

# **M.Tech. in Material Science and Engineering**

**with special focus on**

## **Polymer, Ceramic and Metallurgy**

*Department of Science, School of Technology*

### **About the Programme**

The program aimed to promote interdisciplinary master degree programme offered by Department of Science, School of Technology where students will get foundational training and research in Material Science and Engineering.

Curriculum tailored to bring students to the forefront of research and development in the areas of polymers, ceramics, smart materials, biomaterials and metallurgy. It also offers one-year research /Industrial project with state of the art laboratory facilities to make students pioneering in the field of futuristic application, productive scientists, excellent teachers, entrepreneurs and innovative independent researchers.

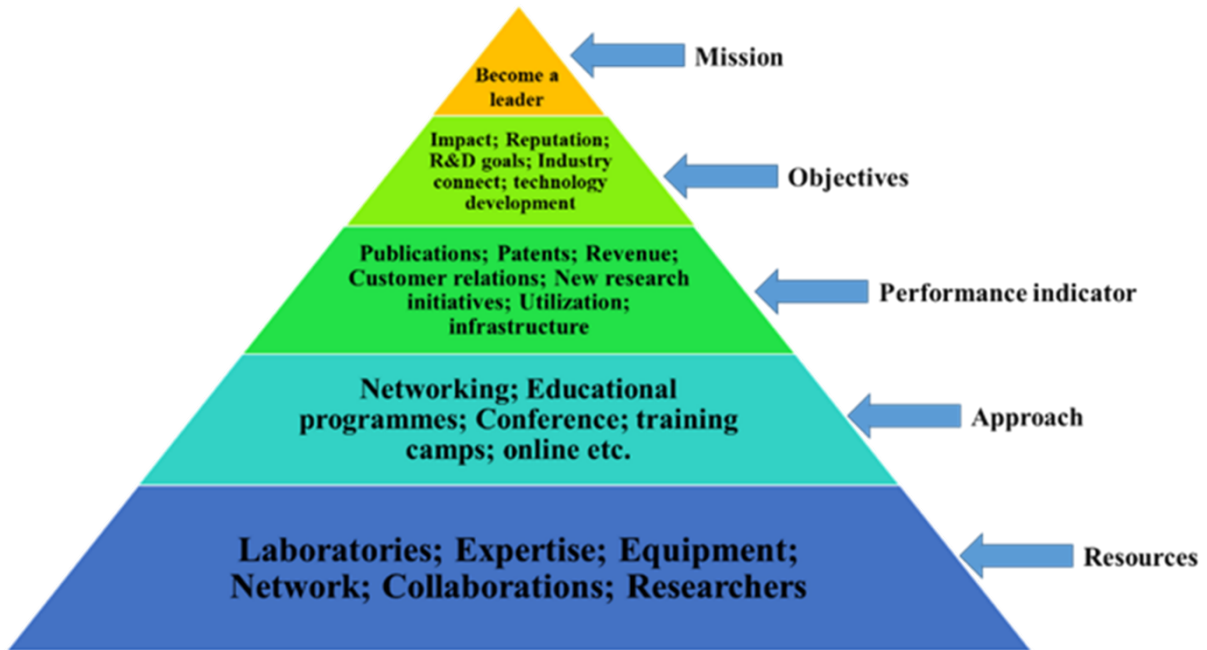
### **Vision**

Material Science and Engineering will facilitate the research and education in emerging fields of materials and nanotechnology to develop the innovative next generation technologies for social and industrial benefit.

### **Mission**

- ✓ To focus primarily on Energy related research and development from the materials, metallurgy and nanotechnology perspective
- ✓ To initiate, promote, serve and develop these areas through research, education and consultancy programmes
- ✓ To engage collaborative research with inter-University and industry connect to serve current and upcoming goals in materials and nanotechnology
- ✓ To train the people to take up the challenges in the thrust areas and develop novel technologies for the benefit of society and industry
- ✓ To create systematic roadmap and key performance indicators to provide leadership goals.

- ✓ To become one of the top centres in the area of research within 10 years.
- ✓ To support the faculty, students and researchers of materials and nanotechnology to develop fundamental understanding of technology which facilitates development of advanced technologies.



