Gramaudyogik Shikshan Mandal's

# MIT™

A Group of Academic & Research Institutions

AURANGABAD

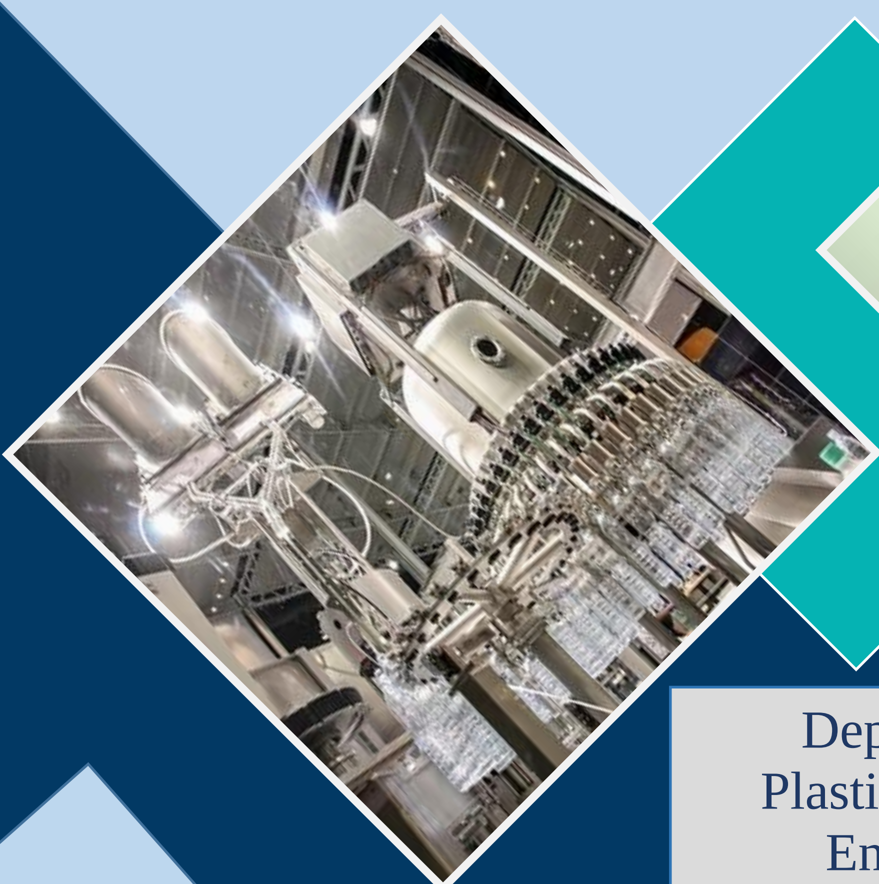
MIT™ Quest for Excellence

# PLASTVISION

## Engineer's Motto

If it isn't broken

Take it Apart & Fix it


Department of Plastic & Polymer Engineering


**Take it,**
**Shape it,**
**Mould it,**
**The way you want.**

Issue Editor: Bhargav.A.Patel

## VISION OF THE DEPARTMENT

*Department of plastic & polymer engineering aspires to achieve excellence by importing education & training to develop young technocrats as multidimensional personalities for the series of mankind.*

## MISSION OF THE DEPARTMENT

*To impart quality education to the aspiring students for fulfilling technologies and societal needs by providing*

*~ State of the art infrastructural facilities and competent facilities.*

*~ Practical training to face challenge of modern plastic and polymer industries.*

## *Content*

# Message from Hod's Desk

*The E-magazine of plastic and polymer engineering is an endeavour of our student, which has paved from last few years. I hope this edition would grow interest among the readers about the application of polymer. It is a great pleasure that our Department of Plastic and Polymer Engineering is releasing Issue 3 of "PLASTVISION", for this academic year to explore the creative ideas and activities of our students. In an era of digitization and e learning, it is apt to go digital for expressing our views on different socio-economic, political or cultural issues. It is an active platform for both staff and students to share information, latest technical knowledge and imaginations in all dimensions. This magazine would not have been possible without the enthusiastic and hard work of all student participants, editorial board members and all faculty members. I register my sincere appreciation to the students and editorial team for their timely effort to bring this issue of magazine. I wish all the staff members and students for success in their future endeavours'.*

