

TIJU THOMAS

Interdisciplinary Program, &

Department of Metallurgical and Materials Engineering, &

Inter-domain coordinator, Indian Solar Energy Harnessing Center (ISEHC) – An Energy Consortium

Indian Institute of Technology Madras

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RESEARCH INTERESTS:

Dr. Thomas' research group (*Applied Nanostructures Engineering and Nanochemistry/ANeN*) focuses on developing compositionally complex oxides, oxynitrides and nitrides, and nanometals for energy and environmental engineering related applications. Among the classes of materials identified here, (i) nano-morphology transformations and control, and (ii) high pressure synthesis and processing are being currently pursued.

In particular using functional nanostructures identified above for solar energy harvesting, efficient light emission systems, and environmental remediation have been the group's engineering thrust areas. While doing so, at times, we often stumble upon novel and exciting atomic-scale phenomena (eg., digestive ripening in oxides, chemically-induced nanorod to nanodot transition, luminophores as atomic-scale structural probes). Eco-friendly, green engineering perspectives guide the synthetic chemical and fabrication routes that the group develops for fulfilling its goals. Furthermore correlations between synthesis, materials processes, and device performance is an increasingly common theme in the group's activities.

Brief bio:

Tiju Thomas is an Assistant Professor and head of the “*Applied Nanostructure Engineering and Nanochemistry*” lab at the Department of Metallurgical and Materials Engineering (Indian Institute of Technology Madras, IITM) in Chennai, India. Before coming to IITM, he was working as a Faculty Fellow at the Materials Research Center in the Indian Institute of Science, Bangalore. Prior to that he was on an industry-academia joint project involving University of Toronto (Chemistry, Optical Science), Memorial University of Newfoundland (Physics), and Lumentra Inc. (a start up company, specializing in light emitting devices). He has graduate degrees (MS, PhD; Electrophysics) from the School of Engineering in Cornell University. His work is highly interdisciplinary; he has published with electrical engineers, applied physicists, and polymer and solid state chemists over the years. He also holds a master's degree (M.S (Engg.)) from the Theoretical Sciences Unit in Jawaharlal Nehru Centre for Advanced Scientific Research. His undergraduate degree is in electrical engineering.

EDUCATION:

Jan. 2011

MS, Ph.D

(Major: Electrophysics, Minors: Materials science and electrical engineering)
Interdisciplinary program run by the ‘*School of Electrical and Computer Engineering*’, Cornell University, Ithaca, NY, USA.

Thesis : Rare Earth Doped Gallium Nitride Powders: Synthesis, Purification, Nanosizing, Luminescence Mechanism, Electrophoretic Deposition, Sintering And Characterization.

Aug. 2007 **MS (Engineering)** (Major: Applied Physics, Minor: Materials Science)
Jawaharlal Nehru Center for Advanced Scientific Research (JNCASR)
Jakkur, Bangalore, India.

Thesis: Polytypes and Stacking Faults in C, Si, Ge and Silicon Carbide

EMPLOYMENT HISTORY:

Jan 2015-current **Assistant Professor**
Interdisciplinary Technology Program, &
Department of Metallurgical and Materials Engineering,
Indian Institute of Technology Madras
Chennai, Tamil Nadu, India

April 2012-Dec 2014 INSPIRE Faculty
Principal Investigator,
Materials Research Centre, Indian Institute of Science (Bangalore)

Feb 2011 - Feb 2012 Joint Postdoctoral researcher with
(a) Department of Physics and Physical Oceanography,
Memorial University of Newfoundland(Prof. Kristin Poduska Group)
&
Institute of Optical Sciences, University of Toronto
(with Dr. VenkatVenkataraman).

(b) Visiting Scientist,
Department of Chemistry,
University of Toronto (Prof. Cynthia Goh Group)

(c) Scientific consultant, Lumentra Inc., Toronto, Canada

Aug. 2007 – Jan 2011 Graduate Research Assistant,
School of Engineering, Cornell University
(Prof. Michael G. Spencer group)

March 2010 – Jun 2010 Research Assistant,
School of Chemistry and Chemical Biology, Cornell University
(Prof. Francis J. DiSalvo group)

Aug. 2005 – Aug. 2007 Research Scholar, Theoretical Sciences Unit,
Jawaharlal Nehru Center for Advanced Scientific Research
(Prof. UmeshWaghmare group)

STRENGTHS:

- Explicit focus on creating a well-functioning, cordial, cross-disciplinary research team that has visible output on a regular basis. This ensures career development of all who associate with us.
- Experience working with students from very diverse backgrounds (chemistry, materials, polymers, electrical, pharmaceutical sciences, physics, nanotechnology, chemical engg., mechanical engg. etc).

