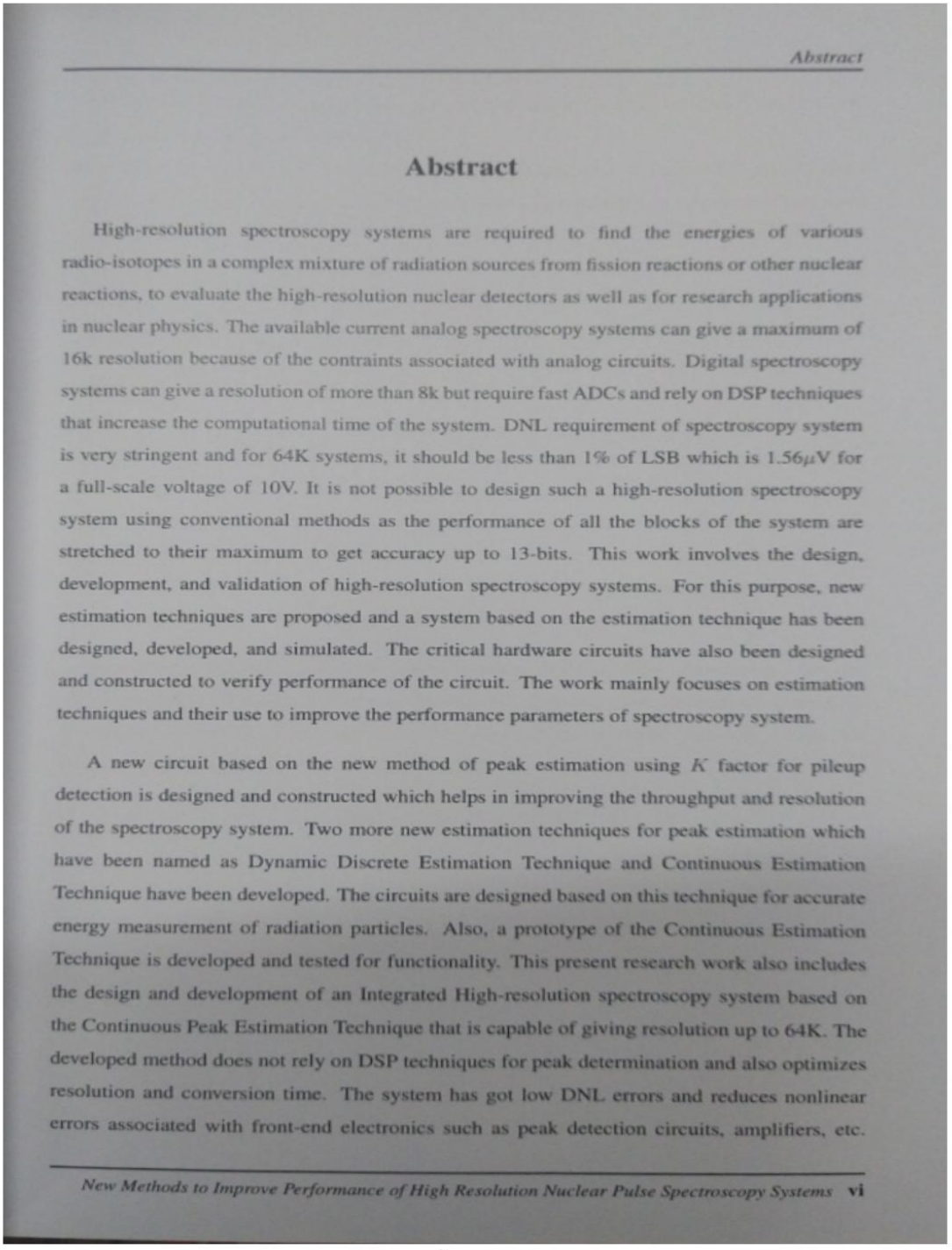


Abstract

High-resolution spectroscopy systems are required to find the energies of various radio-isotopes in a complex mixture of radiation sources from fission reactions or other nuclear reactions, to evaluate the high-resolution nuclear detectors as well as for research applications in nuclear physics. The available current analog spectroscopy systems can give a maximum of 16k resolution because of the contraints associated with analog circuits. Digital spectroscopy systems can give a resolution of more than 8k but require fast ADCs and rely on DSP techniques that increase the computational time of the system. DNL requirement of spectroscopy system is very stringent and for 64K systems, it should be less than 1% of LSB which is 1.56μV for a full-scale voltage of 10V. It is not possible to design such a high-resolution spectroscopy system using conventional methods as the performance of all the blocks of the system are stretched to their maximum to get accuracy up to 13-bits. This work involves the design, development, and validation of high-resolution spectroscopy systems. For this purpose, new estimation techniques are proposed and a system based on the estimation technique has been designed, developed, and simulated. The critical hardware circuits have also been designed and constructed to verify performance of the circuit. The work mainly focuses on estimation techniques and their use to improve the performance parameters of spectroscopy system.

A new circuit based on the new method of peak estimation using K factor for pileup detection is designed and constructed which helps in improving the throughput and resolution of the spectroscopy system. Two more new estimation techniques for peak estimation which have been named as Dynamic Discrete Estimation Technique and Continuous Estimation Technique have been developed. The circuits are designed based on this technique for accurate energy measurement of radiation particles. Also, a prototype of the Continuous Estimation Technique is developed and tested for functionality. This present research work also includes the design and development of an Integrated High-resolution spectroscopy system based on the Continuous Peak Estimation Technique that is capable of giving resolution up to 64K. The developed method does not rely on DSP techniques for peak determination and also optimizes resolution and conversion time. The system has got low DNL errors and reduces nonlinear errors associated with front-end electronics such as peak detection circuits, amplifiers, etc.

Abstract

The design is cost-effective and provides an import substitute for High-resolution spectroscopy systems which so far are not made in India.