## Expected Key Outcomes

The Material Science and Engineering under the umbrella of Department of Science is a nodal point to connect the industry and academia in materials science and nanotechnology

Aim to develop common research and characterisation facilities, laboratories to take up the challenges in the proposed thrust areas

Initiates training programmes and conferences in the thrust research areas

Encourage M.Tech. and Ph.D. student enrolments in the thrust areas with various interdisciplinary research initiatives and serve as mentor to motivate the students toward successful career

Focuses on the development of new technologies in the thrust areas.

Engages in collaborative research initiatives of various areas

Networking with people in the area of research and serve as single contact point to establish high-end collaborative research initiatives.

## **Area of Research**

**Functional Materials:** Design, synthesis, characterisation and application of Materials used in energy storage, energy harvesting, water purification, health care and environment.

**Nanomaterials:** 2D materials, quantum materials, biomaterials, photo-active and self-assembled materials

**Polymers:** Synthesis, functionalization and application of conductive polymers, membranes, supramolecular polymeric systems, biodegradable polymers, aerosols and green methods in polymer research.

**Ceramics:** Low cost ceramic materials, glaze, binders, ceramic supported catalysis and new methods for ceramic processing technologies.

**Metallurgy:** Advanced processing and characterization of Aluminium alloys, Magnesium alloys, Copper alloys, Titanium alloys, Steel, Supper alloys, High entropy alloys and Composites materials.

## **Associated Labs**

### **1. Material Synthesis Laboratory:**

Solution phase synthesis set up, Fume hoods, Hydrothermal synthesizer, flow reactor, ball-milling, microwave synthesizer, Electro-spinning and ultra-sonicator. UV-Vis Spectrophotometer, Glove box, Flash chromatography, Muffle furnace, Centrifuge, Ampere meter, Tablet dissolution test apparatus, Dissolution test apparatus, Carbon filter (Photocatalytic system), pH meter, Conductivity meter, UV Chamber, Polarimeter, Potentiometer, Ultrasonic probe sonicator, Tablet disintegration test apparatus, Infrared spectroscopy, High Performance Liquid Chromatography, Potentiostat/Galvanostat, Auto-titrator, Gas Chromatography.

### **2. Material Characterization Lab:**

Infrared spectroscopy, Atomic Absorption Spectroscopy, Gas Chromatography, Gas Chromatography-Mass Spectroscopy, High Performance Liquid Chromatography, Inductive

Coupled Plasma-Mass Spectroscopy, X-ray Diffraction analyzer, X-ray Photo Electron Spectroscopy, CHNSO Analyzer) Scanning Electron Microscopy, Transmission Electron Microscopy, BET surface analyzer, Thermo gravimetric analyzer, Differential Scanning Colorimeter,

### **3. Device Fabrication Laboratory:**

Current-voltage, FET measurements, Low temperature measurements, IPCE, PL, Laser PL, Battery tester, Battery assembly line, Hall Measurements. Solar cell, Battery, Bio-Sensor and Equipment for water cleaning and purification will be develop.

### **Eligibility**

- B.E./B.Tech. in Mechanical/Electrical/Electronic/Chemical/Material Science and Engineering,
- B.Sc. Hons. in Physics/Chemistry or equivalent in 4 year programme
- M.Sc. in Physics/Chemistry/Electronic/ Nanotechnology with minimum 60% or CPI/CGPA of 6.5 on a 10-point scale.

## Course structure of M. Tech. in Material Science and Engineering

The course structure is prepared by taking into consideration the available expertise, course structure of National and International institutes such as IITs and NITs and in line with IOE and COEs proposed. Proposed course structure to meet the objectives as mentioned above.

Subject	L	T	P	Credit	Contact Hours
<b>Semester-I</b>					
C1–Defects, Dislocation and Diffusion in Solids	3	0	0	3	34
C2–Thermodynamics and Phase Transformations	3	0	0	3	3
C3–Physics of Materials Properties	3	0	0	3	3
C4–Advanced Material Synthesis and Processing	3	0	0	3	3
C5–Techniques for Characterization of Materials	3	0	0	3	3
C6–Crystallography and diffraction	3	0	0	3	3
C7–Numerical methods, Modelling and Simulation in Material Science and Engineering	2	0	0	2	2
MSE Lab-1	0	0	6	3	6
Total	20	0	6	23	26

