



# CIVIL INSIGHTS

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**ANNUAL MAGAZINE  
CIVIL ENGINEERING DEPARTMENT  
IIT BOMBAY  
2020**

# Message From The Magazine Team

A year ago, the Civil Engineering Department, IIT Bombay, published the first-ever edition of our Department magazine "Civil Insights". And now we are back with the second edition!! The Civil Engineering Department, IITB, is a vital part of the institute and also holds international identification. In the pages that follow, we try to give a peek into what the department encompasses, and we hope that this magazine comes to be a fruitful read to all those who wish to get a quick abstract of the department. The edition features all the key events that happened during the session 2019-20. A heartfelt Thank You to all the faculty, staff, and students who made this magazine so varied in its contents through their articles. The team would also like to express sincere gratitude to the HoD, Prof. T.I. Eldho, and to the CEA faculty advisors, Prof. Venkata Delhi, Prof. Meera Raghunandan, and Prof. Albert Thomas, who have helped us with their indispensable advice. Without them, this magazine could not have been as it is now. While we have tried through all our might, to keep the content errorless, the readers may come across mistakes or typographical errors, kindly accept our profound apologies for the same. We hope that this magazine lives up to the vision held by the last year's team while forging the first edition. We aspire for this magazine to serve as an ever-lasting reminiscence for the graduating batch, as the department bids them farewell on the Institute's 58th Convocation. We wish the class of 2020 good luck for their journeys ahead. Cheers!!



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**Prof. T. I. Eldho**  
**Head of Civil Department**

**MESSAGE**



Indian Institute of Technology (IIT) Bombay was established in 1958 and the Civil Engineering Department is part of the Institute since its inception. The Department has grown tremendously over the years and is now recognized as one of the major Engineering Departments in the country. Besides high quality teaching and instruction at both UG and PG levels, the Department is actively involved in basic and applied research and consultancy and provides high quality technical advisory support through various R&D projects and consultancy to various organizations. The Civil Engineering Department with its multifaceted Faculty continues to maintain and cultivate strong links with the infrastructural industry and academic and research institutions both within and outside the country. As the problems the society faces are multi-dimensional, so must be our efforts at combatting them. The value of inter-disciplinary work cannot be overstressed in today's times when problems are deeply connected and solutions to one must account for possible implications on another and we give emphasize for the same. With this view in mind, Civil Engineering Department provide higher education in the various sub-disciplines of Civil Engineering. These include Construction Technology and Management, Geotechnical Engineering, Ocean Engineering, Structural Engineering, Remote Sensing, Transportation Systems Engineering, and Water Resources Engineering. I congratulate all the passing out students of Civil Engineering Department. I hope you have achieved your goal/ ambition in your life with the education in IIT Bombay. I also welcome the newly joined students. I congratulate you on achieving your goal of pursuing your higher studies in one of the top Civil Engineering Departments of the world. I am sure that your dream of doing higher studies in the best Civil Engineering Department will be fulfilled here in IIT Bombay. We are very happy to publish the second edition of Civil Engineering Magazine. The Magazine focus on various activities of the Department for the past one year. The Magazine is meant to give various information on the Department life, academic matters, student activities and information on many aspects of research and development. I appreciate the work of the Magazine Editorial Committee for their contributions in the preparation of this Magazine.

With best wishes.

*(Prof. T. I. Eldho)*



## Department Faculty



**Deo, M.C. [Ph.D.: IIT Bombay] – Ocean Engineering**

**Designation:** Emeritus Fellow

**Research Interests:** Ocean engineering: Random data analysis using artificial intelligence techniques, Neural networks, Genetic programming, Model trees, Locally weighted learning, Support vector machines, Soft computing, Data mining, Statistical and stochastic analysis, Hydrology (Random data analysis using soft computing tools)



**Praipta Banerji [Ph.D.: UC Berkeley] – Structural Engineering**

**Designation:** Professor

**Research Interests:** Earthquake Vibration Control; Damage Detection in Structures; Guided Wave Propagation and Scattering in Structures; Condition/health Monitoring of Bridge Structures.



**Alok Goyal [Ph.D.: UC Berkeley] – Structural Engineering**

**Designation:** Professor

**Research Interests:** Base isolation systems and energy absorbing devices, Earthquake analysis and design, Liquid storage tanks, Bridges, Vibration control of structures, Service life assessment of buildings.



**Ravi Sinha [PhD: Northwestern University] – Structural Engineering**

**Designation:** Professor

**Research Interests:** Earthquake engineering, Vibration control and isolation, Structure rehabilitation and condition monitoring, Disaster management.

# Department Faculty



**D.N. Singh [PhD: IIT Kanpur] – Geotechnical Engineering**

**Designation:** Professor

**Research Interests:** Geotechnical engineering: Environmental geotechnics, radioactive waste disposal, Solid waste utilization, Geotechnical centrifuge modeling.



**Y.M. Desai [PhD: University of Manitoba] – Structural Engineering**

**Designation:** Professor

**Research Interests:** Wind induced vibrations, Computational mechanics, Nonlinear analysis, Finite elements, Parallel computing, Fiber reinforced polymer composites, Composites in construction.