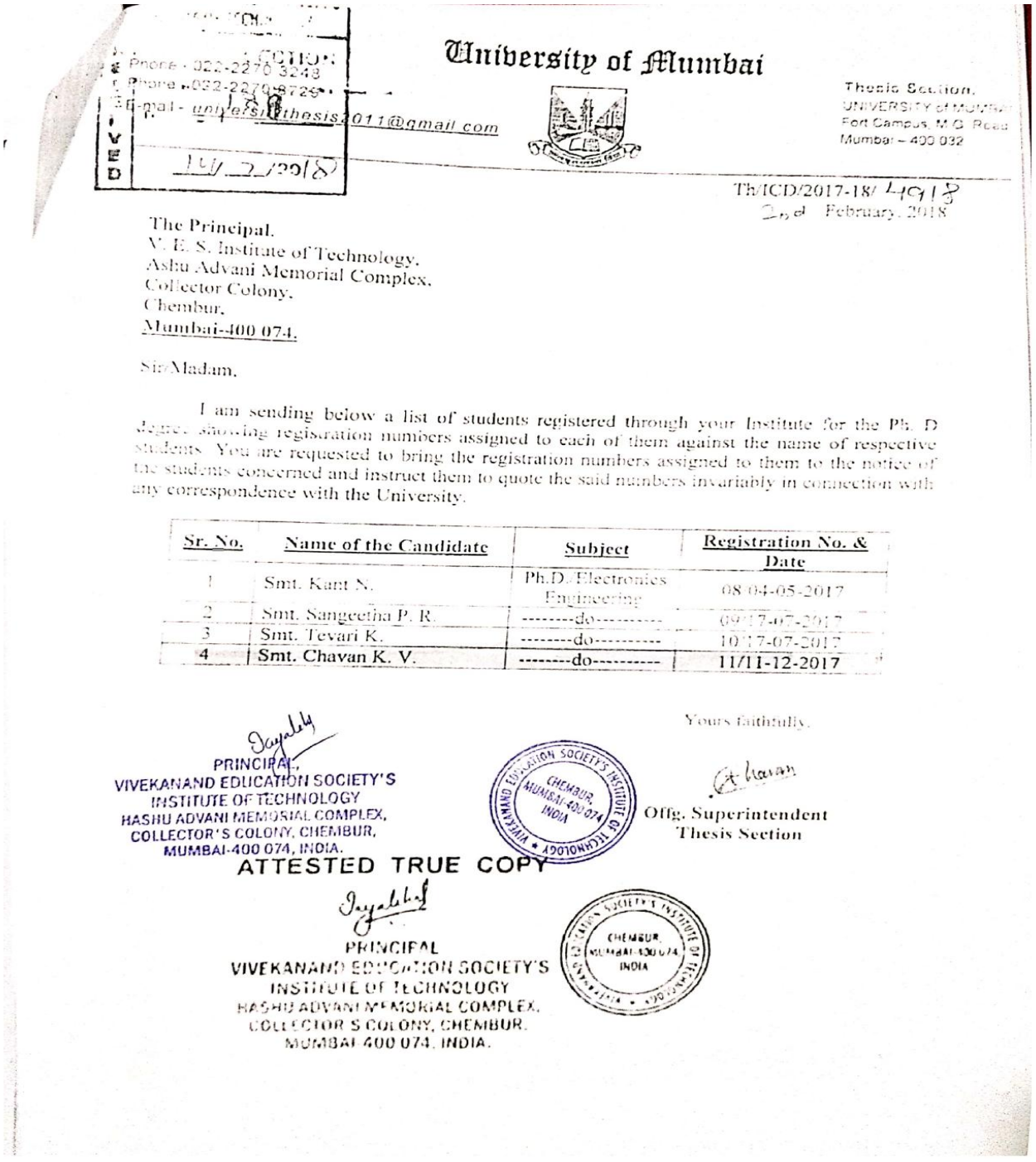
The research work also includes the development of a new type of Flash ADC based on the string of resistor and comparators similar to continuous estimation technique that increases the resolution of conventional Flash ADC or in general any type of ADC by connecting a peripheral circuit. It improves resolution without much affecting the parameters sampling rate, complexity, and power dissipation of the overall system. There is an increase in M bits resolution by the use of 2^M resistors, an equal number of comparators, analog multiplexers, buffers, and an amplifier. This method can be used for residue generation in a sub-ranging type of ADCs with hardly any increase in conversion time.

The research work also includes the development and construction of a validation system using the DAC interpolation method that can validate integral and differential nonlinearity of spectroscopy system having a resolution of up to 64K. Also, a system for generating triangular sweeps is developed using string of resistors and analog multiplexer which is simpler in design compared to the DAC interpolation method and requires low-cost basic components that reduce the system development cost. It is possible to achieve a large range of sweep period from a few hundreds of milliseconds to thousands of seconds.

Keywords: *Radiation Particles, Spectroscopy System, High Resolution, Integral and Differential Linearity, Estimation Techniques, Dynamic and Continuous Estimation Techniques, Pileup Detection and Rejection, Flash ADC, Resistive Network, Triangular Sweeps, Validation System, Interpolation Methods*

Name of the Ph.D Researcher :Mrs. Kanchan Chavan

Title: Time Interval Measurement with High Resolution over Wide Dynamic Range for Nuclear Timing Spectroscopy Applications



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Sr. No.	Name of the Candidate	Subject	Registration No. & Date
1	Smt. Kant N.	Ph.D. Electronics Engineering	08/04-05-2017
2	Smt. Sangeetha P. R.	--------do----------	09/17-07-2017
3	Smt. Tevari K.	--------do----------	10/17-07-2017
4	Smt. Chavan K. V.	--------do----------	11/11-12-2017

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Abstract

Nuclear timing spectroscopy systems requires time interval measurement of pico-second (level. Time interval between two physical events has to be measured with very high accuracy. Various other domain applications too require time interval measurement. Time of flight measurement experiments are conducted in timing spectroscopy applications. Lifetime measurements are needed in atomic and high energy physics, Positron Emission Tomography (PET) etc.

