MDM and OE Orientation

Students' Awareness about the MDM Degree And Open Electives

Orientation in a Phased manner between 22nd Feb – 22nd March 2024

Number of Orientation Programmes: **8**





MDM and OE Orientation

ICT Off Campuses Activities Jalna and Bhubaneshwar

ICT Jalna Campus: 23rd March 2024


Sr. No.	MDM Program	Time	Coordinator/ Instructors	Venue
1	Food Technology	10:30 – 11:00 am	Dr. Ramesh Chavan	Auditorium
2	Pharma Technology	11:00 – 11:30 am	Dr. Navnath Hatvate	Auditorium
3	Lipids Technology	11:30 am – 12:00 pm	Dr. Parag Nemade	Auditorium
4	Materials and Polymers Technology	12:00 – 12:30 pm	Dr. Girish Joshi	Auditorium
5	Energy Technology	01:35 – 02:00 pm	Dr. Supriyo Kumar Mondal	Auditorium
6	Petro Technology	02:00-02:30 pm	Dr. Atul Bari	Auditorium
7	Chemical Sciences	02:30 – 03:00 pm	Dr. Manoj Gawande	Auditorium
8	Physical Sciences	03:00 – 03:30 pm	Dr. Girish Joshi	Auditorium

ICT Bhubaneshwar Campus: 2nd and 6th March 2024


Multi-Disciplinary Minor (MDM) Degree In Biotechnology and Bioengineering

Under the National Education Policy (NEP 2020)

(2023-2024)

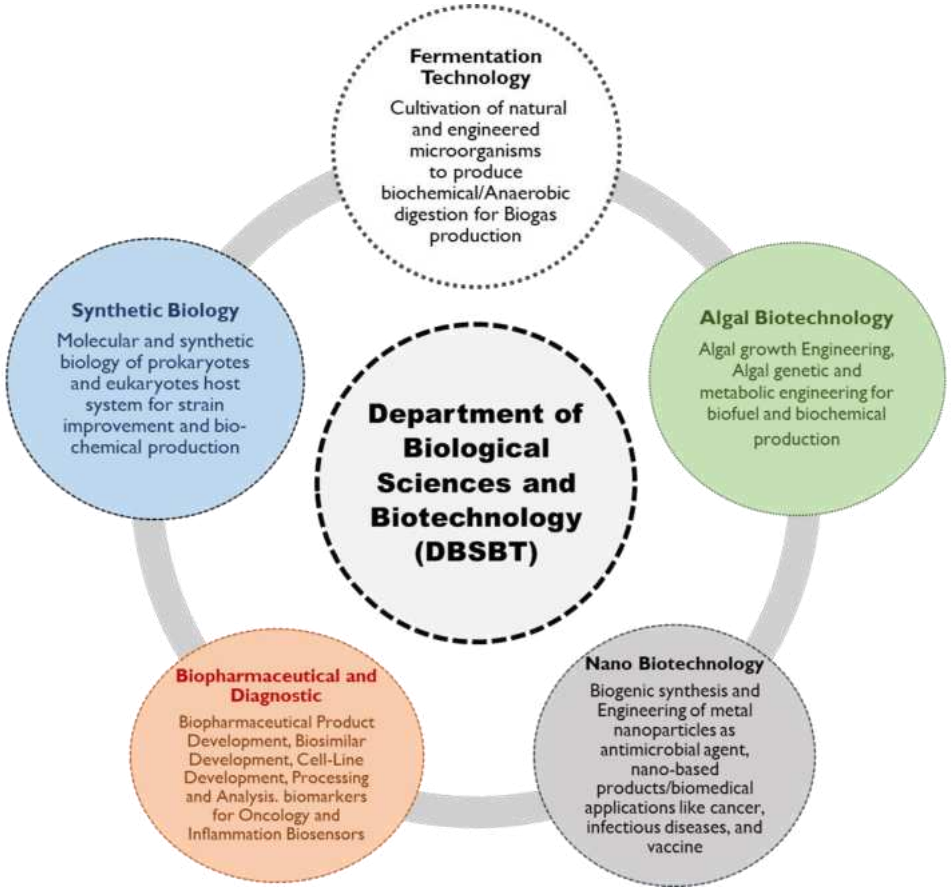
Offered by

DEPARTMENT OF BIOLOGICAL SCIENCES AND BIOTECHNOLOGY

INSTITUTE OF CHEMICAL TECHNOLOGY

(University Under Section-3 of UGC Act, 1956)
Elite Status and Center for Excellence
Government of Maharashtra

Department of Biological Sciences and Biotechnology (DBSBT)



Genesis

DBT-ICT Centre for Energy Biosciences: India's first Bioenergy Centre, established in 2009

DBSBT: An extension, evolution of the DBT-ICT Center to develop the research, training and education and outreach programs in subject of Biotechnology

MDM Degree overview & Structure of the MDM Course

Sr No	Semester	Course Credits	Name of the course
1	III	2	Introduction to Biological Science
2	IV	2	Fundamental of Applied Biotechnology
3	V	4	Lab Techniques in Biotechnology
4	VI	2	Genetic Engineering and Bioinformatics
5	VII	2	Bioprocess Technology
6	VIII	2	Industrial Biotechnology

Subject Code	Semester	Subject	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
BBT1201	III	Introduction to Biological Science	2	2	0	0	20	30	50	100
BBT1202	IV	Fundamental of Applied Biotechnology	2	1	1	0	20	30	50	100
BBP1303	V	Lab Techniques in Biotechnology	4	8	0	0	50	-	50	100
BBT1304	VI	Genetic Engineering and Bioinformatics	2	1	1	0	20	30	50	100
BBT1405	VII	Bioprocess Technology	2	2	0	0	20	30	50	100
BBT1406	VIII	Industrial Biotechnology	2	1	1	0	20	30	50	100
		Total	14	16						600

*5 Theory and 1 Lab course

Recommended batch size

Minimum **15**; Maximum **35**

Eligibility criteria

1. CGPA of the first two semesters.
2. In case the results of the IInd semester are not available, eligibility will be based on CGPA of
   1st Semester (50% weightage) and
   CET/JEE score (50% weightage)

Prerequisites: None

Open Elective offered by DBSBT

Subject Code	Semester	Subject	Credit	Hours/ Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
BBT1203	III	Introduction to Biological Science	2	2	0	0	20	30	50	100
BBT1204	IV	Fundamental of Applied Biotechnology	2	2	0	0	20	30	50	100

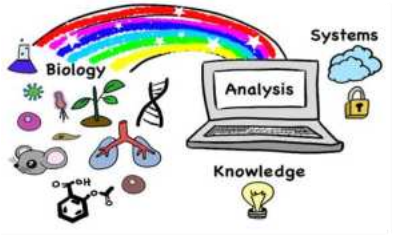
Why Biotechnology?

Money Money.... ($1.4Tn Economy)

Biotechnology Sectors

Biopharmaceuticals

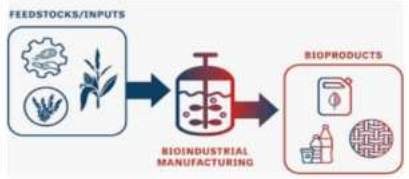
Bioinformatics



Bio-services

Agribiotechnology

Bioindustry



Industry Scenario

Valued at $92.3 Bn in 2023, the Indian Biotechnology Industry is targeted to reach $150 Bn by 2025 and $300 Bn by 2030.

Indian Biotechnology Economy

The percentage share of the biotechnology segments is:

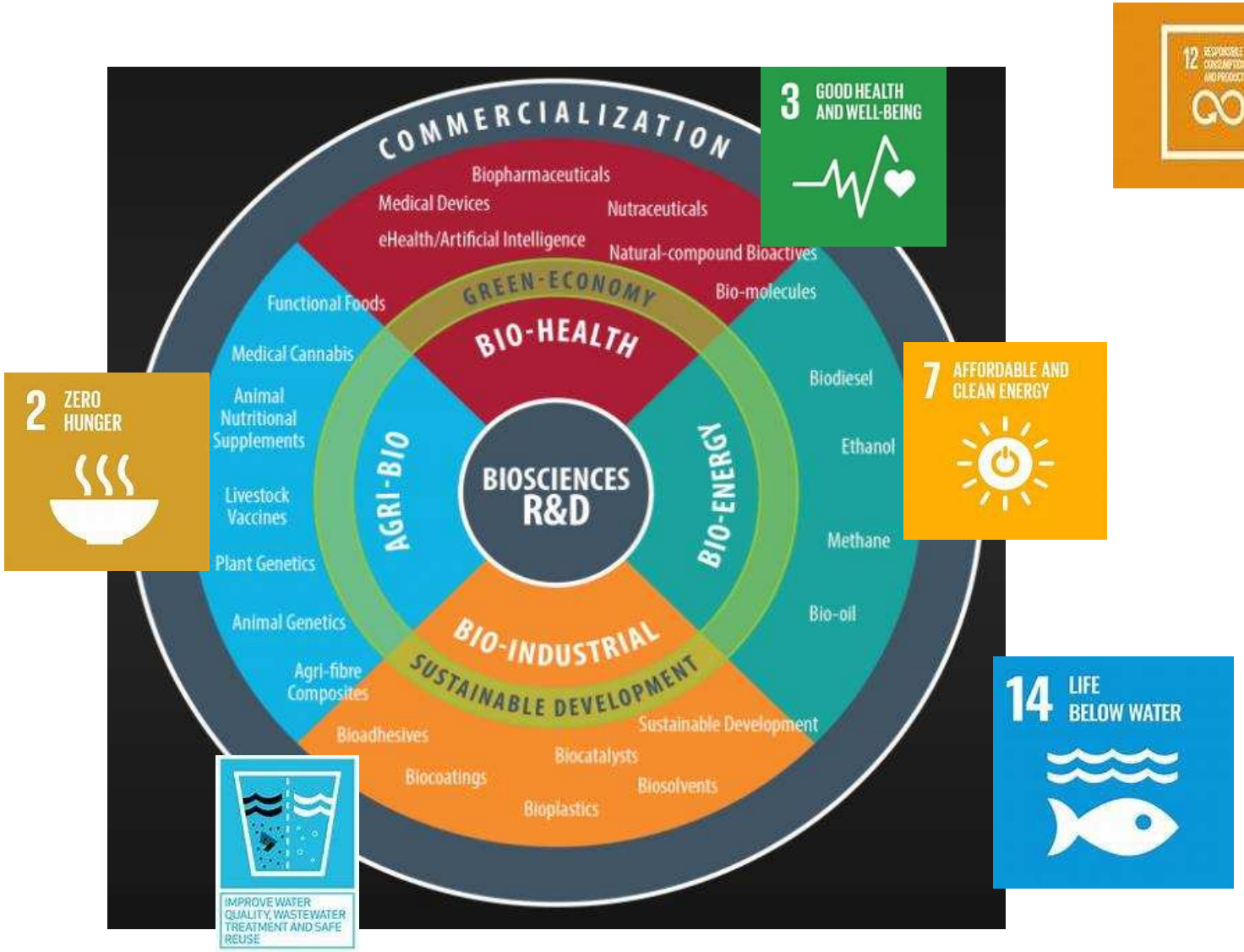
- BioPharmaceuticals- 62% ($57.5 Bn)
- BioAgriculture- 13% ($11.5 Bn)
- BioIndustry- 15% ($14.1 Bn)
- BioIT & BioServices- 10% ($9.3 Bn)

India on track to become a top 5 Global Bio-manufacturing hub by 2025: Union Minister Jitendra Singh

According to a press release by the Ministry of Science and Technology, emphasising the remarkable growth of India's bioeconomy in recent years, Singh outlined the nation's potential to play a crucial role in global trade and the bio-economy, contributing significantly to the Indian economy.

The thrust on Bio-economy is likely to provide newer job and entrepreneurship avenues to trained and skilled manpower in these domains

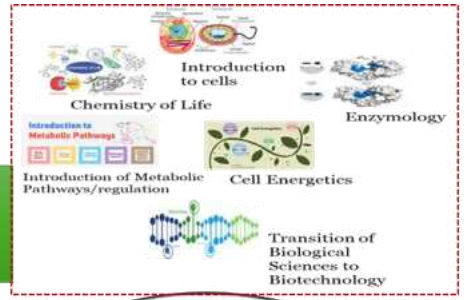
SDG & Biotechnology correlation



MDM course progression

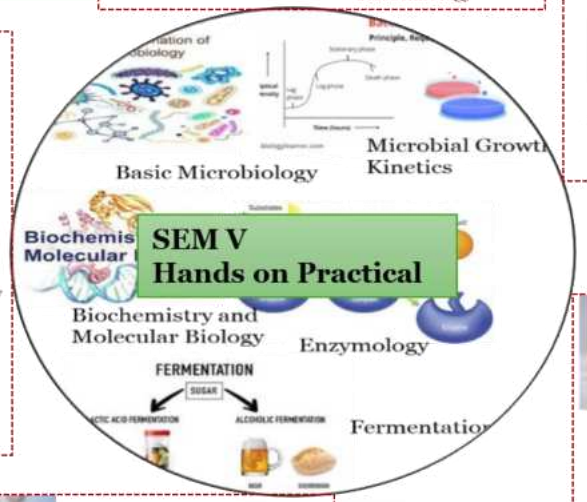
- **Semester III** • Introduction to Biological Science
- **Semester IV** • Fundamental of Applied Biotechnology
- **Semester V** • Lab Techniques in Biotechnology (Practical)
- **Semester VI** • Genetic Engineering and Bioinformatics
- **Semester VII** • Bioprocess Technology
- **Semester VIII** • Industrial Biotechnology

SEM III
Basics of Biotechnology

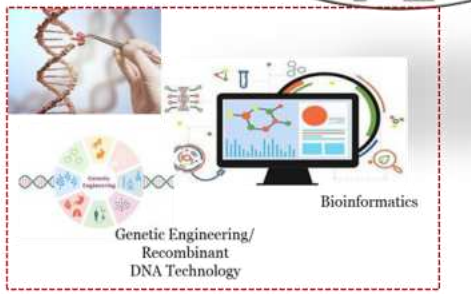


SEM IV
Applied Biotechnology

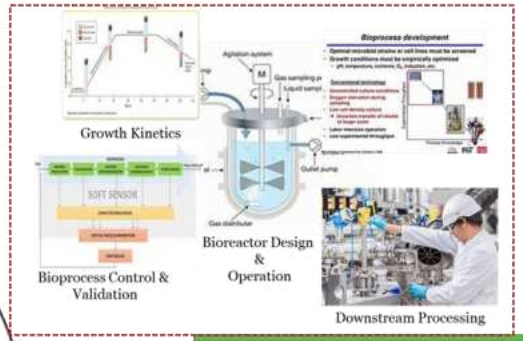
SEM V
Hands on Practical



SEM VI
Specialized Domain of Genetic Engineering & Bioinformatics



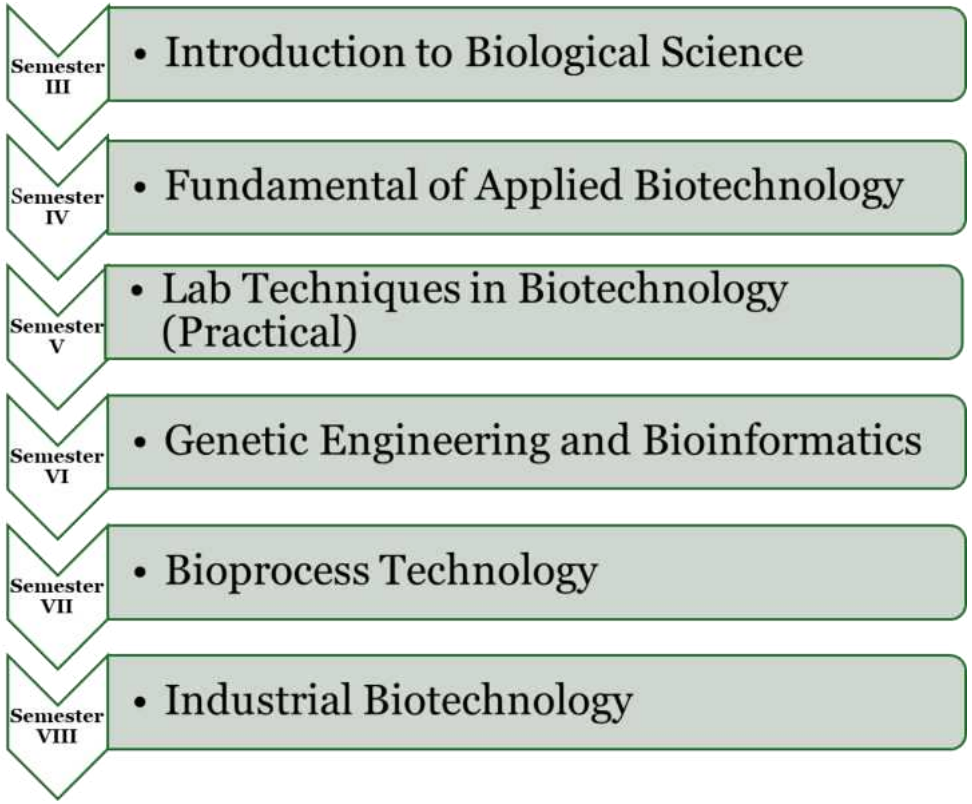
SEM VII
Specialized domain of Bioprocess Technology



SEM VIII
Specialized domain of Industrial Biotechnology

Course Significance & Objective

The Minor degree Course in "Biotechnology and Bioengineering" has been designed
To Encompass Diverse Domains of Biotechnology and Bioengineering



The MDM Degree Will Provide the Opportunity to Explore Wide Spectrum of Biotechnology And Understand Its POTENTIAL and OPPORTUNITIES in Bio-Economy and Overall Sustainable Development.

Know your Faculty

Prof. Samir Kulkarni
PhD: ICT Mumbai
Head

Dr. Ratnesh Jain
PhD: ICT Mumbai

Dr. Gunjan Prakash
PhD: IIT Delhi

Dr. Aniket Gade
PhD: SGB,
Amravati University

Dr. Manju Sharma
PhD: G.N.D University
Amritsar

Dr. Shamlan Reshamwala
PhD: IIT Bombay

Dr. Hitesh Pawar
PhD: ICT Mumbai

Dr. Mayur Ladole
PhD: ICT Mumbai

Dr. Chandrakant Holkar
PhD: ICT Mumbai

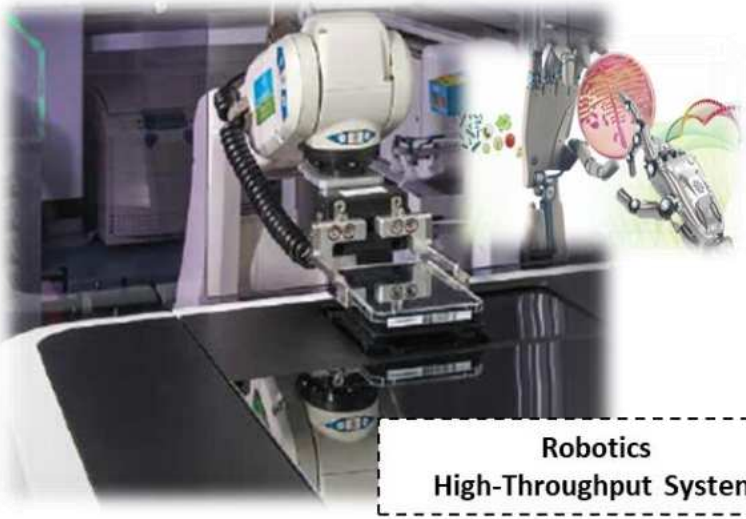
Dr. Anand Jadhav
PhD: ICT Mumbai

Dr. Rohit Sathe
PhD: **IIT** Ropar

Laboratories and R&D Facilities at the DBSBT

Fermentation Lab

Synthetic Biology Lab



Robotics
High-Throughput System

Biogas fermentation

Liquid Handling System

Algal Biotechnology Lab

What do you Acquire...

- Exposure to the exciting field of Biotechnology with real life applications
- Development of Technical Know how and Practical Exposure in the field of Applied Biotechnology
- iGEM participation opportunities
- Mentorship from Faculty for skill development possibilities in the field of Biotechnology

Scope & Opportunities

- Higher Studies in India or abroad
- Ample Entrepreneurship Possibilities In Bio-based Domain.
- Opportunities to align to SDGs for sustainability for our own living and existence.

Thank you

For any further queries
Please Contact or Write to

Head, DBSBT: Prof Samir Kulkarni (sr.kulkarni@ictmumbai.edu.in)
Departmental MDM Coordinator: Dr Gunjan Prakash
g.prakash@ictmumbai.edu.in

Multi-Disciplinary Minor (MDM) Degree In Pharmaceutical Chemistry and Technology

Under the National Education Policy (NEP 2020)

(2023-2024)

Offered by

Department of Pharmaceutical Sciences and Technology, ICT Mumbai

Salient Features:

- Pharmaceutical science and technology have played a crucial role in this evolution, **shaping the manufacturing**/preparations/ formulations / extractions, and distributed of drug substances, drug products, biological, phyto-constituents, fermented bioactive molecules etc.
- The commitment of professionals in these fields has been instrumental in ensuring a safe, abundant, and diverse pharmaceutical products supply for an increasingly global population.
- Department of Pharmaceutical Sciences and Technology has vision to provide **demand-driven**, value-based and quality technical education to make India a developed country through socio-economic transformation.
- In tune of this, the minor degree course in "**Pharmaceutical Chemistry and Technology**" has been designed to encompass different domains of pharmaceutical science and technology from fundamental knowledge to scientific and technological advancement.

Program Specific Outcomes(PSO's)

Key areas: Students will develop their core expertise

- **Pharmaceutical Products Development and analysis**: Able to translate emerging sciences in developing innovative pharmaceutical products. Able to apply analytical techniques for pharmaceuticals safety, quality assurance & regulations.
- **Pharmaceutical Technology Knowledge**: Apply the knowledge of mathematics, science, chemical engineering and pharmaceutical technology fundamentals, and pharmaceutical technology specialization to the solution of complex problems in pharmaceutical formulation technology, Pharmaceutical Chemistry and phytochemical extraction or Herbal technology.
- **Design & Development of innovative Solutions**: Design solutions for complex pharmaceutical technology problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
- **Fermentative Biotechnology**: Able to translate emerging science in developing innovative Fermentative/Biological products.

Important Details

Intake: Minimum **15**; Maximum **35**

Eligibility Criteria:

a. CGPA of the first two semesters.
b. In case the results of the 2nd semester are not available, eligibility will be based on CGPA of the 1st Semester (50% weightage) and CET/JEE score (converted into percentile based on admitted students, 50% weightage).
c. The allotment to the multidisciplinary minor degree programme will be as per the policy of the Institute.

Prerequisites: 12th Standards subjects and First year B. Tech/B.Chem courses.

Pedagogy/Teaching Methods:

- ✓ **Lecture/Discussions**: These sessions will discuss the subject matters of the course
- ✓ **Experiential Learning**: The sessions will involve hands on training.
- ✓ **Tutorials**: Problem solving / case studies / relevant real-life applications / student presentations / home assignments / individual or group projects
- ✓ **Hands on Experience**: Few topics will be demonstrated followed by hands on experience.

Summary of Subjects

Semester	Subject	Credit	Faculty Members
III	Introduction to Technology of Pharmaceuticals and Fine chemicals	02	Prof. Shreerang V. Joshi/ Dr. Nitin Arote
IV	Pharmaceutical Analysis	02	Prof. Ganesh U. Chaturbhuj
V	Phytochemicals-Extraction and Isolation	04	Prof. K.S. Laddha/ Dr Galvina Pereira
VI	Introduction to Formulation Technology	02	Prof. Vandana Patravale/Dr. Sathish Dyawanapelly
VII	Introduction to Fermentative Biotechnology	02	Dr. Prajakta Dandekar Jain /Visiting Faculty
VIII	Pharmaceutical Chemistry and Technology	02	Prof. Shreerang V. Joshi/ Dr. Nitin Arote

Brief Overview of Courses

Course title	Highlights of syllabus
Introduction to Technology of Pharmaceuticals and Fine chemicals	✓ Students are required to know various aspects of the Technology of Pharmaceuticals and Fine Chemicals. This subject will fulfill the need to build the professional career additional in Pharmaceutical Sectors ✓ **General Aspects, Medicinal Chemistry and Process Chemistry, Pharmacology and Pharmacognosy, Dosage forms of the drugs, Drug administration, Overview of drug development and Introduction to biological therapeutics.**
Pharmaceutical Analysis	✓ The course is designed to acquaint the students with the basics of Pharmaceutical Analysis. ✓ This includes **Pharmacopeial monographs, analytical method validation**, spectroscopic and spectrometric techniques such as **Fourier Transform Infra-Red (FT-IR), Nuclear Magnetic Resonance (NMR), Mass Spectrometry and Hyphenated Techniques.**

Brief Overview of Courses

Course title	Highlights of syllabus
Phytochemicals -Extraction and Isolation	✓ The course is designed to train the students with the basics and application of technology in **Separation, Preparation, Isolation, evaluation and detection of phyto-constituents from drugs of natural origin. Hands on experience on herbal extraction technology.**
Introduction to Formulation Technology	✓ The course is designed for basic and practical understanding on various dosages form. ✓ **Overview of Pharmaceutical formulation Industry, Development in Large-scale Manufacturing of Monophasic (Oral and Topical), Biphasic – Suspension and Emulsions, Topical Dosage Forms such as Ointments, Creams, Gels, and Suppositories.**

Brief Overview of Courses

Course title	Highlights of Syllabus
Introduction to Fermentative Biotechnology	✓ To assess the application of biological and engineering principles to problems involving microbial, mammalian, and biological/biochemical systems. ✓ **To understand the fundamentals of fermentation technology to know the basics in mammalian cell culture and genetic engineering and Recombinant microorganisms in fermentation** ✓ **To understand the current concepts in fermentative biotechnology, with a focus on industrial practices**
Pharmaceutical Chemistry and Technology	✓ Introduction to various drug classes with emphasis on synthesis and technology Developments. ✓ **Industrial Synthetic strategies for implantation of technology in manufacturing of Drug and Drug Intermediates.** ✓ **Understanding of industrial practices.**

Laboratories and R&D Facilities at the DPST

- ✓ Nuclear Magnetic Resonance
- ✓ FTIR
- ✓ Spray Dryers
- ✓ High performance liquid chromatography
- ✓ Gas chromatography
- ✓ Glass reactor assembly
- ✓ Pressure Reactors (Hydrogenators)
- ✓ Flow reactor
- ✓ Herbal Product-Extractors.
- ✓ All formulation equipment's
- ✓ Well equipped biotech facility

DPST Faculty

Pharmaceutical Chemistry

Prof. S. V. Joshi (Head of Department)

Prof. M. S. Degani

Prof V. N. Telvekar

Prof. G. U. Chaturbhuj

Prof. P. S. Kharkar

Dr. N. D. Arote

Dr. H. K. Chaudhari

Pharmaceutical Biotechnology

Dr. P. D. Jain

Pharmaceutics

Prof. P. D. Amin

Prof. P. V. Devarajan

Prof. V. B. Patravale

Prof. P. R. Vavia

Dr. Sathish Dyawanapelly

Pharmacognosy

Prof. K. S. Laddha

Dr. Galvina Pereira

Pharmacology

Prof. Sadhana Sathaye

Dr. S. D. Ambavade

Detailed syllabus uploaded on ICT website. Please feel free to reach out for any further queries.

For any further queries
Please Contact or Write to

Head, DPST: **Prof Shreerang V. Joshi** (sv.joshi@ictmumbai.edu.in)
Departmental MDM Coordinator: **Dr Nitin Arote**
nd.arote@ictmumbai.edu.in


Thank you
ありがとうございました
Cảm ơn
Dziękuję
ขอบคุณครับ
谢谢
Gracias
Grazie
اشكُرْ
Σας ευχαριστούμε
धन्यवाद
Tacka
நன்றி
Danke
Merci
ধন্যবাদ
Obrigado
감사합니다
Большое спасибо

Chemical Sciences

Multi-Disciplinary Minor Degree

Department of Chemistry, ICT Mumbai



Salient features:

- Industry relevance: Equip students for diverse roles in numerous industries such as pharmaceuticals, polymers, dyes, and textile industries

- Innovation and Entrepreneurship: Mentor students to successfully combine the expertise in Chemistry and technology to address this expanding market for locally manufactured chemicals

- Research and Development: Students will comprehend and combine both aspects – research and development – through their training to be competent researchers on a global level

- Sustainable development: Sensitize and train students to address global problems through development of clean technologies for energy-efficient transportation, food security and access to health care

Program Specific Outcomes

Following are the key areas in which the students will develop their core expertise:

- Organic Chemistry
- Physical Chemistry
- Computational Chemistry
- Catalysis
- Real life problem solving
- Chemistry for Society

Summary of Courses offered

Semester	Subject	Credit	Faculty Members
III	Chemical Kinetics	02	Prof. R. V. Jayaram
IV	Interfacial Chemistry	02	Prof. R. V. Jayaram
V	Organic Synthesis	04	Dr. A. R. Kapdi
VI	Organic Spectroscopy	02	Prof. A Chaskar / Visiting faculty
VII	Computational Chemistry	02	Dr. R. V. Pinjari
VIII	Organometallic Chemistry & Catalysis	02	Prof. B. M. Bhanage / Dr. A. Kapdi

Brief Overview of Courses

Course title	Highlights of syllabus
Chemical Kinetics	• Study of industrially relevant reactions for example polymerization reactions, homogenous catalysis, enzyme catalysis, interfacial processes • Experimental techniques and theory of kinetic models • Applications in food industry, pharmaceutics, industrial synthesis
Interfacial Chemistry	• Physical and chemical characteristics of surfactants, micelles, colloids (gels, emulsions, foams) and their stability • Applications in heterogeneous catalysis, electrochemistry, separation processes and allied technology fields such as paints, dyes, drug formulations, food industry, textiles

Brief Overview of Courses

Course title	Highlights of syllabus
Organic Synthesis	• Functional group transformations (example – carbonyl chemistry), stereochemistry, heteroaromatic compounds, chemistry of natural products • Applications in speciality chemicals industry, bulk chemicals manufacturing, pharmaceutical manufacturing industry, polymer
Organic Spectroscopy	• Various spectroscopic techniques used for the structural elucidation of organic molecules • UV-visible spectroscopy, Infrared spectroscopy, 1H and 13C NMR, mass spectrometry • Key aspects related to speciality chemicals, research and development

Brief Overview of Courses

Course title	Highlights of syllabus
Computational Chemistry	• Introductory course on computational studies of molecules, supramolecular assemblies and biomolecules • Molecules mechanics, quantum mechanics, molecular dynamics • Applications in research and development, pharma industry, designing of molecules and materials
Organometallic Chemistry and Catalysis	• Introduction to organometallic chemistry and its contemporary applications in industrial catalysis • Important reactions include hydrogenation, formylation, hydroformylation, polymerization, CO2 fixation • Applications in research and development, pharma industry, speciality chemicals industry, green technology

Open Electives (Sem 3 to 5)

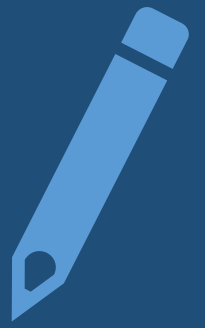
All courses offered for MDM are open electives – meaning students who have opted for MDM other than Chemical Sciences can enroll under open electives

Sem	Subject	Credits
III	Analytical Chemistry	04
III	Organic Synthesis	04
IV	Advanced Analytical Chemistry	02
IV	Interfacial Chemistry	02
IV	Organic Spectroscopy	02
V	Computational Chemistry	02
V	Chemical Kinetics	02
V	Organometallic Chemistry and Catalysis	02

Brief Overview of OE Courses

Course title	Highlights of syllabus
Analytical Chemistry	• **Combination of lectures and laboratory sessions** • Spectroscopic techniques, electroanalytical techniques, chromatographic techniques, AAS • Experiments will be based on applications of the above techniques for chemical analysis
Advanced Analytical Chemistry	• Thermal methods (DSC / TGA), XRD, surface analysis – SEM / TEM, advanced electrochemical methods (coulometry, amperometry, cyclic voltammetry) • Applications in materials science, QC and QA in industries

Detailed syllabus uploaded on ICT website. Please feel free to reach out for any further queries.