**K V Krishna Rao [PhD: IIT Madras] – Transportation Systems Engineering**

**Designation:** Professor

**Research Interests:** Transportation systems engineering: Travel demand modeling, Evolutionary algorithms, Neural networks and GIS in transport planning, Traffic design and analysis.



# Department Faculty



**R S Jangid [PhD: IIT Delhi] – Structural Engineering**

Designation: Professor

Research Interests: Structural mechanics, Structural dynamics and earthquake engineering, earthquake-resistant design, Base isolation for a seismic design of structures, Seismic isolation of bridges and liquid storage tanks, Non-classically damped system, Vibration control using tuned mass dampers.



**B V S Viswanadham [PhD: Ruhr] – Geotechnical Engineering**

Designation: Professor

Research Interests: Geotechnical engineering: Centrifuge modeling, Soil reinforcement, Ground improvement, Environmental geotechnics-waste materials' behavior, waste containment systems.

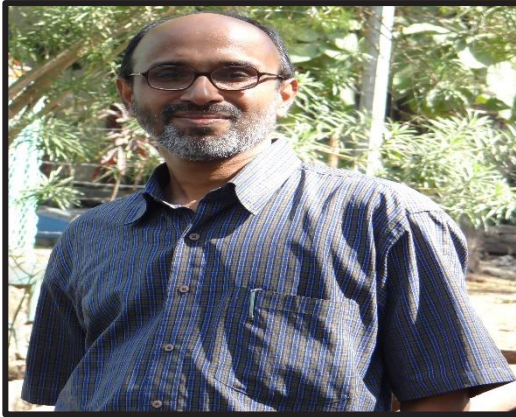


**Kapil Gupta [PhD: University of Sheffield] – Water Resources Engineering**

Designation: Professor

Research Interests: Water resources engineering: Urban water supply systems, Urban drainage, Urban water infrastructure management, Flood Protection structures, Computational fluid dynamics, Optimization, Environmental impact assessment, Water quality analysis and modeling, Constructed wetlands, Urban disaster management.

# Department Faculty



**Eldho, T.I. [Ph.D.: IIT Bombay] – Water Resources Engineering**

Designation: Professor & Head of the Department

Research Interests: Water resources engineering: Groundwater flow, pollutant transport, remediation – numerical & experimental investigations Computational fluid dynamics – Incompressible viscous flows, shallow water flow, estuary dynamics, pollutant transport Watershed management – applications of numerical models, Geographical Information Systems, Remote sensing.



**Bajoria, K.M. [PhD: Cambridge] – Structural Engineering**

Designation: Professor

Research Interests: Structural engineering: Computer aided design, Non-linear analysis, Nuclear structures.



**Naresh K. Chandiramani [PhD: Virginia Tech] – Structural Engineering**

Designation: Professor

Research Interests: Active vibration control, Nonlinear dynamics, Stability; Computational mechanics; Solid mechanics.



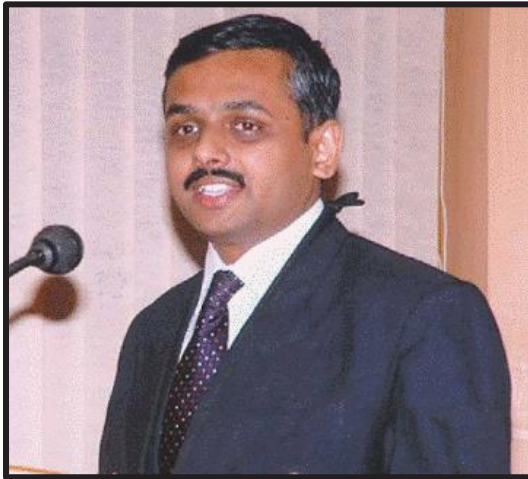
# Department Faculty



**Tom. V. Mathew, PhD [IIT Madras] - Transportation Systems Engineering**

Designation: Professor

Research Interests: Transportation systems engineering: Traffic flow modeling and simulation, Transportation network optimization, control and management.



**Deepankar Choudhury [PhD: IISc Bangalore] - Geotechnical Engineering**

Designation: Professor

Research Interests: Geotechnical engineering: Geotechnical Earthquake Engineering, Earth retaining structures, Slope Stability, Anchor, Pile, Bearing capacity problems, Earth Dams, Seismic effects on Reinforced Soil-Wall, Dynamic Soil-Structure interaction problems, Tsunami resistant design of waterfront structures, Seismic behavior of Landfills, Seismic Ground Characterization, Behavior of Subgrade Soil under Cyclic railway

and airways loads, Soil Dynamics, Machine Foundations, GIS-GPS based Hazard analysis, Soil Liquefaction, Seismic Microzonation, Centrifuge Modeling, Numerical and Analytical modeling of geotechnical problems.



**V. Jothiprakash [PhD: IIT Madras] - Water Resources Engineering**

Designation: Professor

Research Interests: Water Resources Systems Analysis, Reservoir Operation, Policy Issues, Multi-objective Analysis, Stochastic Hydrological Modeling, Time series analysis and modelling, Reservoir Sedimentation, Rain Water Harvesting Airport and Road Side Storm Water Drainage System Water Supply and Sewerage Systems, Irrigation Water Management, Hydrologic Modeling, Rainfall-runoff modelling Non-linear dynamic analysis

using Chaos theory, Singular Spectrum Analysis, Hydraulic Physical and Numerical Model Studies (Orifice Spillways)

# Department Faculty



**Siddhartha Ghosh [Ph. D: University of Michigan] – Structural Engineering**

Designation: Professor

Research Interests: Performance-based seismic design, Reliability-based seismic design, Plastic design of steel structures, Analysis and design of special plate shear walls.