# EDITORIAL MESSAGE

*Dear Readers,*

*It gives us immense pleasure and satisfaction to introduce our third issue of 'E-PLASTVISION' Magazine for the academic session 2020-21. So this time we have attempted to bring out the talent concealed within our student community, which would help to enhance the practical value of Plastic and Polymer Engineering. This issue includes informative technical as well as non-technical articles and many other things. Plastic and Polymers have given the speed and flexibility to humans to perform their day-to-day task. I express my happiness towards the steps taken by the Institute and the Department in strengthening Engineering and Technology through such a type of activity. We hope you will enjoy reading this issue as much as we have enjoyed while making it. I thank my editorial team, technical team, authors and well-wishers, who are promoting this magazine and making it informative.*

# Co-Editorial Message

Mr Ajinkya M Satdive

Assistant Professor, PPED

*"Young people must take it upon themselves to ensure that they receive the highest education possible so that they can represent us well in future as future leaders."*

*-Dr Ambedkar*

*I am glad to pen this wonderful E-Magazine as an appreciation of the commendable efforts put forth by the team for its next issue. The efforts taken to bring about innovative content is appreciable. This E-Magazine is a platform for the students to express their creative pursuit which develops in them originality of thought and perception. The most important aspect we could derive from this stupendous effort is that it brings out the various technical and analytical skills of budding engineers.*

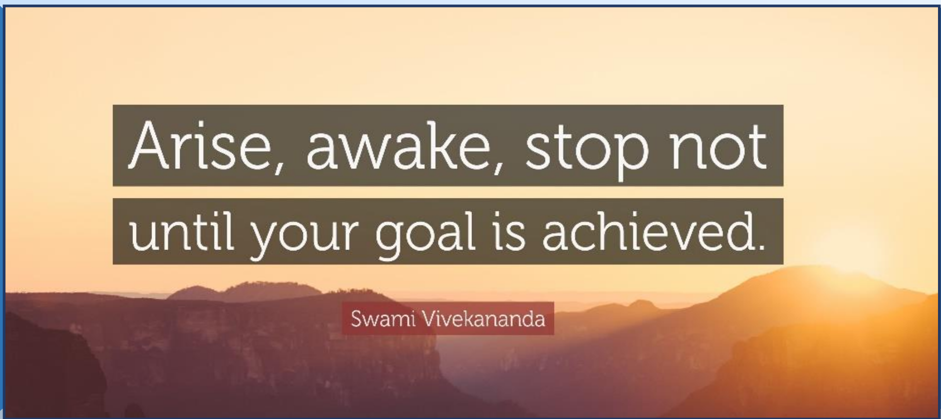
*I welcome students with more interest in bringing the article with more bright concepts and innovative ideas in the next issue. I wish them to experience victory in all of their future endeavours.*

Issue Editor,

Bhargav.A.Patel

(Final year)

*After the Success of our first & second Issue of E-Magazine. It is my immense pleasure to publish the third issue of Plastvision 2021. The objective of this issue is to accumulate latest innovation and technique used in polymer industry for various application in today's life. As we all know this is a very crucial time for all of us during this crisis, I hope we all must stay safe and keep updating our knowledge and ideas.*



# Glance of Department

## MIT-Centre for Industry Relevance in Polymer Science and Technology (M-CIP)


## *Objective*

- *Establish Training Centre for all Plastic manufacturing processes.*
- *Provide maximum facility to new comers in advanced industrial research and innovation.*
- *Provide support to the industry to student & industrial people.*

## *Features of M-CIP*

- *Skill Development*
- *Mould Testing*
- *Trial Runs*
- *Industrial Consultancy*
- *Material Testing*
- *In-Plant for Students*


## *Training Programs*

### *Full time program*

** Plastic Moulding Supervisor*
** Plastic Moulding Operator /Technician*
** Plastic Moulding Helper*

**** Duration : 2 to 6 Months***

### *Specialized short term course*

** Injection Machine Operator*
** Stretch Blow Machine Operator*
** Roto-molding Machine Operator*
** Industrial safety*
** 3D-Printing Technology*