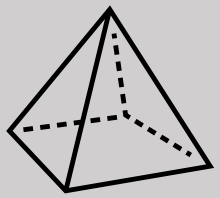
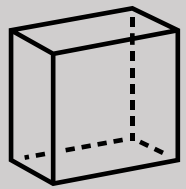
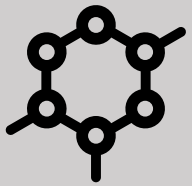
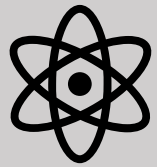


Chemistry matters!

Minor degree in “Materials Science”

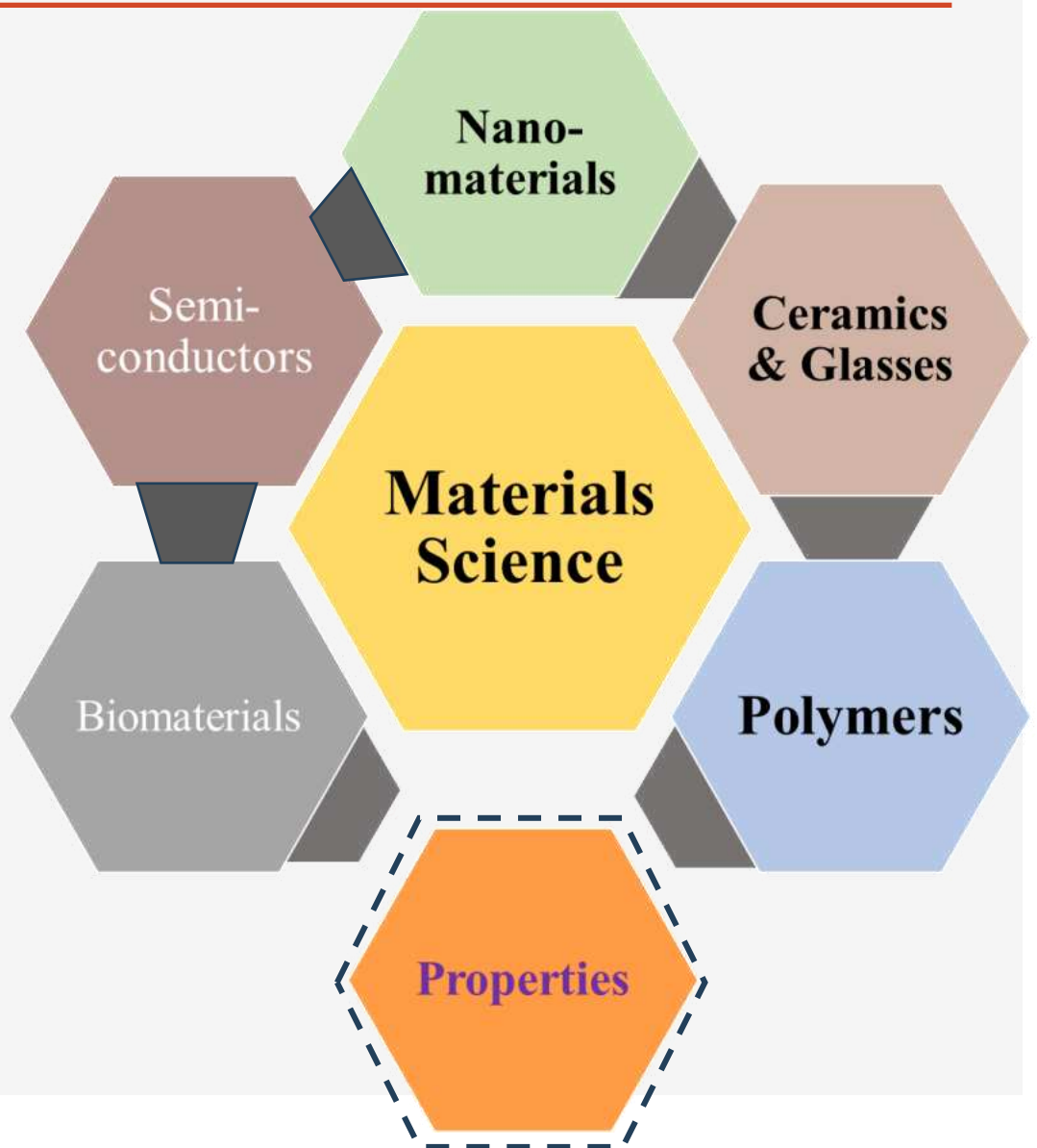
Offered by the Department of Physics

Why? **What?** **Whom?**

Why?

- We live in Materials age, drives the **progress of a country/region**
- Material are crucial to many emerging areas for advancing technology
- Semiconductor industry, solar cells manufacturing, renewable energy, automotive and aerospace industry, biomaterials, to name a few.
- Materials selection and design as per applications: **economic and performance optimization**
- **Abundance of critical** materials is an issue, finding suitable alternatives is needed.
- This program will help understand materials from microscopic viewpoint, their processing and materials selection and design for applications



Structure of Minor degree in Materials Science (Department of Physics)

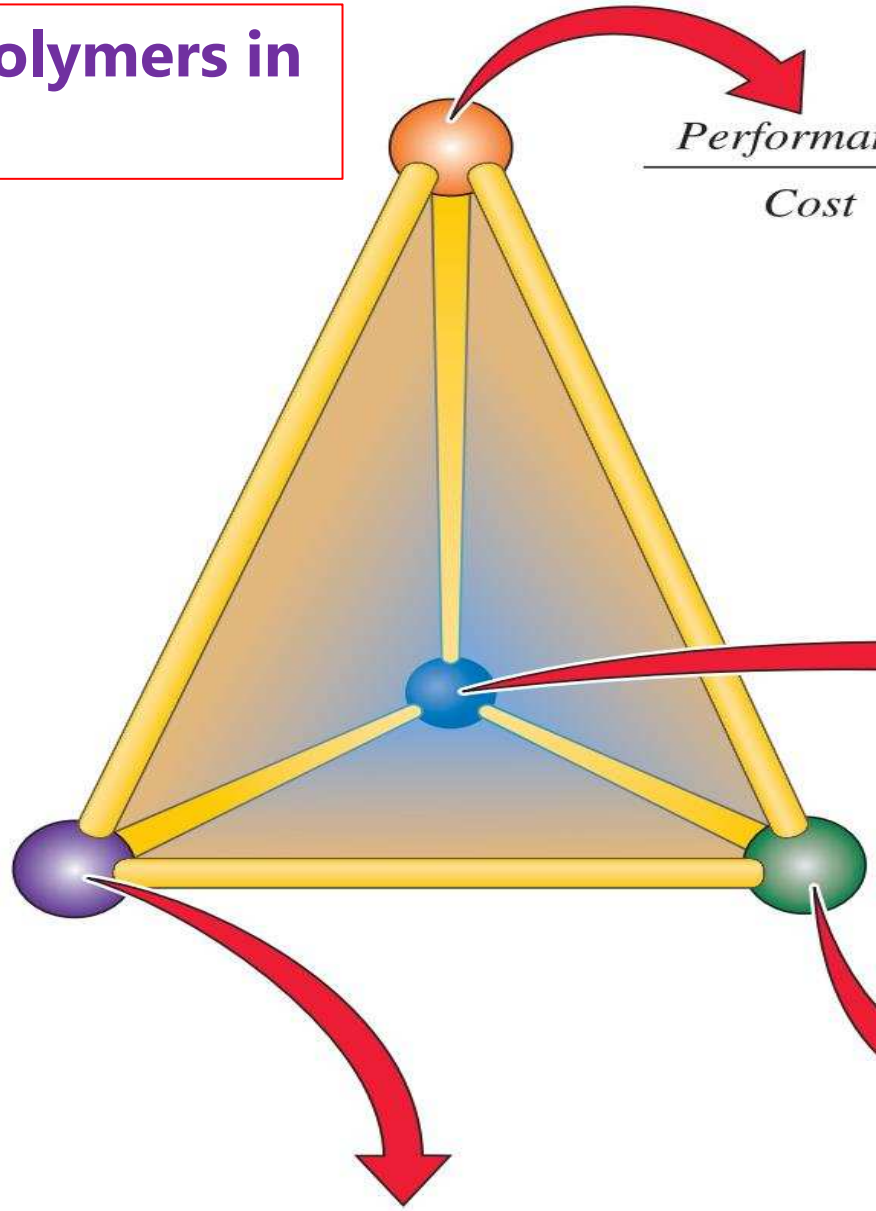
Structure of Minor degree in Materials Science											
Sr. No.	**Course Code**	**Course**	**Semester**	**Credits**	**Hours/week**			**Marks distribution**			
					L	**T**	**P**	**CA**	**MS**	**ES**	**Total**
1.	PYT1301	Solid state Physics	III	2	1	1	-	20	30	50	100
2.	PYT1401	Introduction to Materials Science	IV	2	1	1	-	20	30	50	100
3.	PYT1501	Introduction to Nanophysics and Applications	V	4	3	1	-	20	30	50	100
4.	PYP1601	Materials Characterization Laboratory	VI	2	-	-	4	50	-	50	100
5.	PYT1701	Introduction to Polymer Physics	VII	2	2	-	-	20	30	50	100
6.	PYT1801	Ceramic Science and Technology	VIII	2	2	-	-	20	30	50	100

What we do in Materials Science?

Understand materials behaviour from Atomic to Bulk

Develop strategies for processing and functionalize materials for various applications.

Replacing Si by polymers in MEMS



Performance / *Cost*

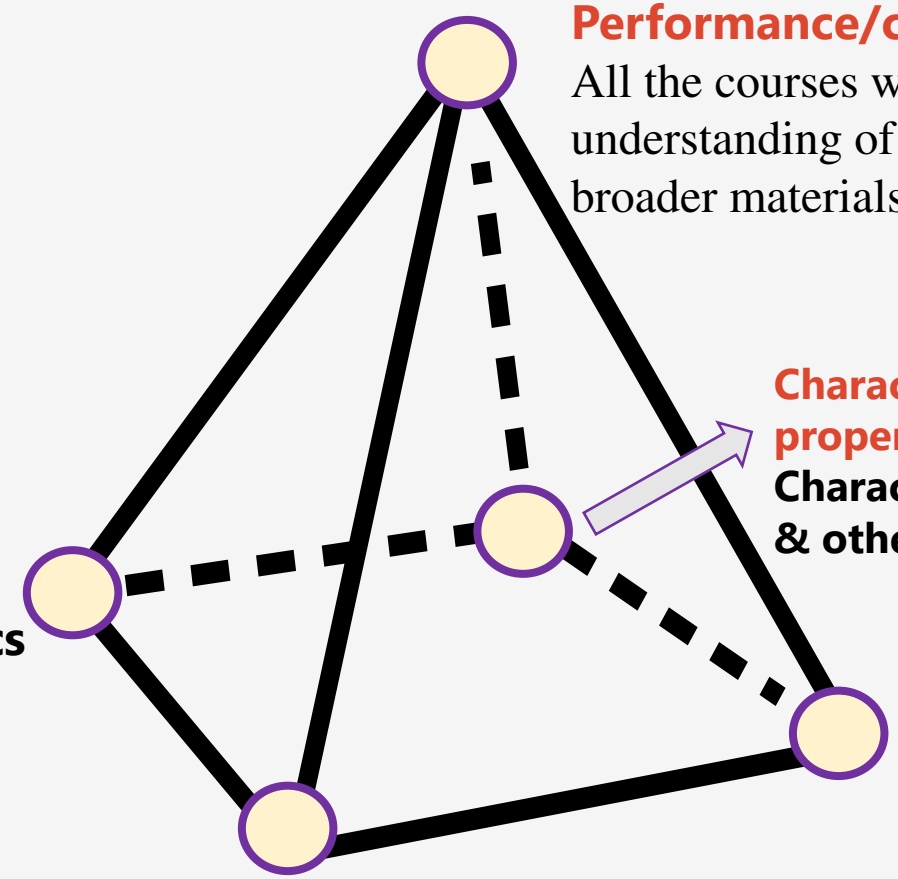
- What are the electrical characteristics?
- How robust are the devices?
- What is the cost of fabrication?
- How does this compare with silicon-based devices?

***A*: Composition**
- What polymers can be used?
- What dopants can be used to control the level of conductivity?

***C*: Synthesis and processing**
- How can thin films be made?
- How can different devices be connected to each other?

***B*: Microstructure**
- How does the nature of the bonding control the conductivity?

How are courses aligned to the Philosophy of Materials science?



Performance/cost

All the courses will help you achieve understanding of this concept over a broader materials gamut

Characterisation and Physical properties

Characterisation Lab
& other courses

Structure:

Solid state Physics
Intro. Mat.Sci.
Ceramics
Nano
Polymers

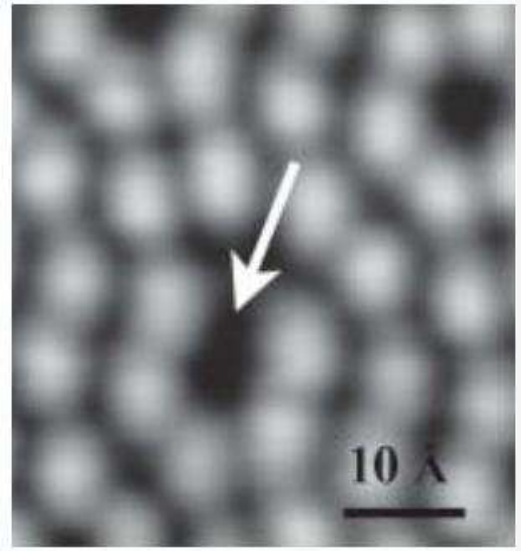
Composition:

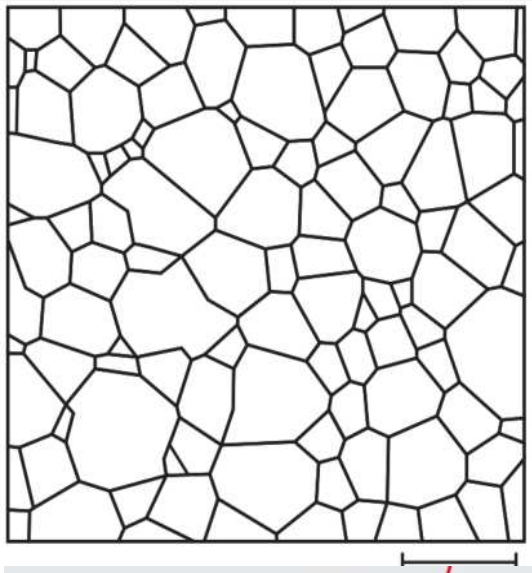
Solid State Physics
Ceramics
Characterisation Lab

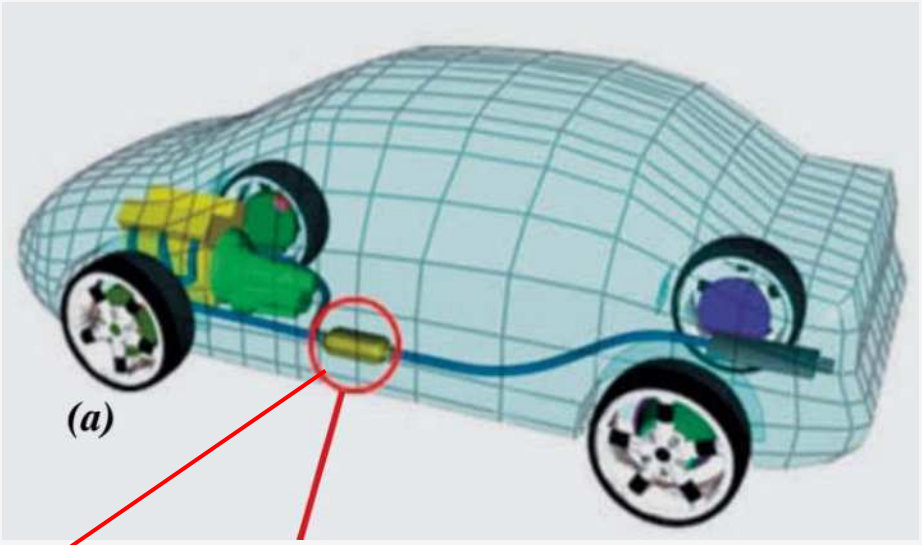
Synthesis:

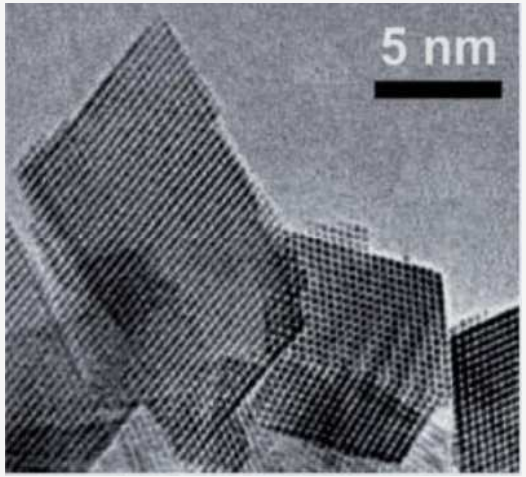
Introduction to Materials Science
Nanotechnology
Ceramics
Polymers

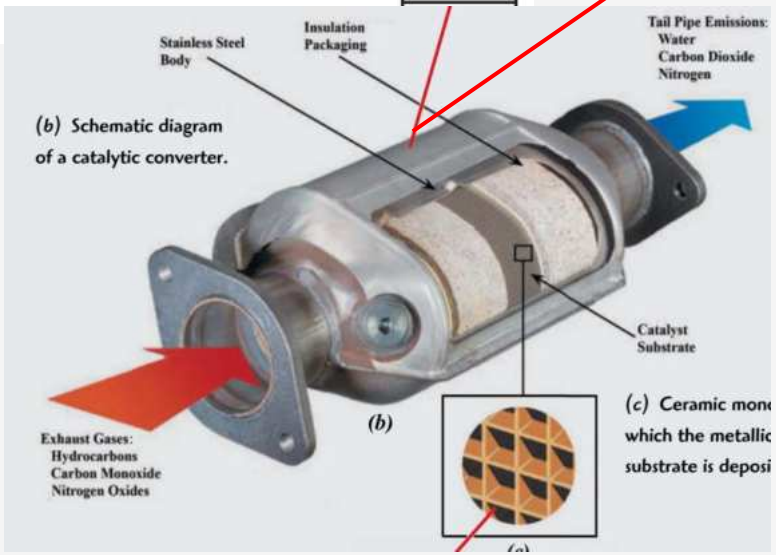
Materials journey from atom to the bulk



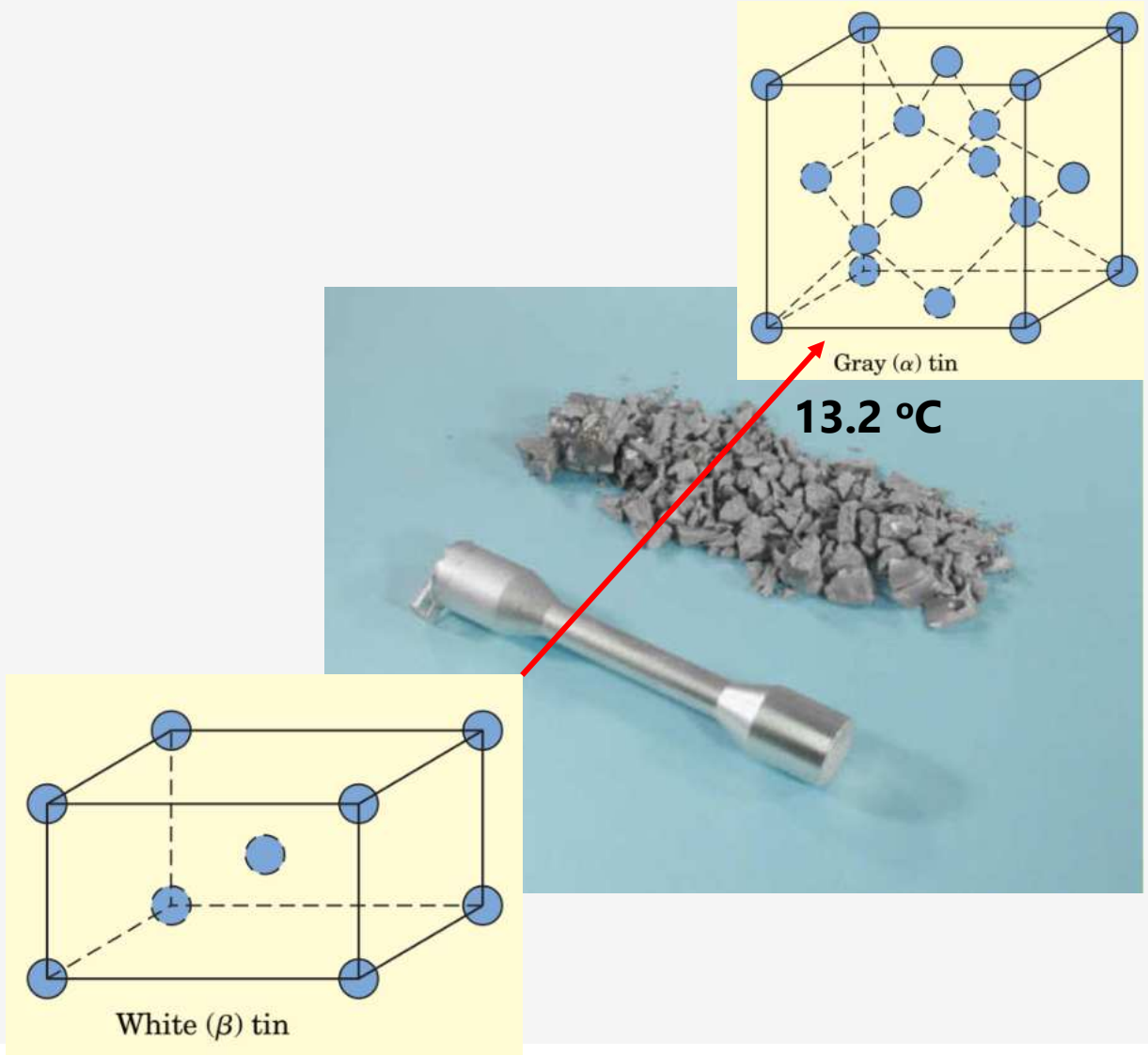








Materials journey from atom to the bulk



Faculties involved in MDM

Prof. Mohan Narayan
Head,
Department of Physics

Prof. R. R. Deshmukh
Sr. Professor

Dr. Neetu Jha
UGC Assistant Professor

Dr. Ashwin Mohan
Assistant Professor

Dr. Archana Kalekar
Assistant Professor

Dr. Paresh Salame
Assistant Professor

Dr. Shraddha Shirbhate
Assistant Professor

Research/Expertise

- Chemical Engineering Ther mo-dynamics
- Statistical mechanics
- Theoretical High Energy Physics

- Plasma Technology
- Polymer Physics
- Functionalization of nano-particles
- Plasma for biomedical applications

- Carbon Nanomaterials
- Fuel Cell
- Supercapacitors
- Zn-ion Batteries
- Nano fluids

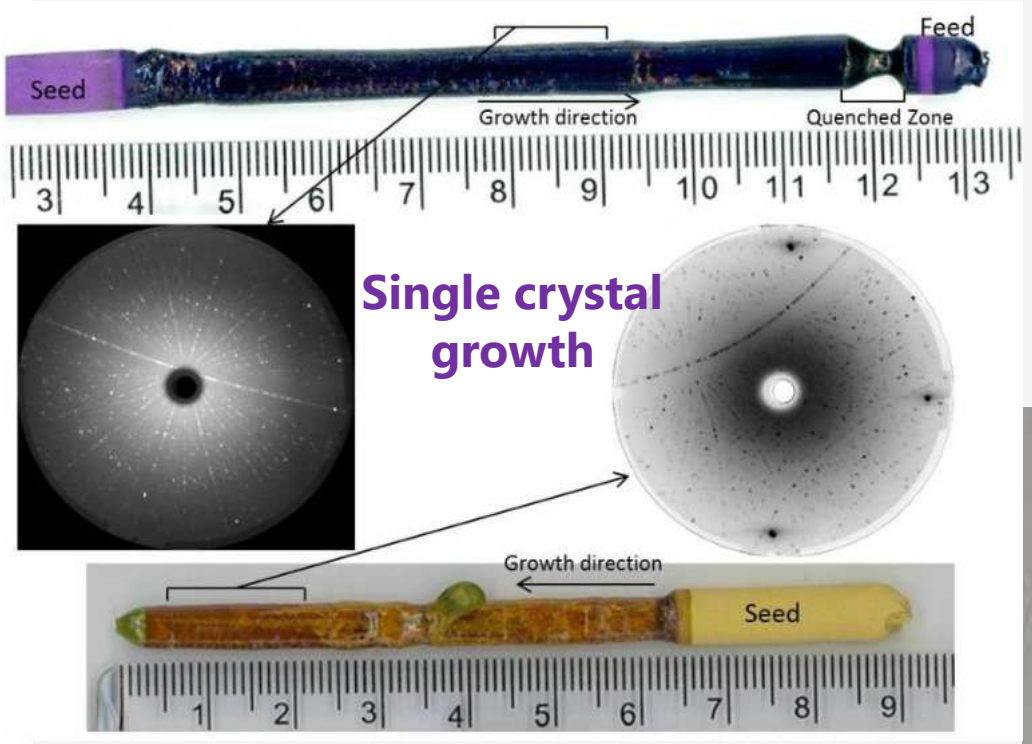
- Materials Physics
- Thermal transport
- Magnetism, low temperature physics
- Low-dimensional quantum magnets

- Energy conversion: Solar cells Photocatalysis.
- Energy storage: Supercapacitor, Batteries
- Sensors

- Sodium-ion batteries
- Supercapacitors
- Multiferroics
- Colossal Dielectric Materials

- SOFC Technology, PEM FC
- Solid electrolyte
- Defect chemistry in Solid
- Piezoelectric Materials

Department's contribution from basic to applied field



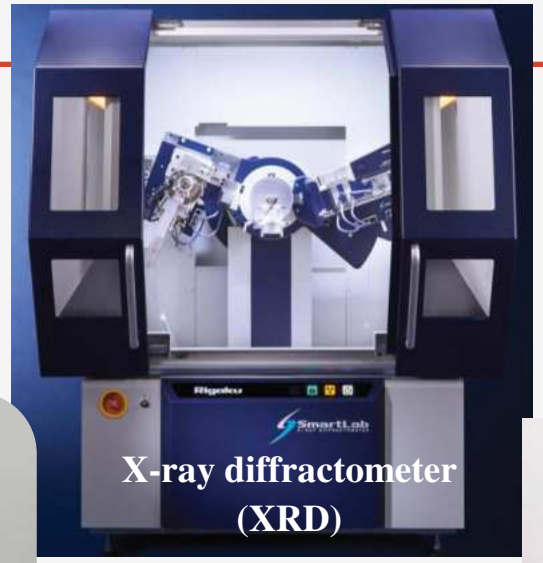
How the courses are shaped?

1. Solid state Physics	2. Introduction to Materials Science	3. Introduction to Nanophysics and Applications	4. Materials Characterization Laboratory	5. Ceramic Science and Technology	6. Introduction to Polymer Physics
• Understanding the origin of **macroscopic** materials properties from the **microscopic** (atomistic) viewpoint. • Theoretical basis of how technologically relevant materials properties arise due to the collective behaviour of building blocks of materials: electrons/atoms/ molecules • Very useful for materials engineering.	• Will introduce to majority of materials category • Materials dependent properties will be explored •For each category, materials function, from microscopic point will be introduced •Will form the base for more detailed courses in materials science	•Understanding of property variation with size and its optimization for application. •Understanding of the synthesis mechanisms and its characterization. •Industrial Applications of Nanotechnology- Present and future. •Smaller, faster, and more economical	•Use of advanced, research-grade experimental facilities used in the characterization of materials properties • Ability to correlate experimental results with materials characteristics and properties •Data analysis techniques to obtain relevant quantities using raw experimental data	• Understanding the structure property correlations in the ceramics • Estimating the toughness and other mechanical properties of the ceramics • Measure and understand the electrical behaviour of the ceramics • Useful for making polymer, metal matrix composites, ceramic membrane, fuel cells, solid electrolytes for batteries.	• There's a certain overlap between polymer chemistry, polymer physics and polymer engineering, combining all these will help understand the polymer science. • Focus will be on structure-property co-relationship in polymers, bonding • Emphasis will be on Mechanical properties, rheological studies, kinetics of reactions

Foundation → **Materials Specific Knowledge and Applications**

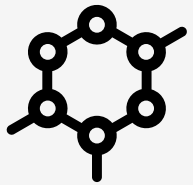
Research facilities student will explore

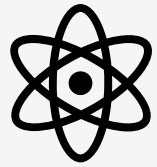
- X-ray diffractometer (XRD)
- Differential Scanning calorimetry (DSC)
- Fourier Transformed Infrared Spectroscopy (FTIR)
- UV Visible Spectrophotometer
- Colour spectrophotometer
- Electrochemical Workstation
- Universal Testing Machine (UTM)
- Rheometer
- Twin screw Extruder
- Hot stage polarising microscope



Prospects for students opting for this Minor

- MS
- PhD
- Industrial R&D



At the end of the program, you will..

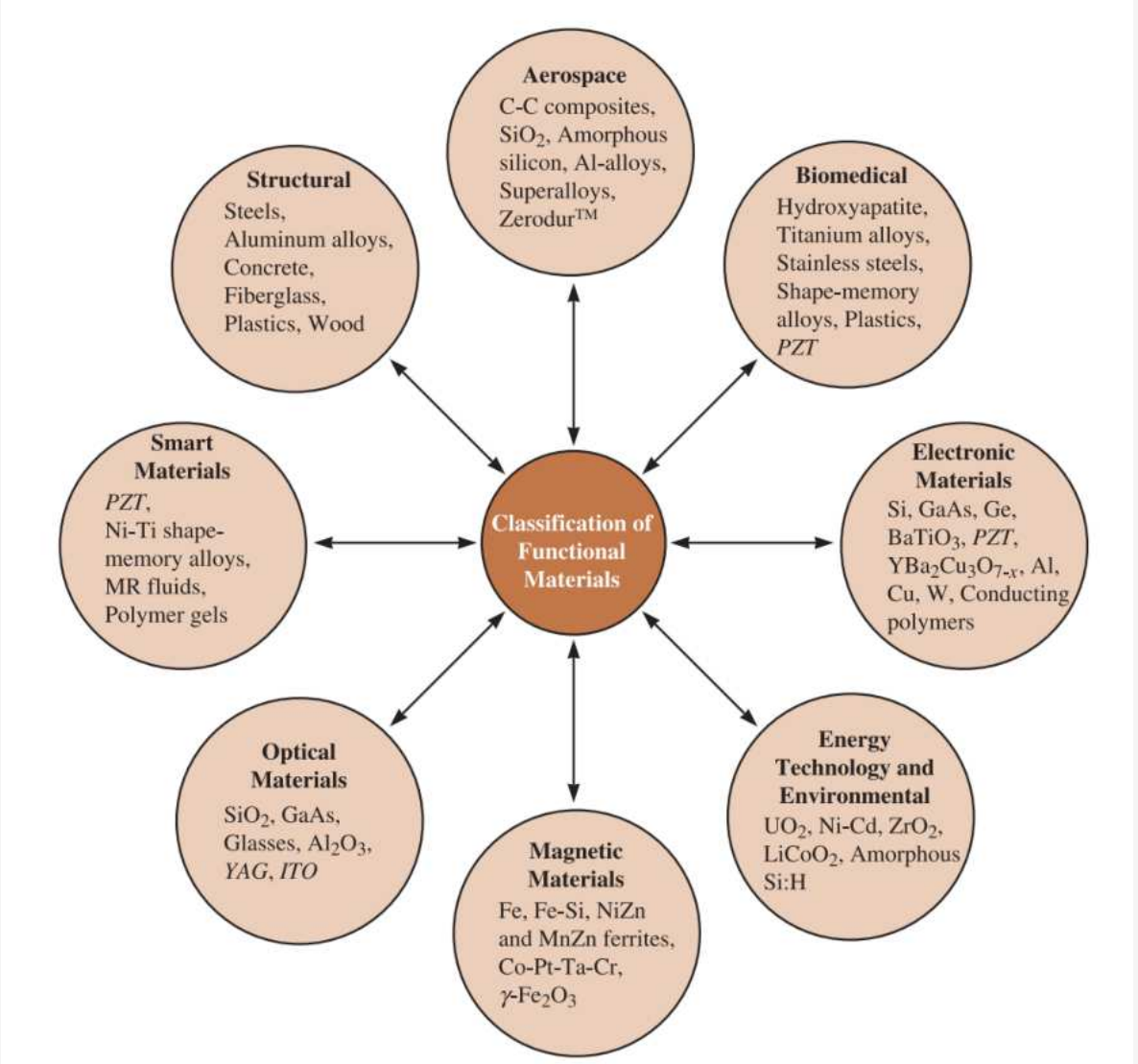
- Understand materials from microscopic perspective

- Selecting materials for various applications, understand alternative to existing materials for a particular applications

What you will ultimately achieve through combining this Minor with major

- Corelate fundamental understanding of various materials through atomic arrangement bonding, structure, microstructure to selecting materials for a particular applications.