**Ashish Juneja [PhD: NUS Singapore] – Geotechnical Engineering**

Designation: Professor

Research Interests: In-situ and laboratory engineering properties of soil, Numerical and physical modeling in geotechniques, Earthwork, Ground improvement.



**Sauvik Banerjee [PhD: UCLA] – Structural Engineering**

Designation: Professor

Research Interests: Structural and solid mechanics, Ultrasonic wave propagation in solids, Non-destructive quality evaluation of composites, Structural health monitoring, Dislocation mechanics, Multiscale materials modeling.



# Department Faculty



**Subimal Ghosh [Ph. D: IISc, Bangalore] – Water Resources Engineering**

Designation: Professor

Research Interests: Regional Modeling and Understanding of Indian Monsoon, Statistical Downscaling, Atmosphere- Land Surface Interactions, Climate Change Projections and Impacts Assessment, Hydro-climatic Extremes.



**Gopal Patil [PhD: Rensselaer Polytechnic Institute] - Transportation Systems Engineering**

Designation: Professor

Research Interests: Transportation systems planning, Network optimization, Freight transportation modeling, Traffic operations, Demand modeling, Traffic emissions.



**Dasaka S. Murty [PhD: IISc, Bangalore] – Geotechnical Engineering**

Designation: Professor

Research Interests: Site investigation, Stability of shallow and deep foundations, Reliability based design, Ground improvement, Landfill engineering and modeling of soil and rock

# Department Faculty



**B. Sivakumar [Ph.D NUS Singapore]**

Designation: Professor

Research Interests: Rainfall and streamflow modeling; Transboundary water management; Large-scale water projects; Climate change impacts on water resources; Ecosystem modeling; Sediment transport in rivers; Groundwater flow and transport; Human-water interactions; Hydrology education; Complex networks; Chaos theory.



**J N Mandal [PhD: IIT Kharagpur] – Geotechnical Engineering**

Designation: Emeritus Fellow

Research Interests: Geotechnical engineering; Geosynthetics for civil engineering construction.



**Perumal Vedagiri [PhD: IIT Madras] - Transportation Systems Engineering**

Designation: Professor

Research Interests: Pedestrian Flow Modeling, Traffic Flow Modeling and Simulation, Traffic Monitoring, Management and Control, Road Safety Audit, Public Transit System Design and Operations.

# Department Faculty



**Mandar Inamdar [PhD: California Institute of Technology] – Structural Engineering**

Designation: Associate Professor

Research Interests: Solid mechanics, Cellular adhesion and motility, Mechanics of soft materials, Dissipation in structural and mechanical systems.



**Janga Reddy Manne [PhD: IISc, Bangalore] – Water Resources Engineering**

Designation: Associate Professor

Research Interests: Water resource systems, Evolutionary computation for single and multi-objective optimization, Stochastic hydrology, Soft computing applications in hydrology, Climate change impacts on watersheds, water resources and agriculture, Design and performance evaluation of drip and sprinkler irrigation systems, Application of remote sensing and GIS tools in watershed development and management, Precision agriculture and developing decision support systems for water resources management.



**Balaji Ramakrishnan [PhD: IIT Madras] – Ocean Engineering**

Designation: Associate Professor

Research Interests: Coastal engineering, numerical and physical modeling of coastal processes (tidal hydrodynamics & wave transformation), wave-structure interaction.



## Department Faculty



**RAAJ Ramsankaran [PhD: IIT Roorkee] – Remote Sensing**

Designation: Associate Professor

Research Interests: Remote sensing and Geographical Information Systems and its applications to water resources engineering, Urban Sensing, High Definition Surveying.



**Nagendra Rao Velaga [PhD: Loughborough University] – Transportation Systems Engineering**

Designation: Associate Professor

Research Interests: Intelligent Transportation Systems (ITS); Transportation accessibility and mobility; GIS and GNSS applications in transport; ICT and smart-mobile phone applications in ITS.



**Avijit Maji [PhD: Morgan State University] - Transportation Systems Engineering**

Designation: Associate Professor

Research Interests: Highway planning, Geometric Design, Innovative intersection/interchange design, Traffic Operations.

## Department Faculty



**Dharamveer Singh [Ph. D: University of Oklahoma] -  
Transportation Systems Engineering**

Designation: Associate Professor

Research Interests: Characterization of Pavement Materials (Asphalt, Hot Mix Asphalt, Soil, and Aggregates), Recycled Asphalt Mixes, Warm Mix Asphalt, Locally Available Materials, Stabilization of Soil and Aggregates, Intelligent Asphalt Compaction, Constitutive Modeling of Pavement Materials, Simple Performance Tests (Rutting, Fatigue, Dynamic Modulus) on Asphalt Mixes, Pavements (Flexible and Rigid) Design and Evaluation, Forensic Investigation of Pavements, Pavement Maintenance and Rehabilitation.