- Very student centric approach to pedagogy and research mentoring.
- Complete openness to work with student's strengths and skills, and sensitivity towards her/his weaknesses and/or background.
- Commitment to human resource development for the greater good of the society.
- Willingness to engage with both blue skied academic projects, as well as industrially/socially relevant technological problems.

FELLOWSHIPS/SCHOLARSHIPS/PROFESSIONAL RECOGNITIONS:

- (a) Kishore Vaigyanik Protsahana Yojana (KVPY): A Science Scholarship instituted by Indian Institute of Science given to students in India showing promise as scientists.
- (b) Scholarship from JNCASR given to MS/PhD students based on an all-India written test and individual interviews to test competency in science and engineering research.
- (c) Full Graduate Research support from Cornell University, Ithaca (NY, USA).
- (d) Indian National Science Academy's INSPIRE (Physics) Faculty Fellowship (2011).
- (e) Fast Track Young Scientist Award from Department of Science and Technology, Govt. of India (2016).
- (f) Member, Editorial Advisory Board, Convergence, A Journal by 'Loyola Institute of Frontier Energy (LIFE)', Loyola College, Chennai,
- (g) Visiting Faculty (by Invitation; funded via a Chinese Academy project), Ningbo Institute of Materials Technology (Chinese Academy of Sciences)
- (h) Adjunct Associate Professor (by Invitation), Shibaura Institute of Technology in Japan (2018-2019 academic year)
- (i) Member (one of the founding members), *International Center for Clean Water – A registered society*. (An IITM initiative, spearheaded by Prof. T. Pradeep and colleagues) (2018)
- (j) Inter-domain Coordinator along with Prof, Sathyan Subbiah of the “*Indian Solar Energy Harnessing Center – ISEHC an Energy Consortium*” headquartered at IITM. (nucleated via a ~39.7 Cr DST project) (2018)
- (k) Fully funded invitation to INESC-TEC, a leading translational research institute in Portugal and IRESEN (Green Energy Park) in Morocco for identifying *strategic international technology* partnerships involving India (in particular the *ISEHC- an Energy Consortium* headquartered in IITM). (Jul 25-31, 2018)
- (l) Elected member/fellow of the Indian National Young Science Academy (2017/2018).

Important outcomes of recent interactions/collaborations with academic colleagues within IITM and our visitors:

* Co-convended "*Industry-academia*" interaction meeting on Surface Engineering (July 23, 2015).

Initiating discussions on A Center for Surface Engineering in IITM (co-conveners: Prof. Ganesh Sundararaman, Prof. M. Kamaraj, Prof. A. Subrahmanyam, Dr. Srinivasa Rao Bakshi)

* *Co-editor* (along with Prof. Manoj Gupta of NUS) for Special Issue on "*Smart Interfaces in Nanostructured Materials*", CSM International (scheduled for Jan 2017)

Media coverage and international attention of hydrogen energy and water research work from group:

“From The Lab: New way to clean water polluted by mercury”

(May 22, 2018)

<http://indianexpress.com/article/explained/from-the-lab-new-way-to-clean-water-polluted-by->

[mercury-5185917/](https://doi.org/10.1039/C8CY01859G)

** corresponding patent – available for licensing

Our work featured in 'Science Trends', a technical magazine based off the US, having wide circulation. (Aug 2018)

<https://sciencetrends.com/water-splitting-in-contaminated-waters/>

** corresponding patent – available for licensing

“Room temperature hydrogen production from Hg contaminated water, with desirable throughput, and simultaneous Hg-removal” (Dec 2017)

<https://reginnovations.org/key-scientific-articles/room-temperature-hydrogen-production-hg-contaminated-water-desirable-throughput-simultaneous-hg-removal/>

** corresponding patent – available for licensing

Journals I have refereed/am refereeing for: RSC Physical Chemistry Chemical Physics, RSC Crystal Engineering Communication, Materials Chemistry and Physics, Plasmonics, Journal of Electrochemical Society, Journal of Hazardous Materials, Inorganics, IEEE Magnetics, Materials Research Symposium Proceedings, Research on Chemical Intermediates, Korean Journal of Chemical Engineering, Solar Energy, Transactions of Indian Institute of Metals, Scientific Reports (a journal from the *Nature* Publishing Group), Journal of Industrial and Engineering Chemistry, Materials Physics and Chemistry, ACS Applied Energy Materials, Materials Characterization, Journal of Materials Chemistry C, Bulletin of Materials Science.