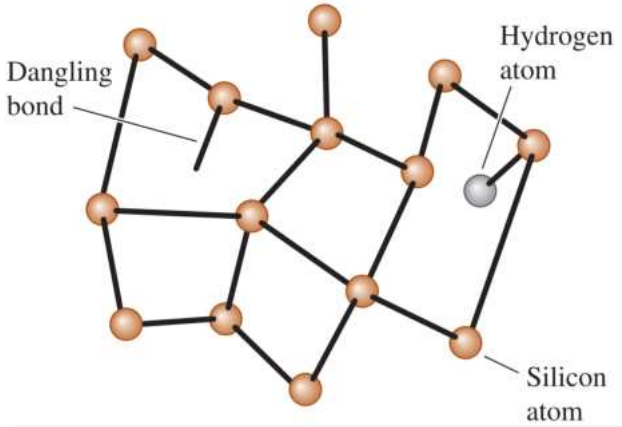
- Advance to Functional Materials, witness their applications

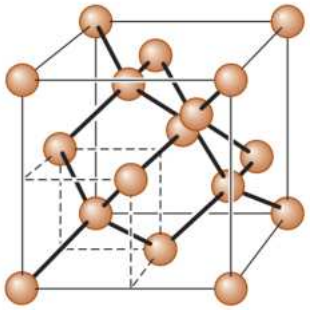


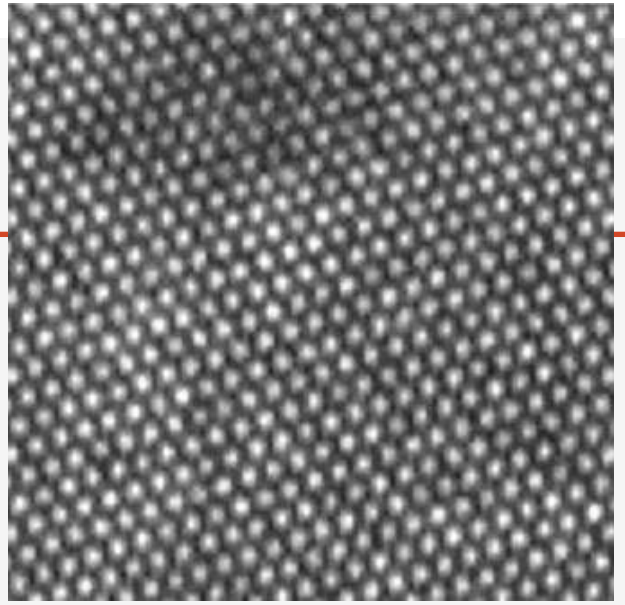
Whom?

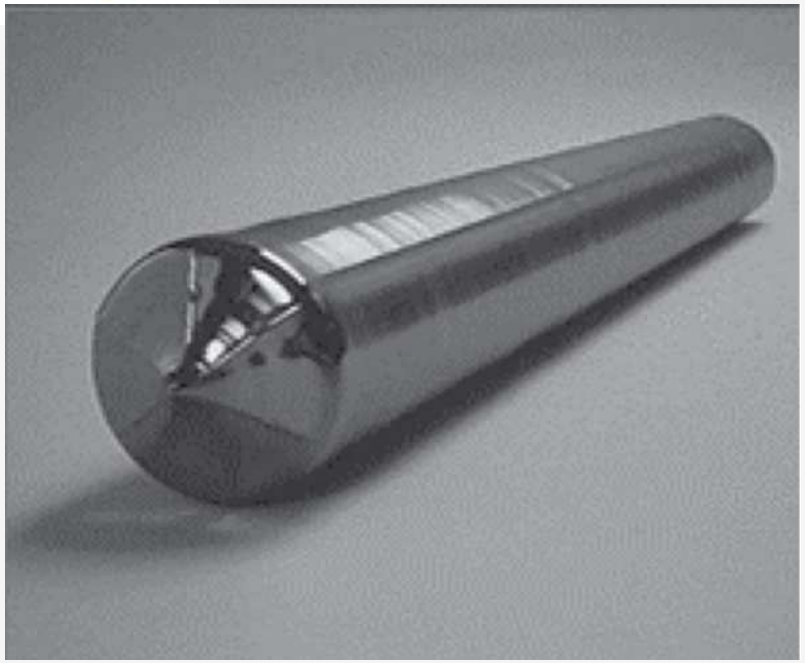
Anyone who's interested in learning basic of materials science from fundamental point of view to exploring them from application point of view will find this minor degree in Materials science useful and in tandem with their major program..

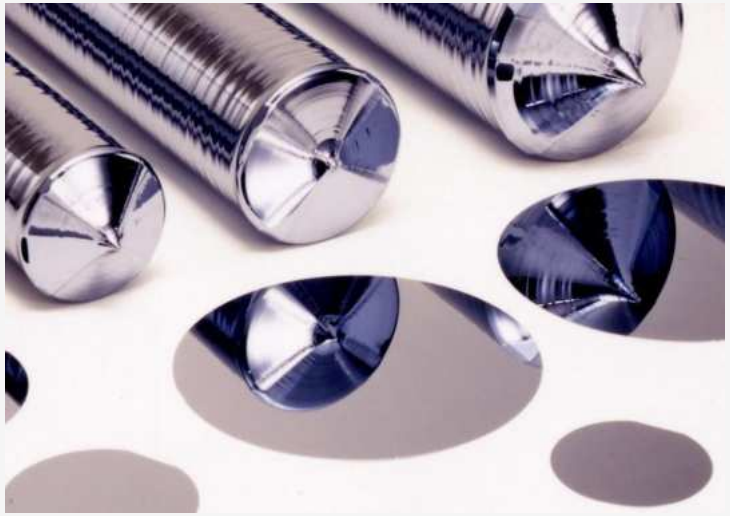
and for those who don't find direct co-relation with this program...join, enjoy and explore fascinating world of materials…



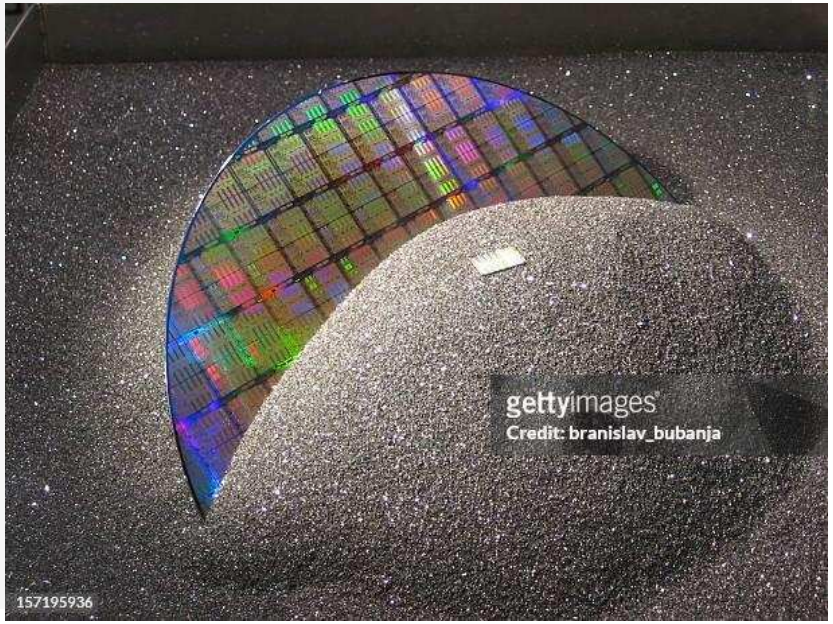








Material's Journey…

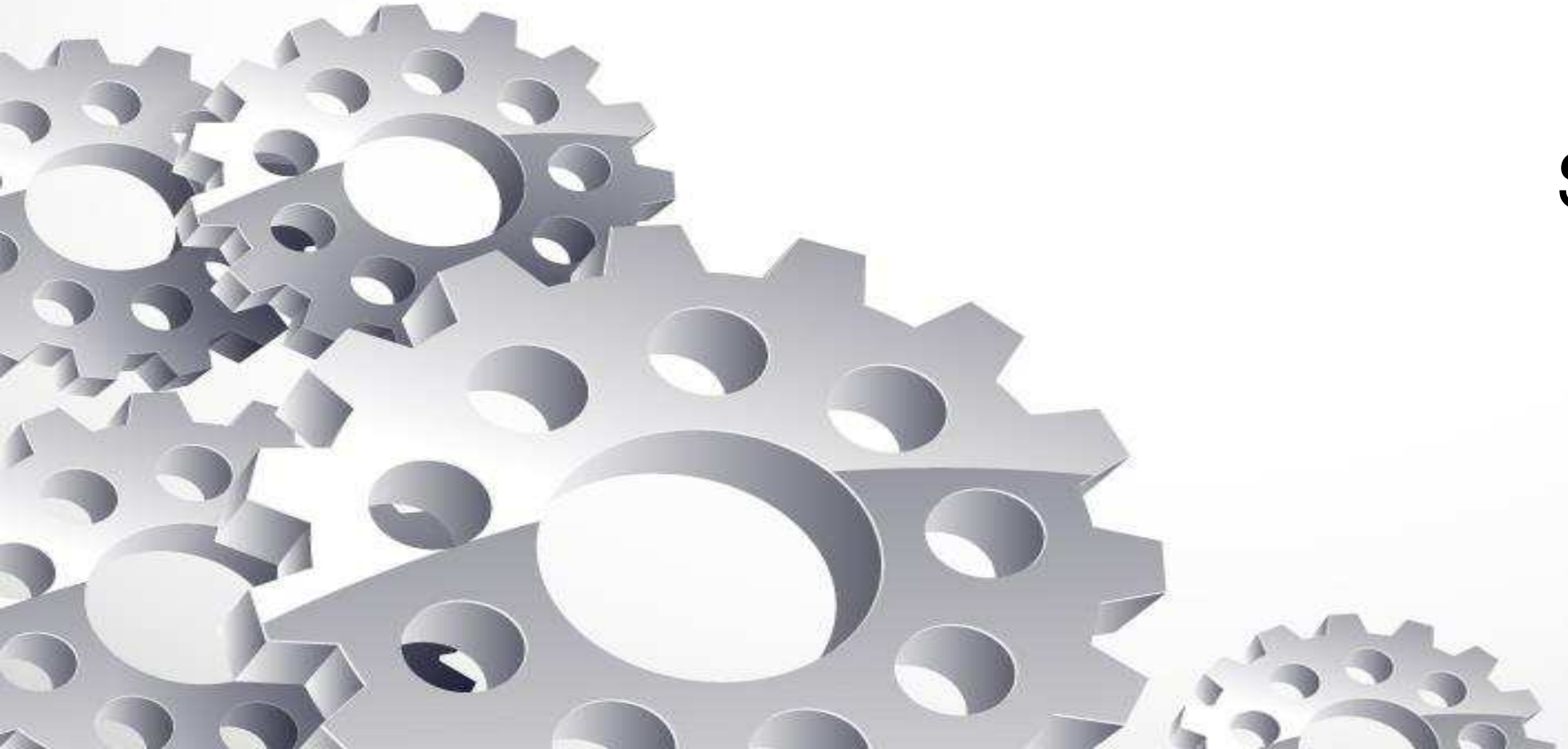


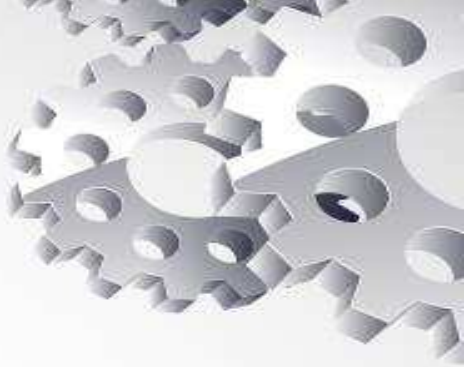
Thank You!

MANAGEMENT SCIENCE

MDM MINOR

SEMIII-SEMVIII





ENGINEERS AS PROBLEM SOLVERS

(and that is where the problem begins!)

Management Teaches Engineers to be More **Collaborative**

- Engineering Problems Are Multifaceted
- Tap into Diverse Perspectives and Skills
- Achieve Better Solutions Together
- Foster innovation and creativity

Subject Code	Sem	Subject	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
MGT1101	III	Organizational Behaviour	2	2	0		20	30	50	100
MGT1102	IV	Principles of management and Organization structures	2	2	0		20	30	50	100
MGT1103	V	Interpersonal processes and Human Resource Management	4	3	1		20	30	50	100
MGT1104	VI	Fundamentals of marketing management and Market research	2	2	0		20	15	25	100
MGT1105	VII	Professional ethics	2	2	0		10	15	25	100
MGT1106	VIII	Operations and Supply Chain management	2	2	0		10	15	25	100
		Total	14							

Management Teaches Engineers to **Speak Business**

Profits----Markets---Product---Engg

CASH----------KASH

Language ‘Architecture’ understood globally

(Fin mgmt/economics/production mgmt/ covered in major)

Subject Code	Sem	Subject	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
MGT1101	III	Organizational Behaviour	2	2	0		20	30	50	100
MGT1102	IV	Principles of management and Organization structures	2	2	0		20	30	50	100
MGT1103	V	Interpersonal processes and Human Resource Management	4	3	1		20	30	50	100
MGT1104	VI	Fundamentals of marketing management and Market research	2	2	0		20	30	50	100
MGT1105	VII	Professional ethics	2	2	0		20	30	50	100
MGT1106	VIII	Operations and Supply Chain management	2	2	0		20	30	50	100
		Total	14							

Management Teaches Engineers to Be **Ethical Business Leaders**

- Engineering-Organization role fit
- Understand hierarchy, managing engineers and non engineers
- Communicate effectively across the entire organization

Subject Code	Sem	Subject	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
MGT1101	III	Organizational Behaviour	2	2	0		20	30	50	100
MGT1102	IV	Principles of management and Organization structures	2	2	0		20	30	50	100
MGT1103	V	Interpersonal processes and Human Resource Management	4	3	1		20	30	50	100
MGT1104	VI	Fundamentals of marketing management and Market research	2	2	0		20	30	50	100
MGT1105	VII	Professional ethics	2	2	0		20	30	50	100
MGT1106	VIII	Operations and Supply Chain management	2	2	0		20	30	50	100
		Total	14							

Management Creates
New Career Opportunities

- Roles in project management, engineering sales and marketing, and senior management positions across many different types of organizations and industries

- Technical expertise+ People Understanding

Management Strengthens the Skills of **Entrepreneurial Engineers**

- Launch own enterprise
- Job takers Job creators ⟶

Subject Code	Sem	Subject	Credits	Hrs/Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
MGT1101	III	Organizational Behaviour	2	2	0		20	30	50	100
MGT1102	IV	Principles of management and Organization structures	2	2	0		20	30	50	100
MGT1103	V	Interpersonal processes and Human Resource Management	4	3	1		20	30	50	100
MGT1104	VI	Fundamentals of marketing management and Market research	2	2	0		20	30	50	100
MGT1105	VII	Professional ethics	2	2	0		20	30	50	100
MGT1106	VIII	Operations and Supply Chain management	2	2	0		20	30	50	100
		Total	14							

MULTIDISCIPLINARY MINOR DEGREE

IN

MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

Department of Mathematics

22nd February 2024

THE DEPARTMENT OF MATHEMATICS

- **Established in the year 1944.**
- **Vision**
  - The Department of Mathematics, Institute of Chemical Technology, Mumbai, aims to be an internationally leading mathematics department that will offer innovative educational and research programmes in mathematical sciences and their applications in science and technology
- **Mission**
  - Offer courses and programs that will ensure that the student get practical knowledge in mathematics which will be relevant to the society
  - Provide a modern educational environment for instruction and research
  - Create an environment for the learner to engage in solving real-world problems
  - Contribute to the understanding of complex mathematical structures and their applications.

FACULTY MEMBERS

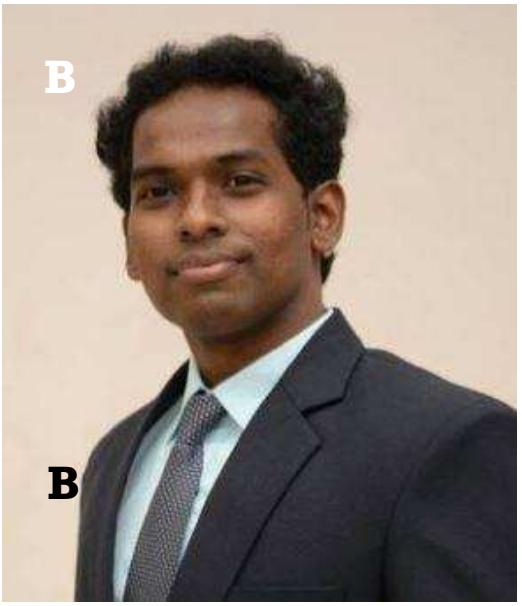
Head
Dr. Ajit Kumar
M.Sc. And Ph.D. Mumbai University
(Optimization, Machine Learning, Mathematical Pedagogy)

(A) Dr. Amiya Ranjan Bhowmick
   I. M.Sc. IIT Bombay, Ph.D. University of Calcutta
   II. Mathematical Modelling and Data Science

(B) Dr. Akshay S. Rane
   I. M.Sc. Mumbai University, Ph.D. IIT Bombay
   II. Functional Analysis

(C) Dr. Vikram Aithal
   I. M.Sc. Mumbai University, Ph.D. IIT Bombay
   II. Differential Geometry

(D) Dr. Gunvant A. Birajdar,
   I. M.Sc. And Ph.D. University of Aurangabad
   II. Fractional Differential Equations



PROGRAMMES OFFERED

- M.Sc. in Engg. Mathematics
  - UGC Innovative Scheme (2011)
- Ph.D. in Mathematics
  - Several students are pursuing their Ph.D. in Mathematics
  - CSIR – JRF, DST-Inspire
  - College Teachers
  - Collaboration with other institutes
- MDM in ML-AI

COMPUTATIONAL FACILITY

- Modern and high-level computational facilities
- 50 All-In-One Computers,
- Two Servers, one workstation,
- High-Performance Computing (HPC) cluster.
- All computers are installed with software such as MATLAB (Campus License) Mathematica, R, Python and Sagemath etc.

PSO1	**Foundation of Mathematics:** Strong foundation of Applied Mathematics which is directly connected to solving real life problems in different domains by means of mathematical modelling and analysis.
PSO2	**Foundation of Statistics and Data Science:** Strong foundation of Mathematics and Statistics of Data science and good hold on various statistical methodologies including probability theory, estimation, and testing of hypothesis etc.
PSO3	**Foundation of Computer Programming:** Understand and employ modern computational methods of Machine Learning, Deep Learning and Artificial Intelligence and use them effectively using free and proprietary advanced computational platforms for solving large scale problems arising from different research areas.
PSO4	**Conduct investigations of complex problems using AI:** Use research-based knowledge in machine learning and artificial intelligence and research methods including design of experiments, analysis, and interpretation of data to unfold complex problems from industry and academia and provide intelligent solutions.
PSO5	**Project based Teaching Learning:** Function effectively as an individual, and as a member in large scale data science projects in multidisciplinary settings involving both academic and industrial research.
PSO6	**Societal Applications of AI and ML:** Apply reasoning informed by the existing knowledge pool and address various societal issues using Machine Learning and AI tools.

SALIENT FEATURES OF THE PROGRAMME

- **Industry Relevance:** Students develop the skills and knowledge in Machine Learning and Artificial Intelligence which are relevant to the different industry verticals including Finance, Healthcare, Marketing, Chemical Industry, etc.
- **Enhancing Data-driven Problem-Solving abilities:** By integrating data-driven modeling in engineering curriculums, students will be able to overcome intricate engineering challenges more efficiently and effectively.
- **Innovation and Design:** The use of AI and ML enables engineering students to create innovative solutions and optimize designs in analysis of complex systems.
- **Fostering Interdisciplinary Collaboration:** AI and ML intersect with other disciplines, including mathematics, statistics, and computer science. Use of AI and ML in engineering education encourages interdisciplinary collaboration, fostering a comprehensive approach to problem-solving and opening doors to new possibilities.
- **Addressing Ethical and Societal Implications:** Students develop a comprehensive understanding of the ethical implications of AI and ML technologies and learn how to design and deploy them responsibly.

STRUCTURE OF THE MDM

Subject Code	Semester	Subject	Credits	Hours/ Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
MAT 1501	III	Statistical Computing	2	2	0	0	20	30	50	100
MAP 1601	IV	Data Analytics with R/Python	2	0	0	4	20	30	50	100
MAT 1502	V	Mathematical Methods in AI and ML	4	4	0	0	0	50	50	100
MAP 1602	VI	Machine Learning	2	0	0	4	20	30	50	100
MAP 1603	VII	Deep Learning	2	0	0	4	20	30	50	100
MAP 1604	VIII	AI Project	2	0	0	4	0	50	50	100
		Total	14							600

CA: Continuous Assessment; MS: MID Semester; ES: End Semester

A TRANSFORMATIVE JOURNEY

Prerequisites

- Applied Mathematics – I
- Good Mathematical Understanding will help

I, II

Statistical Computing

- Foundation of Probabilistic Computing
- Fundamental Statistical Compects
- Theory of Point Estimation
- Testing of Hypothesis

III

Data Analysis with R/Python

- Foundations of Computer Programming
- Data Wrangling and Data visualization
- Regression Modelling with Large data sets
- Project

IV

Mathematical Methods for AI and ML

- Foundation Course on Mathematics of AI and ML
- deeper understanding of different AI and ML methods by emphasizing their mathematical foundations.

V

Machine Learning

- Supervised Learning
- Unsupervised Learning
- Semi-supervised Learning
- Introduction to Generative AI
- Feature Engineering

VI

Deep Learning

- Artificial Neural Network (ANN) Arthitecture and related algorithms
- Convolution Neural Network (CNN)
- Recurrent Neural Netowork (RNN), LSTM
- Transformer, GAN and Large Language Models

VII

AI Project

- Ethical Considerations in AI
- Different Industry and Academia
- Supply Chain Management
- Computer vision, Finance etc

VIII

WHAT THE DEPARTMENT OF MATHEMATICS CAN OFFER!

Inter-institutional collaboration

- You can be a part of the existing collaborative research activities going on with several universities and industry
- National and International collaborations with other Institutions
- Industrial collaborations: Rises Analytics AI, Statinfer Solutions etc

Part of ongoing projects

- Application of Deep Learning Methods in Health Care Domain
- AI-ML in Water and AIR Quality Assessment
- Data Science and Machine Learning Applications in natural sciences

Computational Mathematics and Optimization

- Faculty members are involved in various domains related to Machine Learning and Optimization including Bayesian computation, Generative AI etc.
- Collaborative research work with Master's and Ph.D. students
- Collaborative research with other departments of ICT

OPPORTUNITIES

- MS and Ph.D. opportunities
- Data Scientist
- Business Analyst
- AI-ML Researcher in various industry verticals
- AI Engineer in chemical and allied industries
- Finance
- Market Research

MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

A UNIQUE MULTIDISCIPLINARY FRAMEWORK

Industry
Academia
Interdisciplinary

Real life problems (AI Project)

Giving Solutions using Mathematics

Climate Change, AI and Health Care, Environmental Data Science, Engineering, Sustainable development, Finance, Marketing, etc.

Calculus, Optimization

Linear algebra

Mathematical Methods

Probabilistic Computation and Simulation

Statistical Computing

Building Data Models under Uncertainty and Inference

Machine Learning

Knowledge of Modern AI tools and techniques

Deep Learning

Scientific Computation using R, Python, SageMath

Computational Tools

LIST OF OPEN ELECTIVES

Subject Code	Semester	Subject	Credit	Hours/ Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
MAT1302	III	Differential Equations and Numerical Methods	4	4	0	0	20	30	50	100
MAT2232	III	Optimization Techniques	4	4	0	0	20	30	50	100
MATXXXX	IV	Discrete Mathematics	2	2	0	0	20	30	50	100
MATXXXX	IV	Statistical Inference	2	2	0	0	20	30	50	100
MATXXXX	V	Machine Learning	2	2	0	0	20	30	50	100
MATXXXX	V	Mathematical Modelling	2	2	0	0	20	30	50	100

ELIGIBILITY CRITERIA: OPEN ELECTIVES

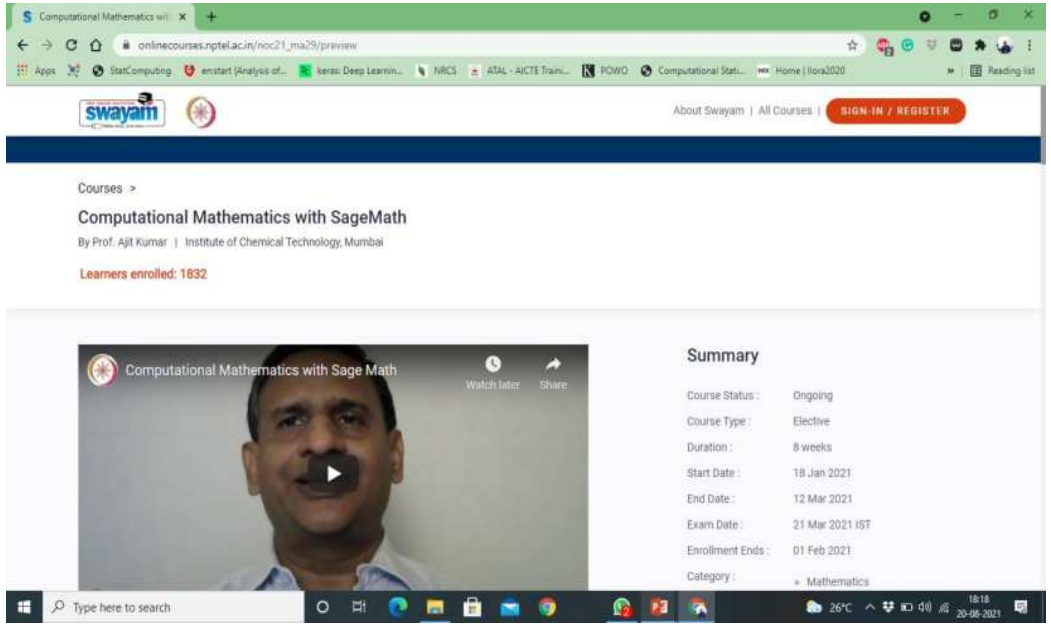
Subject Code	Semester	Subject	Open for	Comment
MAT1302	III	Differential Equations and Numerical Methods	Bachelor of Technology	
MAT2232	III	Optimization Techniques	Bachelor of Chemical Engineering	
MATXXXX	IV	Discrete Mathematics	Bachelor of Technology Bachelor of Chemical Engineering	
MATXXXX	IV	Statistical Inference	Bachelor of Technology Bachelor of Chemical Engineering	Not available for students enrolled in MDM in Machine Learning and Artificial Intelligence
MATXXXX	V	Machine Learning	Bachelor of Technology Bachelor of Chemical Engineering	Not available for students enrolled in MDM in Machine Learning and Artificial Intelligence
MATXXXX	V	Mathematical Modelling	Bachelor of Technology Bachelor of Chemical Engineering	

Multidisciplinary Educational Environment

- Applied Research with Strong foundation on Fundamentals of Mathematics, Statistics and Programming

ILORA) database has ecological, socio-economic, and geographic attributes for more than 1700 alien plant species ever reported from India.

- NPTEL lectures by Prof. Ajit Kumar on SageMath is training thousands of students, researchers and professionals across the globe.



14
14

THANK YOU

CONTACTS

- **Head of the Department**
  - Ajit Kumar, Ph.D.
  - Professor and Head
  - Email: a.kumar@ictmumbai.edu.in

- **Department MDM Coordinator**
  - Amiya Ranjan Bhowmick, Ph.D.
  - Assistant Professor
  - Email: ar.bhowmick@ictmumbai.edu.in

INSTITUTE OF CHEMICAL TECHNOLOGY, MUMBAI

(Deemed University under Section 3 of UGC Act 1956;
Elite Status and Centre of Excellence – Govt. of Maharashtra)

WELCOMES

INSTITUTE OF CHEMICAL TECHNOLOGY, MUMBAI

(Deemed University under Section 3 of UGC Act 1956;
Elite Status and Centre of Excellence – Govt. of Maharashtra)

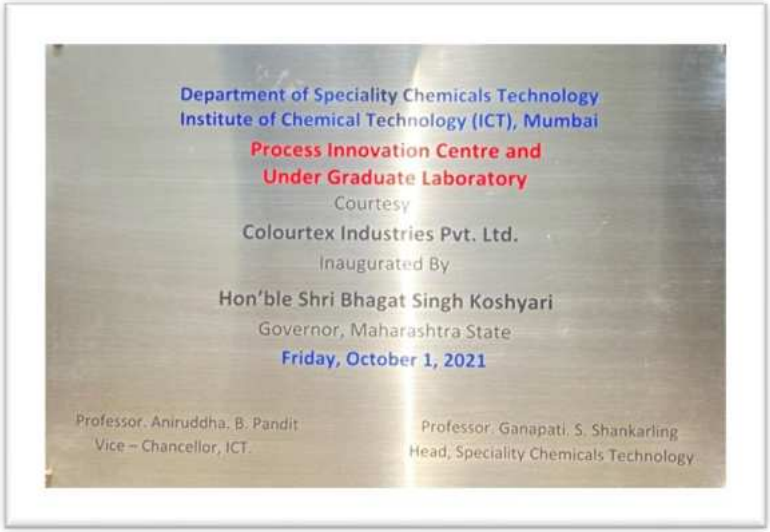
DEPARTMENT OF SPECIALITY CHEMICALS TECHNOLOGY (ESTABLISHED IN 1944)

By: Prof. N. Sekar
(Head of Department)

About the department ..