**Manasa Behera [PhD IIT Madras] – Ocean Engineering**

Designation: Associate Professor

Research Interests: Computational ocean dynamics and coastal processes, Numerical modelling of water waves, tide, tsunami and storm surge, Impact of changing climate on coastal and ocean processes, Wave-current interaction, Wave and tidal energy assessment, Multi-phase flows, Fluid-structure interaction.



**Swagata Basu [PhD: University of California, Irvine] –  
Structural Engineering**

Designation: Associate Professor

Research Interests: Earthquake Engineering, Bridge Engineering, Risk and Reliability Analysis, Structural Resilience, Bridge Performance Assessment under Multiple Hazards

## Department Faculty



**Prasenjit Basu [PhD: Purdue University] – Geotechnical Engineering**

Designation: Associate Professor

Research Interests: Energy Geotechnics; Thermo-hydro-mechanical Characterization of Soil; Coupled (thermo-hydro) Flow in Ground; Engineering of Foundations; Computational Geomechanics



**Prakash Nanthagopalan [PhD: IIT Madras] – Construction Technology & Management**

Designation: Associate Professor

Research Interests: High performance concrete, Sustainable construction materials, Mineral and chemical admixtures in concrete, Rheology of cement based materials.



**Basudev Biswal [Padova University, Italy] – Water Resources Engineering**

Designation: Associate Professor

Research Interests: Water resources management, Catchment hydrology, Rainfall Runoff Modeling.



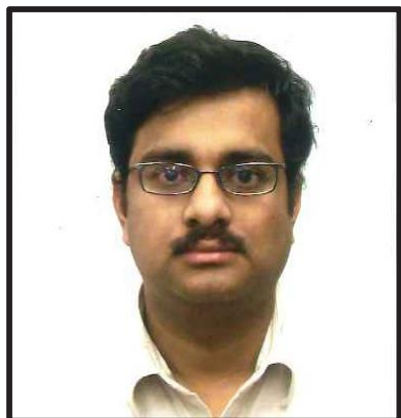
## Department Faculty



**Amit Kumar Das [PhD Carnegie Mellon University] – Structural Engineering**

Designation: Assistant Professor

Research Interests: Computational Mechanics, Plates and Shells, Building information modeling, formwork for concrete structures, analysis of pavements.



**Arghadeep Laskar [PhD: University of Houston] – Structural Engineering**

Designation: Assistant Professor

Research Interests: Reinforced and Prestressed concrete, Experimental study and analysis of full-scale structural specimens, finite element modeling and analysis of structures, seismic simulation of structures.



**Santiram Chatterjee [PhD: The University of Western Australia] – Geotechnical Engineering**

Designation: Assistant Professor

Research Interests: Offshore Geotechnical Engineering, Pipeline Geotechnics, Soil Characterization, Numerical Modelling, Earthquake Geotechnical Engineering



**Jayadipta Ghosh [PhD: Rice University] – Structural Engineering**

Designation: Assistant Professor

Research Interests: Seismic fragility analysis of civil engineering structures, bridge engineering, life cycle analysis of structures, inverse reliability problems, uncertainty propagation techniques.

## Department Faculty



**Venkata Santosh Kumar Delhi [PhD: IIT Madras] – Structural Engineering**

Designation: Assistant Professor

Research Interests: Infrastructure Project Governance, Construction Project Management, Organization in Construction Projects and Infrastructure Sustainability, Structural Engineering.



**Indu Jaya [PhD: IISc Bangalore] – Remote Sensing**

Designation: Assistant Professor

Research Interests: Microwave Remote Sensing; Uncertainty in Radar Based Rainfall; Nowcasting of Precipitation; Applications of Remote Sensing in Hydrology and Water Resources Engineering; Image Processing Using Synthetic Aperture Radar; Fuzzy Logic



**Meera Raghunandan [PhD: University of Colorado, Boulder] – Structural Engineering**

Designation: Assistant Professor

Research Interests: Earthquake Engineering, Probabilistic Seismic Risk Analysis of Structures, Performance Prediction of Structures under Dynamic Loads, Building Code Evaluation.

## Department Faculty



**Arpita Mondal [PhD: IISc Bangalore] – Water Resources Engineering**

Designation: Assistant Professor

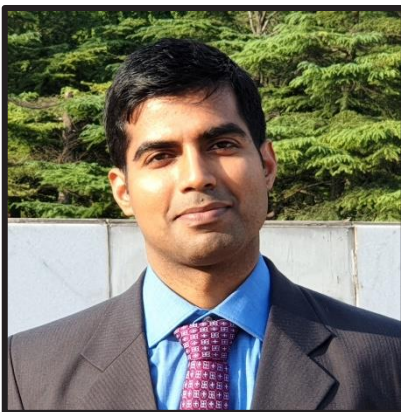
Research Interests: Detection, Attribution and Impact of Climate Change, Spatio-Temporal Modeling of Hydro Climatic Extremes, Regionalization and Frequency Analysis of Floods and Droughts, Risk Assessment Under Non-stationarity, Urban Flooding, Hydrologic Statistics and Machine Learning, Uncertainty Modeling.