PROFESSIONAL AFFILIATIONS: Materials Research Society, IEEE, American Chemical Society, Electron Microscopy Society of India (Life member), Rare Earth Society of India (Life member).

Patents

1. “A perovskite $Na_{0.5}A_{0.5-x}RE_xZO_3$ and a process thereof”, Indian Patent (application no. 2211/CHE/2013)
2. “Soft, self-assembly process of low dimensional Au nanostructures using slanted-substrate method” (2016,) Indian Patent (application no. 201641033963); filing date: 04/10/2016.
3. "Hydrogen generation from waste water via galvanic corrosion of in-situ formed aluminum amalgam" (2016) (Indian Patent application no. 201641027502; International application no: PCT/IN2017/ 050334
4. “Digestively-ripened seed/nucleus-driven rapid and high yield synthesis of monodispersed ceramic/compound semiconductor nanoparticles” (2017) (IIT Madras IDF- 1567 – Indian Patent filed)

Projects with IITM affiliation

Project No	Agency	Title	Start Date	Close Date	Value Rs. In Lakhs
SOL/1819/001/DSTX/HOCX	DST	Indian Solar Energy Harnessing Center – An Energy Consortium (Am one of the two Inter-domain coordinators, with Prof. Sathyan S; coordinating all four domains – PV, Solar Thermal, Solar Fuels, and Energy Storage - of the Consortium)			3973
CCE/QIP/04/TT/7-18	AICTE	Materials Chemistry: Solids, Nanomaterials, and Semiconductors (QIP program: 29.10.2017 - 05.11.2017)	29-10-2017	05-11-2017	4.5
MET1617146D STXTIJU	Department Of Science & Technology	Morphology Transitions In Nanostructures Of Transition/rare Earth Metal Compunds And Their Applications	24-04-2016	-	24.14
MET1516139D STXTIJU	Department Of Science & Technology	Liquid crystal nanoscience: new directions in hybrid materials research Full solar spectrum absorbers for photovoltaic applications	01-01-2015	08-11-2019	24.26
MET1415832N FIGTIJU	New Faculty Initiation Grant	Complex Oxides And Oxynitrides	02-04-2015	02-03-2017	5.00
MET1516655N FSCTIJU	New Faculty Scheme	Self-assembled And Nitride Transition Metal Compound Nanostructure For Charge Transfer (in Energy Harvesting, Sensing Platforms) And Remediation Related	15/05/2015	14/05/2018	35.00

	Applications				
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Presentations

Invited talks at INESC-TEC Portugal and IRESEN-Green energy park on the strategic theme: “*Identification of international energy research partnerships with India via ISEHC consortium*” (July 25-31, 2018)

Conducted discussions at the University of Porto to facilitate engagement through joint supervision and joint doctoral programs. In conjunction with the Faculty of Engineering in University of Porto (FEUP), envisioned a *mobility masters* program on entrepreneurship (to be run on a parallel track without affecting current MS(Entrepreneurship at IITM). Proposal to be taken forward via an MoU, on the anvil.

Invited talk as an IITM-Delegate at the *University of Southampton-IITM Strategic Partnership and Workshop* (11 July 2018)

“*Inclusive education – preparing everyone for thriving in our society*”, Teaching Learning Center, II Madras (1 May, 2018) (*Invited Talk*)

“*A tool box approach to band gap tuning: curious possibilities with multivalent oxides, ferrites and digestively ripened quantum dots*”, (Feb 28, 2018) International Seminar on Advanced Materials- University of Madras (*Invited Talk*)

“*Inclusive education – preparing everyone for thriving in our society*”, Teaching Learning Center, II Madras (17 Nov, 2017) (*Invited Talk*)

“*Developing a balanced – technically and ethically sound – proposal*”, Loyola College, Chennai (23 Oct, 2017)

“*Science and Engineering of - Nitrides & Nanostructures*”, Guindy College of Engineering (Mar 13, 2017) (*Invited Talk*)

“*Science and Engineering of - Nitrides & Nanostructures*”, Sri Ramakrishna Engineering College (Feb 17, 2017) (*Invited Talk*)