History

- Established - 1944 under the stewardship of Prof. K. Venkatraman
- Inaugurated and renamed - 1st October 2021, Department of Speciality Chemicals Technology

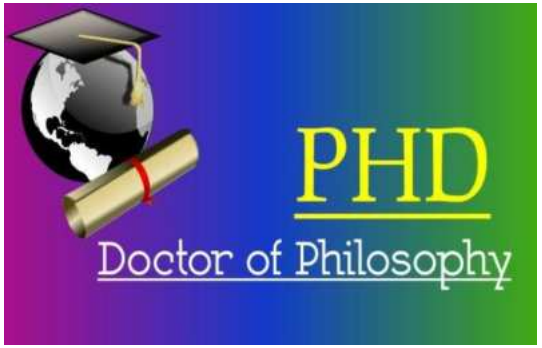


Courses Offered in the Department

Courses offered B. Tech. (Dyes)

M. Tech. (Dyes)

M. Tech. (Perfumery)



Ph. D. (Tech/Science)

Outputs

- Trained more than 1000 under graduate students
- Trained more than 500 PG/Ph. D. students

Late Prof. K. Venkataraman (Head 1943-1957)		**His books, "The Chemistry of Synthetic Dyes" in eight volumes are treated as Bible for dyestuff chemists and technologists**
Late Prof. B. D. Tilak (1957-1966)		**Extensive work in the field of vat dyes, anthraquinone, and naphthoquinone moieties and on azide chemistry**
Prof. S. V. Sunthankar (1966-1979)		**Synthesis of macro-cyclic compounds involving fragmentation of steroids**
Prof. S. Seshadri (1979-1996)		**His enormous contribution to Vilsmeier-Haack reaction and extensive work on coumarin synthesis**
Prof. D. W. Rangnekar (1996-2000)		**His work on Gewald reaction for disperse dyes is well appreciated**
Prof. V. R. Kanetkar (2000-2008)		**His enormous contribution to pigment and process development intermediates**
Prof. P. M. Bhate (2008-2013)		**His work on Carbohydrate chemistry and dyestuff chemicals**

Our Shinning Stars

Department has produced a more than 80 first generation entrepreneurs

First Time Entrepreneurship

Pidilite

SUDARSHAN

Techno Color Corporation

B. J. Corporation

Puraj Chemicals

SISCO RESEARCH LABORATORIES PVT. LTD.

gauri Gauri Fine Chemicals

Our Successful Entrepreneur

Sr. No.	Our Renowned Alumni	Company Name
1.	Dr. Murzban Karai	Jenrashid Consultants
2	Mr. Jayesh Shewale	Swadeshi Food And Beverages Pvt Ltd
3	Mr. Vimal Dosi	Vaibhav Agency
4	Mr. Shivanand Patil	Indu Dyes
5	Mr. Kisan Chavan	Deepak Colour Chem
6	Mr. Siddharth Sikchi	Clean Science and Technology Ltd
7	Shri. N. K. Parikh	**Pidilite Industries Ltd**
8	Dr. Jayesh Malankar	Six Sigma Projects
9	Mr. K. L. Rathi	**Sudarshan Chemical Industries Ltd**
10	Mr. Parag Zaveri	Yasho Industries Ltd
11	Mr. Dishit Zaveri	Yasho Industries Ltd
12	Mr. Aman Desai	Aether Industries Ltd
13	Dr. Rajagopal	Know Genix

Sr. No.	Our Renowned Alumni	Company Name
14	Mr. Savinder Sarna	Sarna Chemicals Pvt. Ltd
15	Ms. Gauri Bhave	**Gauri Fine Chemicals**
16	Dr. N. Chodankar	Asolutions Pharmaceuticals Pvt. Ltd.
17	Dr. Kishore M. Shah	Sauradip Chemical Industries Pvt. Ltd
18	Mr. R. T. Shah	**Techno Colour Corporation**
19	Mr. Sohan Taware	Sohan Industries Pvt
20	Mr. Swapneel Nerkar	Shubham Speciality Products Pvt. Ltd.
21	Mr. Vijay Bujle	GVC Ciba Tech Pvt Ltd
22	Mr. K. R. Datar	Puraj & Sitaram Chemicals
23	Mr. D. G. Udas	Ultraconserve Pvt. Ltd.
24	Mr. Chetan Patel	Casilla Foods
25	Dr. D. R. Tatke	Synthone Laboratories & Consultants Pvt. Ltd.
26	Mr. Mukund Turakia	Neelikon Food Dyes and Chemicals Ltd

Our alumni spread across different sectors of the industry

Achievements/ Recognitions

Departmental Achievements

- Placement of students in **renowned industries**
- Produced **26 class entrepreneurs**
- Received **DST-PURSE 2020-21** & **DST-FIST 2018-19**
- More than **200 international publications** in the past three years
- Received more than **5 crore** from various industries and **Colourtex Industries Pvt. Ltd.**
- Industry sponsored **felicitation** to **renowned persons**
- **Endowment lectures**

Faculty level Achievement

Prof. N. Sekar (Faculty ranked as top 2% Global scientists – Stanford University's Precious list)

Dr. S. Some (Research Assistant Professor for 2 years at Gwangju Institute of Science and Technology, South Korea)

frontiers in Catalysis

Dr. S. Saha (Associate Editor of Organocatalysis (Specialty section of Frontiers in Catalysis)

THE Welch FOUNDATION

Prof. G. S. Shankarling

- **Welch Award in Technology**
- **>30 consultancy projects in industry**
- **Filed 25 patents- 5 accepted**

Dr. Nabanita Sadhukhan (Convener for Webinar series on women in STEM)

Student Achievements

1. Graduate as well as post graduate students are severing in various **industrial sectors** such as **colorants, perfumery, pharmaceutical, agrochemical, specialty, chemicals, IPR,** etc.
2. For the year 2021, the **average graduate student package is 5.85 lac**, with the **highest package being 8.5 lac**.
3. **4th International Conference** on Desalination using Membrane Technology, **Perth, Australia**, Oceania, 2019 presented by Krusha Patel and Harsh Patel
4. Poster selected for presentation in **International Conference (SMST-2020)** by Praful Patil and Gauri Ingole
5. **Best Thesis** Award Ph.D. (Dr. Pravin Wadekar)

Content delivery and Teaching methodology

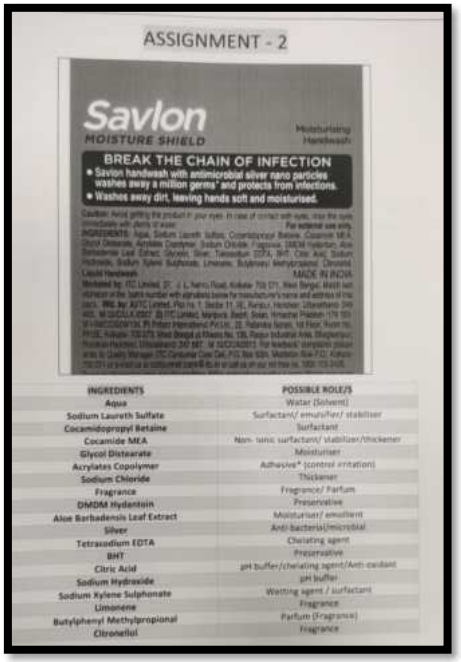
- Chalk-board
- Audio-visual from YouTube and JoVe Scientific Journal

- Practical experience from Practical subject
- Live demo of analytical instrument and Hand-on experience

- In-plant training
- Industry Visit

- Workshop on literature survey
- Training on manuscript and scientific report writing

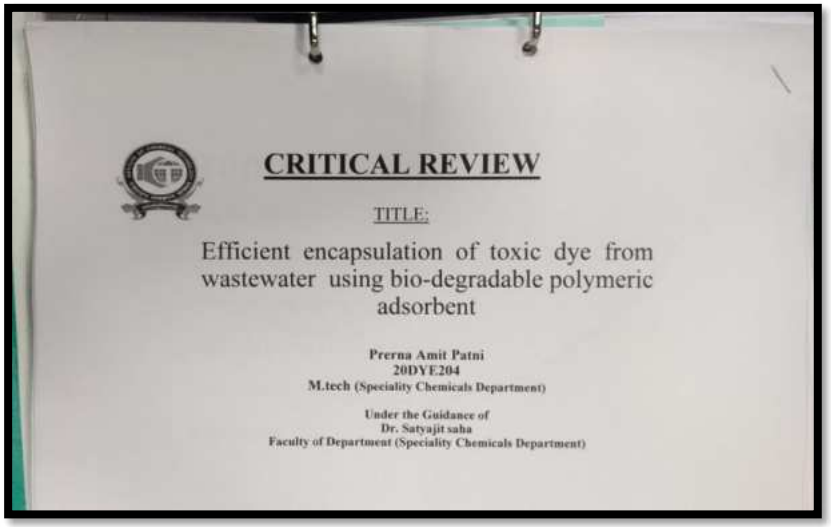
Continuous Evaluation Process


ASSIGNMENT - 2

Savlon
MOISTURE SHIELD
Moisturising Handwash

BREAK THE CHAIN OF INFECTION
- Savlon handwash with antimicrobial silver nano particles washes away a million germs* and protects from infections.
- Washes away dirt, leaving hands soft and moisturised.

INGREDIENTS	POSSIBLE ROLE/S
Aqua	Water (Solvent)
Sodium Laureth Sulfate	Surfactant/ emulsifier/ stabilizer
Cocamidopropyl Betaine	Surfactant
Cocamide MEA	Non- ionic surfactant/ viabilizer/thickener
Glycol Distearate	Moisturiser
Acrylates Copolymer	Adhesive* (control irritation)
Sodium Chloride	Thickener
Fragrance	Fragrance/ Parfum
DMDM Hydantoin	Preservative
Aloe Barbadensis Leaf Extract	Moisturiser/ emollient
Silver	Anti-bacterial/microbial
Tetrasodium EDTA	Chelating agent
BHT	Preservative
Citric Acid	pH buffer/chelating agent/Anti-oxidant
Sodium Hydroxide	pH buffer
Sodium Xylene Sulphonate	Wetting agent / surfactant
Limonene	Fragrance
Butylphenyl Methylpropional	Parfum (Fragrance)
Citronellol	Fragrance

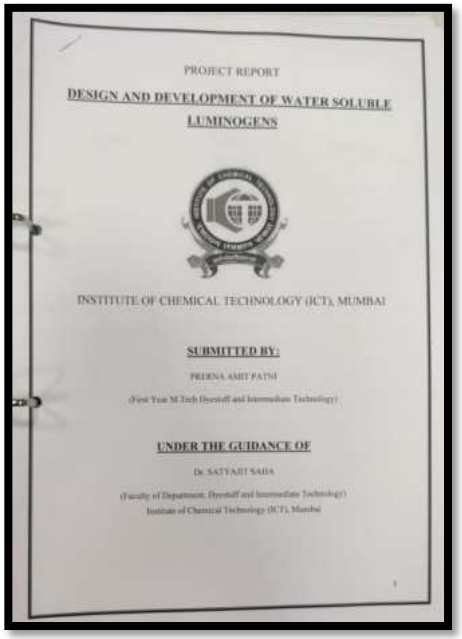

CRITICAL REVIEW

TITLE:

Efficient encapsulation of toxic dye from wastewater using bio-degradable polymeric adsorbent

Prerna Amit Patni
20DYE204
M.tech (Speciality Chemicals Department)

Under the Guidance of
Dr. Satyajit saha
Faculty of Department (Speciality Chemicals Department)


PROJECT REPORT

DESIGN AND DEVELOPMENT OF WATER SOLUBLE LUMINOGENS

INSTITUTE OF CHEMICAL TECHNOLOGY (ICT), MUMBAI

SUBMITTED BY:

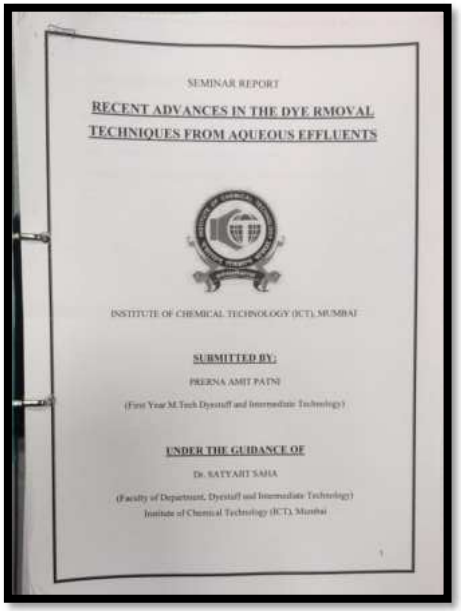
PRERNA AMIT PATNI

(First Year M.Tech Dyestuff and Intermediate Technology)

UNDER THE GUIDANCE OF

Dr. SATYAJIT SAHA

(Faculty of Department, Dyestuff and Intermediate Technology)
Institute of Chemical Technology (ICT), Mumbai


SEMINAR REPORT

RECENT ADVANCES IN THE DYE RMOVAL TECHNIQUES FROM AQUEOUS EFFLUENTS

INSTITUTE OF CHEMICAL TECHNOLOGY (ICT), MUMBAI

SUBMITTED BY:

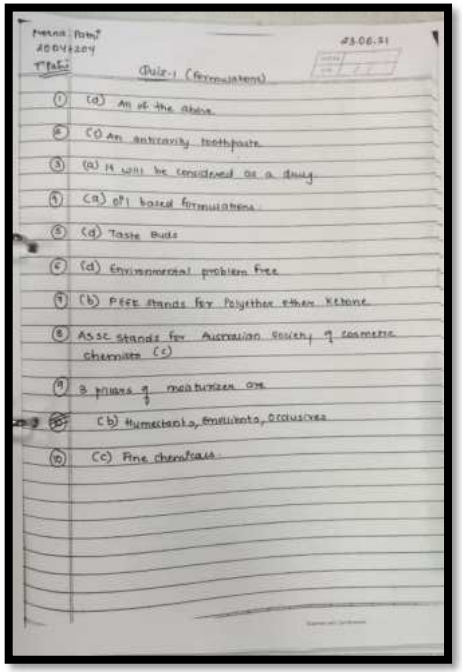
PRERNA AMIT PATNI

(First Year M.Tech Dyestuff and Intermediate Technology)

UNDER THE GUIDANCE OF

Dr. SATYAJIT SAHA

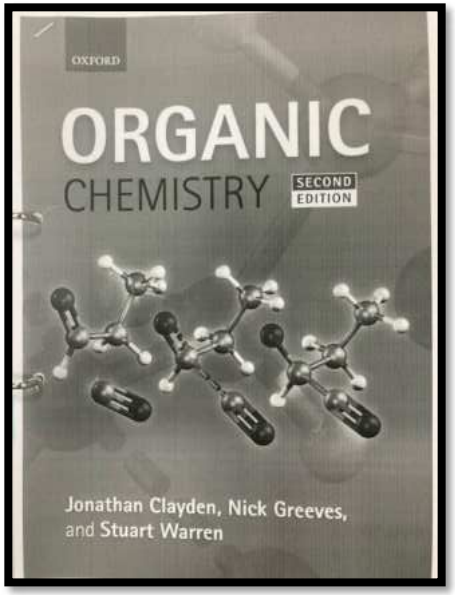
(Faculty of Department, Dyestuff and Intermediate Technology)
Institute of Chemical Technology (ICT), Mumbai

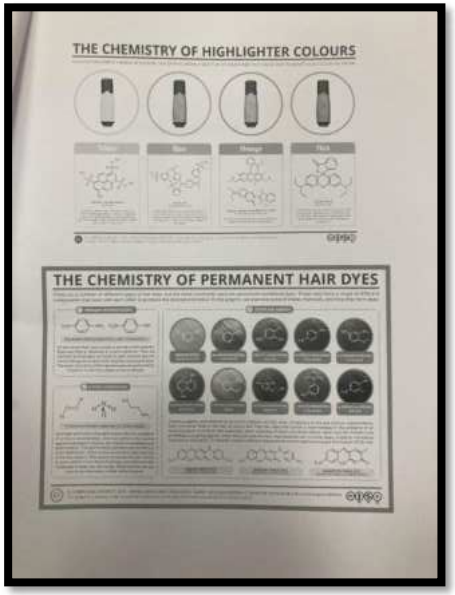

Quiz-1 (Formulations)

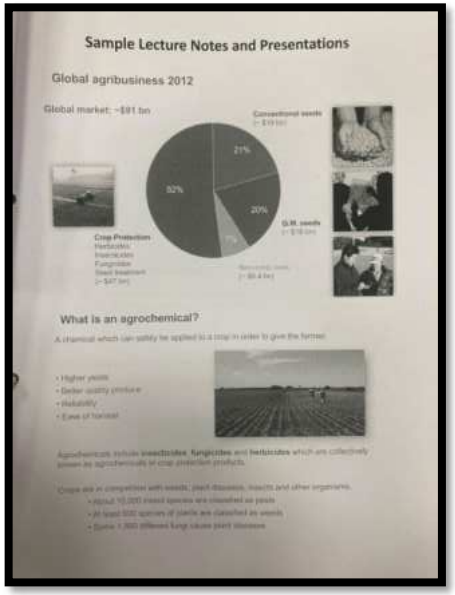
1. (a) All of the above
2. (c) An antiseptic toothpaste
3. (a) It will be considered as a drug
4. (a) oil based formulations
5. (d) Taste Buds
6. (d) Environmental problem free
7. (b) PEEK stands for Polyether ether Ketone
8. ASSC stands for Association Society of cosmetic chemists (c)
9. 3 pillars of moisturizer are
   (b) Humectants, emollients, occlusives
10. (c) Fine chemicals

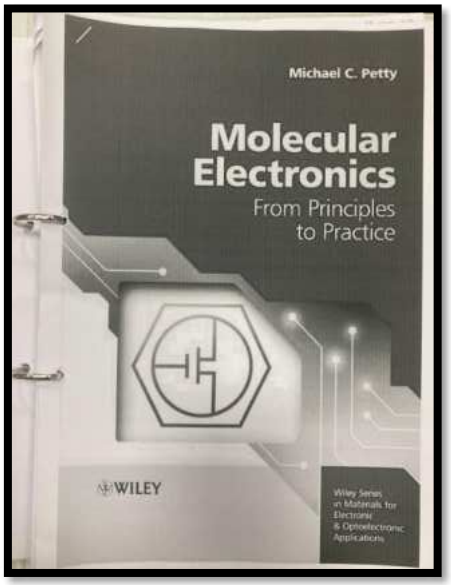
- Critical Review presentation
- Quiz competition
- Project Report
- Assignments
- Mid-semester, End-semester, Continuous assessment test
- Seminar

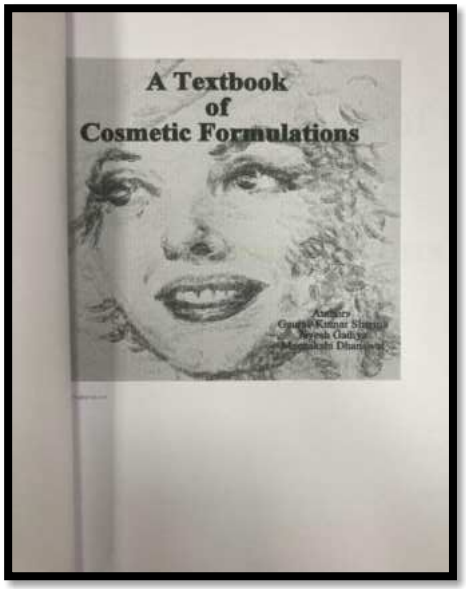
Contents Beyond Syllabus

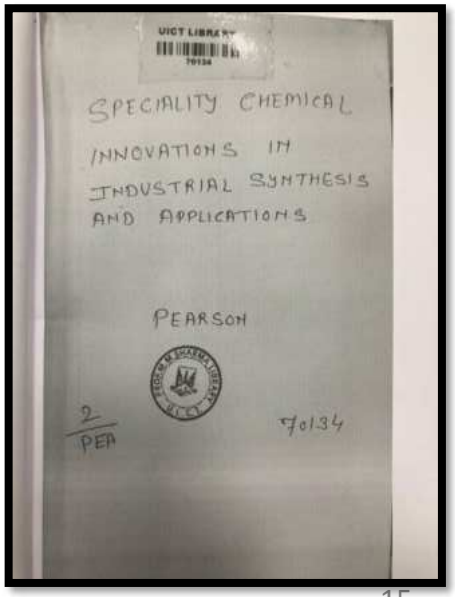












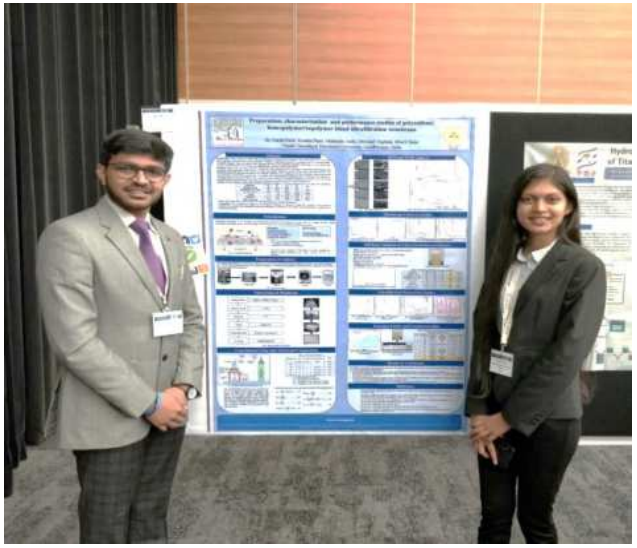
Companies	Logo	2019-21	2018-20
Jay chemicals		1	0
Deepak Nitrite		4	0
UPL		1	0
Marico		1	0
SRL		1	0

For Academics	Logo	2019-21	2018-20
Institute of Chemical Technology		0	1 (Ph. D.)

Student Co-Curricular Activities

International Conference (SMST-2020) attended by

1. **Praful Patil**
2. **Gauri Ingole**



4th International Conference on Desalination using Membrane Technology, Perth, Australia, Oceania, 2019

1. **Krusha Patel**
2. **Harsh Patel**

Industrial Training and Internship

Sr. No.	Student Name	Roll No.	**Organization**
1	Aadeshkumar L. Chordiya	18DYE201	**Tata chemicals limited innovation centre, Pune (2019)**
2	Praful Suresh Patil	18DYE203	**Gopinath Chem-Tech Ltd. Ahmedabad (2019)**
3	Aditi Vilas Mate	18DYE204	**Tata chemicals limited innovation centre, Pune (2019)**

TATA

11th December, 2019

INTERNSHIP CERTIFICATE

To Whomsoever It May Concern

1. Name of the Intern	:	Ms. Aditi Mate
2. Semester / Year	:	Final Year
3. Category	:	Project Intern
4. Sponsoring Inst. / College	:	ICT
5. Discipline	:	M. Tech in Dyestuff & Intermediate Technology
6. Period of Training	:	12th June 2019 to 11th December, 2019
7. Internship placement	:	Material Science & Technology
8. Project / Industrial Report	:	Materials for Fuel cell
9. Name of Project Guide	:	Dr. Nawal Mal
10. Designation of Project Guide	:	Sr. Scientist
11. Performance during training	:	Good
12. Conduct	:	Good

Aditi has successfully completed her internship with Tata Chemicals Innovation Centre. We wish her success in all her endeavors.

For TATA Chemicals Ltd.,

K R Venkatadri
Chief Innovation & Digital Officer

TATA CHEMICALS LIMITED

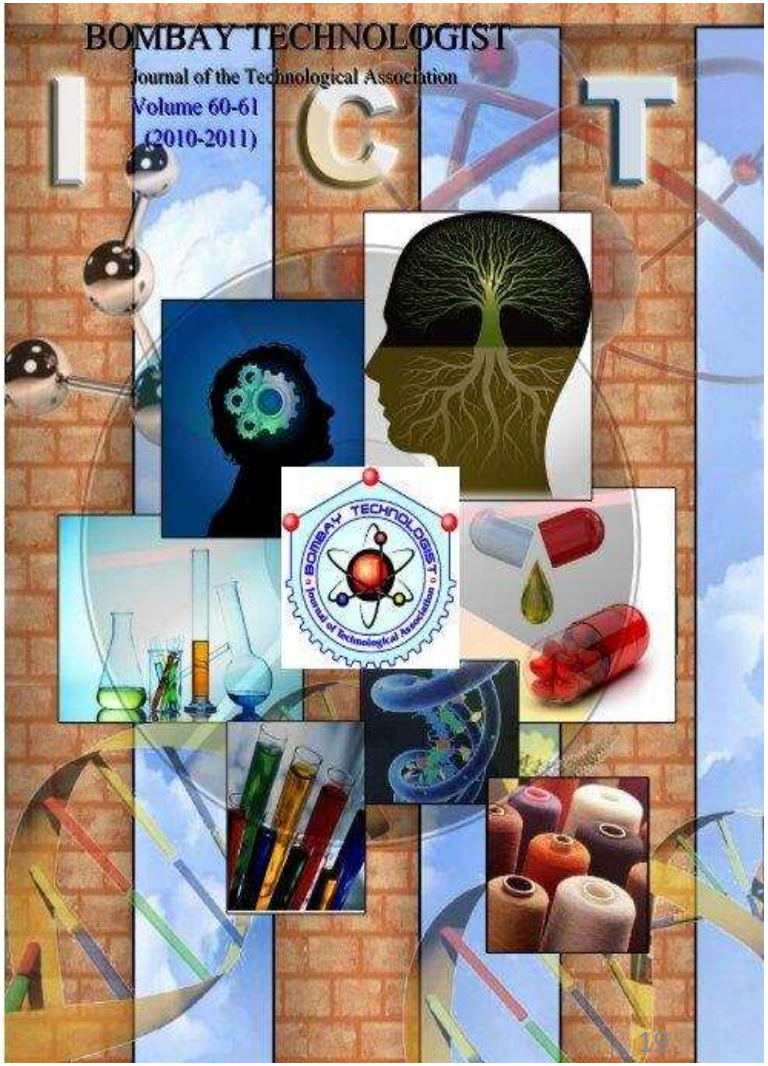
Student extracurricular activities

➢ Publication in Technical Magazine & Newsletter

The Bombay Technologist
Institute of Chemical Technology

Bombay Technologist Journal :

- ✓ It is the in-house peer reviewed research
- ✓ Journal of the Institute of Chemical Technology
- ✓ Published semi-annually.



Professional societies/chapters and organizing engineering events, Extracurricular Activities

Vortex :

- Industry Defined Problems
- Master Class- Lecture Series
- Papyrus : Oral Presentations
- Manifesto : Poster Presentations
- PharmWiz (Quiz Competition)
- Quantity Sufficient (QS)

❖ **Participation in Vortex by 2-4 students**

Student Extra- Curricular Activity

1. Art Club of ICT
2. Music Club of ICT
3. Literary Club of ICT
4. Manthan(Marathi Club)
5. Manzar(Cultural Festival)
6. SPORT-saga
7. Nature Trek
8. Hostel Day Celebration
9. All Religious Festivals
10. Clean Up Drive
11. TEDx ICT Mumbai ()
12. Jazbaa (Story tellor)
13. Cinergy (Cinamography)
14. Christmas photography challenge
15. In a nut shell (Short Film)
16. Fun Tech

❖ **Participation in YUVAM by 2-4 students**

Research Scholars participation in Workshops/conferences/seminars Funded by TEQIP-III

Sr. No.	Period of Activity	Activity	Name Of the Student	Location
1.	27th to 30th Dec. 2018	CHEMCON - 2018	Miss Khushbu Patel	Dr. B. R. Ambedkar National Institute of Technology, Jalandhar, Punjab, India.
2.	14th to 18th Jan 2019	Gaussian Workshop	Miss Vandana Kumari Shukla	Kolkata
3.			Mr. Suryapratap J. Sharma	
4.			Mr. Sumeet S. Sonvane	
5.			Miss. Zeba Khan	
6.	28th Feb and 1st March	COC-19	52 participants from the Dyes department (UG,PG, Research scholars)	Mumbai

Departmental Faculty

Prof. G. S. Shankarling
Professor

Expertise Looking for…

Dr. S. Some
Asst. Professor

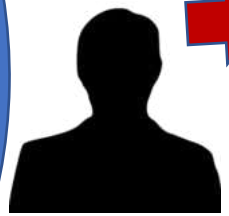
Prof. N. Sekar
Professor and
Head of the Dept.

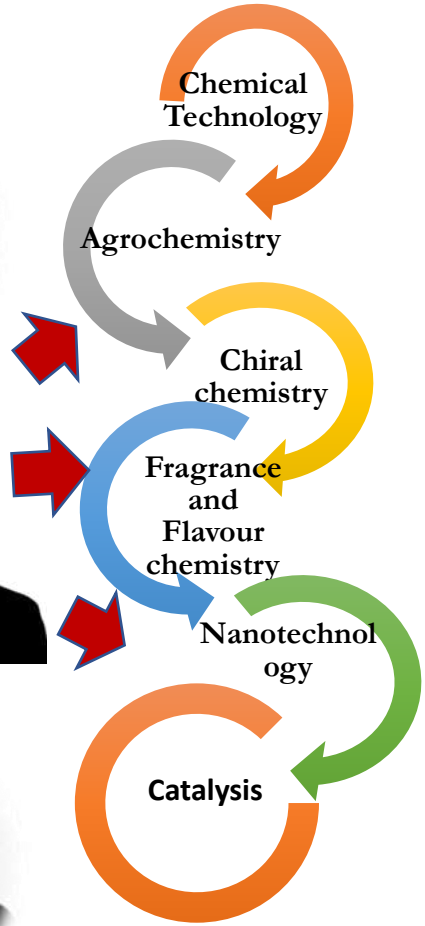
Dr. S. Saha
Asst. Professor

Current Faculty Strength

10 Sanctioned Faculty Positions

Prof. N. Sadhukhan
Asst. Professor





Professor	Assistant Professor
02	03

Departmental Seminars
Alumni Contribution

Topic: Job scenario of for dyes and allied industries in US
Speaker: **Dr. Ram Sabnis**
Date: 1st Jan 2019
Venue: Dyes department
Participants: Researchers, Students (UG/PG)

Department of Dyestuff Technology Lecture under "Sauradip Chemical Industries Pvt. Ltd. Visiting Fellow in the areas of Dyestuff Technology and Textiles Processing Technology"

Topic: Challenges of Dyestuff Industry
Speaker: **Dr. Nilesh Mistry**
Date: Monday, 15th April, 2019
Venue: K. V. Auditorium, ICT, Matunga.
Participants: Faculties, Researchers, Students (UG/PG)

Topic: Discussion on Management studies
Speaker: **Sohom D'souza**
Date: 22nd March 2019
Venue: Department of Dyestuff Technology, ICT Mumbai

Funding Agencies

Departmental Level

- DST- FIST
- DST-PURSE
- TEQIP

Faculty Level

- CSIR
- DST-SERB
- BRNS
- WOOL
- ONGC

TEQIP
Technical Education Quality Improvement

सत्यमेव जयते
Department of Sciences
& Technology
Government of India

वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
CSIR-INDIA

राष्ट्र की सेवा में परमाणु
BRNS
ATOMS IN THE SERVICE OF THE NATION

ओएनजीसी
ongc

Industry Supported Laboratories

Sr. No.	Industrial Support
1	Colourtex Industries Pvt. Ltd.
2	Astik Dyestuff Pvt. Ltd.
3	Lakhani Dyestuff Pvt. Ltd.
4	Bharat Organics
5	Gauri Fine Chemicals
6	Dhiren Chemical Industries
7	S.K Dyestuff & Organic Chemicals Pvt. Ltd.
8	Vasant Chemicals Pvt. Ltd.
9	Diamond Dyechem Ltd.
10	Neelikon Food, Dyes & Chemicals
11	Gopinath Chemtech
12	QV labs, Ankleshwar

NEELIKON
ColoursGlobal

Vasant Chemicals

Bharat Organics

colourtex®
The Dyestuff Company

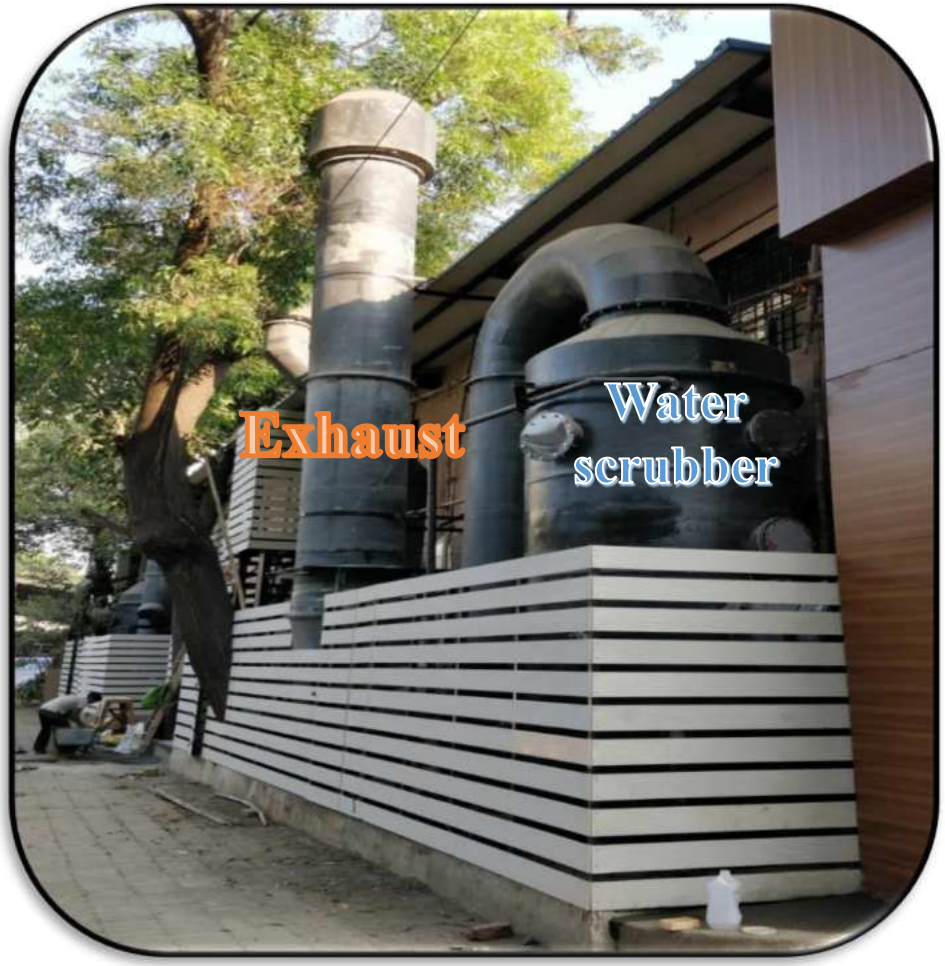
gauri
Gauri Fine Chemicals

Dhiren Chemical Industries

ASTIK DYESTUFF PVT. LTD.