**Muhammad Salman [PhD: KU Leuven, Leuven, Belgium] – Construction Technology & Management**

Designation: Assistant Professor

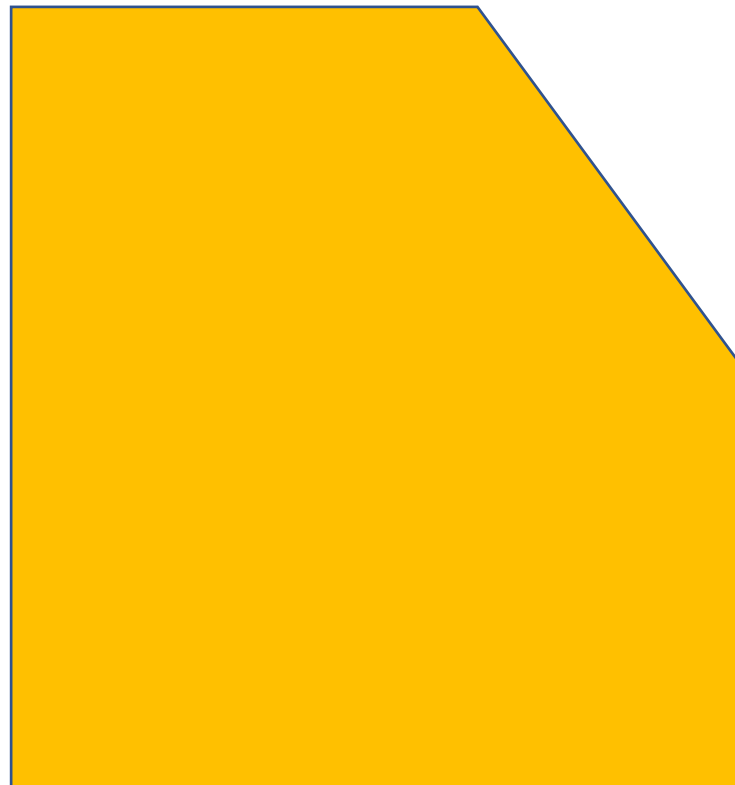
Research Interests: Alkali-activation and geopolymerisation of industrial residues, Concrete technology, Mineral Carbonation, Sustainable construction materials, Microstructural analysis, Phase analysis of cementitious materials.



**Manish Kumar [PhD: State University of New York (SUNY) at Buffalo] – Structural Engineering**

Designation: Assistant Professor

Research Interests: Earthquake Resistant Design of Structures, Seismic Isolation, Analysis and Design of Nuclear Structures, Blast and Impact Loads on Structures.





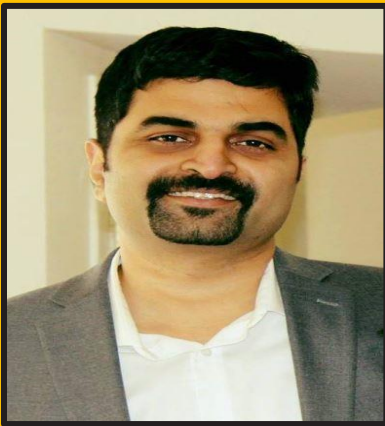
## Department Faculty



**Riddhi Singh [PhD: The Pennsylvania State University] – Water Resources Engineering**

Designation: Assistant Professor

Research Interests: Rainfall Runoff Modelling, Model Diagnostics, Hydrologic Predictions in Data Scarce Regions, Catchment Classification and Hydrologic Similarity, Multi-stakeholder Analysis of Resource Constrained Systems, Decision Making Under Uncertainty.



**Albert Thomas [University of Michigan] – Construction Technology & Management**

Designation: Assistant Professor

Research Interests: Sustainable Construction Management Practices, Building Energy Simulation, Lean Construction, Life Cycle Energy Analysis, Project Scheduling and Earned Value Analysis, Construction Project Lifecycle Management.



**Eswar Rajasekaran [IISc Bangalore] – Remote Sensing**

Designation: Assistant Professor

Research Interests: Thermal Remote Sensing, Modelling Evapotranspiration from RS, RS Applications in Hydrology, Drought Monitoring

# Department Faculty

**Rao, E. P. [Ph.D.: IIT Bombay] – Remote Sensing**

Designation: Adjunct Associate Professor

Research Interests: Remote sensing, Remote sensing applications to water resources, Runoff modeling, Water distribution systems optimization.

**Milind Wankade – Engineering Law**

Designation: Adjunct Professor

Research Interests: Arbitration in Government Construction Contracts.

