

University of Mumbai

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Academic Authorities,
Meetings & Services (AAMS)
Room No. 128, M. G. Road, Fort,
Mumbai - 400 032.
Tel. 022-68320033

Re- accredited with A ++ Grade (CGPA 3.65) by NAAC
Category- I University Status awarded by UGC

No. AAMS_UGS/ICC/2025-26/34

Date : 26th May, 2025.

CIRCULAR:-

Sub : Certificate Course in Microscopic Techniques (SEM, TEM, AFM & STM).

All the Principals of the Affiliated Colleges, Head of the University Departments and Directors of the recognized Institutions under Faculty of Science and Technology are hereby informed that the recommendations made by the Ad-hoc Board of Studies in Nano Science and Nano Technology at its meeting held on 23rd September, 2024, and subsequently passed by the Board of Deans at its meeting held on 30th November, 2024 vide Item No. 6.4 have been accepted by the Academic Council at its meeting held on 4th December, 2024 vide Item No.6.36 (N) and subsequently approved by the Management Council at its meeting held on 21st February, 2025 vide Item No. 22 and that in accordance therewith, in exercise of the powers conferred upon the Management Council under Section 74(4) of the Maharashtra Public Universities Act, 2016 (Mah. Act No. VI of 2017) the following program with Ordinance for Title of the program, Eligibility and Regulation numbers for Duration of Program, Intake Capacity, Scheme of Examinations, Standard of Passing and Credit Structure along with syllabus of **Certificate Course in Microscopic Techniques (SEM, TEM, AFM & STM)** as per appendix have been introduced and the same have been brought into force with effect from the academic year **2025-26.**

Sr. No	Name of the Program	Ordinance no. for Title	Ordinance no. for Eligibility	
A	Certificate Course in Microscopic Techniques (SEM, TEM, AFM & STM)	O.SU - 535 A	O.SU - 536 A	Two Week

2/-

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Date : 26th May, 2025.

: 2 :

Regulation Nos	
Duration	R. SU - 586
Intake Capacity	R. SU - 587
Scheme of examination	R. SU - 588
Standard of Passing	R. SU - 589
Credit Structure	R. SU - 590

(The said circular is available on the University's website www.mu.ac.in).

MUMBAI – 400 032
26th May, 2025

(Dr. Prasad Karande)
REGISTRAR

A.C/6.36 (N)/4/12/2024.
M.C/22/21/2/2025.

Copy forwarded with Compliments for information to:-

- 1) The Chairman, Board of Deans
- 2) The Dean, Faculty of Science & Technology,
- 3) The Chairman, Board of Studies in Nano Science and Nano Technology,
- 4) The Director, Board of Examinations and Evaluation,
- 5) The Director, Board of Students Development,
- 6) The Director, Department of Information & Communication Technology,
- 7) The Director, Centre for Distance and online Education (CDOE), Vidyayagari,
- 8) The Co-ordinator, MKCL

Copy forwarded for information and necessary action to :-	
1	The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Dept)(AEM), dr@eligi.mu.ac.in
2	The Deputy Registrar, Result unit, Vidyanagari drresults@exam.mu.ac.in
3	The Deputy Registrar, Marks and Certificate Unit,. Vidyanagari dr.verification@mu.ac.in
4	The Deputy Registrar, Appointment Unit, Vidyanagari dr.appointment@exam.mu.ac.in
5	The Deputy Registrar, CAP Unit, Vidyanagari cap.exam@mu.ac.in
6	The Deputy Registrar, College Affiliations & Development Department (CAD), deputyregistrar.uni@gmail.com
7	The Deputy Registrar, PRO, Fort, (Publication Section), Pro@mu.ac.in
8	The Deputy Registrar, Executive Authorities Section (EA) eau120@fort.mu.ac.in He is requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to the above circular.
9	The Deputy Registrar, Research Administration & Promotion Cell (RAPC), rapc@mu.ac.in
10	The Deputy Registrar, Academic Appointments & Quality Assurance (AAQA) dy.registrar.tau.fort.mu.ac.in ar.tau@fort.mu.ac.in
11	The Deputy Registrar, College Teachers Approval Unit (CTA), concolsection@gmail.com
12	The Deputy Registrars, Finance & Accounts Section, fort draccounts@fort.mu.ac.in
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14	The Assistant Registrar, Administrative Sub-Campus Thane, thanesubcampus@mu.ac.in
15	The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan, ar.seask@mu.ac.in
16	The Assistant Registrar, Ratnagiri Sub-centre, Ratnagiri, ratnagirisubcentar@gmail.com
17	The Director, Centre for Distance and Online Education (CDOE), Vidyanagari, director@idol.mu.ac.in
18	Director, Innovation, Incubation and Linkages, Dr. Sachin Laddha pinkumanno@gmail.com
19	Director, Department of Lifelong Learning and Extension (DLLE), dlleuniversityofmumbai@gmail.com