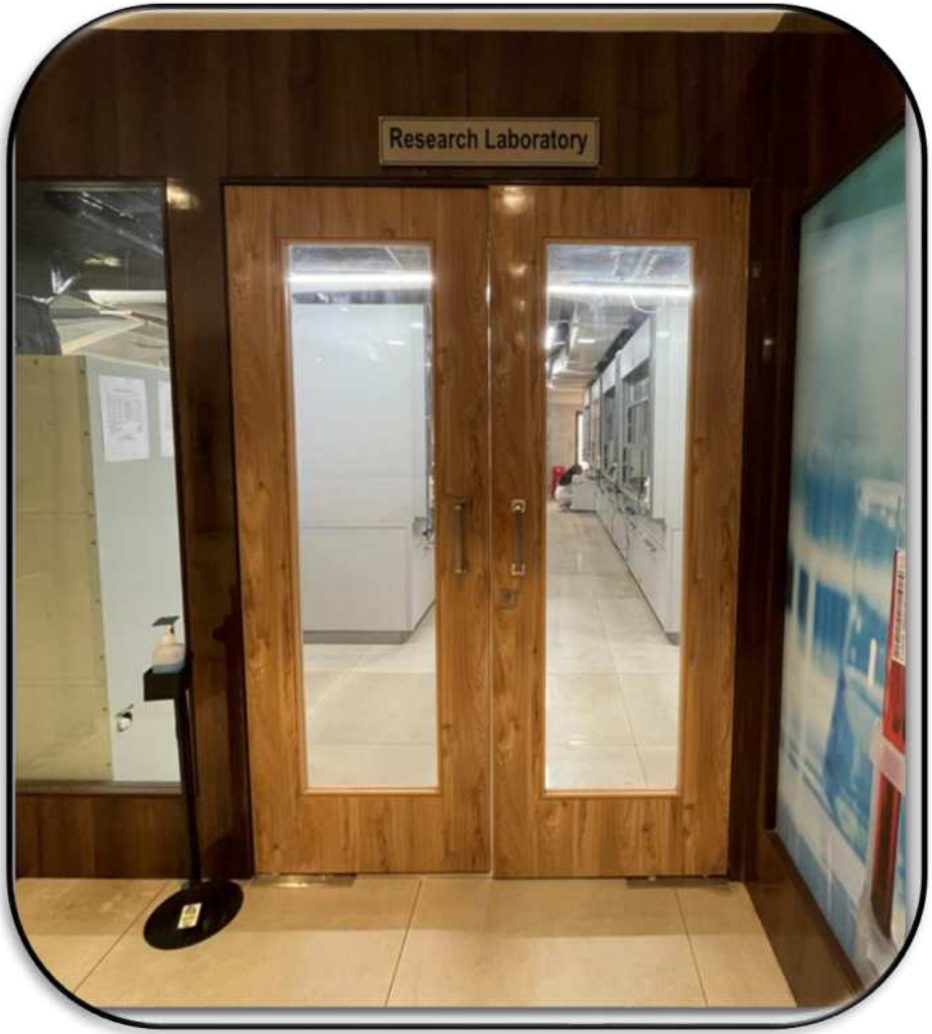
Departmental View

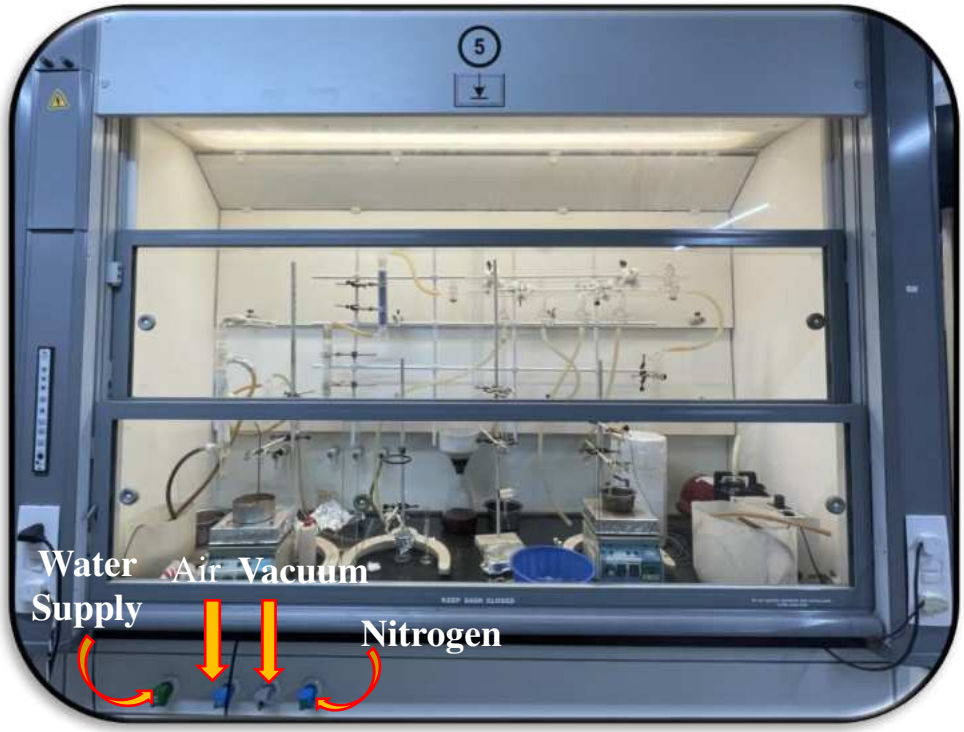
Department of Speciality Chemicals
Front View



Department of Speciality Chemicals
Back View

Lab Capacity : 48 students

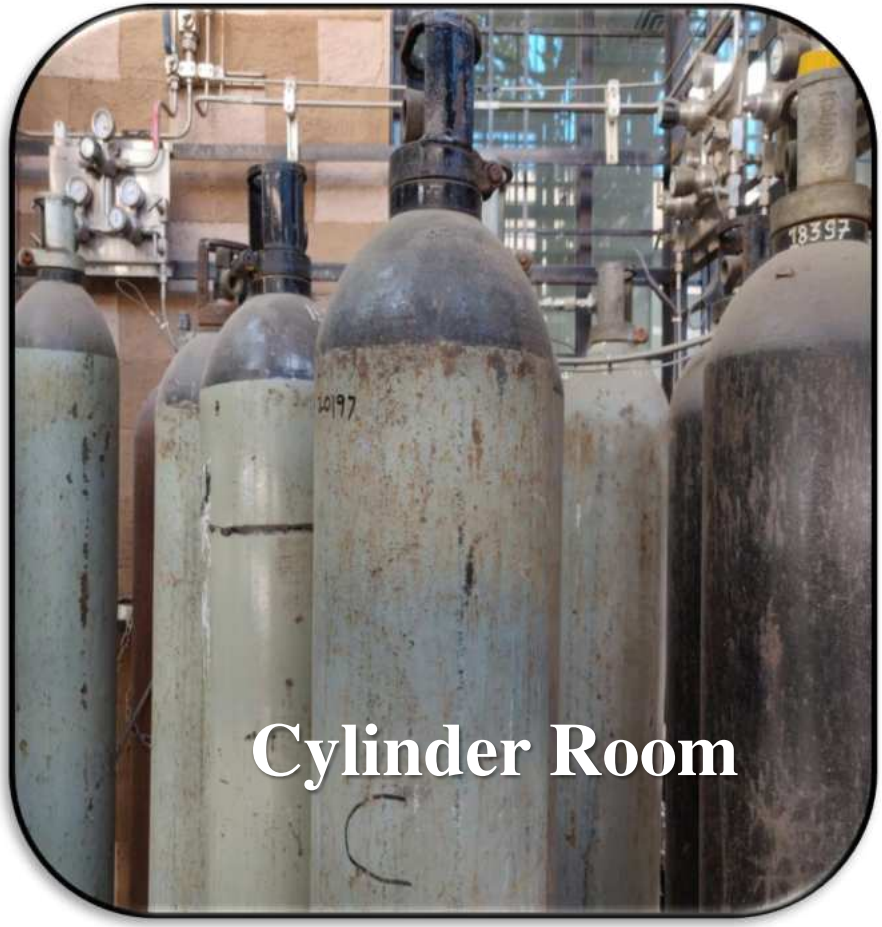




Lab Capacity : 16 Fume Hoods
3 Students per Fume Hood

Chemical Storage Room
With Fireproof Cabinet


Instrument Laboratory


Cylinder Room


Air Generator Machine
Ingersoll Rand.

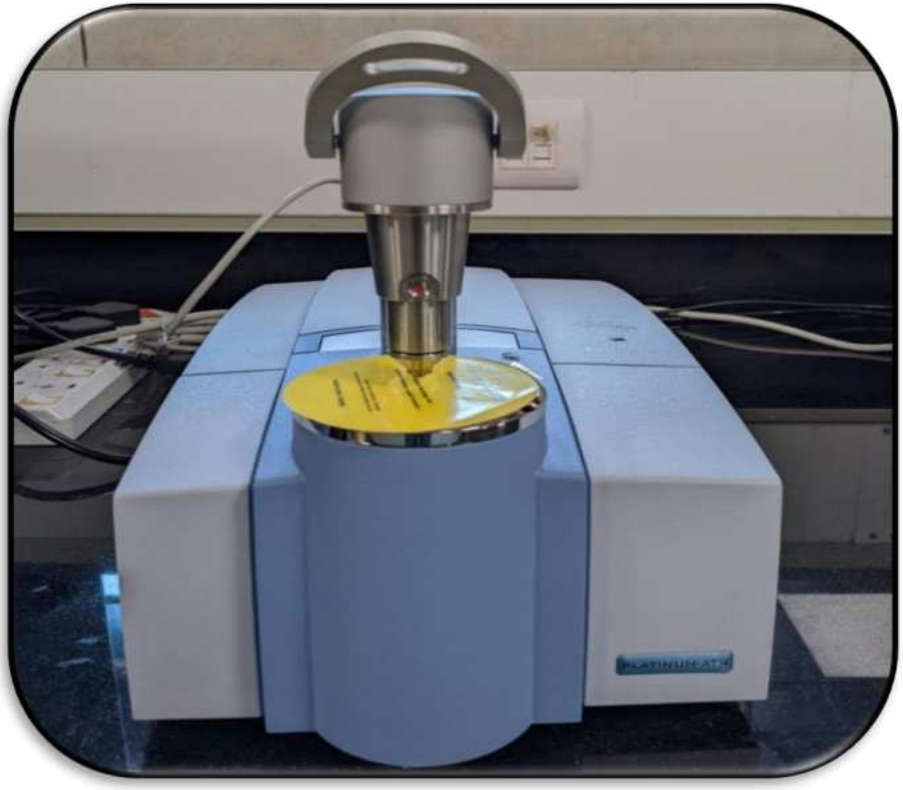
Major Instruments

500 MHz NMR with Autosampler Facility
Grant: 3047/CREATION OF CAPITAL ASSETS/PSA
Year: 2012
Make: Agilent Technologies

TLC-Mass Analyser

Grant/Purchase year: DST-FIST/2020
Instrument Make: Advion
Component:
Plate Extractor ; Sprayer with detector ; Vacuum pump ; Computer

FTIR-ATR



Grant/Purchase year: DST-FIST/2020
Instrument Make: Bruker
Component:
FTIR with Aattenuated Total Reflectance (ATR) ; Computer

Gas Chromatography (GC)

Grant/Purchase year: TEQIP-II/2013
Instrument Make: Thermo-Fischer
Component:
GC with Auto sampler ; Computer

HPLC

Grant/Purchase year: CSIR/2016
Instrument Make: Analytical Technologies
Component:
Column ; Detector ; Solvent System ; Computer ; Printer

Instruments for Photo-Physical Study

UV-Visible Spectrophotometer

Grant/Purchase year: TEQIP-II/2014
Instrument Make: Labindia

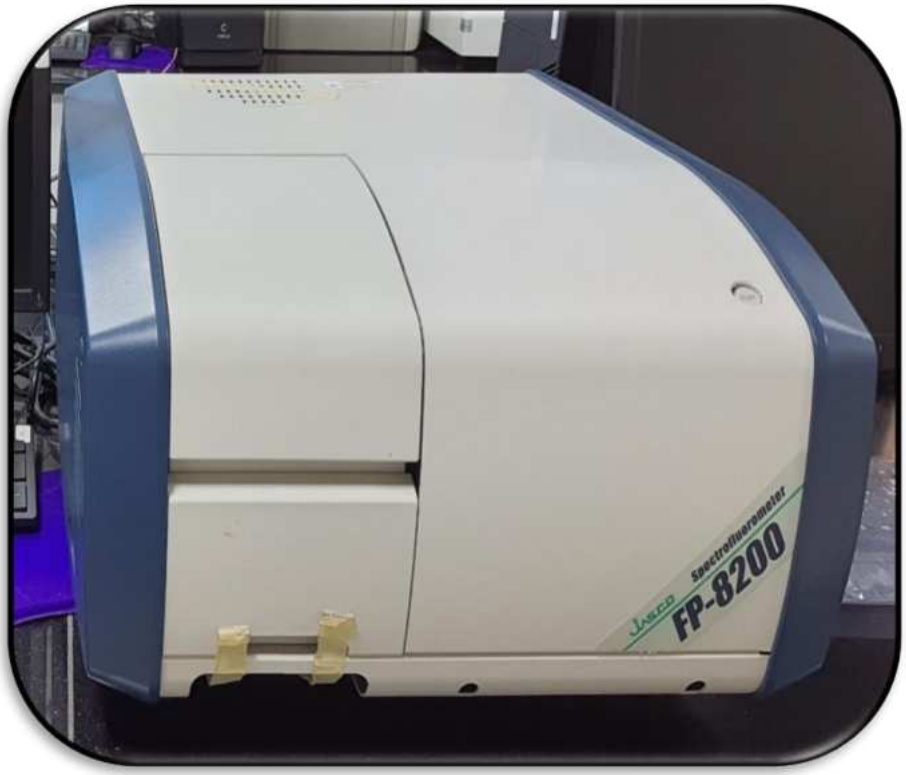
Grant/Purchase year: DST-SERB /2016
Instrument Make: Jasco

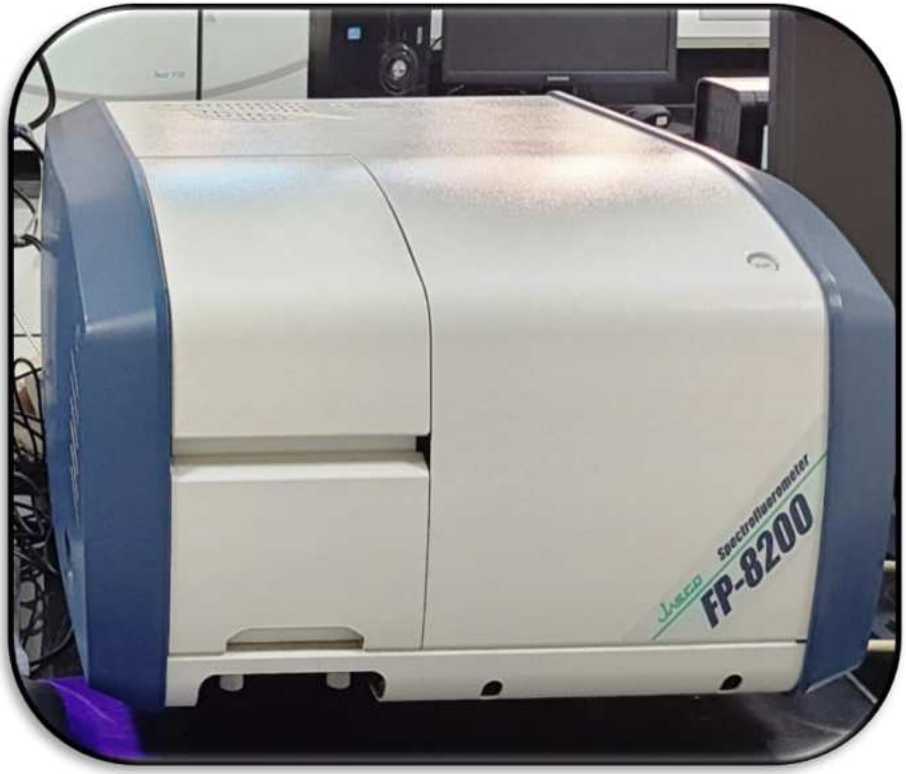
Grant/Purchase year: 3047/PSA-1 /2011
Instrument Make: Perkin-Elmer

Component:

Light source ; Monochromator ; Sample holder ; Detector ; Interpreter ; Computer

Spectrofluorometer (Solid state / Solution State)





Grant/Purchase year: CSIR /2019
Instrument Make: Jasco
Component:
Light source ; Sample holder ;
Detector ; Cuvettes ; Computer

Specification
High sensitivity S/N > 4,500 (RMS)
Dynamic range up to six digits
High speed scanning up to 20,000 nm/min
Wavelength range: 200 to 750 nm
Higher order diffraction band-pass filter

Lab Specific Instruments

Lab Weighing Balance

To weigh the chemicals accurately.
Grant/Purchase year: UGC start-up grant
Instrument Make: Winsar
Total No. of Weighing balance: 5
Weighing balance capacity: 220g
Least count: 0.1mg

ICE Machine

Generating Capacity: 100 Kg/ 24 Hrs.
Storing Capacity: 50 Kg
No. of ice machine: 2

Rotary Evaporator

Grant/Purchase year: DST-SERB/2016
Instrument Make: Heidolph / IKA
Total No. of Rotary Evaporator: 6
Component:
Water chiller ; Vacuum pump

Flash Chromatography

Grant/Purchase year: TEQIP / 2014
Instrument Make: Yamazen
Total No. of Flash Chromatogram: 2
Component:
Pump System ; Pump Control ; Glass columns ; Pre Columns ; Fraction Collector ; Detectors

Probe Sonicator

Grant/Purchase year: TEQIP/2016
Instrument Make: Electro Sonics Ind.
Component:
Generator ; Converter ; Horn ; Probe

Centrifuge Machine

Grant/Purchase year: UGC star- up grant/2015
Instrument Make: Remi
Component:
Lid ; Motor ; Rotor


Hank Machine


Water bath Machine

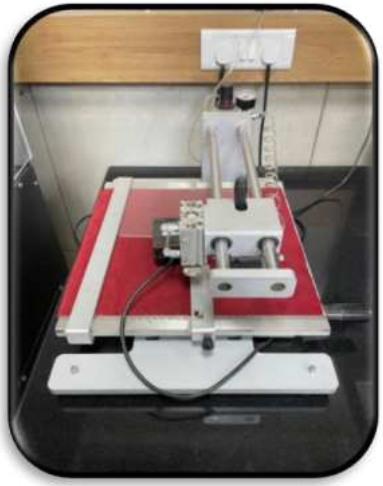

Shaker Bath

Program Specific Instruments

Dye Sensitized Solar Cell (DSSC) Fabrication System

Fabrication System

TiO_2 Coater



Glass Cutter

Annealer

Grant / Purchase Year: DST-FIST / 2020

Instrument Make: Elixir Technologies

Solar Simulator

DSC-TGA

Grant/Purchase year: TEQIP/2020
Instrument Make: Hitachi
Component:
Ultra-micro balance ; DSC heat flow measurement ; Computer

Micro-Reactor

Grant/Purchase year: DST-FIST/2020
Instrument Make: Vapourtec Ltd.
Component:
Monitor ; Reactor Column ; Vacuum pump

CVD

Grant/Purchase year: SERB & BRNS /2016

Instrument Make: VB ceramic solutions

Component:

Furnace ; Gas Controller; Quartz glass tube ; Vacuum Pump

Muffle Furnace

Grant/Purchase year: ICT/Alumni Association / 2019

Instrument Make: Labaiders

Component:

½ Quartz window ; PC communication port ; Temperature Controller ; Protection Latch

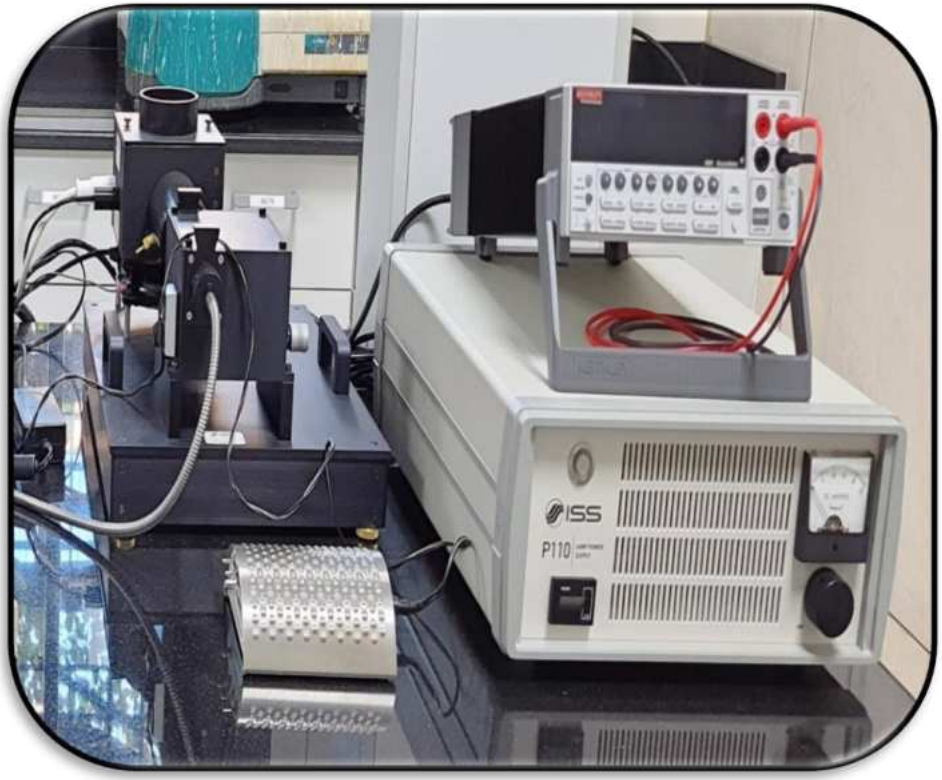
Vacuum Oven

Grant/Purchase year: DAE/BRNS /2015
Instrument Make: Labline
Component:
Vacuum Pump

Freeze Dryer

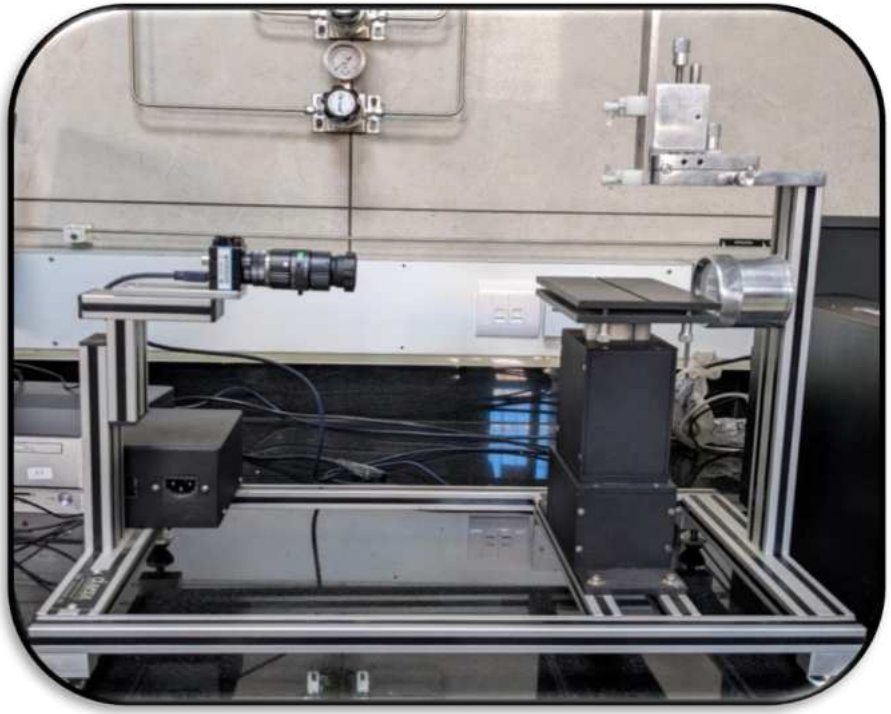
Grant/Purchase year: TEQIP-II /2016
Instrument Make: Sub-zero
Component:
Freeze Tubes ; Bent Tubes ; Rubbers

EL & PL



Grant/Purchase year: DST-FIST /2020
Instrument Make: Sinsil International
Component:
Light source ; Light-pass filter ; link cable ; Monochromator

Water Contact Angle



Grant/Purchase year: ONGC /2019
Instrument Make: Apex instrument Pvt. Ltd.
Component:
Camera ; Computer ; Water Contact Angle Assembly

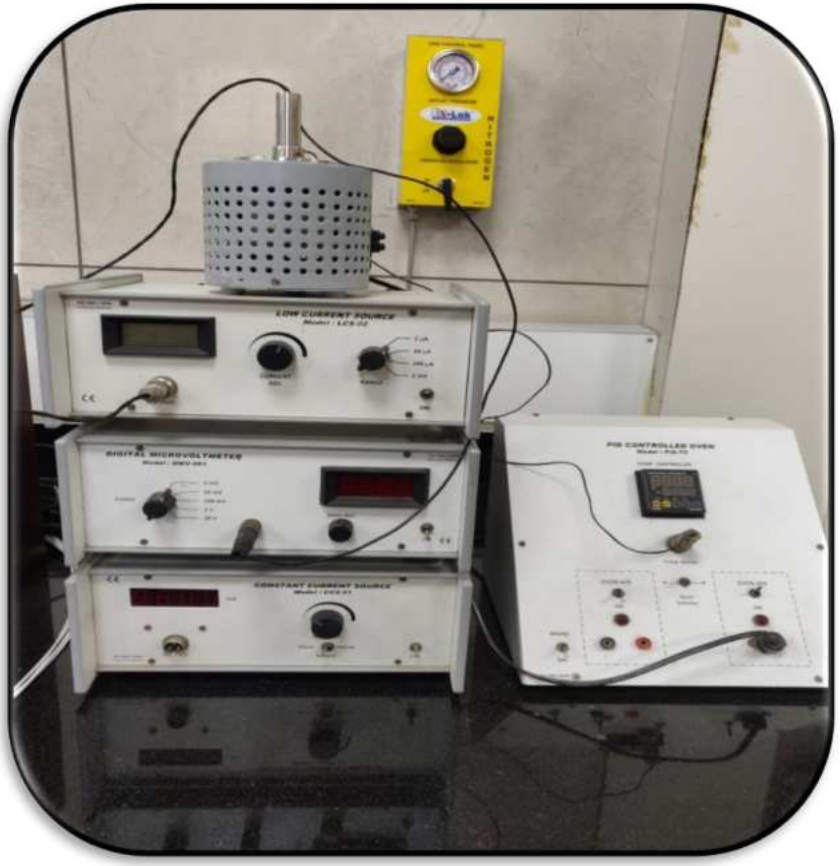
Cyclic Voltametry (CV aqueous)

Grant/Purchase year: UGC start-up /2015
Instrument Make: Sinsil International
Component:
CH-Instrument ; Electrode

Oxidation-reduction reaction

Grant/Purchase year: ONGC /2019
Instrument Make: Sinsil international
Component:
ORR Assembly ; Computer ; Printer

Four Point Probe Resistivity Measurement



Grant/Purchase year: TEQIP-III/2018
Instrument Make: ISO9001:2008
Component:
Four Probe ; Oven ; Resistivity meter

De-ionised Water Unit

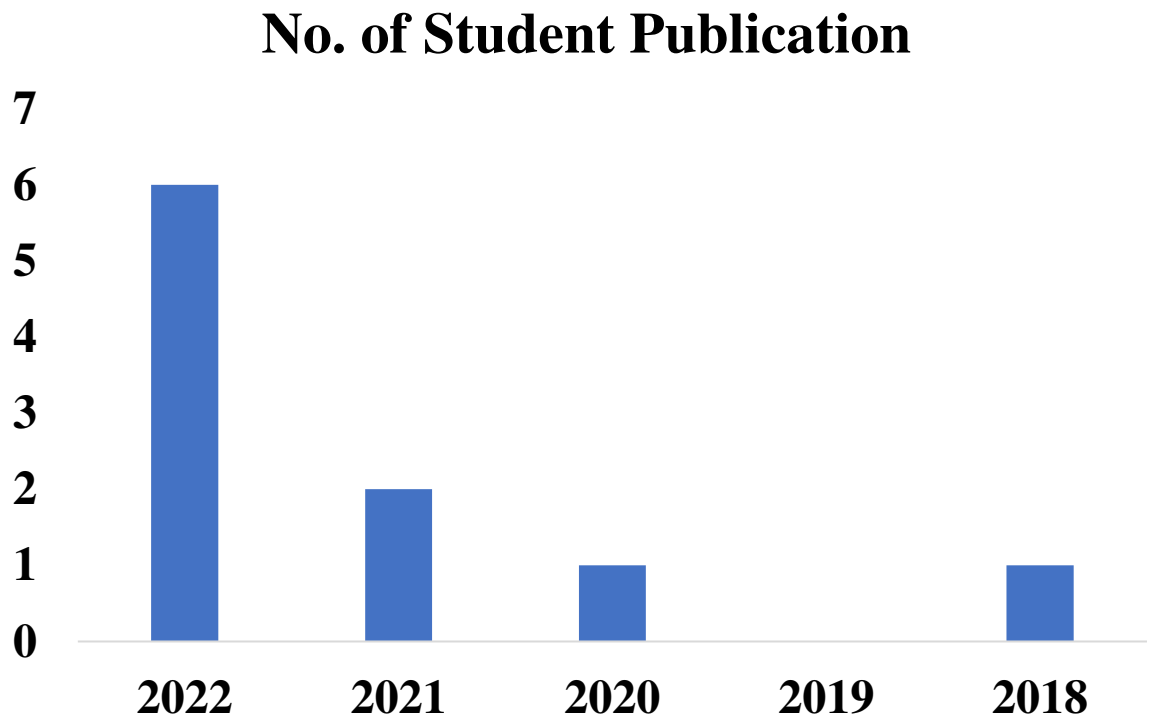
Grant/Purchase year: UGC start-up / 2015
Instrument Make: Komal Enterprises
Component:
Ion Exchange Resin ; Conductivity meter