**Mazumder B.S. [Ph.D. IIT Kharagpur] – Water Resources Engineering**

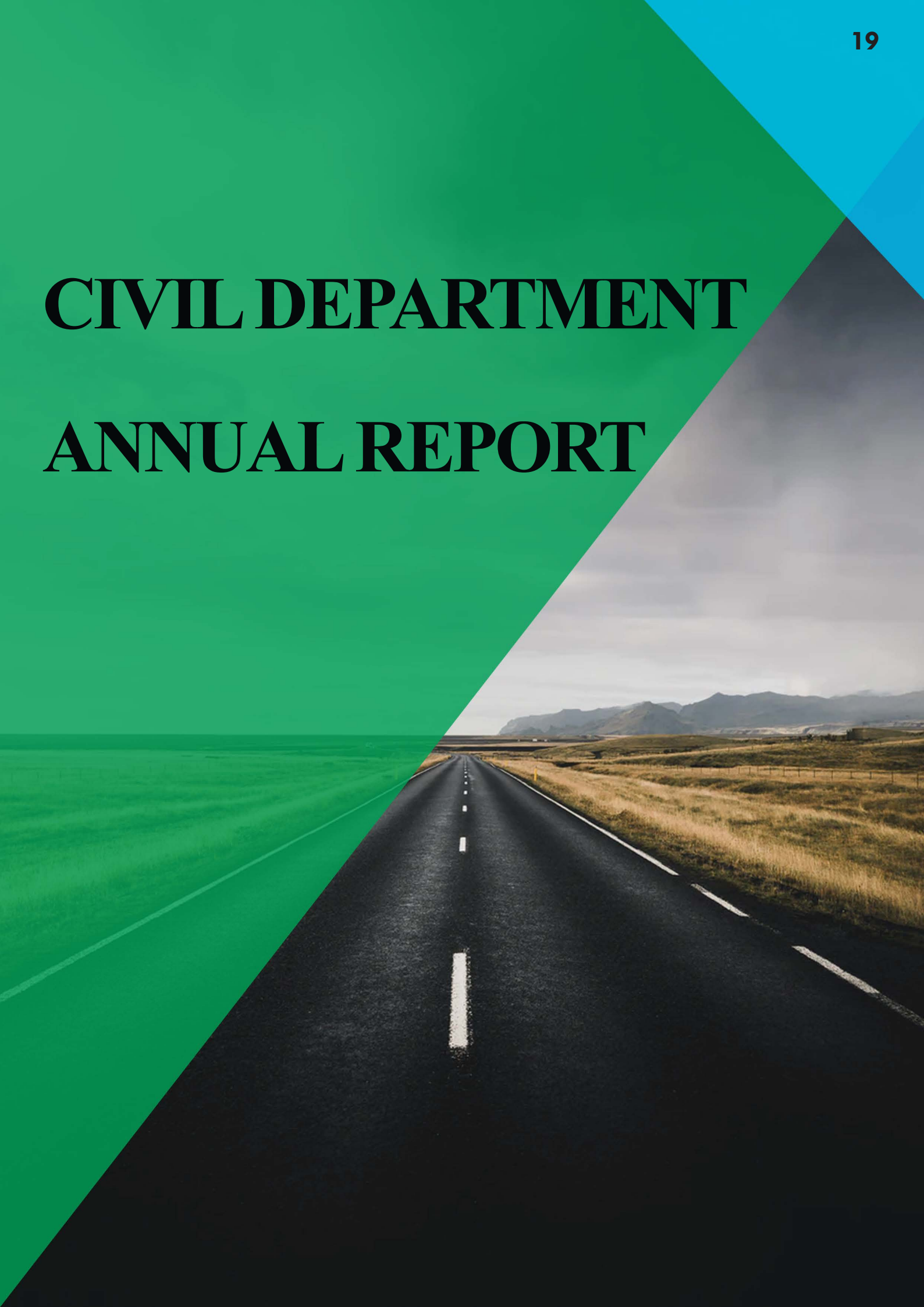
Designation: Visiting Professor

Research Interests: Fluid Mechanics, Turbulence, Hydraulics, Experimental Studies.

**Prof. Tarun Kant. [Ph.D. IIT Bombay] – Structural Engineering**

Designation: Senior INSA Scientist

# CIVIL DEPARTMENT ANNUAL REPORT





## Introduction

The Department of Civil Engineering, one of the founding Departments of IIT Bombay, over the years, has grown tremendously, and is now recognized as one of the best and major Engineering Departments in the country and ranked highly in the world for Civil Engineering. With its multifaceted Faculty, the Department continues to maintain and cultivate its strong links with the building and construction industry and academic and research institutions both within and outside the country. Besides high quality teaching and instruction at both UG and PG levels, the Department is actively involved in basic and applied research and consultancy and provides high quality technical advisory **support** through various R&D projects and consultancy services to various organizations. The Department has attracted a significant amount of sponsored research consultancy funding from government and private agencies.

## Academic Programs

The Department of Civil Engineering offers broad-based undergraduate B. Tech degree program. Dual degree (B.Tech-M.Tech) programs are also run in various specializations. Postgraduate M.Tech (admissions through GATE/sponsorships) and PhD (through selections/ sponsorships) programs are offered in the following seven specializations:

- Transportation Systems Engineering
- Geotechnical Engineering
- Water Resources Engineering
- Structural Engineering
- Ocean Engineering
- Remote Sensing
- Construction Technology and Management

At present the annual intake into B.Tech., M.Tech., and Ph.D. programs stands at 137, 74 and about 43 respectively. B.Tech. students have the option of converting into B.Tech - M.Tech dual degree program, and M.Tech. students into M.Tech. – Ph.D. dual degree program. During 2018-19, 119 B.Tech. degrees, 3 B.Tech. - M.Tech. dual degrees, 56 M.Tech degrees, and 24 Ph.D. degrees were awarded from the Department.

## Significant Awards / Distinctions of Faculty Members & Students

The students and faculty have won prestigious national and international awards and recognition, and continue to bring laurels to the Department and the Institute. For the first time in the history of the Civil Engineering Department, Prof. Subimal Ghosh won the prestigious Shanti Swarup Bhatnagar Award and Swarnajayanti Fellowship of Government of India, for his research in the areas of climate and hydrological science. Further, 14 of our faculty members have won 16 prestigious awards this year. Some of the important awards received by Faculty and Students are listed below.