“*Science and Engineering of - Nitrides & Nanostructures*”, DST-INSPIRE Meeting, Chandigarh University (Feb 9-10, 2017) (*Poster*)

"(Nano) Materials Challenges at the Energy-Environment nexus" UGC- Refresher at the University of Madras (Nov 15 2016) (Invited Talk)

*"(Nano) Materials Challenges at the Energy-Environment nexus"*Valedictory Speech at end of a Certification Program, Center for Research in Science and Technology (CRIST), Stella Maris College, Chennai (March 11 2016) (Invited Talk)

*"(Nano) Materials Challenges at the Energy-Environment nexus"*ZnO JSPS-DST meetings, IITM, Chennai (Jan 2016) (Invited Talk)

"(Nano) Materials Challenges at the Energy-Environment nexus", Recent Advances in Nano- and Bio-Inorganic Materials (RANBM 2015), MSRIT, Bangalore, Karnataka (Jul 16, 2015) (Invited Talk)

"(Nano) Materials Challenges at the Energy-Environment nexus", Department of Physics and Nanotechnology, SRM University, Tamil Nadu (Jul 2, 2015) (Invited Talk)

"Materials Challenges at the Energy-Environment nexus", Dalian Institute of Chemical Physics – Chinese Academy of Sciences (Oct, 2014) (Invited Talk)

"Water remediation using room temperature synthesized oxides", International Conference in Asia-IUMRS (December 2013) (Oral presentation).

"Materials Challenges at the Energy-Environment nexus", Institute of Metals Lecture, Indian Institute of Technology (Madras) Oct 2013. (Invited Talk)

"Fabrication of periodic array of 1-D Au using self-assembly, electron beam and focused ion beam lithography", International Conference in Asia-IUMRS (December 2013) (Poster)

"One step Synthesis and Characterization of a Single-Composition Trichromatic White-Light $Y_2O_3:Eu^{3+},Zn^{2+},Bi^{3+}$ phosphor", International Conference in Asia-IUMRS (December 2013)(Poster)

"Removal of malachite green from aqueous solution by adsorption onto combustion derived nano $CuFe_2O_4$ ", International Conference in Asia-IUMRS (December 2013) (Poster).

"Design, development and analysis of functional materials", M. S. Ramaiah Institute of Technology, Bangalore, Apr 2013.(Invited Talk)

"Functional Materials for a sustainable future", JNCASR-Cambridge Winter School, Bangalore, Dec 2012.(Poster)

"Complex synthesis-photoactivity correlations in functional oxides", American Chemical Society-IISc meeting, Bangalore, Oct 2012.(Poster)

"Design, development and analysis of functional materials", Indian National Science Academy, Delhi, India, Nov 2011.(Invited Talk)

"Trends in electrical properties and optical profiles of electrodeposited ZnO/metal posters and

presentations contacts", Canadian Association of Physics, St. John's, Newfoundland, Jun 2011. (Poster)

"Nanoparticle synthesis of luminescent materials: high temperature, mechanical and aqueous solution growth methods", Chemical Biophysics conference, Toronto, Mar 2011. (Talk)

"Gallium Nitride powders: a prospective low cost material for optoelectronic, high pressure and radiation specific applications?", Cornell Electron Devices Society Seminar, Ithaca, April 2010. (Talk)

"Purification and luminescence enhancement in Europium doped GaN powders", Materials Research Symposium, Boston, December 2008. (Poster)

"Synthesis and Characterization of Europium doped GaN", Cornell Engineering Research Conference, Ithaca, September 2008. (Talk)

"Polytypes and Stacking Faults in C, Si, Ge and SiC", JNCASR, Bangalore, June 2007. (Poster)

"Stacking Faults in Silicon Carbide", ICMR-JNCASR Winter School in Chemistry and Physics of Materials, Bangalore, 2006. (Poster)

Professional services to IITM so far (Jan 2015 - date):

(i) **Doctoral examiner** (internal) for RadhaGobindaBhuin (Registration no. CY10D047); date: 6th July 2015

(ii) Frequently serve in the **Institute Postdoc Selection Committee**.