<b>Semester-II</b>					
Subject	L	T	P	Credit	Contact Hours
C8-Artificial Intelligence for Materials Analysis	3	0	0	3	3
C9-Research Methodology Intellectual Property Rights and Technical Writings	3	0	0	3	3
Elective 1	3	0	0	3	3
Elective 2	3	0	0	3	3
Elective 3	3	0	0	3	3
Elective 4	3	0	0	3	3
MSE Lab – 2	0	0	6	3	6
<b>Total</b>	18	0	6	21	24
<b>Semester-III</b>					
Seminar/ /Research Review Paper				4	
Dissertation/Industrial Training/Industrial project Part 1				16	
<b>Total</b>				20	
<b>Semester-IV</b>					
Seminar//Research Review Paper				4	
Dissertation/ Industrial project Part 2				16	
<b>Total</b>				20	
Sem. I	Sem. II	Sem. III	Sem. IV	Total Credit	Total Contact Hours
23	21	20	20	84	50

## **List of Elective Courses**

E1 – Principles of Extractions of Metallurgy

E2 – Electronic Properties of Materials

E3 – Degradation of Materials

E4 – Introduction to Biomaterials and Applications

E5 – Mechanical behaviour of Materials

E6 – Nanoscience and Nanomaterial's

E7 – Electronic Materials and Devices

E8 – Energy Materials

E9 – Solar Photovoltaic Science and Engineering

E10 – Surface Engineering and Tribology (Wear)

E11-Modelling and Simulation of Materials

E12-Advances in Material Sciences

E13-Sustainable and Smart Material

E14-Advanced Engineering Materials

E15-Corrosion of Materials

E16-Functional Materials

E17-Polymeric Materials

E18-Organic Electronic Material-synthesis, applications and properties

E19-Composite Materials

E20-Degradation of Materials

E21-Ferrous and Nonferrous materials

E22-Additive manufacturing

E23-Battery

## Faculty Body of the Centre and their Profiles

### **Dr. Manoj Pandey**

Associate Professor

Department of Science

Email: [manoj.pandey@sot.pdpu.ac.in](mailto:manoj.pandey@sot.pdpu.ac.in)

Phone: +91 79 2327 5444

**Area of interest:** Research focuses on addressing energy, environmental and health issues. Synthesis of energy harvesting materials, biosensor and OLEDs, supramolecular materials for bio applications, synthesis of novel adsorbents for water remediation, biofuel technology, developing strategies for C-H activation and new synthetic methodology.

**RIMS page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=manoj.pandey>

### **Dr. Ramesh K. Guduru**

Associate Professor

Department of Mechanical Engineering

E mail: [Ramesh.Guduru@sot.pdpu.ac.in](mailto:Ramesh.Guduru@sot.pdpu.ac.in)

Phone: +91 79 2327 5352

**Area of interest:** Energy Storage, Electrochemistry and Corrosion of Materials, Coatings, Hydrogen Generation, CO<sub>2</sub> Capture and Mechanical Behaviour of Materials

**RIMS Page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=ramesh.guduru>

### **Dr. Manoj Kumar**

Associate Professor

Department of Science

Email: [manoj.kumar@sse.pdpu.ac.in](mailto:manoj.kumar@sse.pdpu.ac.in)

Phone: +91 79 2327 5455

**Area of interest:** Silicon solar cells and its characterisation, pervoskite materials for energy harvesting, electrocermics for their dielectric properties.

**RIMS page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=manoj.kumar>

### **Dr Pravin V Kodgire**

Associate Professor

Department of Chemical Engineering

Email: [Pravin.Kodgire@sot.pdpu.ac.in](mailto:Pravin.Kodgire@sot.pdpu.ac.in)

Phone: +91 79 2327 5477



**Areas of Interest:** Fluid Mechanics, Energy and Environment, Biofuels, Nano materials for structural applications etc. Polymer composites.

**RIMS Page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=p.kodgire>

**Dr. Pankaj Sahlot**

Assistant Professor

Department of Mechanical Engineering

Email: [pankaj.sahlot@sot.pdpu.ac.in](mailto:pankaj.sahlot@sot.pdpu.ac.in)

Phone: +91 79 2327 5460

**Area of interest:** Additive manufacturing, Friction Stir Welding and processing, Microstructural and mechanical characterization of materials

**RIMS Page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=pankaj.sahlot>

**Dr. Syed Shahabuddin**

Assistant Professor

Department of Science

Email: [syed.shahabuddin@sot.pdpu.ac.in](mailto:syed.shahabuddin@sot.pdpu.ac.in)

Phone: +91 79 2327 5338

**Area of interest:** Research area focussing on waste water treatment and Energy. The area of interests include: Synthesis of Nanomaterials, 2D-MXene, Graphene, Conducting polymer nanocomposites for water treatment, photo catalysis, supercapacitors, dye-sensitized solar cells, nanofluids for solar thermal applications and phase change materials.