***Duration : 7 To 30 Days***

### *Different Training Programs*

*Other than above mentioned training programs, M-CIP can develop tailor made training programs as per the requirement of industries.*

## *Injection moulding machine*

*Injection moulding machine moulds can be fastened in either a horizontal or vertical position. The majority of machines are horizontally oriented, but vertical machines are used in some niche applications such as insert moulding, allowing the machine to take advantage of gravity. Some vertical machines also do not require the mould to be fastened. There are many ways to fasten the tools to the platens, the most common being manual clamps (both halves are bolted to the platens).*

## *Rotational moulding machine*

*Rotational moulding machines are made in a wide range of sizes. They normally consist of moulds, an oven, a cooling chamber, and mould spindles. The spindles are mounted on a rotating axis, which provides a uniform coating of the plastic inside each mould. Moulds (or tooling) are fabricated either from welded sheet steel or from cast. The fabrication method is often driven by part size and complexity; most intricate parts are likely made out of cast tooling.*

# MIT-Centre for Advanced Materials Research and Technology Lab (M-CAMRT)

## *Facilities at M-CAMRT*

### Processing

* Vacuum furnace
* Two Roll mill
*Compression moulding
* Muffle furnace
* Single screw extruder

### Sample Preparation

Ultrasonicator
*Notch cutter
*Tensile test specimen
*Compression testing machine

### Characterization

*FTIR*

*UV-Vis Spectrophotometer*

*Differential Scanning Calorimeter*

*Thermogravimetric Analyzer*

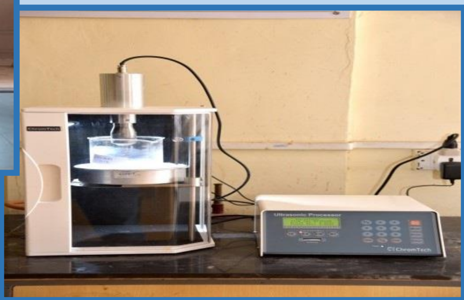
*Dynamic light scattering particle size analyzer*

*Surface zeta potential analyzer*

*Universal tensile testing machine*

*Hardness tester*

*Rheo & Mooney viscometer tester*

# *Our Utmost Priorities*

## *Objectives*

- *Facilitate*
- *Support*
- *Solve*
- *Develop Skills*

## *Our Services*

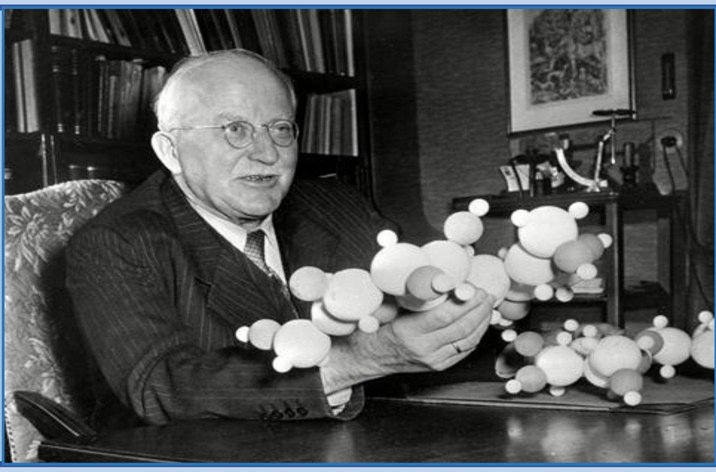
- Training & Testing
- Research
- Safety Management
- Consultancy
- Customer Satisfaction

# ***ISO Certification***

***ISO 9001:2015 Certification to M-CAMRT & M-CIP***

# From Students Corner

## Renowned Polymer Scientists



***Hermann Staudinger, the Foundation of Polymer Science.***

***(1881-1965)***

*Hermann Staudinger's pioneering theories on the polymer structures of fibers and plastics and his later research on biological macromolecules formed the basis for countless modern developments in the fields of materials science and biosciences and supported the rapid growth of the plastics industry. For his work in the field of polymers,* ***Staudinger was awarded the Nobel Prize for chemistry in 1953.***