Copy for information :-	
1	P.A to Hon'ble Vice-Chancellor, vice-chancellor@mu.ac.in
2	P.A to Pro-Vice-Chancellor pvc@fort.mu.ac.in
3	P.A to Registrar, registrar@fort.mu.ac.in
4	P.A to all Deans of all Faculties
5	P.A to Finance & Account Officers, (F & A.O), camu@accounts.mu.ac.in

To,

1	The Chairman, Board of Deans pvc@fort.mu.ac.in
2	Faculty of Humanities, Offg. Dean 1. Prof.Anil Singh Dranilsingh129@gmail.com Offg. Associate Dean 2. Prof.Manisha Karne mkarne@economics.mu.ac.in 3. Dr.Suchitra Naik Naiksuchitra27@gmail.com
	Faculty of Commerce & Management, Offg. Dean, 1 Prin.Ravindra Bambardekar principal@model-college.edu.in Offg. Associate Dean 2. Dr.Kavita Laghate kavitalaghate@jbims.mu.ac.in 3. Dr.Ravikant Balkrishna Sangurde Ravikant.s.@somaiya.edu 4. Prin.Kishori Bhagat kishoribhagat@rediffmail.com

	Faculty of Science & Technology Offg. Dean 1. Prof. Shivram Garje ssgarje@chem.mu.ac.in Offg. Associate Dean 2. Dr. Madhav R. Rajwade Madhavr64@gmail.com 3. Prin. Deven Shah sir.deven@gmail.com
	Faculty of Inter-Disciplinary Studies, Offg. Dean 1. Dr. Anil K. Singh aksingh@trcl.org.in Offg. Associate Dean 2. Prin. Chadrashekhhar Ashok Chakradeo cachakradeo@gmail.com 3. Dr. Kunal Ingle drkunalingle@gmail.com
3	Chairman, Board of Studies,
4	The Director, Board of Examinations and Evaluation, dboee@exam.mu.ac.in
5	The Director, Board of Students Development, dsd@mu.ac.in DSW directr@dsd.mu.ac.in
6	The Director, Department of Information & Communication Technology, director.dict@mu.ac.in

University of Mumbai



Title of the Program

Certificate Course in Microscopic Techniques (SEM, TEM, AFM & STM)

Equivalent to the On Job Training as per NEP 2020

Syllabus for the Course

Ref: GR dated 16th May, 2023 for Credit Structure of PG

(With effect from the academic year 2025-26)



Syllabus for Approval

Sr. No.	Heading	Particulars
1	O: <u>SU - 535 A</u> Title of Course	Certificate Course in Microscopic Techniques (SEM, TEM, AFM & STM)
2	O: <u>SU - 536 A</u> Eligibility	Graduate in Chemistry, Biochemistry, Life science, Environmental Science, Pharmacy, Physics, Material Science, Nano Science, Nano Technology.
3	Duration of program R: <u>SU - 586</u>	Two weeks
4	Intake Capacity R: <u>SU - 587</u>	Maximum twenty PG students Maximum five from Industry
5	Scheme of Examination R: <u>SU - 588</u>	As per NEP 50% Internal, Continuous Assessment 50% External, Course-End Examination Individual passing in Internal and External Exams.
6	Standards of Passing R: <u>SU - 589</u>	40%
7	Credits R: <u>SU - 590</u>	04
8	Pattern:	Short Term Certificate Courses
9	Status:	New
10	To be implemented from Academic Year :	From Academic Year: 2025-26

Sign of the BOS
Prof. Vishwanath R. Patil
Chairman
BOS in Nanoscience &
Nanotechnology

Sign of the
Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science &
Technology

Sign of the Offg. Dean
Prof. Shivram S. Garje
Faculty of Science &
Technology

Preamble

1) Introduction

This program is designed to provide a comprehensive and in-depth understanding of the fascinating world of instrumental analyses. Through the academic curriculum and hands-on research experience, we aim to nurture the intellectual curiosity and scientific acumen of our students, preparing them for successful careers in various sectors of the Chemical/Environmental/Material Science/Pharmaceutical industries. The Certificate courses are structured to equip students with a strong theoretical foundation, practical skills, and critical thinking abilities necessary to address the challenges and opportunities in the diverse fields of chemistry or pharmacy. Our esteemed faculty members are experts in their respective fields, with a passion for both teaching and research. They are committed to providing a nurturing learning environment, encouraging open discussions, and fostering collaborative research endeavors. Through their mentorship, students will have the opportunity to engage in cutting-edge research projects, pushing the boundaries of scientific knowledge and contributing to the advancement of the sciences.