Improvement in Laboratories

1. A **new laboratory** building constructed
2. Built up a **state-of the art facility** for research laboratory
3. Laboratory equipped with **16 fume hoods**, all connected with centralised **high vacuum pump, water supply** and **inert gas line(N_2)**.
4. Designed with international safety standards
5. Maintain **pollution and environmental regulations** with **powerful exhaust**.
6. Laboratory has been equipped with various major and minor instruments required for the research and learning the subject.
7. **11 new major** equipment has been procured / sectioned **by DST-FIST**

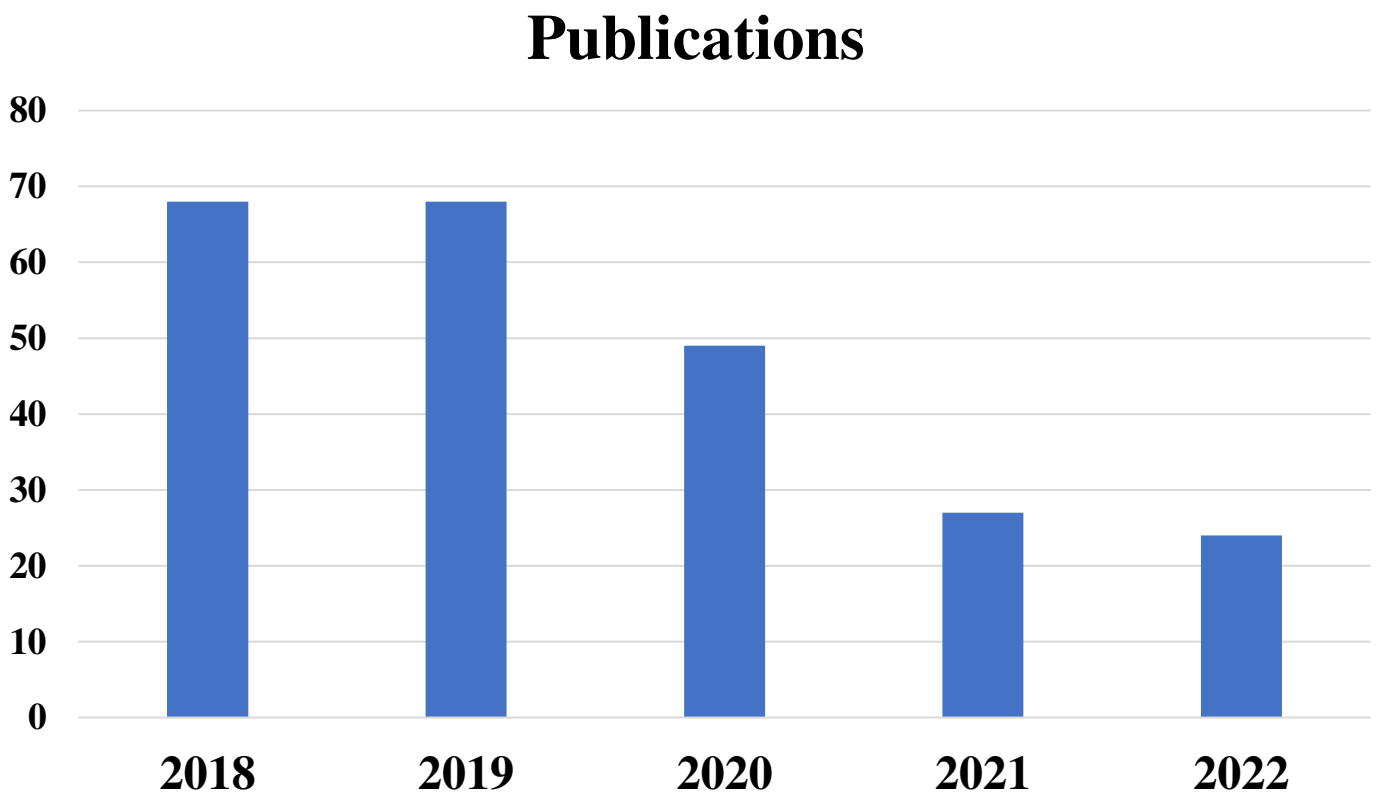
Student Publication

Year	No. of Publications	Communicated	Total No. of Publication
2022	2	4	**6**
2021	2	0	**2**
2020	1	0	**1**
2019	0	0	**0**
2018	1	0	**1**



Faculty Publication

Year	2018	2019	2020	2021	2022
Publications	68	68	49	27	24

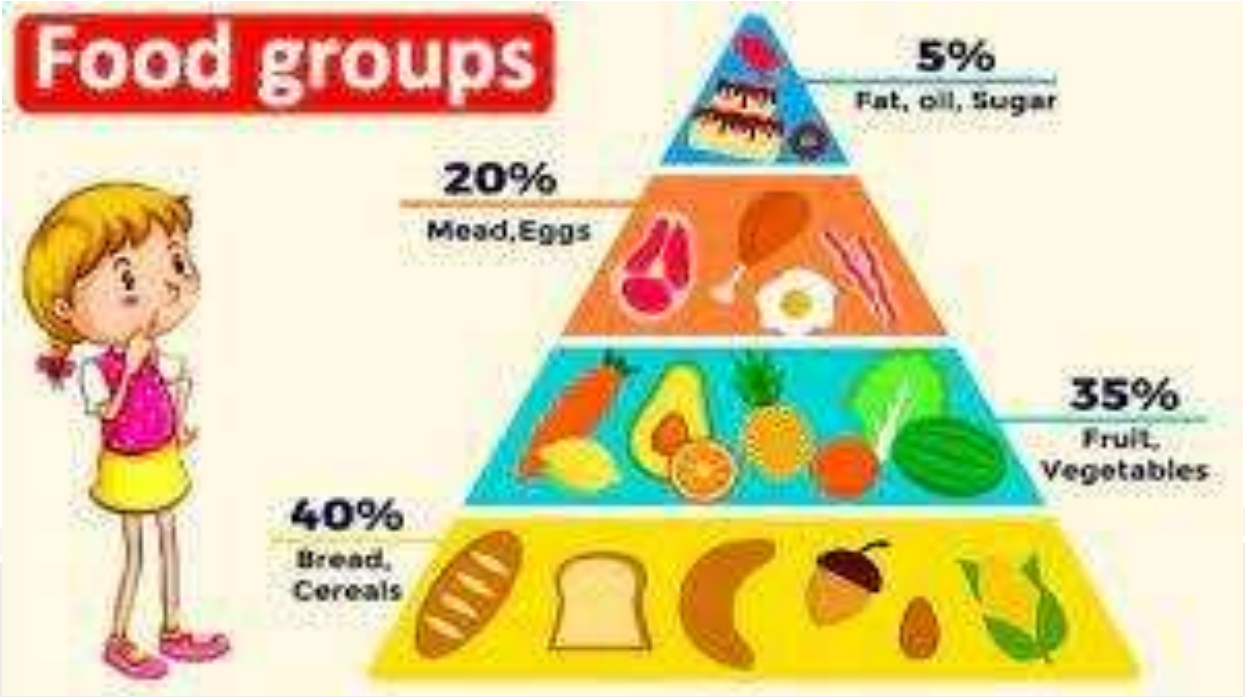



Thank
you

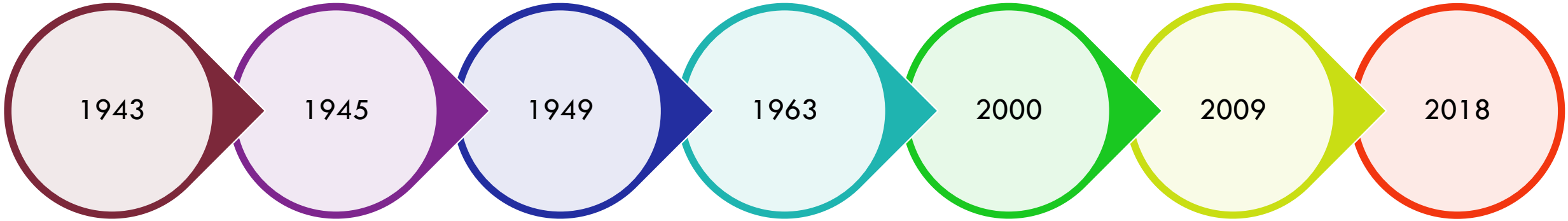
Multidisciplinary Minor Degree in Food Science and Technology

Professor Rekha S. Singhal

Head, Department of Food Engineering and Technology



Genesis of the department



- 1943
  - B. Sc. (Tech) in Chemistry of Foods and Drugs
- 1945
  - Masters and Ph.D. (Tech.) programs
- 1949
  - Full fledged B.Sc (Tech) degree course in Food Technology; Masters and Ph. D. (Tech.) programs
- 1963
  - Master's program in Fermentation Technology was initiated
  - Renamed as 'Food & Fermentation Technology Department'
- 2000
  - All graduate program aligned as 12+4 pattern
  - Name changed to 'Food Engg & Tech Department'
- 2009
  - M.Tech. (Food Biotech) program
- 2018
  - Platinum Jubilee of the department

Department of Food Engineering & Technology (FETD)

Establishing a center of excellence to provide demand driven, value-based and quality technical education to make India a developed country through socio-economic transformation

To improve food especially Indian traditional food in terms of nutrition, safety and functionality employing fundamental and applied sciences.

To produce trained personnel of highest standards for the benefit of the industry & society in the field of Food Engineering & Technology & Food Biotechnology.

To provide leadership qualities in areas of education, research, innovations & solutions in food & biotech sciences, technology & engineering in order to direct overall activity towards economic growth of India.

Courses offered by the department

Sr. No.	Degree	Comments	Intake
1	B.Tech. (Food Engineering & Technology)	• AICTE Approval in 1993 • AICTE approval for (12 + 4) Pattern in 2008 • NBA accredited for 6 years till 2028	16
2	M. Tech. (Food Engineering & Technology)	• AICTE Approval in 2008 • NBA accredited for 6 years till June 2026	18
3	M. Tech. (Food Biotechnology)	• AICTE Approval in 2008 • NBA accredited in 2021 till 2027	10
4	Ph. D. (Tech.) (Food Engg. & Tech) Ph. D (Tech) (Food Biotechnology) Ph. D (Tech) (Bioprocess Technology) Ph. D (Biotechnology) Ph. D (Biochemistry) Ph. D (Food Science) Ph. D (Microbiology)	• 10 UGC-SAP fellowships from 2007 to 2014. • 15 UGC-SAP fellowships (Food 10 + 5 BPT) from 2009 to 2014. • AICTE NDF	15

FETD faculties

Prof. R. S. Singhal
Professor of Food Technology & Head, FETD

Prof. U. S. Annapure Director, ICT Marathwada Campus, Jalna & Professor in Food Chemistry

Dr. S. S. Arya Professor in Food Technology

Dr. Jyoti Gokhale
UGC Assistant Professor
Coordinator Mtech FBT

Dr. Snehasis Chakraborty Assistant Professor

Dr. Yogesh Gat Assistant Professor

Dr. Roji Waghmare Assistant Professor

Dr. Nirali Dedhia Assistant Professor

Eminent adjunct faculty of the department

Prof. Mukund Karwe

Dean of International Programs,

Dept of Food Science, Rutgers University, USA
Editor, Journal of Food Engineering

Prof. R.C. Anantheswaran

Professor of Food Engineering & Director for Education by Non-Traditional Delivery

Penn State University, USA

Editor, International Food Research Journal

Prof. K. Niranjan

Professor of Food Bioprocessing

University of Reading, UK

Editor, Journal of Food Engineering

Prof. Shyam S. Sablani

Associate Department Chair

Biological Systems Engineering,

Washington State University, USA

Editor, Journal of Food Science

Prof. Kalidas Shetty

Associate Vice President for International Partnerships
Plant Metabolism & Food Security

North Dakota State University, USA

Editor Journal Food Science and Technology

Department facilities

DVR-CAFT Lab

Food Processing Lab

Continuous Microwave Pasteurizer

Twin Screw Extruder

Atmospheric Plasma

Pulsed Light Treatment

Rheometer

Texture analyzer

GCMS

HPLC

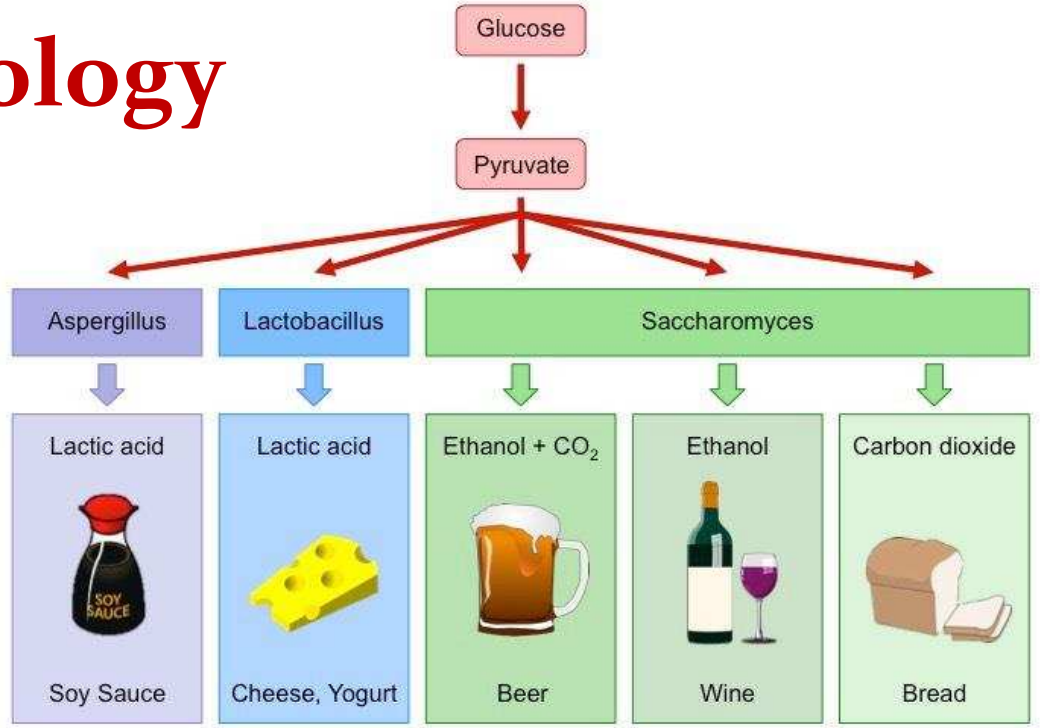
MDM in FST: Programme Specific Outcomes

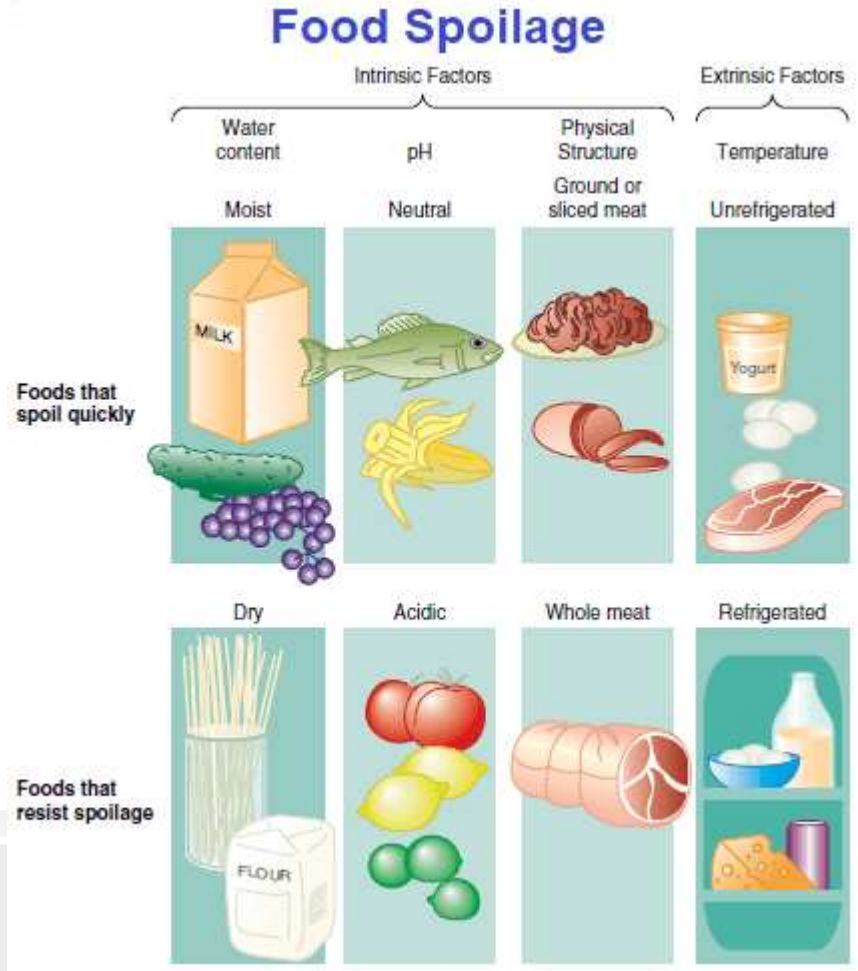
Food Analysis	• Able to apply analytical techniques for food safety, quality assurance
Innovations in Food Products Development	• Able to translate emerging science in developing innovative food products.
Food Preservation	• Able to apply principles of food preservation techniques in processed foods
Food Biotechnology	• Able to apply biological sciences in food processing and preservation
Fostering collaboration	• Facilitating understanding and working in interdisciplinary areas
Food sustainability	• Ability to work for food and nutritional security

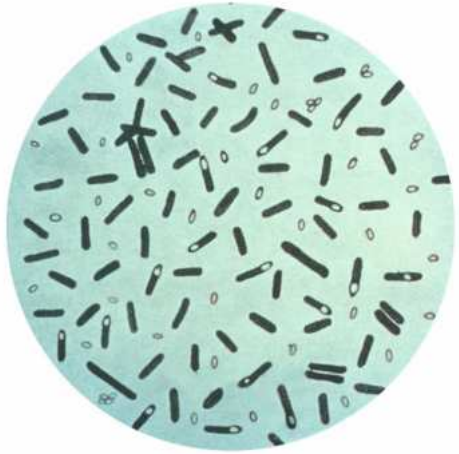
MDM structure

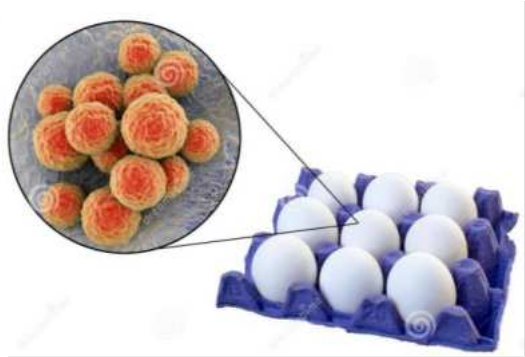
Semester	Course Code	Subjects	Faculty
III	FDT1071	Principles of Food Microbiology	VF
IV	FDP1013	Food Microbiology Lab	BSBT Faculty
V	FDT1072	Fundamentals of Food Science and Technology	SSA/ YSG
VI	FDT1073	Food Preservation Technology	USA/ SC
VII	FDP1018	Food Analysis Lab	JSG/ NJD
VIII	FDT1074	Food Quality and Regulations	RBW

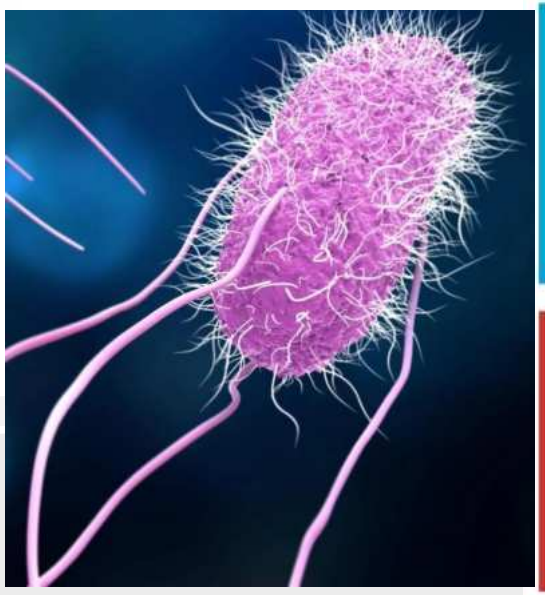
Food Microbiology



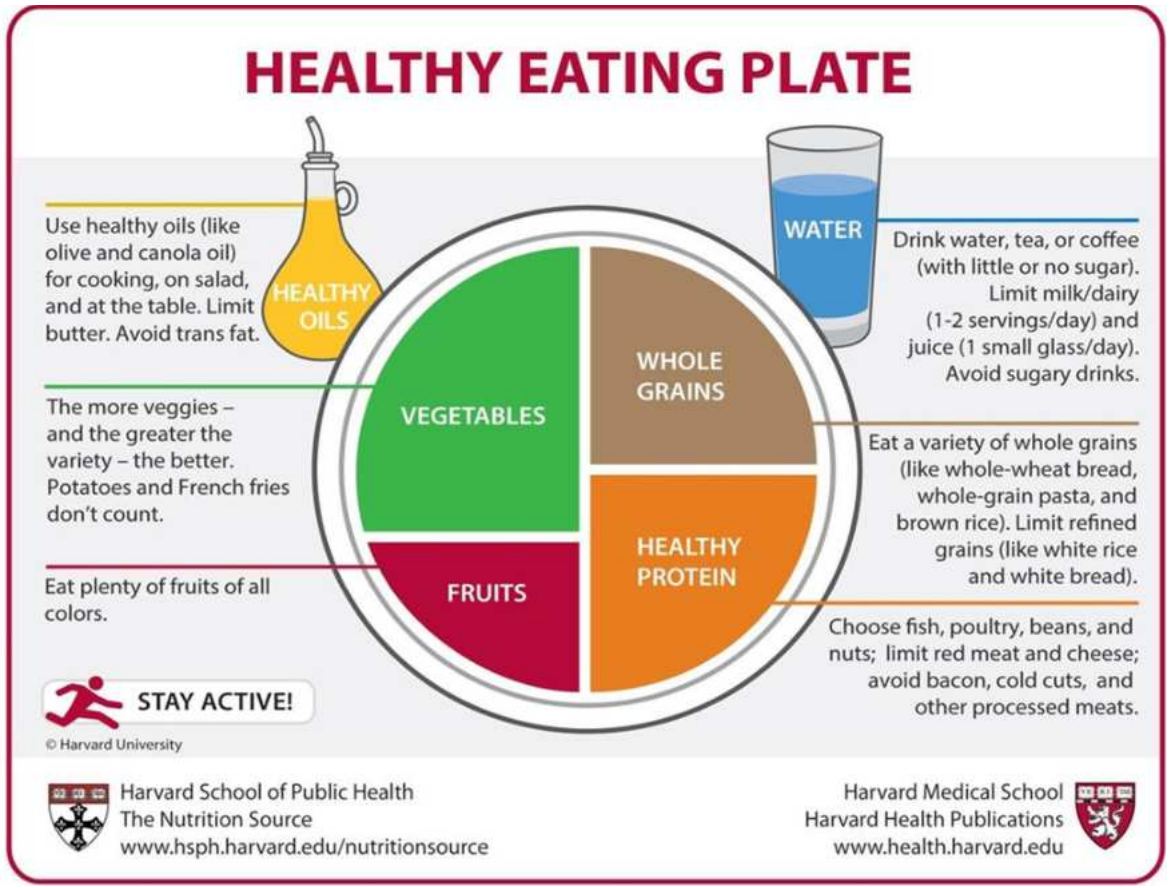


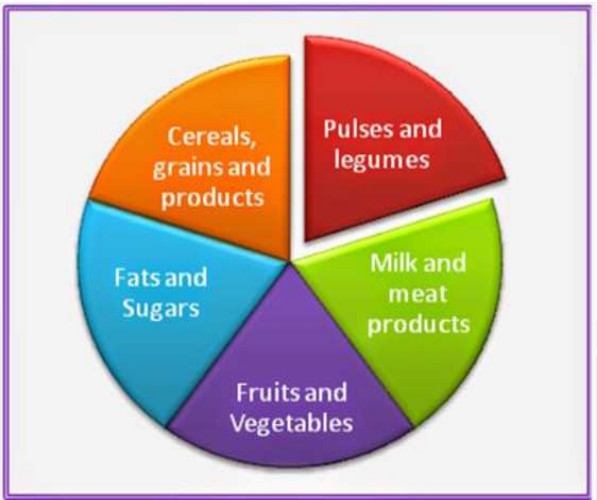


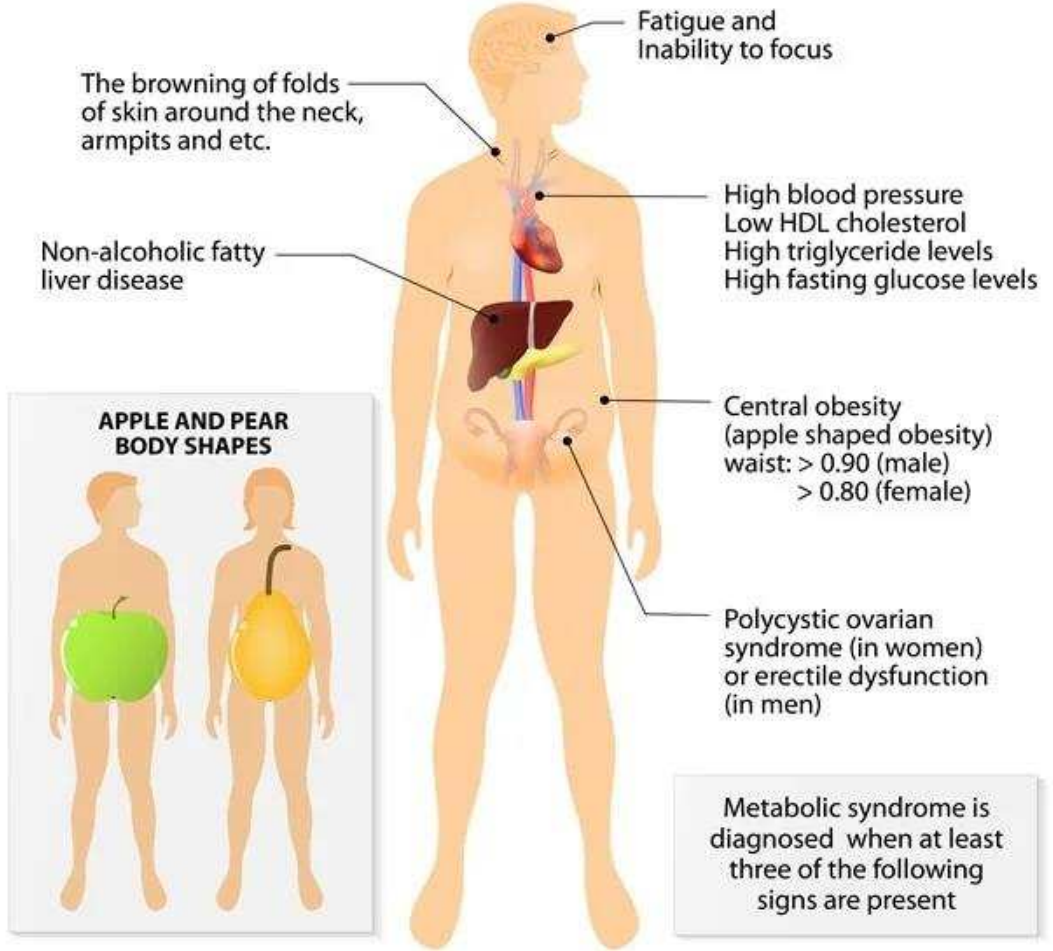




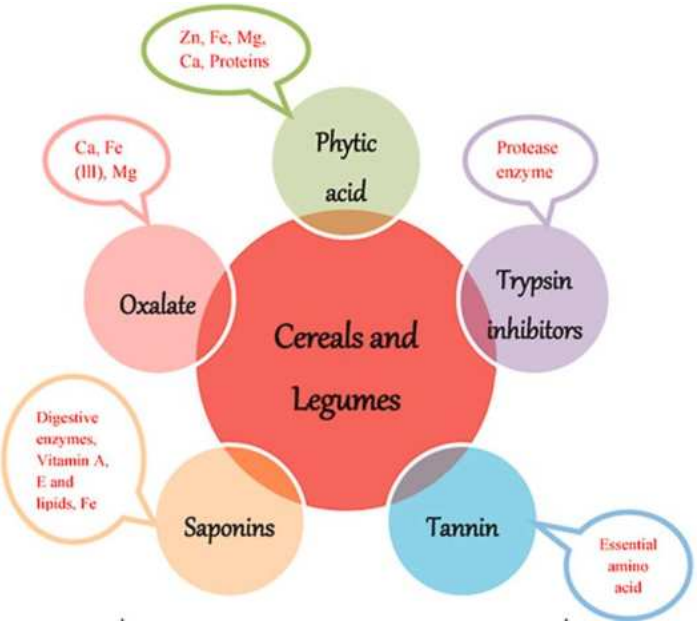
Introduction to Food Science & Technology