Prof. D.N. Singh: 2018 Canadian Geotechnical Journal Fredlund Award Canadian Science Publishing (publisher of the Canadian Geotechnical Journal). GeoSt.John's November 2019.

Prof. M.C. Deo: Lifetime Achievement Award Indian Society for Hydraulics Headquarter: Central Water and Power Research Station, Pune 411024 December 2019.

Prof. Deepankar Choudary: Elected as Fellow (F.ASCE) of the American Society of Civil Engineers (ASCE), USA. Since November 2019.

Prof. V Jothiprakash: "Certificate of outstanding Contribution in Reviewing", from Journal of Hydrology. Best Paper in Climate Change and Extreme Events Osmania University, HYDRO-2019 Osmania University, Hyderabad Dec 18 2019.

Prof. Sauvik Banerjee: Prof. S. P. Sukhatme Award for Excellence in Teaching, IIT Bombay, 2019.

Prof. Subimal Ghosh: PRL Award PRL, Ahmedabad August, 2019; Shanti Swarup Bhatnagar Award CSIR September 2019; Swarnajayanti Fellowship DST December 2019.

Prof. RAAJ Ramsankaran: Asian Universities Alliance (AUA) scholarship for collaboration with Tsinghua University, Beijing, China Asian Universities Alliance (AUA) Dec 2019.

Prof. Nagendra Velaga: Best paper award Transport Research Group of India Dec 2019.

Prof. Avijit Maji: Best Paper Award International Conference on Transportation Infrastructure Projects: Conception to Execution Indian Institute of Technology (IIT) Roorkee January 2020.

Prof. Dharamveer Singh: IRC - Pt. Jawaharlal Nehru Birth Centenary Award- 2018" instituted by Indian Roads Congress, Nov. 2019.

Prof. J Indu: Selected as Member of NASA PMM Science Team NASA June 2019.

Prof. Manish Kumar: Sustainable Transportation Systems and Infrastructure (STSI) Award Hokkaido University Japan March; Visiting Scholar Award Beijing University of Technology Beijing, China August.

Prof. Albert Thomas: Runner-Up position for the poster presentation at ILCC, Pune India Institute of Lean Construction Excellence Pune, India November 2019.

## **Projects Undertaken by Department**

The Department has attracted significant amount of sponsored research funding from government and private agencies and delivered excellent output in terms of implementable solutions. During the year 2019-20, around 31 new sponsored projects have been sanctioned with an outlay of Rs.25 crores (approximately) taking the total number of currently running sponsored projects to 91. During the current year 17 sponsored projects have been successfully completed delivering the intended objectives to the sponsoring agencies. Our faculty members have taken up about 530 consultancy jobs (including new and ongoing) worth about Rs. 30 crores and delivered solutions to the host of industrial/ field problems.

## **Extension Activities**

The Department disseminates the knowledge gained from its high quality research through training programs and interacts with world renowned personalities through workshops and conferences. During the year 2019-20, the Department has conducted 10 quality improvement and continuing education programmes for the academicians, students and field engineers.

## **Visitors to the Department**

During 2019-2020, 26 Distinguished Academicians from world renowned Universities have visited the department and enlightened our faculty and students with their seminal presentations. Few of these Distinguished Professors have spent one month to six months in the Department as Visiting Faculty contributing to our teaching and research.

## **Editors/ Editorial Board Members**

Quite a good number of our faculty members continue to be Editors or Associate Editors or Members of the Editorial Boards of more than 20 reputed International/ National Journals.



## Patents Granted /Filed

Prof D.N.Singh: Patent granted: A Novel Method and System to Enhance Capacity of Flyash Dykes and Tailing Dams with Ashish Gharpure

[http://www.ipindia.nic.in/writereaddata/Portal/IPOJournal/1\\_4769\\_1/Part-2.pdf](http://www.ipindia.nic.in/writereaddata/Portal/IPOJournal/1_4769_1/Part-2.pdf) page 42.

Prof D.N.Singh: Patent granted: A Novel Method and System to Enhance Capacity of Flyash Dykes and Tailings Dams; with B. Jha.

[http://www.ipindia.nic.in/writereaddata/Portal/IPOJournal/1\\_4769\\_1/Part-2.pdf](http://www.ipindia.nic.in/writereaddata/Portal/IPOJournal/1_4769_1/Part-2.pdf) page 42.

Prof T.I.Eldho: Patent granted: Flexible Solar Photovoltaic System (SPV) and Method Thereof: Aswini U., B.V. Ao, C.D. Malleswar, Eldho T.I. & S.P. Dutta Gupta 320241. 19/11/2019.

Prof D.N.Singh: Patent filed: Novel Method and System for Reclaiming Coastal Land for Infrastructure Developments; 13/5/2019; with Aarif Mohamamd.

Prof D.N.Singh: Patent filed: Composition for Constructing Road Subgrades Using By-Products from Alumina Refinery and Method of Preparing Thereof; 12/4/19; with Ganarak J., Himanshu Roy and P K Banerjee.