We envision our certificate courses pass-outs act as catalysts for positive change, equipped to drive innovation, shape industries, and address societal challenges through their expertise. Whether your passion lies in research, industry, education, or beyond, our program aims to provide the knowledge and skills necessary to excel in your chosen path.

2) Aims and Objectives

The aims and objectives of this Certificate course are designed to provide students with a well-rounded and advanced education in the field of Microscopy, especially in SEM, TEM, AFM and STM. These goals focus on equipping students with a deep understanding of chemical principles, fostering research and analytical skills, and preparing them for successful careers in various sectors of the chemical, environmental, material science and pharmaceutical sciences. This Certificate course aims to produce skilled and knowledgeable professionals who can contribute to scientific research, industrial innovation, and the betterment of society through their expertise.

3) Learning Outcomes

The learning outcomes of the Certificate Courses are designed to equip students with a comprehensive and advanced understanding of the field of Chemistry, Environmental Sciences, Material Science and Pharmacy. These learning outcomes will reflect the knowledge, skills, and competencies that students are expected to gain upon successful completion of the program.

4) Other point (if any):

The skills and knowledge acquired during this program will make the students well-equipped for diverse roles.

SYLLABUS

**Certificate Course in Microscopic Techniques
(SEM, TEM, AFM & STM)
Equivalent to On Job Training as per NEP 2020**

UNIVERSITY OF MUMBAI

**A. Syllabus for Certificate Course in Microscopic Techniques
(SEM, TEM, AFM & STM)
Equivalent to On Job Training as per NEP 2020**

PROGRAM OUTLINE

COURSE CODE	COURSE TITLE	PAGE NO.
NCNNUM CC03	Certificate Course in Microscopic Techniques (SEM, TEM, AFM & STM) Equivalent to On Job Training as per NEP 2020	

PROGRAMME SPECIFIC OUTCOME (PSOs)

1. Gain knowledge of the basic and advanced concepts in the topic, scrutinize and accomplish a solution to problems encountered in the field of research and analysis.
2. Apply the basic knowledge to perform various tasks assigned to them at the workplace in industry and academia to meet the global standards.
3. Deduce qualitative and quantitative information of chemical compounds using advanced microscopic methods which can further be analysed using practical skills inculcated in them during the course.
4. Imbibe the attitude as well as aptitude of a scientific approach along with analytical reasoning with respect to the novel techniques actually implemented in the industry.
5. Use the subject knowledge, communication and ICT skills to become an effective team leader/team member in the interdisciplinary fields.
6. Understand, manage and contribute to solve basic societal issues and environmental concerns ethically based on principles of scientific knowledge gained.
7. Exhibit professional work ethics and norms of scientific development.

PROGRAM:	Certificate Course in Microscopic Techniques (SEM, TEM, AFM & STM) Equivalent to On Job Training as per NEP 2020		
Course Code:	NCNNUM CC03		
Teaching Scheme			Evaluation Scheme
Lectures (Hours per day)	Practical (Hours per day)	Continuous Assessment (CA) (Marks- 50)	Semester End Examination (Marks- 50)
02	04	50%	50%
Learning Objectives: • To enable learners to have comprehensive knowledge and understanding of the basic and advanced concepts in microscopy, its history, theory and classification. • To enable learners to acquire knowledge of microscopic instruments such as SEM, TEM and AFM, STM. • To understand the construction and functioning of SEM, TEM and AFM, STM. • To apply the basic knowledge of microscopy to perform various tasks assigned to them at the workplace in industry and academia to meet the job requirements as per global standards. • Accomplish a solution to problems encountered in the field of research.			
Course Outcomes: • The learners will understand the theory and applications of microscopy. • The learners will apply the advanced knowledge of microscopy for understanding the morphology and topography of the samples. • The learners will evaluate the different techniques of microscopy as per the sample requirement. • The learners will implement the applications of microscopy to real samples. • The learners will utilize theoretical knowledge of microscopy for the qualitative identification of compounds. • The learners will try to accomplish a solution to problems encountered in the field of research.			