Conventional timing spectroscopy system makes use of Time Pick-off circuit, Time to Amplitude Converter (TAC), Multi-Channel Analyzer (MCA), delay component and biased amplifier. The conventional timing spectroscopy system has limitations because of errors associated with individual blocks used in the system. These individual blocks have been studied for their performance and the error contributed by each block has been analyzed. In this context, a totally new integrated timing spectroscopy (ITS) system using two tracking Analog-to-Digital Converters (ADCs) and ramp is proposed, designed and implemented. The integrated system makes use of two tracking ADCs and free running ramp. The free running ramp and the two tracking ADCs track the reference voltage fluctuation and the temperature effect in such a manner that the system provides self compensation mechanism. External spectrum stabilization technique is not needed for the system. ADC non-linearity errors differential non-linearity (DNL) and integral non-linearity (INL) are scaled down to the acceptable level without using conventional sliding scale linearization technique. New system eliminated the requirement of the delay component and therefore biased amplifier is also not required in the system. So, the errors associated with these components have been completely eliminated because of which level resolution can be obtained. Also, the free running ramp feature enables the wide range of time interval measurement, of the order of and . The method offers a low dead time of .

Time to Digital Converter method is also implemented to measure time interval using a linear ramp. The ramp period is counted using a digital counter. The advantages offered by this method are discussed and presented. A comparative study of both the methods TDC & ITS, mentioned above for time interval measurement is presented here. The advantages, range and resolution offered by both the methods are explained.

For validation of timing spectroscopy system, a jitter measurement system is proposed. The existing conventional nuclear timing spectroscopy system accuracy and jitter in the time interval measurement can be measured using jitter measurement system. Jitter measurement system makes use of 16-bit ADC which can be further upgraded with 18-bit ADC. Performance of both systems and resolution obtained by the two systems is presented.

Name of the Ph.D Researcher :Ms. Tejashree Phatak

Title: Evaluation of Neutron reaction Cross Section Data

Outline of the Research Proposal Submitted for the Degree of Doctor of Philosophy (Tech) in the subject of Electronics.

Title of the proposal

Evaluation of Neutron Reaction Cross-section Data

Name of the Candidate	:	Tejashree Suresh Phatak
Educational Quantification of the candidate :		B.E (Electronics and Telecommunication) M.E (Electronics and Telecommunication)
Name and Designation of Research Supervisor :		Dr.(Mrs.) J. M. Nair Principal, V.E.S.I.T, Chembur –400074
Place of Research Place	:	V.E.S Institute of Technology H.A.M,C Collector's Colony Chembur, Mumbai-400 0074
Date of Submission of Proposal	:	
Signature of the candidate	:	Phatak
Signature of the Research Supervisor	:	1) Jayalakshmi 2)