*Staudinger studied chemistry at the universities of Darmstadt and Munich, and he received a Ph.D. from the University of Halle in 1903. He held academic posts at the universities of Strasburg (now Strasbourg) and Karlsruhe before joining the faculty at the Swiss Federal Institute of Technology in Zürich in 1912. He left the institute in 1926 to become a lecturer at the Albert Ludwig University of Freiburg in Breisgau, where in 1940 an Institute for Macromolecular Chemistry was established under his directorship. Staudinger's wife, the Latvian plant physiologist Magda Woit, was his co-worker and co-author. He retired in 1951.*

***Staudinger's first discovery was that of the highly reactive organic compounds known as ketenes. His work on polymers began with research he conducted for the German chemical firm BASF on the synthesis of isoprene (1910), the monomer of which natural rubber is composed. The prevalent belief at the time was that rubber and other polymers are composed of small molecules that are held together by "secondary" valences or other forces. In 1922, Staudinger and J. Fritschi proposed that polymers are actually giant molecules (macromolecules) that are held together by normal covalent bonds, a concept that met with resistance from many authorities. Throughout the 1920s, the researches of Staudinger and others showed that small molecules form long, chainlike structures (polymers) by chemical interaction and not simply by physical aggregation. Staudinger showed that such linear molecules could be synthesized by a variety of processes and that they could maintain their identity even when subject to chemical modification.***

*The development of polymer sciences stimulated the production of new materials with a wide variety of applications in high technology. As early as 1926, Staudinger emphasized the significance of macromolecules for biochemistry and biology. His intention, supported by his wife, Magda, was to create a new research discipline of macromolecular bioscience or, as we would call it today, macromolecular life science.* ***He concluded his Nobel Prize acceptance speech by describing his vision: "In the light of new insights in macromolecular chemistry, the miracle of life shows an exceptional multitude and perfection of architectures characteristic of living matter."***

*Nature uses a very small number of monomers, such as amino acids and saccharides, to produce a large variety of biopolymers with specific functions in cell structures, transport, catalysis and replication. Today, innovations in life sciences, especially biotechnology, will continue to stimulate the creation of new synthetic biopolymers, with unprecedented control of molecular architectures and biological activities*

## *Subramanian Ramakrishna*

## *(27 August 1960)*

Subramanian Ramakrishna is an Indian polymer chemist, a professor at the department of inorganic and physical chemistry and the designer at macromolecular design and synthesis group of Indian institute of science. He is known for his studies on design and synthesis of controlled polymer structures. The apex agency of the Government of India for scientific research awarded him the Shanti Swarup Bhatnagar Prize for Science and Technology, one of the highest Indian science awards, in 2005, for his contributions to chemical sciences.

Specialization: Polymerizable Surfactants, Polymer Synthesis, Polymer Folding & Assembly and Hyper branched Polymers

Ramakrishna's researches are focused on the study of molecularly designed polymeric materials and the development of synthetic routes such as the trans etherification route developed by his team for preparing segmented polyethylene oxide and their analogues to be used as solid polymer electrolytes. He is known to have succeeded in designing and synthesizing controlled polymer structures with predetermined properties. His team has also demonstrated that the physical properties of conjugated polymers can be modulated by tuning the average molecular conjugation length. Ramakrishna received the Bronze Medal of Chemical Research Society of India and the MRSI Medal of Material Research Society of India in 2002.

# Bio steel fibre

*Bhargav Patel*

*(Final year B.Tech)*

BioSteel is a trademark name for a high-strength fibre-based material made of the recombinant spider silk-like protein. The fabric Bio steel has been made from non-allergenic, vegan material. It includes natural carbon and bacteria, which helps it to degrade when in contact with the enzyme solution. Based on a replication of natural silk, Bio steel's German manufacturer AM Silk says the material is the strongest fully natural material ever. It is also 15% lighter than conventional silk fibers, and is 100% biodegradable.

In comparison with conventional fibres, the Bio steel fibre boasts some outstanding properties:

It is extremely robust, lightweight (with a weight reduction of 30% compared to conventional fibres), antiallergenic, highly breathable and moisture wicking. Bio steel textiles are already used in the apparel industry. The latest generation of this biopolymer is based on natural spider's silk – a natural material that is extremely resilient and elastic.