**RIMS page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=syed.shahabuddin>

**Dr. Pankaj Yadav**

Assistant Professor

Department of Solar

Email: [pankaj.yadav@sse.pdpu.ac.in](mailto:pankaj.yadav@sse.pdpu.ac.in)

Phone: +91 79 2327 5315

**Area of interest:** Thin film devices, solar photovoltaic, perovskite solar cells, hydrogen generation, fuel cells, energy generation and storage devices, and electro analytical characterizations.

**Web page:** <https://drpankajyadav.wixsite.com/mysite-1/resume>

**Dr. Vivek Patel**

Assistant Professor

Department of Mechanical Engineering

Email: [vivek.patel@sot.pdpu.ac.in](mailto:vivek.patel@sot.pdpu.ac.in)

Phone: +91 79 2327 5484

**Area of interest:** Friction stir welding of aluminum and magnesium alloys; Friction stir ; Processing, Grain refinement; Superplasticity; Surface composites; Ultrasonic welding

**RIMS page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=vivek.patel>

**Dr. Mohendra Roy**

Assistant Professor

Department of Science/ ICT

Email: [mohendra.roy@sot.pdpu.ac.in](mailto:mohendra.roy@sot.pdpu.ac.in)

Phone: +91 79 2327 5483

**Area of interest:** Artificial Intelligence, Physics of Intelligence, Bio Photonics, Biosensors

**RIMS Page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=mohendra.roy>

**Dr. Kalisadhan Mukherjee**

Assistant Professor

Department of Science

Email: [Kalisadhan.Mukherjee@sot.pdpu.ac.in](mailto:Kalisadhan.Mukherjee@sot.pdpu.ac.in)

Phone: +91 79 2327 5450

**Area of interest:** Nano-materials, Chemical Sensor, Photovoltaic, Adsorbents

**RIMS Page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=kalisadhan.mukherjee>

**Dr. Manish Kumar Sinha**

Assistant Professor

Department of Chemical Engineering

Email: [manish.sinha@sot.pdpu.ac.in](mailto:manish.sinha@sot.pdpu.ac.in)

Phone: +91 79 2327 5314

**Area of interest:** Membrane Fabrication, Functional Materials, Water Treatment

**RIMS Page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=manish.sinha>

**Dr. Brijesh Tripathi**

Assistant Professor

Department of Science

Email: [brijesh.tripathi@sse.pdpu.ac.in](mailto:brijesh.tripathi@sse.pdpu.ac.in)

Phone: +91 79 23275455

**Area of interest:** Research focuses on modelling, simulation and experimental development of electronic devices, dye-sensitized solar cells, organic solar cells, concentrator photovoltaics and thin film solar cells.

**RIMS page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=brijesh.tripathi>

**Dr Balanagulu Busupalli**

Assistant Professor

Department of Science

Email: [brijesh.tripathi@sse.pdpu.ac.in](mailto:brijesh.tripathi@sse.pdpu.ac.in)

Phone: +91 79 23275263

**Areas of Interest:** Energy harvesting from soft materials such as polymer and lipid-based vesicular systems forms the core research interest. Electricity generation from shape fluctuations induced in such soft material systems through external agents such as temperature and osmotic pressure. Electrochemical hydrogen generation from metal-based layered and molecular materials. Chemical modifications of such metal-based molecular materials for energy applications.

**RIMS Page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=busupalli.balanagulu>

**Dr. Rama Gaur**

Assistant Professor

Department of Science, School of Technology

Email: [rama.gaur@sot.pdpu.ac.in](mailto:rama.gaur@sot.pdpu.ac.in)

Phone: +91 79 23275356

**Area of interest:** Nanoscale materials for photocatalytic applications. Electrochemical sensing, energy storage.

**RIMS Page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=rama.gaur>

**Dr Paawan Sharma**

Assistant Professor

Department of Information and Communication Technology

Email: [Paawan.Sharma@sot.pdpu.ac.in](mailto:Paawan.Sharma@sot.pdpu.ac.in)

Phone: +91 79 23275313

**Area of Interest:** Information and Communication Technology, Artificial Intelligence.

**RIMS Page:** <http://orsp.pdpu.ac.in/adminfacviewprofile.aspx?facid=paawan.sharma>