Syllabus

Course code NCNNUM CC03	Theory on Microscopic Techniques (SEM, TEM, AFM & STM)	15 Hrs (One Credit)
	Basic and advanced concepts in microscopy, its history, theory and classification.	3 Hrs
	Theory, instrumentation, functioning and applications of SEM.	3 Hrs
	Theory, instrumentation, functioning and applications of TEM.	3 Hrs
	Theory, instrumentation, functioning and applications of AFM.	3 Hrs
	Theory, instrumentation, functioning and applications of STM.	3 Hrs
Course code NCNNUM CC03	Practicals on Microscopic Techniques (SEM, TEM, AFM & STM)	90 Hrs (Three Credits)
	Practical – • Functioning of SEM, Real sample analysis, data interpretation. • Functioning of TEM, Real sample analysis, data interpretation. • Functioning of AFM, Real sample analysis, data interpretation. • Functioning of STM, Real sample analysis, data interpretation. Industrial Visit	
	Total Credits	4

Reference Books:

1. Instrumental Analysis, Skoog, Holler and Crouch, 7th edition
2. HPLC Practical and Industrial Applications; E.B.Sandell and H.Onishi 2 nd Ed., CRC Press
3. Principles of Instrumental Analysis - Skoog, Holler and Nieman, 5th Edition, Ch: 12, 20
4. Analytical Chemistry Principles – ; John H Kennneddy, Saunders College Publishing, 2nd edition, (1990).
5. Modern Analytical Chemistry; David Harvey; McGraw Hill Higher education publishers, (2000).
6. Vogel's Text book of quantitative chemical analysis; Pearson Education Limited, 6th edition, (2007).
7. Instrumental Methods of Analysis; Willard, Merrit, Dean and Settle, CBS publishers, 7th edition

Modality of Assessment/Credit Structure**Theory Examination Pattern:**

- A. Internal Assessment/Continuous Assessment**
Two Assignments of 25 marks each.
- B. External Examination-**
Course End Practical Exam: 50 Marks
Duration: Three hours
- C. Passing Marks: Individual passing of 40% in Internal and External**

Justification for Certificate Course in Microscopic Techniques (SEM, TEM, AFM & STM)

1.	The necessity for starting the course:	Certificate course in Microscopic Techniques is necessary for those who seek to deepen their knowledge, specialize in a particular area of morphology and topography of material and pursue advanced careers in research, industry, or other chemistry, environment, material sciences or pharma related fields. It offers numerous opportunities for personal and professional growth, enabling you to make a positive impact on the world through scientific exploration and discovery.
2.	Whether the UGC has recommended the course:	Yes
3.	Whether all the courses have commenced from the academic year 2025-26?	Yes, we plan to start them from the current academic year, 2025-26. under NEP 2020
4.	If the courses started by the University are self-financed, whether an adequate number of eligible permanent faculties are available?	This course is self-financed. There is a requirement of Course Coordinator, Technical Assistants and sweeper which is included in the budget provision of the course.
5.	To give details regarding the duration of the Course and is it possible to compress the course?	The duration of the program is two weeks. It is not possible to compress the course.
6.	The intake capacity of each course and the number of admissions given in the current academic year:	The intake capacity of the program is 20 (twenty) PG science students and 5 (five) from industry, per batch. Admissions for different batches for the academic year 2025-26 will be sought as per program schedule of the year.
7.	Opportunities of Employability or Employment available after undertaking these courses:	Certificate course students will have a wide range of employment opportunities across various sectors, including chemistry, environment and pharma industry, in particular. The skills and knowledge acquired during the course program will make them well-equipped for entry to the industry. Some of the common areas where these students can find employment include; Research and Development (R&D), Pharmaceutical Industry, Chemical Manufacturing, Environmental and Analytical Chemistry, Quality Assurance and Control, Regulatory Affairs, Materials Science and

		Nanotechnology, Teaching and Academia, Healthcare and Clinical Research etc. The key to employability for the students is to build a strong resume through hands on experience on the sophisticated instruments which otherwise is not available for UG or PG students. Additionally, staying updated with the latest advancements in the field and continuously improving their skills can enhance their competitiveness in the job market.
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**Sign of the BOS
Prof. Vishwanath R. Patil
Chairman
BOS in Nanoscience &
Nanotechnology**

**Sign of the
Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science &
Technology**

**Sign of the Offg. Dean
Prof. Shivram S. Garje
Faculty of Science &
Technology**