

SCHOOL OF ENERGY MATERIALS

MAHATMA GANDHI UNIVERSITY

Value Added Course on

**Advanced Characterization Techniques for Energy
Storage and Conversion Devices**

Advanced characterization techniques for energy storage and conversion devices

(Value Added Programme - Certificate Course)

Programme Project Report

(a) Programme's mission & objectives:

Value-added courses are designed to enhance the standard of the students beyond those levels specified in the academic curriculum. The aim of the value-added course on advanced characterization techniques for energy storage and conversion devices prepare students to become experts and develop skills for doctoral studies, and /or professional industrial careers in operando characterizing energy storage and conversion devices. This module will provide the student with an understanding of the theory, practices, and instrumentation associated with synchrotron facilities and associated spectroscopic techniques.

Value added course is not mandatory to qualify for any programme and the credits earned through this course shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree.

(b) Relevance of the program with HEI's mission and goals:

The course focuses on state-of-the-art developments in synchrotron facilities and various beamlines associated with it. Special emphasis will be given on how to utilize the synchrotron facilities for operando characterization of energy storage devices such as Li-ion batteries as well as conversion devices such as Fuel Cells. This course places a strong emphasis on the professional development of the students. Such a qualification will enable and facilitate career progression for the students.

(c) **Nature of prospective target group of learners:**

Students with science backgrounds can join the programme. Students doing their-
Masters/Doctoral studies can join the program to strengthen their analytical skills.

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(c) **Appropriateness of programme to be conducted in Add mode to acquire specific skills and competence:**

This course places a strong emphasis on the professional development of the students. Such a qualification will enable and facilitate career progression for the students. Upon successful completion of this module, a student will be able to (i) Understand the principles, practices, and instrumentation associated with synchrotron facilities (ii) Various advanced characterization techniques feasible at synchrotron facilities, (iii) Operando characterization of energy storage and conversion devices and (iv) Critically appraise the literature and identify future trends in this area.

(d) **Instructional design :**

The duration of the Value added course is 30 hrs which includes theory (60%) and practicals (40%). Classes for a VAC are conducted beyond the regular class hours. The value added courses may be also conducted during weekends/vacation periods. A student will be permitted to register for only one Value Added Course in a Semester. The course can be offered only if there are at least 5 students opting for it.

(e) **Procedure for admissions, curriculum transaction, and evaluation:**

Any student with minimum B.Sc. in chemistry, physics, and biology can apply. The student has to pay an amount for the programme which is decided by the School. For practicals, 20% will be virtual and remaining will be direct laboratory work. This course will have three types of graded activities that will be included in the overall course grade. These include: **Quizzes (20%), Open-ended Questions (30%), and**

Final project (50%). At the end of the course, the candidate will be asked to complete a final project. The final project will be conducted in groups of 2 students. It will consist of a written report that focuses on the utilization of spectroscopic techniques for various applications. The final project will be graded and will contribute to 50% of the overall course grade

(f) **Requirement for the laboratory support and library resources:**

Seminar Hall, with projectors

Syllabus

Advanced characterization techniques for energy storage and conversion devices

- 1) Principles, instrumentation, and applications of synchrotron facilities
- 2) Characterization techniques at synchrotron facilities
- 3) Operando characterization of batteries and fuel cell by X-ray Absorption techniques
- 4) Operando Characterization using scattering techniques (XRD, PDF etc)