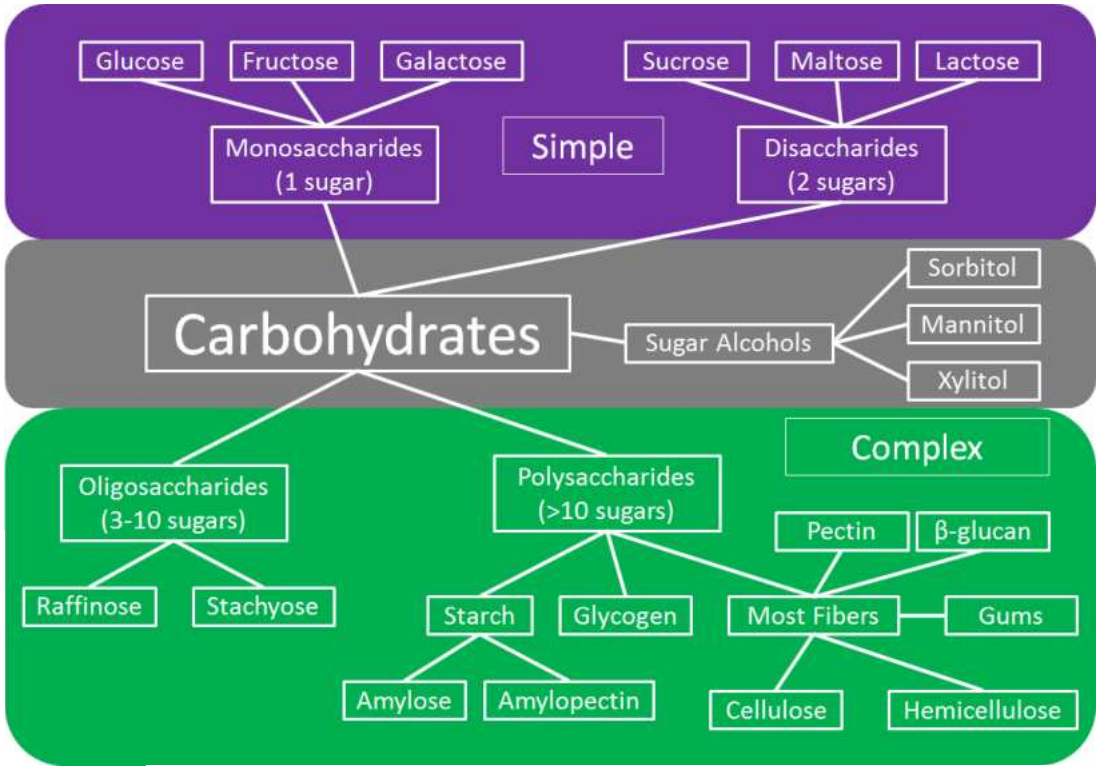


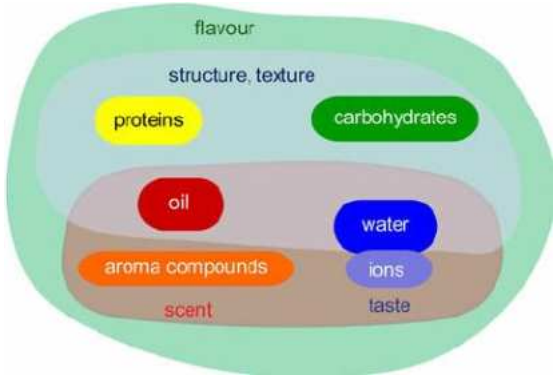


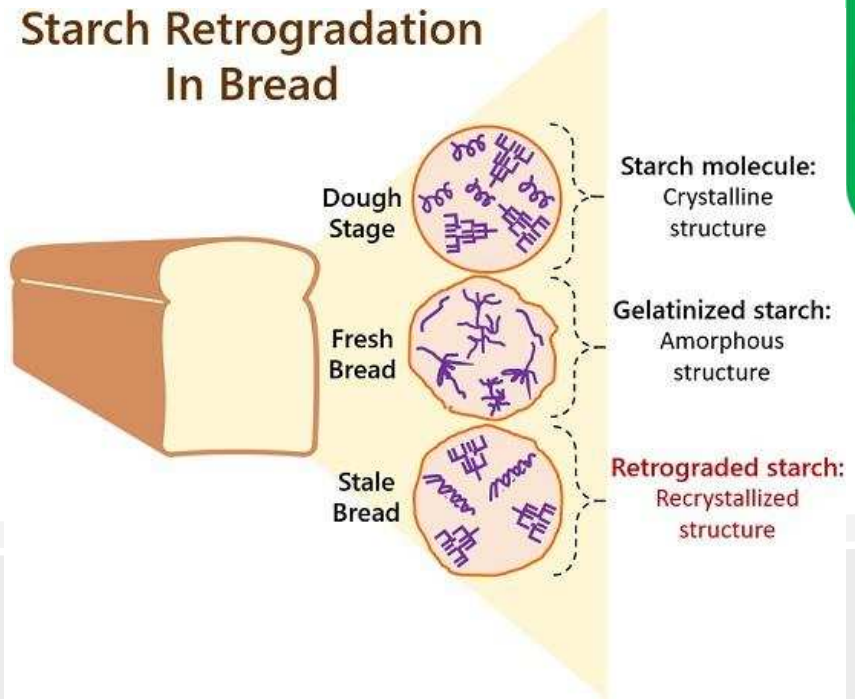


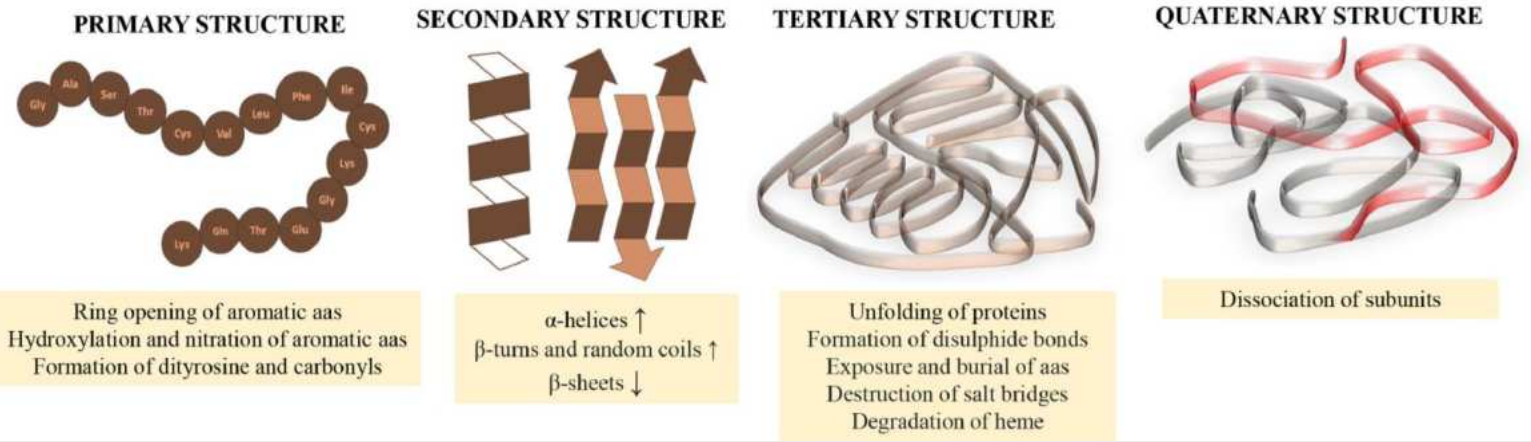
Introduction to Food Science & Technology







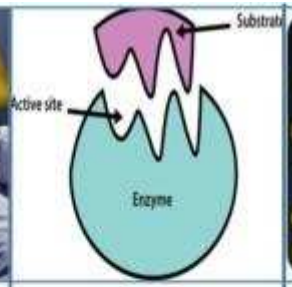




Food Preservation Technology

Microbiological

- Microorganism Growth
- Off-flavor
- Toxin production



Enzymatic

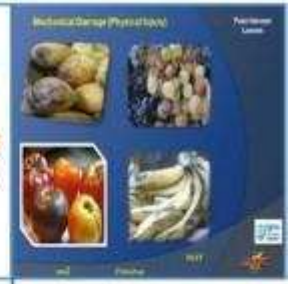
- Browning
- Color change
- Off flavor

Chemical

- Color loss
- Flavor loss
- Nonenzymatic browning
- Nutrient loss
- Oxidation-reduction
- Rancidity

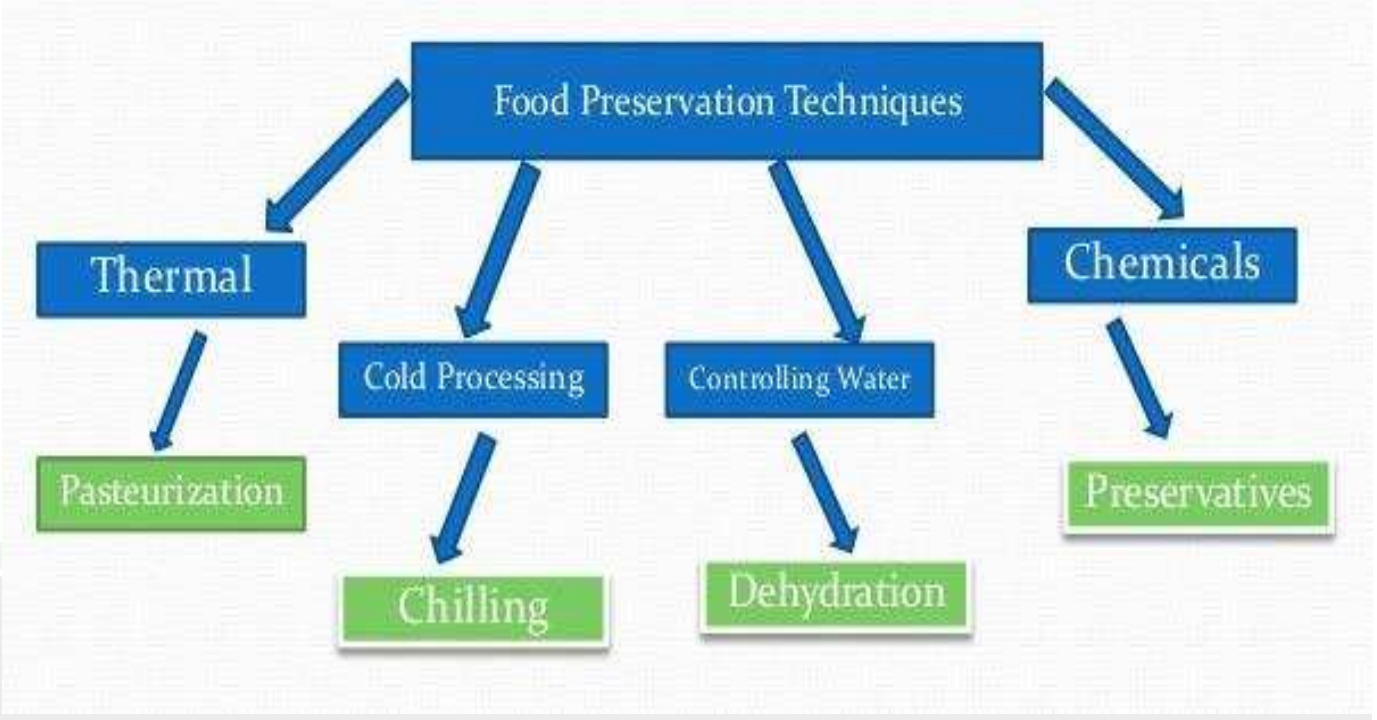
Physical

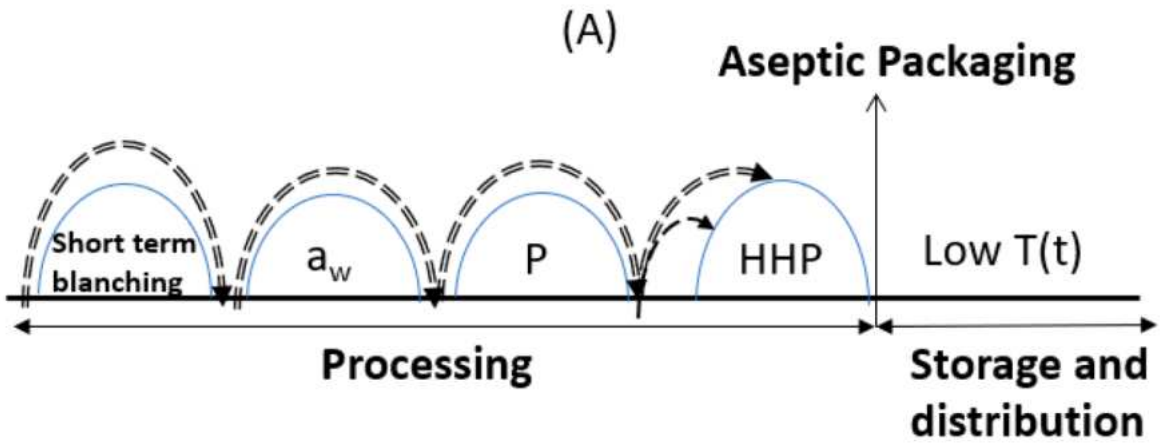
-Collapse
-Controlled release
-Crystallization
-Flavor encapsulation
-Phase changes
-Recrystallization
-Shrinkage
-Transport of component

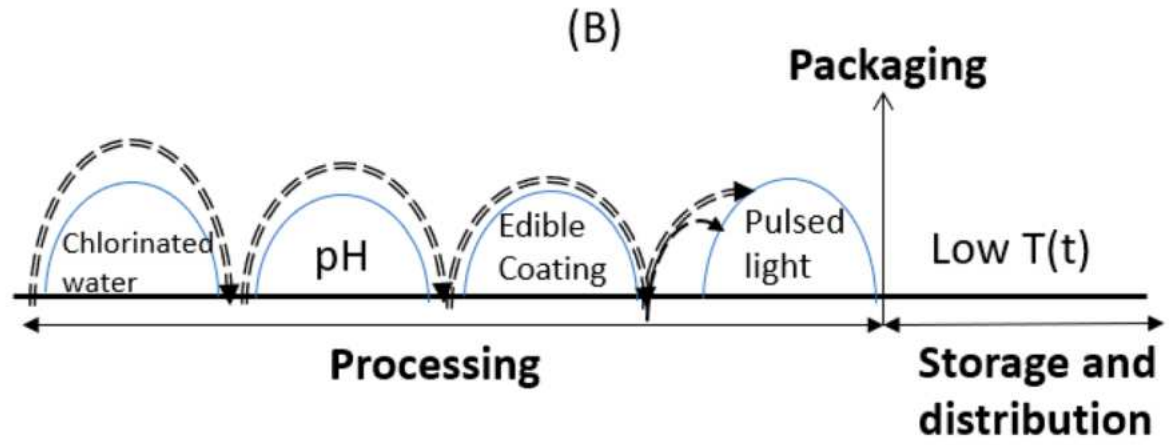


Mechanical

-Bruising due to vibration
-Cracking
-Damage due to pressure







Food Quality and Regulations

fssai

Hazard·Analysis HACCP Critical·Control·Point

International Organization for Standardization ISO 22000

CODEX ALIMENTARIUS

Food and Agriculture Organization of the United Nations

World Health Organization

Do join Department of Food Engineering and Technology
to know
"Science & Technology behind your favourite foods"

Thank you!!!

For any further queries
Please contact or write to
Head, FETD: Prof Rekha Singhal
rs.singhal@ictmumbai.edu.in)

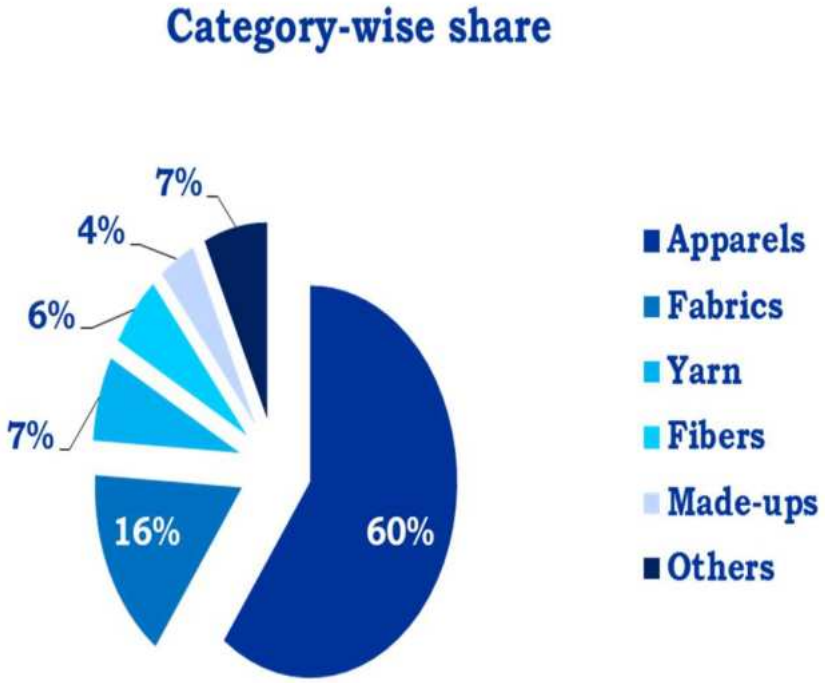
Departmental MDM Coordinator: Dr Jyoti Gokhale
js.gokhale@ictmumbai.edu.in

Fibres and Textile

Processing Technology

Global Textile Market

US$ bn



Global Textile and Apparel trade for 2025 estimated to be $1500 bn

Textile Segments

- **Apparel Wear**

  - intimates, casual, formal, outerwear, occasional, festive

- **Home Decor**

  - carpets, curtains, mats, seat covers, towels, bed covers

- **Outdoor Coverage**

  - tarpaulins, tents, awnings, umbrella, canopy

- **Specialised Function**

  - tyre, belt, parachute, sail, ropes, flags

Changing trend of Consumer's Wardrobe

10 years ago	Current	After 10 years
		
Need-Based Clothing Shirts Trousers Jackets Sarees Salwar Kameez	**Occasion Specific Clothing** Sports|Gym wear Specific ethnic wear Casual wear Office wear Night wear Party wear Work wear	**Detail Oriented** Design-based assortments occasion wear Fast fashion Eco-friendly apparel Technical Garments (Temperature controlled | IT embedded)
Basic function + Comfort + Price	Look + Trend	Fashion + Exclusivity + Technical function

Types of Textile Substrates

- **Natural**
  - **Plant**
    - Cotton
    - Jute
    - Linen
    - Coir
    - Bamboo
  - **Animal**
    - Wool
    - Silk
    - Camel
    - Mohair
- **Man Made**
  - **Regenerated**
    - Viscose
    - Acetate
    - Tencel
    - Modal
  - **Synthetic**
    - Nylon
    - Polyester
    - Acrylic
    - Lycra








Textile Industry in India

- **No 1** producer of Cotton & Jute
- **No 2** producer of Polyester & Silk
- **No 3** producer of Viscose Rayon
- **No 4** producer of Nylon & Acrylic
- **About 5 cr** people employed in the value chain
- **Earn 15 %** of export revenue
- **Consume 5.2 kg** per person & growing fast

Desired Effects

Casual wear

- Easy care
- Shape retention
- Comfort feel

Corporate Wear

- Wrinkle resistance
- Dimensional Stability
- Stain release

Denim

- Fading effects
- Shape fitness
- Soil release

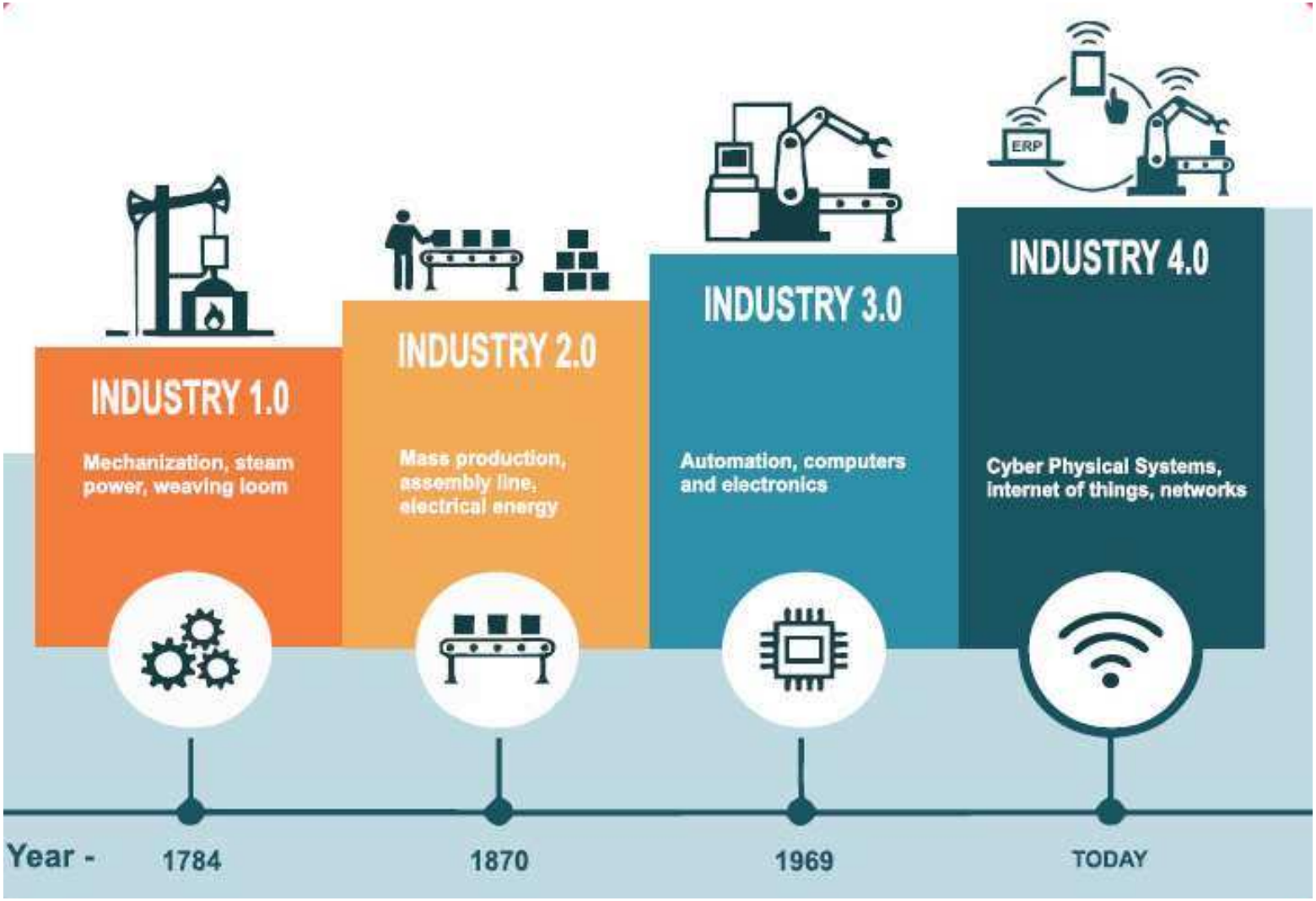
Work wear

- Flame Retardency
- Water & Oil Repellent
- Anti microbial
- Moisture management


Farm
Minimize Impact
Efficient Farming
Fiber
Minimize Utility
Rationalize ETP & RM
SUSTAINABILITY GOALS
Fabric
Efficient Design
Understand Complexity
Finish
Prevent Wastage
Conserve Resources
Fashion
Meet Expectations of Brands
Apply Synergy

Textile 4.0

What is it and how it is applicable to textile industry globally



Performance Enhancement

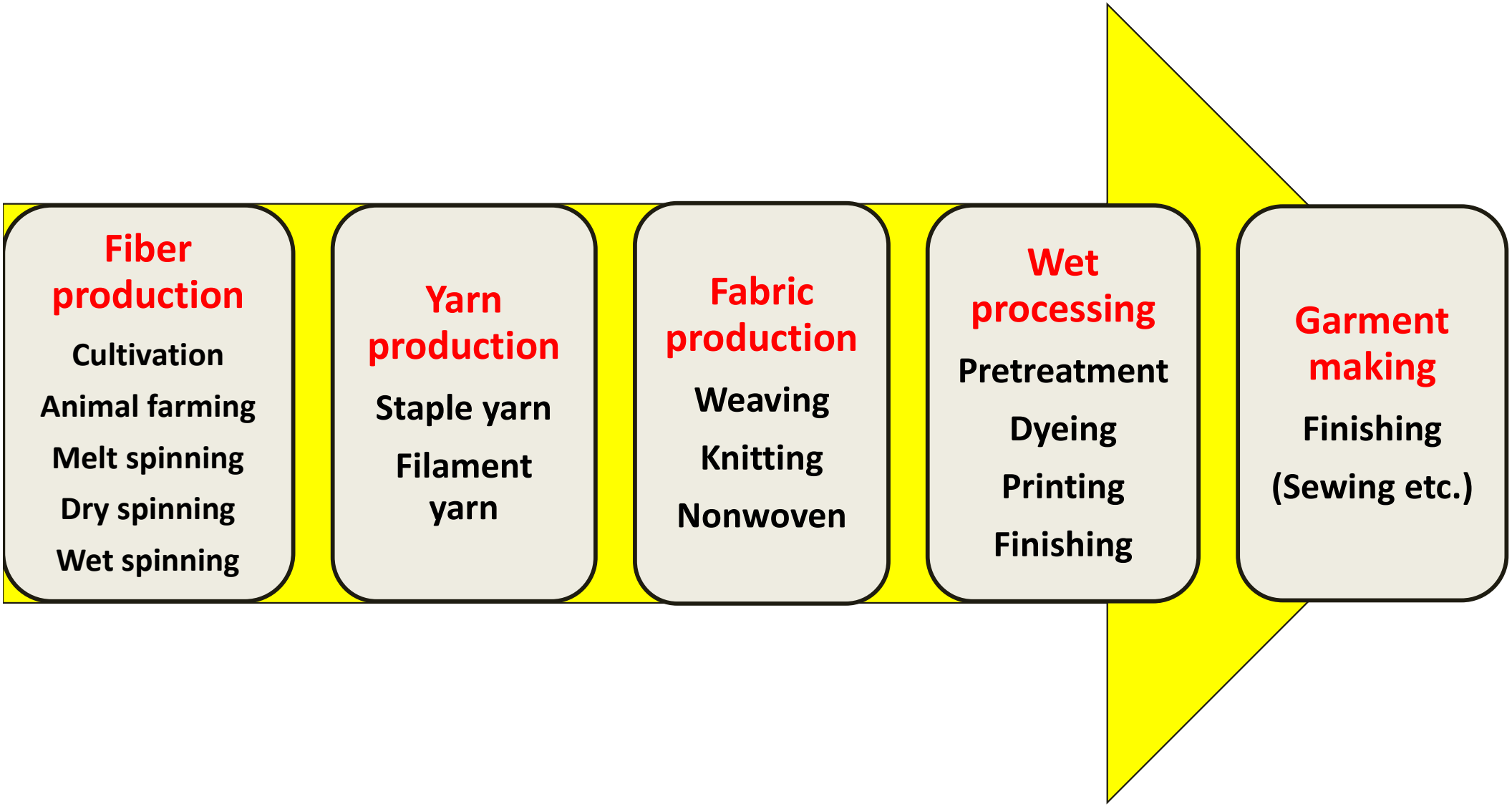
- **Nano - Technology**
- **Bio – Technology**
- **Information – Technology**

Converging these technologies in a textile material to develop

- Smart components
- Specialty effects
- Synergistic improvement
- Engineered marvel

Technical Textile

TEXTILE PRODUCTION FLOWCHART



Forms of Textile Processing

- **Fiber - loose stock, tops**

- **Yarn - hank, package, beam**

- **Fabric - woven, knit, terry towel**

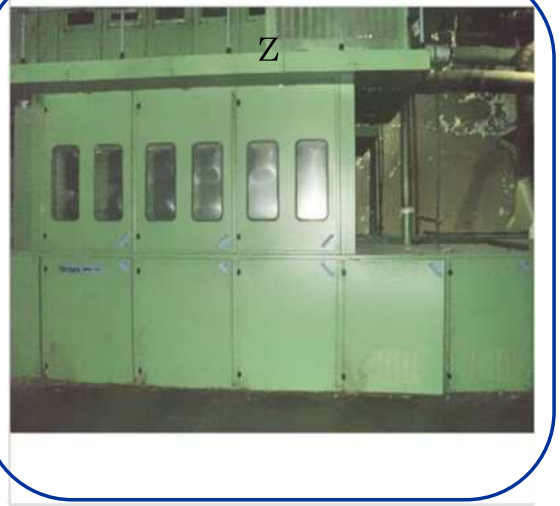
- **Made up - garment**

Popular blends

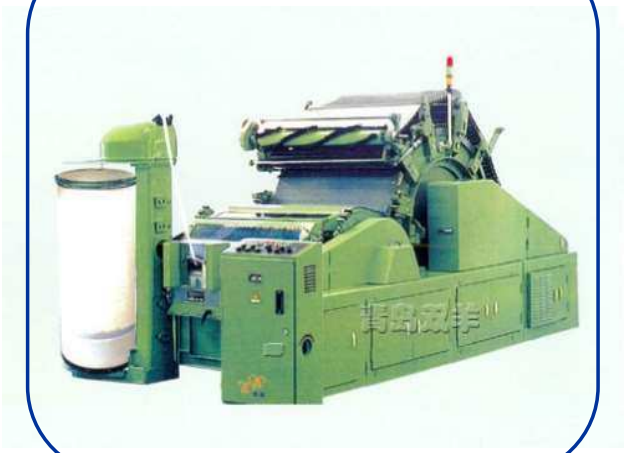
- Polyester + Cotton
- Polyester + Viscose
- Polyester + Wool
- Nylon + Viscose
- Acrylic + Cotton
- Blends with Lycra

Textile Manufacturing - Overview

(Cotton: Yarn Manufacturing)



Blow room



Carding

Drawing

Spinning

Textile Processing - Overview

(Cotton: Yarn dyed woven fabric)

Inspection of Grey yarn packages → Scouring | Bleaching → Package dyeing → Winding & Rewinding → Warping | Beaming → Sizing → Weaving → Singeing & Desizing → Mercerisation | Mild Bleaching → Chemical finish → Calendering → Sanforising → Garment preparation

Dyestuffs & Substrates

Class of Dyestuff	Principal Substrates
Vat	Cellulosic fibre (Cotton | Rayon | Linen)
Sulphur	Cellulosic fibre (Cotton | Rayon)
Reactive	Cotton | Rayon | Linen | Wool | Silk
Disperse	Polyester | Nylon | Cellulose Acetate | Acrylic | Plastics
Direct	Cellulosic fibre (Cotton | Rayon | Linen) | Paper | Leather
Acid	Nylon | Wool | Silk | Paper | Leather | Inks
Basic	Acrylic | Cationic Dyeable Polyester | Modified Nylon
Azoic	Cotton | Rayon | Cellulose acetate

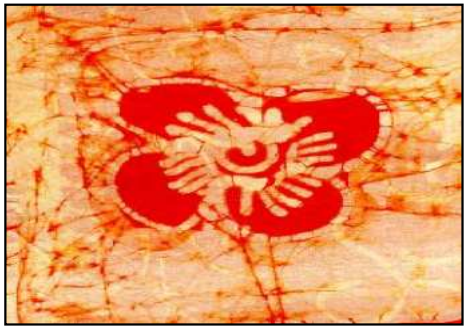
PRINTING

- **Special Styles of Printing**

Crimp/Crepon

Carbonized/Burnt-out

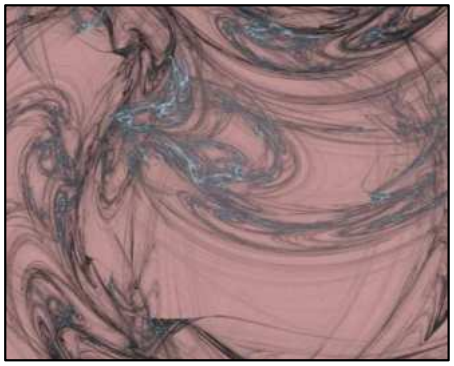
Brasso



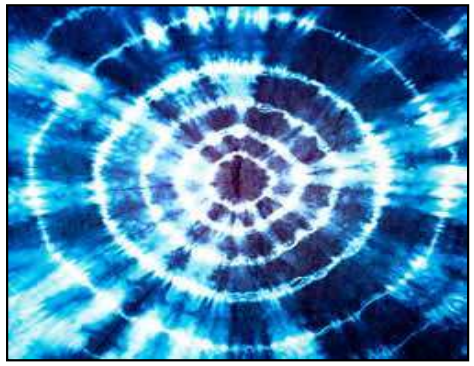
Batik

Damask effect

Kalamkari



Marble effect



Tie & Dye

Methods of Printing

- Direct
- Discharge
- Resist
- Camouflage
- Transfer
- Inkjet

Value Addition

Fashion
Design, Print, Colour, Fit, Accessories

Skincare
Aloe vera, Vitamins, Aromatherapy, Anti allergy, Medicinal

Freshness & Hygiene
Fragrance, Anti-odour, Antimicrobial

Comfort
Comfort, Skin friendly, Breathable, Moisture transport, Stretch

Special Finishes
Mosquito/ Insect repellent, Antistatic, Soil repellent

Sustainability
Eco-friendly
Non toxic chemicals

Protection/Safety
UV absorbent, Anti allergy, Protection from wind, cold and adverse weather conditions

Strength
Fabric construction, Dimension stability

Perceptive & Protective

- **Eye** - Color enhancement
- **Ear** - Rustling/scrooping sound
- **Nose** - Aroma/fragrance, feel good factor
- **Skin** - Feel & Comfort wear
- **Taste** - Baby wear, bitter/sour

- **Skin care** –anti-ageing/rejuvenating
- **Health care** –antimicrobial
- **Fire protective** – flame retardant
- **Sun protection** – UV absorbers
- **Soil free** - antistatic
- **Stain free-** oil & water repellent
- **Quick dry** - moisture management