The new Adidas Bio steel fibre running shoe, for example, which combines high performance with 100% bio-degradability," states Severin Bertsch, Head of Fibre Business, Am silk.

"The sports shoes which have been developed together with adidas are the first products worldwide with a high-performance material made of nature-identical silk biopolymers."

# Reducing Plastic Pollution with Worms

*Yash Dhotre (T.Y B.Tech)*

Waxworms are the caterpillars of insects, recognized generally as wax moths. Waxworms are medium-white caterpillars with black-tipped feet and small, black or brown heads.

Two species of waxworm, *Galleria mellonella* and *Plodia interpunctella* have both been observed eating and digesting polyethylene plastic. The waxworms metabolize polyethylene plastic films into ethylene glycol, a compound which biodegrades rapidly.

Two strains of bacteria, *Enterobacter asburiae* and *Bacillus* isolated from the guts of *Plodia interpunctella* waxworms, have been shown to decompose polyethylene in laboratory testing. In a test with a 28-day incubation period of these two strains of bacteria on polyethylene films, the films' hydrophobicity decreased. In addition, damage to the films' surface with pits and cavities (0.3-0.4 μm in depth) was observed using scanning electron microscopy.

Placed in a polyethylene shopping bag, approximately 100 *Galleria mellonella* waxworms consumed almost 0.1 gram (0.0032 ounces) of the plastic over the course of 12 hours in laboratory conditions.

About 100 wax worms had chewed their way out of a polyethylene shopping bag in around 40 minutes. The bag was significantly shredded within a span of just 12 hours.

The researchers wanted to make sure whether the worms were just chewing through the plastic or actually eating it. Hence, they smashed the worms and smeared the plastic with the paste for observation. They noticed that about 13% of the plastic had disappeared after 14 hours! This led the scientists to believe that there was some compound in the digestive system of the worms that enabled the digestion of the plastic. On thorough analysis of the residual chewed up plastic bag, they also discovered ethylene glycol, the main compound in antifreeze, -confirming [polyethylene] degradation.

As stated earlier, about 100 wax worms were able to make holes in a plastic bag within 40 minutes and reduce it by 92 mg in 2 hours. In other words, the plastic-eating bacteria in the worms were capable of biodegrading plastic at a rate of 0.13 mg per day.

# New Technique Converts Plastic Waste to Fuel

Atharv Khurd (Final Year)

About six billion tons of plastic waste has been generated around the world in the past 50 years. Very little this waste is recycled, and close to 80 percent of it sits in landfills or in the natural environment, where it harms wildlife, leaches harmful chemicals, and emits greenhouse gases.

Nearly a quarter of all plastic waste is polypropylene, used to make things like food containers, bottles, pipes, and clothing. So chemical engineer Linda Wang and her colleagues focused their efforts on reusing this type of plastic. Plastics are hydrocarbons that are made from petroleum, and they can be converted back to liquid fuel. Researchers have typically used a process called pyrolysis to do this, which requires heating the plastics at a high temperature.

The Purdue team use a technique called hydrothermal processing. Others have employed it before to convert other types of plastic feedstock to oil, but the yield of those processes has been low. Wang and her colleagues place the polypropylene in a reactor filled with water, and heat it up to temperatures ranging from 380–500°C for up to five hours at a pressure of 23 Megapascals. At the high heat and pressure, water breaks down the plastic and converts it into oil.

The researchers were able to transform 91% of the plastic into oil. The oil, which is a mix of different hydrocarbon compounds, can be used to make buildings blocks for gasoline and other fuels and chemicals.

The team's preliminary analysis shows the conversion process uses less energy and results in fewer emissions than incinerating polypropylene plastics or mechanically recycling them. Now, the team is working to optimize the conversion process to produce high-quality gasoline or diesel fuels.

# Polymer composites for EMI shielding

Nirmay (TY Year)

Successful protecting of electromagnetic interference (EMI) waves with progressed materials hence develops as major research field to avoid cross talking among electronic gadgets. Advancements of polymer-based EMI half breed with carbonadoes, metallic, attractive and nano/micro materials are summarized well.