(iii) **Advisor** for IITM summer fellows: Akshay Chaudhary (IITM; March-July 2015)

(iv) **Advisor** to doctoral students: Kousika (MM15D408); Malek A. (Chemistry students; jointly advised with Prof. Edamana Prasad); Bhusankar Talluri (jointly advised with Prof. Edamana Prasad), Tanvi Gupte (jointly with Prof. Pradeep), Santosh Bahera

(v) **Graduate test committee**/doctoral committee members of students from across several departments (Physics, Chemistry, EE, Materials) in IITM. (a) Annu Sharma (MM15D405); (b) Sonia Sharma (MM13D017), (d) Khadambari B (PH15D303); (e) Anupama PP (CY14D032), (f) Nithin George (EE15S008), several others from new batches (>14 DC committees)

(vi) (a) **Materials Processing Lab** guidance for: Arvapalli Sai Srikanth (MM12B004); Bommidi Jaswanth (MM12B008).

(b) **Bachelors and DD thesis supervision**: Diwakar Mandloi, Jithu K Das, Sai Srikar

(vii) **Reviewed** 2 institute postdoctoral application (1 to MME, 1 to Physics)

(viii) **Core Member** of the "**Teaching Learning Center (TLC)**".

(ix) Advisor to **exchange international students**: (a) Mr. Takuya (from Nagaoka Institute of Technology, Japan; Visiting Research Student; Sep 2015 - Feb 2016); (b); Visiting student for coursework; Aug-Dec 2015); Mr. Macdonald from Harare Institute of Technology, Zimbabwe (currently)

(x) Initiated **academic exchange** with Prof. Raju Ramanujam (NTU, Singapore) to begin the process of joint-research work.

(xi) Initiated and coordinated the **comprehensive exam revamp** for MME department.

(xii) Department representative in the **Interdisciplinary Research Program (IDRP) Committee** of IITM.

(xiii) Taught (a) Introduction to Research (ID 6020, ID6021), (b) Advanced Materials and Processes

(MM3180), (c) Physical Ceramics

(xiv) Proposed

(a) updating the syllabus of "Advanced Materials and Processes - MM3180" (opened up this course for students from all branches; eliminated stipulations concerning number of participants)

(b) **anew ID course "Chemical Physics of Technical Ceramics- ID6XXX"**. (approval awaited from BAC). This course will be available for all MS/doctoral students or aspiring materials researchers from any science or engineering background.

(xv) Institute Committee to determining modalities for the newly conceived Dual Degree (BTech + MTech) in Energy Science and Engineering

(xvi) Inter-Domain Coordinator for the proposed *Southern Solar Hub @ IITM*

(xvii) Active **research engagement/collaboration** with faculty from (a) Chemistry (Prof. Edamana Prasad, Prof. Ranga Rao, Prof. T. Pradeep), (b) Physics, (c) Electrical Engineering, (d) Chemical Engineering, (e) Metallurgical and Materials Engineering (Prof. Balasubramaniam, Prof. Somnath Bhattacharyya, Prof. S. S. Bhattacharya), (f) Engineering Design (Prof. Nilesh J Vasa)

(xviii) Participated for Michigan State University-IITM talks between Jan 20-23, 2017. This was done with the intention of creating a plan for Joint Doctoral Programs (JDPs).

(xix) Off-campus engagements with (a) Dalian Institute of Chemical Physics (Prof. Minghui Yang), Guindy College of Engineering, MSRIT (Bangalore), BMS Institute of Technology (Bangalore), Indian Institute of Science (Bangalore), Karlsruhe Institute of Technology (Germany), Ohio University (USA), Nagaoka Institute of Technology (Japan), Nanyang Technological University (Singapore), National University of Singapore.

(xx) Industrial Consultancy and Sponsored Research, IITM - Board Member

(xxi) Creation of new courses: ID 6050 "Chemical Physics of Technical Ceramics" and a new course on "Materials for energy storage and conversion".

(xxii) Updates contents for the course titled "Advanced Materials and Processes" (MM3180).

(xxiii) Coordinator of institute wide 'Introduction to research' (produced a comprehensive document that highlights means by which students can ensure a positive research experience)

(xxiv) Served on multiple MS/PhD admission committees (for Materials and Interdisciplinary programs).

INDUSTRIALEXPERIENCE and OUTREACH:

(a) Co-convened "*Industry-academia*" interaction meeting on Surface Engineering (July 23, **2015**).

Initiating discussions on A Center for Surface Engineering in IITM (co-conveners: Prof. Ganesh Sundararaman, Prof. M. Kamaraj, Prof. A. Subrahmanyam, Dr. Srinivasa Rao Bakshi)

(b) Currently collaborating with Dr. Vijay Kanuru (CEO, Applied Nanomaterials Inc., Mumbai).