Fastness properties

Popular Test methods:

- **ISO** — International Organisation for Standardisation
- **AATCC** — American Association of Textile Chemists and Colorists
- **M&S** — Marks & Spencer

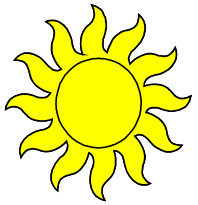
Wash Fastness tester

Perspiration | Water Fastness tester

Rub Fastness tester

Sublimation Fastness tester

Light Fastness tester



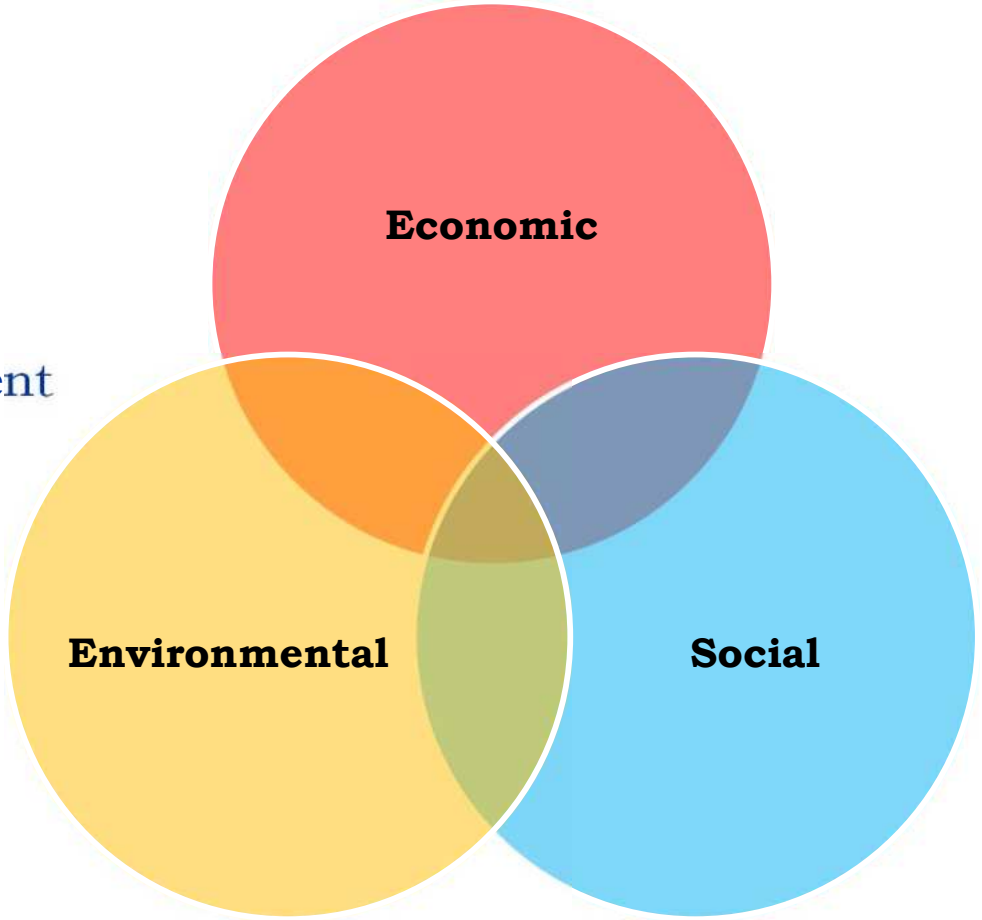
Sustainability - Challenges

Synthetic fibres

- Non bio-degradable
- Higher carbon footprint

Natural fibres

- High water footprint
- Heavily pesticides dependent



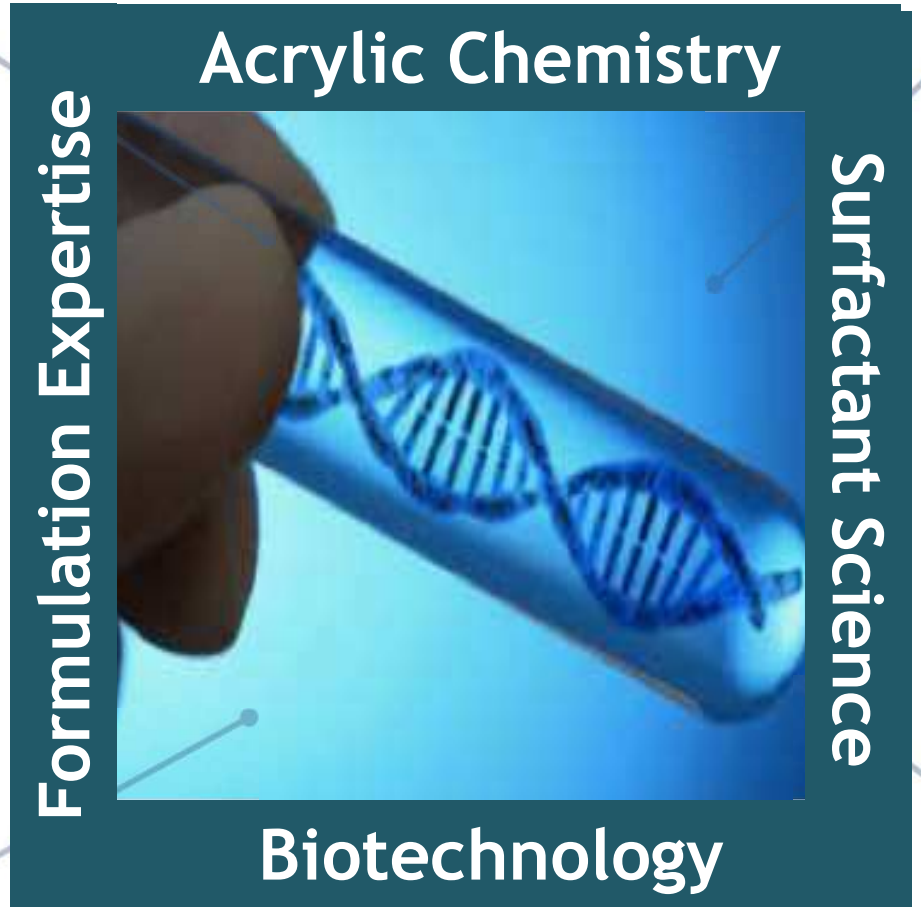
Circularity

Replace

- ✓ Hazardous Chemicals

Reduce

- ✓ Effluent load
- ✓ Utility



ReUse

Recycle

'Disposable' products are Unsustainable

Opportunities & Prospects

- **Farming** – Organic, sericulture, rearing
- **Manufacturing** -Fibre production Nylon, PES, Rayon,
- **Engineering** – Spinning, Weaving, Knitting, Garmenting
- **Machinery** – Preparatory, Colouration, Finishing
- **Processing** - Apparels, home furnishing, technical textiles
- **Instruments** - Computer color matching and lab equipments
- **Fashion** - Designing, garmenting
- **Merchandising** – Retail and Brands
- **Laboratory** - Academy | Independent testing | R & D | QC labs | IP
- **Government** - Textile Ministry departments, Pollution control board
- **Marketing** - Dyes, chemicals, machinery and accessories

Multi-Disciplinary Minor (MDM) Degree
in
Mechanical Engineering

Under the National Education Policy-NEP 2020 in

(2023-2024)

Offered by

DEPARTMENT OF GENERAL ENGINEERING

INSTITUTE OF CHEMICAL TECHNOLOGY

(University Under Section-3 of UGC Act, 1956) **Elite Status and**

Center for Excellence Government of Maharashtra

Preamble:

The mechanical engineering minor is tailored to students who want to understand the fundamentals of mechanical engineering other than courses covered in engineering sciences. The students will develop abilities in design, analysis and experimentation through foundation of math, physics, chemistry including modelling, energy engineering, mechanics of materials, product design and hydraulics.

The students can combine the skills and technological expertise of this minor with a major in technology of aligned branch and chemical engineering to prepare for a wide variety of opportunities in industrial fields and in demand careers.

Programme Specific Outcomes of MDM:

PSO1	Use of Mechanical engineering knowledge in the design of chemical process equipment's, energy conservation systems.
PSO2	To provide specialized aspects of mechanical engineering to enhance their skill set and capabilities within their discipline specific field.
PSO3	To expand the working knowledge of Mechanical engineering principles to broader engineering activities.

Details of Programs offered by the department

Master of Engineering (Plastic Engineering) : Programme started in 1972

Sr. No.	PG Program Name	Corresponding UG Program/Department Name	Current Year Sanctioned Intake
1	M.E. (Plastic Engineering)	N.A.	18

Ph.D.

- Plastic Engineering
- Mechanical Engineering
- Civil Engineering
- Electrical Engineering
- Electronics Engineering

Faculties in the Department:

Name of Faculty	Specialization / Research Area
Prof. D. D. Sarode	Concrete Technology – Performance Enhancing Construction Chemicals Plasticizers, Superplasticizers, VMA. Risk Analysis and its mitigation. Recycling of wastes. Recycling of agricultural waste and improving soil fertility
Prof. S.P. Deshmukh	Polymeric Composites, Engineering Materials, Plastic Processing, Design of Molds, Analysis of Plastic component using CAD, CAE tools. Solar Hybrid Energy,

	Refrigeration Air Conditioning, Heat Transfer through the microchannel.
Prof. V. R. Gaval	Particulate filled polymer composites, conversion of Metal parts into plastic using design software's, Tribology, Mold flow analysis
Dr. R.S.N. Sahai	Polymer Composites, Nanocomposites and its applications in Mechanical Engineering, Mould design, Energy Engineering.
Dr. Prerna Goswami	Sustainable Energy, MATLAB simulations, Electrical Engineering
Dr. Sachin G. Solanke	Materials engineering, Composite materials, Tribology, Plasma coating, Load bearing biomaterials and Electrospinning
Dr. V. S. Korpale	Plastic products design and analysis, computational fluid dynamics, Equipment design and analysis, powder-flow equipment designs.
Dr. D. Biswas	Renewable energy, Solar Thermal, Heat Exchanger, Heat Transfer, Polymer composites

Laboratories Facility:

Plastic Processing and Testing laboratory:

The laboratories of the department

GEP 2104 Plastic Processing and Testing laboratory:

Sr. No.	Name of experiments/ syllabus	Equipment
1	Extrusion of various polymer	Twin-screw extruder
2	Preparation of polymer composites	Twin-screw extruder
3	Compression molding	Compression Moulding machine
4	Injection molding	Injection Moulding machine
6	Preparation of composite samples and plastic components	3D printer
7	Impact test to find out impact strength of the polymer	Izod impact testing machine
8	To find the melt flow index of various polymers	Melt flow index apparatus
9	Measurement of heat deflection temperature	Heat Deflection temperature tester
10	Measurement of Hardness	Shore Hardness Tester
11	Determination of Tensile Strength and percentage elongation	Universal Testing Machine


Rotational Molding


Blow Molding


Injection Molding


Twin Screw Extruder


Mixer


Compression Molding

Plastic Testing laboratory:


Testing Lab


Impact Tester


Compression testing machine


HDT Tester & Melt Flow Index Tester

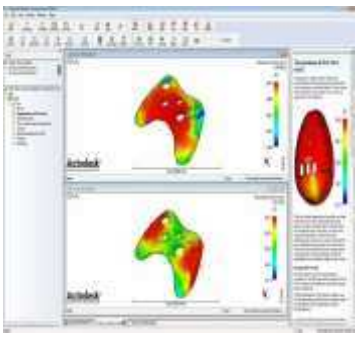

Universal Testing machine


Shore Hardness tester

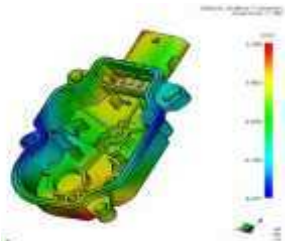
CAD/CAM/CAE Laboratory

GET 2110 Design of molds and CAD/CAM/CAE laboratory:

Sr. No.	Name of experiments/syllabus	Equipment/lab
1	Design and draw compression molds for plastic products	Drawing hall
2	Design and draw transfer molds for plastic products	Drawing hall
3	Design and draw Injection molds for plastic products	Drawing hall
4	Understand the basic principles of design of extrusion dies	Drawing hall
5	Make solid models of plastic and mechanical components	CAD/CAM lab
6	Design various molds and dies using computer-aided design	CAD/CAM lab
7	Understand the basics of the computer-aided manufacturing program	CAD/CAM lab
8	Analyze variation in pressure, temperature and time graph using Computer Aided program	CAD/CAM lab



CAD/CAM/CAE lab



Department of General Engineering (M.E. Plastic Engineering) : ICT Mumbai : October 2729, 2023

Research Facilities

Sr. No.	Name of Facility	Specialized Equipment Name	Equipment details
1.	3D Printing	3D Printer	3D Prototype Printer, FDM/ FFF Wanhao Duplicator-6 Plus; DLP Resin Wanhao Duplicator-7
2.	Optimization Software	Optimization Software	Statistical Module
3.	Altair HyperWorks CAE	Altair HyperWorks CAE	125 Units Research Bundle with Unlimited Nodes
4.	Workstation Computer	Workstation Computer	Intel i7-8th Gen, 16GB RAM, 250GB SSD, 1TB HDD, 2GB Graphics, Win10
5.	Minitab 18	Minitab 18	Statistical Module
6.	NX-Unigraphics	NX-Unigraphics	CAD CAM software by SIEMENS for CAD Design, NX Tooling, Mold wizard
7.	Moldex3D	Moldex3D	Mold Design Software, Educational Perpetuity: Professional – Generic Solution/ Project/ Designer/ Designer BLM/ MDE/ MFE/ Flow/ Pack/ Cool/ Warp/ 3D Coolant CFD

A. Structure of the MDM course:

Subject Code	Semester	Subject	Credits	Hrs./Week			Marks for various Exams			
				L	T	P	CA	MS	ES	Total
GEP1132	III	Workshop Practice	2	0	0	4	50	-	50	100
GET1133	IV	Advanced strength of Materials	2	1	1	0	20	30	50	100
GET1134	V	Energy Engineering & Management	4	3	1	0	20	30	50	100
GET1135	VI	Mechanical design of chemical process equipment's.	2	1	1	0	20	30	50	100
GET1136	VII	Industrial Hydraulics	2	1	1	0	20	30	50	100
GET1137	VIII	Product Design and Development	2	1	1	0	20	30	50	100
		Total	14							600

B. **Intake:** Minimum 15 and maximum 35 students

C. **Duration:** 3 years (6 semesters)

D. **Eligibility criteria:** Students enrolled in B. Chem. Engg and B. Tech programme are eligible. The allotment of minor degree programme will be as per the policy of the Institute.

E. **Pedagogy/Teaching Method:**

Lecture/Discussions: These sessions will discuss the subject matters of the course.
Experiential Learning: The sessions will involve hands-on training.

Tutorials: Problem solving / case studies / relevant real-life applications / student presentations / home assignments / individual or group projects.

F. Method of Evaluation/Delivery

Subject Code	Semester	Course	Method of Evaluation	Methods of Delivery
GEP 1132	III	Workshop Practice	a) Continuous internal Evaluation on assigned Job. b) Skill based end exam.	a) Hands on Training
GET 1133	IV	Advanced strength of Materials	a) Minimum 2 class tests b) Assignments c) Seminar/ Presentation d) Report submission	a) Lectures/Face to face training b) Tutorials c) Case study d) Presentation (PPT) e) Group Projects

GET 1134	V	Energy Engineering & Management	a) Minimum two class test b) Assignments c) Seminar/ Presentation d) Report submission	a) Lectures/Face to face training b) Tutorials c) Case study d) Presentation (PPT) e) Group Projects
GET 1135	VI	Mechanical design of chemical process equipment's.	a) Minimum two class tests b) Assignments c) Seminar/ Presentation d) Report submission	a) Lectures/Face to face training b) Tutorials c) Case study d) Presentation (PPT) e) Group Projects
GET 1136	VII	Industrial Hydraulics	a) Minimum two class test b) Assignments c) Seminar/ Presentation d) Report submission	a) Lectures/Face to face training b) Tutorials c) Case study d) Presentation (PPT) e) Group Projects
GET 1137	VIII	Product Design and Development	a) Minimum two class tests b) Assignments c) Seminar/ Presentation d) Report submission	a) Lectures/Face to face training b) Tutorials c) Case study d) Presentation (PPT) e) Group Projects

G. Faculty/Instructor for the course

Subject Code	Semester	Course	Instructor/Faculty
GEP 1132	III	Workshop Practice	Dr. Sachin Solanke
GET 1133	IV	Advanced strength of Materials	Prof. Dilip Sarode
GET 1134	V	Energy Engineering & Management	Dr. D. Biswas
GET 1135	VI	Mechanical design of chemical process equipment's.	Prof. Suresh Deshmukh/Prof V. R. Gaval
GET 1136	VII	Industrial Hydraulics	Prof. R.S.N. Sahai
GET 1137	VIII	Product Design and Development	Dr Vikram Korpale

H. Detailed syllabus:

	Course Code: GEP 1132	Course Title: Workshop Practice	Credits = 2		
			L	T	P
	Semester: III	Total contact hours: 60	0	0	4
List of Prerequisite Courses					
	Engineering Graphics				
List of Courses where this course will be prerequisite					
	Equipment Design and Drawing, Design and fabrication of Molds				
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1	Introduction to various Production Processes		5		
2	Study of Construction, Mechanism and Application of Lathe Machines, Drilling Machine, Milling etc.		16		
3	One composite job using a minimum of four Machining operations such as plane turning, taper turning, external threading and knurling etc. with its process sheet.		16		
4	Classification of various Joining and metal forming processes and their applicability such as adhesive bonding, mechanical fastening, welding, and allied processes.		10		
5	Industrial visit to Chemical process equipment fabricators demonstrating use of forming, bending, rolling, and welding processes.		8		
6	Basics of CNC Machines and 3D Printing technology.		5		
List of Textbooks/ Reference Books					
1	Mechanical Workshop Practice by K C John, PHI Learning 1. Workshop Technology Vol. 1 and 2 by Raghuvanshi B. S. Dhanpat Rai & Sons,1998.				
2	Workshop Technology by Chapman W.A. J and Arnold E. Viva low priced, student edition, 1998.				
3	Workshop Practices, H S Bawa, Tata McGraw-Hill, 2009.				
4	Workshop Practices and Materials, B J Black, CRC Press.				
5	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Media promoters and publishers private limited, Mumbai, Vol. I 2008 and Vol. II 2010.				
Course Outcomes (students will be able to....)					
CO1	Understand different operations performed using Lathe, drilling, and milling machine		K2		
CO2	Apply knowledge of lathe operations to fabricate engineering part		K3		
CO3	Justify the choice between joining and forming process for a suitable application.		K4		
CO4	Understand fabrication methods such as forming, bending, rolling and CNC machines		K2		

Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)			
	PSO1	PSO2	PSO3
CO1	1	3	3
CO2	1	3	2
CO3	3	2	1
CO4	3	2	2

	Course Code: GET 1133	Course Title: Advanced Strength of Materials	Credits = 2		
			L	T	P
	Semester: IV	Total contact hours: 30	1	1	0
List of Prerequisite Courses					
	Structural Mechanics, Basic Mechanical Engineering, Applied Mathematics				
List of Courses where this course will be prerequisite					
	Equipment design and drawing, Design and fabrication of molds, Home paper				
	Course Contents (Topics and subtopics)		**Reqd hour**		
1	Thick and Thin cylinders - concept of radial, longitudinal stresses, behavior of thin cylinders. Problems on thin cylindrical and spherical shells. Behavior of thick cylinders (theory only).		3		
2	Torsion of a circular shaft - concept, basic derivation, shear stress distribution, simple problem.		3		
3	Short and Long columns (Struts) - Basic concept, crippling load, end conditions. Euler's and Rankine's approach (without derivations)		3		
4	Advance stresses and strains – Representation of stress and strain at a point, Stress stain relationship, plane stress and plane strain. Transformation of stresses and its importance, Principal stresses and strains, maximum shearing stress, Mohr's circle its use and construction.		6		
5	Basics of Engineering Design - Steps in the engineering design, Importance of analysis, 1-D, 2-D and 3-D analysis and interpretation of results. Force displacement relationship, Strain deformation relationship, Introduction to finite element Analysis. Computer aided analysis and design.		5		
6	Different types of loads, load factor, factor of safety, Design philosophies, Working stress approach, Ultimate stress approach and Limit state theory. Performance based design Approach.		2		
7	Natural Materials, Manmade materials, Alloys, Composite Materials – Types of composite materials, Cement and its varieties, cement composites, properties, recycling of waste, Sustainable materials		4		
8	Advance materials for industrial applications - Advances in materials, Materials used for coatings, anticorrosive coatings, special purpose floorings, water proofing compounds, Various polymers and epoxies used for industrial applications.		3		
9	Different types of performance enhancing and special purpose construction chemicals. Plasticizers and super-plasticizers, air entraining agents, accelerators and retarders, viscosity modifying agents, corrosion inhibitors		4		
List of Textbooks/ Reference Books					
	1. Engineering Materials by Rangwala 2. Strength of Materials by Ferdinand Singer and Andrew Pytel, Harper Colins Publishers 3. Introduction to Mechanics of Solids by Egor Popov, Prentice Hall of India Pvt. Ltd Strength of Materials by S. Timoshenko and D. H. Young, McGraw Hill Publications. 4. Concrete Technology by A. M. Neville, Pearson Education ltd 5. Concrete Technology – Theory and Practice by M. S. Shetty, S. Chand & Co.				

	6. Fundamental of Fibre reinforced composite materials by A. R. Busell and J. Renard, 7. Taylor & Corrosion and Corrosion Protection Handbook by Philip A. Schweitzer, CRC press	

Course Outcomes (students will be able to....)		
CO1	Understand stresses induced in thin cylinders, shafts and columns.	K2
CO2	Apply knowledge of equilibrium for analysis of complex stress situations.	K3
CO3	Analyse different complex problems in engineering design.	K3
CO4	Understand Force displacement relationship, Strain deformation relationship.	K2
CO5	Apply knowledge of materials for various engineering applications.	K3

Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)

	PSO1	PSO2	PSO3
CO1	3	1	2
CO2	3	1	2
CO3	3	2	2
CO4	1	1	2
CO5	2	2	2

3-Strong Contribution; 2-Moderate Contribution; 1-Low Contribution

	Course Code: GET 1134	Course Title: Energy Engineering and Management	Credits = 4		
			L	T	P
	Semester: V	Total contact hours: 60	3	1	0
List of Prerequisite Courses					
	Elements of Mechanical Engineering, Basic Mechanical Engineering, Applied Mathematics				
List of Courses where this course will be prerequisite					
	Heat Transfer Equipment design, Chemical Project Economics, Chemical Industrial Management				
	Course Contents (Topics and subtopics)		**Reqd. hours**		
1.	**Energy Scenario:** • Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security • Energy Conservation and its Importance, Features of Energy Conservation Act-2001, • Basics of Energy and its various forms, Material and Energy balance.		06		
2.	**Energy Audit Principles:** • Definition, Energy audit- need, Types of energy audit, Energy audit and management, approach-understanding energy costs, Bench marking, Energy performance, maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. • Elements of monitoring & targeting: Energy audit Instruments; Data and information-analysis. • Financial analysis techniques: Simple payback period, NPV.		16		
3.	**Energy Management and Energy Conservation in Electrical Systems** • Electricity billing, Electrical load management and maximum demand Control, Energy efficient equipment and appliances, star ratings. **Energy efficiency measures in lighting system, Lighting control** • Occupancy sensors, daylight integration, and use of intelligent controllers, Energy conservation opportunities in water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.		16		
4.	**Energy Management and Conservation in Thermal Systems** • Steam Power Plant: Rankine cycle, Reheat cycle, Regenerative cycle. • Boilers and furnaces: Classification, Study of various Boilers such as Babcock & Wilcox Boiler, Cochran Boiler, La-Mount Boiler, Benson Boiler, Boiler Mountings and Accessories, Boiler Performance • Steam Turbine: Classification, Calculation of Power Developed by Steam Turbine, Compounding of Steam Turbine • Elements of Steam condenser, various types of steam condenser, Condenser Efficiency • Waste heat recovery, use of insulation- types and application.		16		
5.	**Non-Conventional Energy Sources**: • Role and importance of non-conventional and alternate energy sources such as solar thermal, solar Photo-voltaic, Cooling techniques to cool Photovoltaic cells, wind, ocean, bio-mass and geothermal.		06		
List of Textbooks/ Reference Books					

	1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science 2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System 3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons 4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI). 5. Energy Management Principles, C. B. Smith, Pergamon Press 6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press 7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press 8. Thermodynamics by P.K. Nag 9. Power plant by Morse 10. Heat Engines by P.L. Balani 11. Renewable Energy resources by Tiwari and ghosal, Narosa publication. 12. Non-conventional energy sources, Khanna publications	
Course Outcomes (students will be able to ....)		
CO1	To identify and describe the present state of energy security and its importance.	K2
CO2	To identify and describe the basic principles and methodologies adopted in energy audit.	K3
CO3	To describe the energy performance evaluation of electrical and thermal installations and identify the energy saving opportunities.	K3
CO4	To analyse the data collected during performance evaluation and recommend energy saving measures.	K4
CO5	Discuss the steam formation process, working of steam boilers, mountings, and accessories and their properties.	K2
CO6	Explain the need for and importance of various renewable energy sources.	K2
CO7	Employ this knowledge for energy saving in various devices.	K3

Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)

	PSO1	PSO2	PSO3
CO1	3	1	2
CO2	3	1	2
CO3	3	1	2
CO4	3	1	1
CO5	1	1	2
CO6	3	1	1
CO7	3	1	2

3-Strong Contribution; 2-Moderate Contribution; 1-Low Contribution

	Course Code: GET 1135	Course Title: Mechanical Design of Chemical Process equipment	Credits = 2		
			L	T	P
	Semester: VI	Total contact hours: 30	1	1	0
List of Prerequisite Courses					
	Structural Mechanics, Basic Mechanical Engineering, Advanced Strength of Materials, Engineering Graphics				
List of Courses where this course will be prerequisite					
	Chemical Process Equipment Design and drawing, Home paper, Internship/ On Job Training Project				
	Course Contents (Topics and subtopics)		**Reqd. hour**		
1	Introduction to Basic Design concepts		2		
2	Design of Pressure Vessel Introduction to Pressure vessels used in process Industries. Design consideration for pressure vessels Design criterions, Design stresses, factor of Safety, Types of stresses on Vessels Vessels operating at Elevated and low temperatures. Cyclic loading and consideration for corrosion for design Design of vessel Shell for Internal pressure, combined loading and for external stresses, Use of reinforcement rings for shells Design of various types of head or cover Design and types of Nozzles, Design and types of Flange Joints for shell and nozzles Various types of supports for pressure vessels		16		
3	Design of Storage Vessel, Types and uses of storage Vessels used for storing various fluids and gases. Loss mechanism in storage vessels. Design of Rectangular tank Design of Vessel shell, Design of bottom Plate Wind girders, roof top angle curbs, Design of self-supporting tank roof Use of support columns for roof		12		
List of Textbooks/ Reference Books					
	1. Process Equipment Design by, V. V. Mahajani 2. Equipment Design by Dawande 3. Equipment Design by Young 4. Welding Technology by O. P. Khanna				
Course Outcomes (students will be able to....)					
CO1	Understand Basic Design concepts.		K2		
CO2	Design of Pressure Vessel and Storage Vessel		K4		
CO3	Design with real time data		K5		

Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)			
	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1

3-Strong Contribution; 2-Moderate Contribution; 1-Low Contribution

	Course Code: GET 1136	Course Title: Industrial Hydraulics	Credits = 2		
			L	T	P
	Semester: VII	Total contact hours: 30	1	1	0
List of Prerequisite Courses					
	Applied Physics, Basic Mechanical Engineering,				
List of Courses where this course will be prerequisite					
	Instrumentation and process control, Home Paper				
	Course Contents (Topics and subtopics)		Reqd. hours		
1.	**Introduction to Hydraulics:** Basics of hydraulics, Pascal law, Advantages of Hydraulic drives, Quality requirement of hydraulic fluids and its requirements, Standard symbols for hydraulic lines, pumps, valves, motors, Check valves, its functions, various types and its applications, Directional control valve, two way and four way, Two positions and three positions direction valve, Rotary valve		8		
2.	**Valves:** Pilot operated check valve, working and its applications, Flow control valve, its functions, various types and its applications, Pressure compensated flow control valve, Relief valve, simple and compound, Balanced Piston relief valve, Sequence valve and its applications. Study of various types of filters.		9		
3.	**Pumps and Hydraulic motors**: Pumps, Gear pumps, vane pumps, Positive displacement axial piston pump, Pressure intensifier, Accumulator, Hydraulic motors		5		
4.	**Hydraulic circuits**: Study of various Hydraulic circuit used in industry; Study of various Hydraulic circuit used in Polymer processing		4		
5.	**Pneumatic systems & components:** Compressor, Receiver / Reservoir Tank, Starting Unloader & Controller, Filters, Regulators / Valves, Lubricators, Mufflers / Silencer, After Cooler, Air Dryers, and Indicators (Pressure, Temperature etc.)		4		
List of Textbooks/ Reference Books					
	1. Hydraulics by Vickers 2. Esposito A, Fluid Power with application, Prentice Hal 3. Majumdar S.R, Oil Hydraulic system- Principle and maintenance, Tata McGraw Hill 4. Majumdar S.R, Pneumatics Systems Principles and Maintenance, Tata McGraw Hill 5. Stewart H. L, Hydraulics and Pneumatics, Taraporewala Publications				
Course Outcomes (students will be able to....)					
CO1	Understand basics of hydraulics.		K2		
CO2	Analyse applications of valves in hydraulics.		K5		
CO3	Applications of pumps in hydraulics.		K3		
CO4	Design hydraulic circuits for industrial applications.		K6		
CO5	Applications of pneumatics in industry.		K3		

Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)			
	PSO1	PSO2	PSO3
CO1	1	2	2
CO2	1	2	2
CO3	2	2	1
CO4	1	1	1
CO5	3	2	1

3-Strong Contribution; 2-Moderate Contribution; 1-Low Contribution

Course Code: GET 1137	Course Title: Product Design and development	Credits = 2		
		L	T	P
Semester: VIII	Total contact hours: 30	1	1	-

	List of Prerequisite Courses	
	Engineering Graphics, Structural Mechanics, Elements of Mechanical Engineering, Materials Engineering	
	List of Courses where this course will be prerequisite	
	Internship/ On Job Training Project	
	Course Contents (Topics and subtopics)	**Reqd. hours**
1	**Basics of Design:** Design definitions and attributes, Product configurations and component matrix, Understanding and analysing product contexts, Modularity, and design of modular systems, understanding design situations-parallel and future	08
2	**Product design aspects:** Design issues, Selection of materials and technical requirements, Dimensional accuracy and functional requirements, Surface finish, Making a product specification etc.	04
3	**General Design features:** Effect of wall thickness, corner radius, drafts, shrinkage, and warpage, inserts and parting lines. Design of ribs, bosses, threads etc., Cost economics.	06
4	**Design thinking:** Steps in design thinking, relevance of design thinking with product development	06
5	**Product design procedures:** Product design of engineering load bearing components such as gears, bearings, filament wound storage tanks, pipes etc.	06
	List of Textbooks/ Reference Books	
1.	Plastic product design handbook by Edward Miller	
2.	Product design and development by Karl T. Ulrich	
3.	Change by Design by Tim Brown	
	Course Outcomes (students will be able to....)	
CO1	Understand the product design and development procedure	K2
CO2	Apply the product design concepts to prepare industrial product	K3
CO3	Analyse basics of plastic product design	K4
CO4	Design engineering plastic products based on technical requirements	K6

Mapping of Course Outcomes (COs) with Programme Outcomes (PSOs)

	PSO1	PSO2	PSO3
CO1	1	1	2
CO2	3	2	1
CO3	2	1	2
CO4	1	2	3

3-Strong Contribution; 2-Moderate Contribution; 1-Low Contribution