Accentuation has been given to speak about the a part of nano/micro materials estimate and shape, their electronic, mechanical, chemical properties in tuning the EMI protecting adequacy (EMI SE) of polymer hybrid. EM radiations ought to be a significant challenge in numerous zones like military, communications, hardware and therapeutic devices/instruments.

Many EMI shielding studies are allotted on conducting polymers like PAN, PP and ABS because of their advantageous properties like lightweight and excellent corrosion resistance. Among the family of conducting polymers, PANI has been identified joined of the foremost highly pursued materials due to its excellent stability and tunable electrical and optical properties. Simple and eco-friendly synthesis, environmental stability and facile doping process to attain adequate conductivity, make PANI much preferable materials in shielding application. PANI in various forms like freestanding films, multilayer films, PANI fabrics, nanoparticles, thick pellets, and its composite with other polymers, are evaluated for his or her SE within the MHz and GHz frequency ranges.

PANI nanofibers are attractive nanostructured materials for EMI shielding thanks to their high conductivity, large ratio, high specific area, and excellent process ability.

Despite noteworthy accomplishments during this field, quick growing request of another era EMI protecting requests more slender, lighter and highly effective polymer cross breeds. Alongside customization of materials properties of polymer/filler, unused materials should be created and investigated to fulfil the request. During this respects, as recently created 2D conducting materials may rise as key filler materials. Moreover, crucial understanding of materials electronic and structural properties is prime to optimized SE of polymer crossovers

# Wearable Electronics Powered by Plastics

Akash Malusare (Final Year)

Wearable technology is any kind of electronic device designed to be worn on the user's body. Such devices can take many different forms, including jewellery, accessories, medical devices and clothing (or elements of clothing). The term wearable computing implies processing or communications capabilities, but in reality, the sophistication among wearable's can vary.

The most sophisticated examples of wearable technology include AI hearing aids, Google Glass and Microsoft's HoloLens, and a holographic computer in the form of a VR headset. An example of a less complex form of wearable technology is a disposable skin patch with sensors that transmit patient data wirelessly to a nearby control device.

Protecting your pricey electronics from wear and tear is one of the key reasons why many wearable activity trackers are made with plastics. Plastics bring a wide range of benefits to wearables, such as:

**Durability**: Plastics are a great choice for wearable electronics because they are durable and long lasting. Plastics add the other meaning of "wear" to wearables.

**Scratch resistance**: Plastics are highly scratch resistant, which is helpful since wearables often are scraped and scuffed during the course of everyday activity.

**Flexibility**: Want to try a tricky new yoga position? Many trackers made with plastics will move with you.

**Lightweight**: Wearable's made with lightweight plastics can feel almost like wearing nothing at all—many people say they forget that they're wearing anything, which leads to the next benefit …

# *Article on Graphene and Montmorillonite Nanocomposites*

*By;*
*Omkar Bhoir*
*Shivansh Jaiswal*
*Abhijeet mohite*

***Synthesis of graphene oxide and montmorillonite (METHODOLOGY)***

- *GCM nanocomposites were prepared by a solvent method with GO and M as precursors.*
- *To prepare GO suspension, a desired amount of GO was loaded in a beaker of deionized water.*
- *Mixture was ultra-sonicated using an ultrasonic cleaner (40 KHz, 200 W) until it was transparent.*
- *After that, the M suspension was added dropwise under stirring and ultra-sonication.*
- *The whole process was conducted at ambient temperature. After 1 h, the mixture was removed from ultrasonic cleaner and continually stirred for a further 2 h to form yellowish-brown homogeneous suspension. To reduce GO-M composite, ascorbic acid is added.*
- *During the reaction, the suspension turned black. After 1.5 h, the suspension was collected through vacuum filtration and washed with deionized water several times, then air-dried at 50 °C, ground and sieved through a 200-mesh sift.*
- *The obtained product was transferred to a glass bottle for storage in a desiccator containing silica gel. According to the proportions of GO to Mt, the resulting materials were denoted as GCM10 (1:10), GCM20 (2:10).*

***CONCLUSION:***
*Composites are currently used in a wide range of activity sectors, ranging from consuming electronics to aeronautics and space industries.*

The excellent mechanical properties and low specific weight from the basis of the increasing volume structural applications. During last few decades a number of novel composite materials have been produced using graphene, which is stronger than any material known. . The performance advantages along with graphene can also reduce inter laminar shear failure, eliminate micro cracking issues within composites and enhance the impact resistance/toughness.
These improved properties of montmorillonite and graphene Nano composites were better than base materials and other carbon filler-based composites. This research can give the knowledge about adsorption properties of GO & MMT nanocomposite in the removal of toxic heavy metals from aqueous solutions.