(c) Co-founded IISc's Entrepreneurship Group (EntIISc), which aimed to provide support for members of the IISc community who wish to use their experience gained on-campus for starting firms/companies of their own. **(2013)**

(d) Developed proprietary LED phosphor technologies for Lumentra Inc. (Toronto, ON, Canada). **(2011)**

(e) Started MUNTech (Memorial University's Technology Entrepreneur club), a forum for highly trained engineering and science students to work together to develop marketable technologies. In near future, the club also aims to commercialize technologies developed through entrepreneurial ventures. **(2011)**

(f) Built an electrophoretic set up to achieve uniform deposition of nanophosphors for large screen display technologies. Currently pursuing commercialization of this technology with Versatls Inc. (Vermont, USA). **(2011)**

(g) Demonstrated a simple mechanical method to achieve rare earth doping in GaN, in collaboration

with Boston Applied Technologies Inc. (Boston, MA, USA), (2010, 2009).

(h) Worked collaboratively with Primet Technologies Inc. (Ithaca, NY, USA) towards nanosizing rare earth doped GaN, for phosphor applications. (2008)

SOCIAL OUTREACH:

1. Amalgam 2015 ; member of panel of judges for the extempore competition on materials science topics (GD challenge).
2. Consistent engagement with colleagues in MSRIT, and publishing papers with them.
3. Ongoing efforts to develop research ties ups with SRM University, VIT in Chennai, SREC, Michigan State University, Nagaoka Institute of Technology (NUT), Nanyang Technological University and National University of Singapore, Karlsruhe Institute of Technology (Germany).
4. Engaging in an interesting teaching-research engagement exercise through the creation of a “virtual” undergrad students group called the “*Nanostructures Cluster*”. This group engages students from many institutions on problems to do with theoretical science of nanostructures. 1 paper published through this engagement; 2 more on the anvil.
5. A large number of students (~20) from various institutions work with us on ad hoc basis on various projects resulting in highly multidisciplinary projects which are oftentimes publishable.

TEACHING EXPERIENCE:

- Currently teaching “*Physical Ceramics*”, “*Advanced Materials and Processes*”, and “*Introduction to Research*” and “*Chemical Physics of Modern Technical Ceramics*”, “*Materials for energy storage and conversion*” in IITM to senior undergrads, and beginning and advanced level graduate students.
- Taught AICTE-Faculty Development Program-- ~35 hour course/workshop on “*Materials Chemistry: Semiconductor, Solids, and Nanomaterials*”. 15 College teachers, most of them on PhD track benefitted from this course. (Oct 30-Nov 5, 2017)
- Offer “*Academic Writing*” and “*Lab safety*” modules, as part of the departmental component of “*Introduction to Research*” course.
- Coordinated campus wide “Introduction to research” Fall 2017 (*with >550 students*, from across all departments).
- Advisor to students taking the “*Materials Processing Laboratory*”.
- Developed study materials for the course “*Materials Characterization*” for AMIE (Associate Member of Institution of Engineers) students.
- Undergraduate summer research supervision for Physics students of Memorial University of Newfoundland, Canada.
- Informally tutored (i.e outside the university setting) undergraduate level solid state science, physical chemistry, signals and systems, general chemistry, electricity and magnetism (to students from VTU, Cornell University).
- Interacted extensively with visiting scientists and new students in JNCASR and Cornell aiding in their smooth transition to research in their new setting.

Examples of undergraduate and graduate courses/modules that I can offer or improvise in near future based on academic needsof IITM and/or industrial requirements:

- (a) Innovation and entrepreneurship in materials technology
- (b) Quantum mechanics and statistical mechanics for engineers
- (c) Advanced Materials and Processes
- (d) Physical Ceramics

- (e) Physico-chemical principles in Ceramic Science
- (f) Functional Materials
- (g) Solid State electronic materials and devices
- (h) Materials for energy and environmental applications
- (i) Physics of Engineering Materials
- (j) Materials Chemistry for engineers - solids, nanomaterials, and semiconductors
- (k) Materials synthesis and characterization
- (l) Energy materials and devices
- (m) Materials Science for Engineers
- (n) Chemical Physics of Technical Ceramics
- (o) Materials for energy storage and conversion
- (p) Introduction to research

ENTREPRENEURSHIP

Co-founder and Advisor (Technology and Education) of *Art of Programming Edulabs LLP*.

REFERENCES:

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