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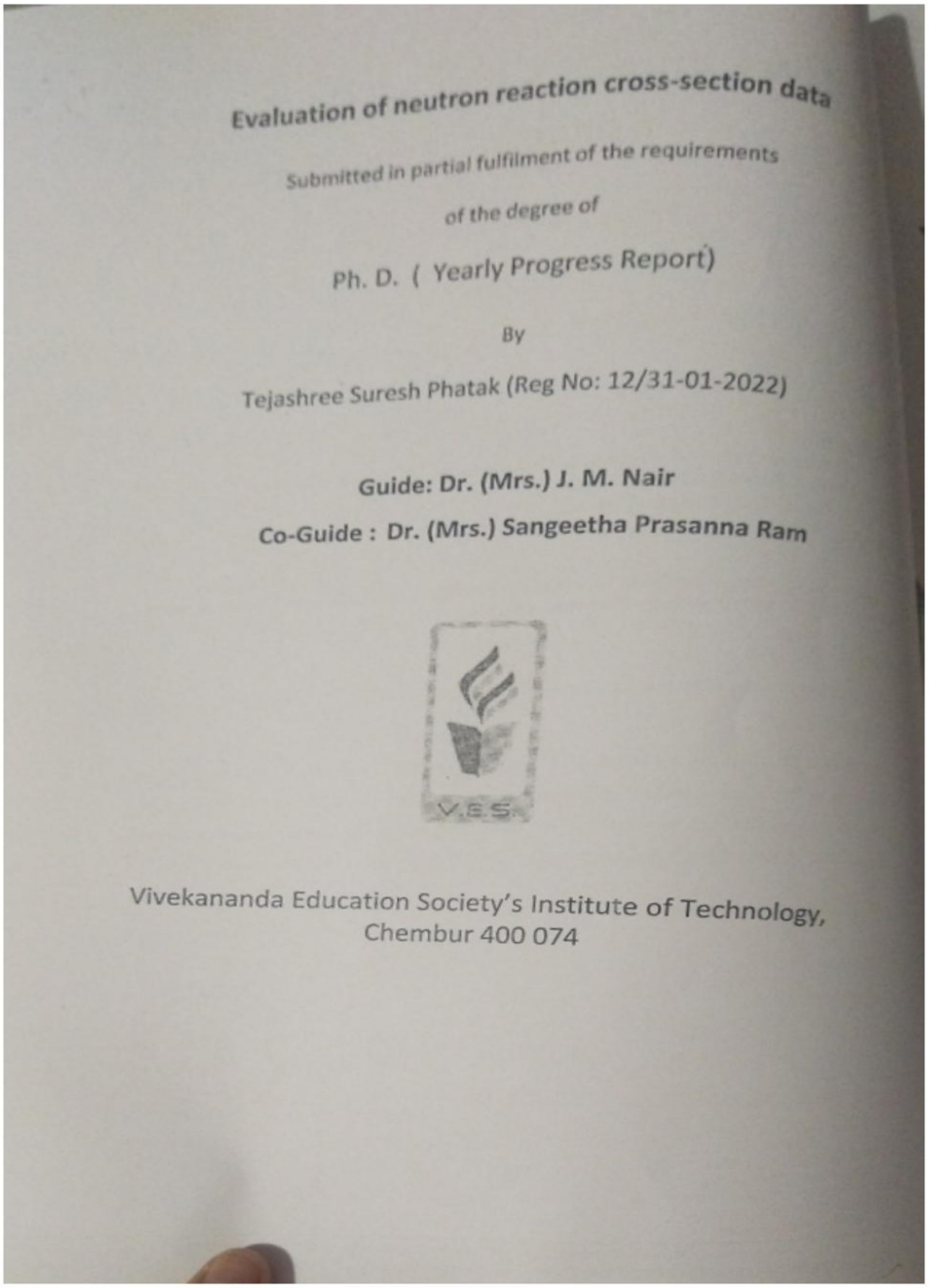
Sr. No.	Name of the Candidate	Subject	Registration No. & Date
1	Kum. Phatak T. S.	Ph.D. / (Sci. & Tech.) Electronics Engineering	12 / 31- 01-2022

Yours faithfully

Deputy Registrar 20/5/22
(RAPC)



Evaluation of neutron reaction cross-section data

Submitted in partial fulfilment of the requirements

of the degree of

Ph. D. (Yearly Progress Report)

By

Tejashree Suresh Phatak (Reg No: 12/31-01-2022)

Guide: Dr. (Mrs.) J. M. Nair

Co-Guide : Dr. (Mrs.) Sangeetha Prasanna Ram

V.E.S.

Vivekananda Education Society's Institute of Technology,
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