# *Practice Questions for Gate*

(1) **Buna-N is also called**
(A) Butyl rubber
(B) Nitrile rubber
(C) Neoprene
(D) Thiokol
Answer: Option B

2) __________ **scrap can be recycled & reutilised.**
(A) Bakelite
(B) Epoxy resin
(C) Polythene
(D) None of these
Answer: Option C

3) **Pick out the correct statement.**
(A) Plastics are good conductors of heat and electricity
(B) All the polymers are crystalline in nature
(C) Polymers can be vaporised by heating to a very high temperature
(D) The liquid polymer becomes greasy, then waxy and finally solid on increasing the degree of
Polymerisation
Answer: Option D

4) **Low density polythene as compared to high-density polythene is**
(A) Harder
(B) Tougher
(C) Chemically inert
(D) More flexible
Answer: Option D

5) **Paper like thin plastic articles can be produced by**
(A) Blow moulding
(B) Vacuum thermoforming
(C) Injection moulding
(D) None of these
Answer: Option B

6) **Plasticisers are added to synthetic plastics to**
(A) Impart flexibility
(B) Improve workability during fabrication
(C) Develop new improved properties not present in the original resin
(D) All (A), (B) and (C)
Answer: Option D

7) **Polycaprolactam is nothing but**
(A) Orlon
(B) Nylon-66
(C) Nylon-6
(D) Saran
Answer: Option C

8) __________ **is a natural fibre.**
(A) Cellulose
(B) Dacron
(C) Nylon-6
(D) None of these
Answer: Option A

9) **The main use of butadiene is**
(A) As a plasticiser for unsaturated polyester
(B) In the manufacture of synthetic rubber
(C) As an anti-skimming agent in paint
(D) None of these
Answer: Option B

10) **Teflon is**
(A) Phenol formaldehyde
(B) An inorganic polymer
(C) Polytetrafluoroethylene (PTFE)
(D) A monomer
Answer: Option C

11) **Which of the following types of polymers has the strongest inter p particle forces?**
(A) Elastomers
(B) Fibres
(C) Thermoplastics
(D) Thermosetting polymers
Answer: Option D

12) **Maximum consumption of polymers is in**
(A) Electrical insulation
(B) Toys making
(C) Coating and films
(D) Packaging
Answer: Option C

13) **The synthetic fibres produced from** __________ **are known as rayon.**
(A) Lignin
(B) Cellulose
(C) Polyamides
(D) Ethylene glycol
Answer: Option B

14) **Viscosity of a polymer solution or melt**
(A) Decreases with increase in molecular weight
(B) Decreases with increase in temperature
(C) Increases with increase in temperature
(D) Does not vary with temperature rise
Answer: Option C

15) **Polyvinyl alcohol is used as a**
(A) Cation/anion exchanger
(B) Water soluble adhesive
(C) Textile fibre
(D) Non-sticky coating on frying pans
Answer: Option B

16) **Molecular weights of plastics ranges from**
(A) 1000 to 5000
(B) 5000 to 1000
(C) 20000 to 25000
(D) 109 to 1011
Answer: Option C

17) **Poly-methyl-methacrylate (PMMA) is known as**
(A) Bakelite
(B) Teflon
(C) Perspex
(D) Nylon-6
Answer: Option C

18) **Bristles of toothbrushes are made of**
(A) Nylon-6
(B) Nylon-66
(C) Polystyrene
(D) PVC
Answer: Option B

19) **Most of the plastics are safe to be used upto a maximum temperature of __________ °C.**
(A) 100
(B) 150
(C) 350
(D) 450
Answer: Option B

20) **Contact lenses for eyes are made of Perspex, which is nothing but**
(A) poly-methyl-methacrylate
(B) Polystyrene
(C) Unsaturated polyester
(D) Polypropylene
Answer: Option A

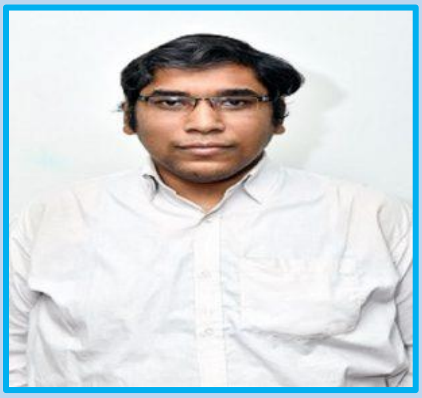
# Gratitude from the Heart!



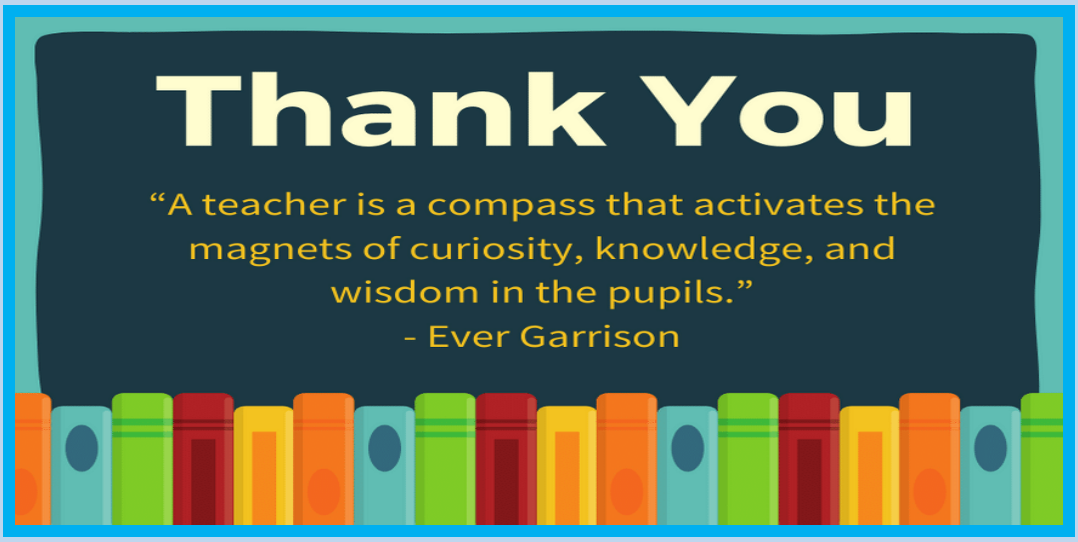











Thank You
“A teacher is a compass that activates the magnets of curiosity, knowledge, and wisdom in the pupils.”
- Ever Garrison

ABC
education
THANK YOU
TEACHER

## *Department of Plastic & Polymer Engineering*

## *In / Off Campus Placement, Academic Year 2020-21*

"When planning for a year, plant corn. When planning for a decade, plant trees. When planning for life, train and educate people."

G.S. Mandal's

# Maharashtra Institute of Technology Aurangabad

(An Autonomous Institute)

DTE Code 2113

(Institute approved by AICTE, New Delhi and DTE Mumbai, Permanently affiliated to Dr.Babasaheb Ambedkar Marathwada University)

## Department of Plastic & Polymer Engineering

Batch : 2019-20 | Think Engineering and Technology | Think Placement and Startups | Think MIT | Batch : 2019-20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Rushikesh Taro
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Krushna Pawar
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Dhruvtara Wiretech Pvt. Ltd. Aurangabad


Rushikesh Lathe
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Preditek Components Pune


Vyankatesh Kshirsagar
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# Maharashtra Institute of Technology Aurangabad

(An Autonomous Institute)

DTE Code 2113

(Institute approved by AICTE, New Delhi and DTE Mumbai, Permanently affiliated to Dr.Babasaheb Ambedkar Marathwada University)

## Department of Plastic & Polymer Engineering

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