Prof. Y.M.Desai: Patent filed: PALANQUIN, Chakravarthy, B.K., Desai, Y.M.,Ajugia, M.N.,Bhagat, A.V.,Srambical, P., Vaibhav, K., Jain, K.,Pundir, A.,Iqbal, R.,Khanzode, V., Maulik,S.; 06.06.2019

Prof. Jothiprakash: Patent filed: Life Saving Helmet for a Sewage Cleaner ; 4/12/2019 with Tarika Vohra.

Prof. Jothiprakash: Patent filed: A system for cleaning Blockages in Sewers; 9/8/2019

Prof. R. Balaji: Patent filed: An interface circuit for an accelerated corrosion test apparatus; 20/9/2019; with Raghava Kumar Vanama.

Prof. R. Balaji: Patent filed: System and method for corrosion acceleration of rebar in reinforced concrete pull-out specimen; 20/9/2019; with Raghava Kumar Vanama.

## Publications

Through academic and sponsored research, our faculty and students have published large number of research publications in quality Journals having high impact factor. During the year 2019-20, 212 high quality research papers were published in reputed Journals and 196 papers were published in Conference Proceedings by Civil Department Faculty and students. During the year, our Faculty have also published 26 book chapters.

## Books/ Book Chapter/ Lecture notes

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# TECHNICAL ARTICLES



## Macroscale Hydrological Modelling To Assess The Impact Of Land Cover Change On Streamflows

Ph.D. Students/ RA: Navya Chandu, Kashish Sadhwani, Rakesh Kumar Sinha  
Advisor/PI: Prof. T.I Eldho

Western Ghats of India is identified as one of the biological hotspots with diversified flora and fauna. However, for the river basins in this region starting from Tadri to Kanyakumari is undergoing continuous land-use land-cover (LU/LC) changes in the past few decades. These changes in LULC has caused major hydrological impacts in this region. In this study, the hydrological impacts of LU/LC changes in the river basins of Tadri to Kanayakumari in Western Ghats is assessed using the VIC model. Initially the LU/LC changes for the past four decades are analysed using the Landsat images for the years 1985, 1995, 2005 and 2016. It is observed that, there are reduction in forest areas (7%), increase in croplands (4%) and increase in urban areas (4%). Using 30 years (1979-2015) of climate data and changing LU/LC, the hydrological impacts were assessed using the VIC model. It is observed that impact due to change in land use pattern in mean basin runoff is noticeable ( $\pm 5$ mm/year). Further station wise analysis showed that, there is noticeable variation in the streamflow ie, 11 mm/year (increase) at Bantwal (Nethravati river) due to conversion of forest land into built up and at the same time 12 mm/year (decrease) at Karathodu (Kadalundi river). From Fig. 1, we can see the impact of LU/LC on runoff is noticeable. When we analyse the LU/LC classes over that area we can see earlier it was of waste land and then by 2016, it gets converted to urban built up which reduces the infiltration capacity and finally an increase of runoff. Similarly, most of the forest regions in the basin gets depleted which increased the runoff in those grids of upper and middle part of the basins

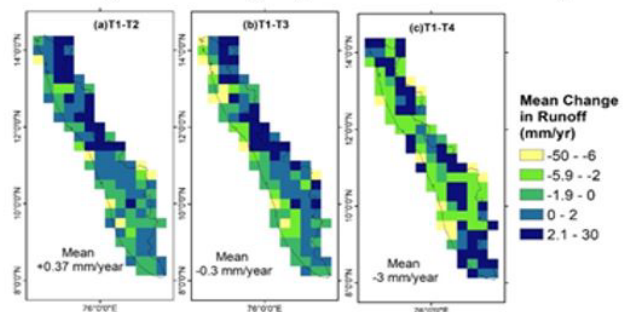


Fig: Change in runoff from the base period for (a) 1985 - 1995, (b) 1985 - 2005, and (c) 1985 - 2016

(Reference : Aswathi Sebha John, Navya Chandu, T I Eldho (2019) "Macroscale hydrological modelling to assess the impact of land cover change on streamflows" Proc. HYDRO International Conference Hydraulics, Water resources Coastal Engineering, 18-20 Dec 2019, Osmania University, Hyderabad, India.)

### Assessing Impact of Climate Change and Landcover Change over stream flow using semi-distributed Hydrological Model

Climate change is an issue of serious concern and we are witnessing several changes around us which are directly or indirectly influenced by changing climate. Streamflow is one such variable. Reduced streamflow leads to water scarcity which may give rise to drought and its excess may lead to floods. Streamflow is majorly affected by land use practices also, so a study on impact of climate change (CC) and land cover change (LCC) is analysed over Periyar River basin, Kerala, India using a semi-distributed model, Soil and Water Assessment Tool (SWAT). The study area covering 4792.83 sq. km was first analysed with impact of LCC from 1988 to 2016 by changing LC maps for 1992, 2002 and 2016 respectively. Then the combined effect of CC and LCC was analysed for the period 1984-1993, 1994-2003 and 2006-2015 with landuse data for 1988, 2002 and 2016 respectively as shown in figure below.

The results show that there is an increment in streamflow with respect to LCC but a decrement due to combined effect. This indicated that for streamflow CC impact is dominant over LCC (Fig. 2).

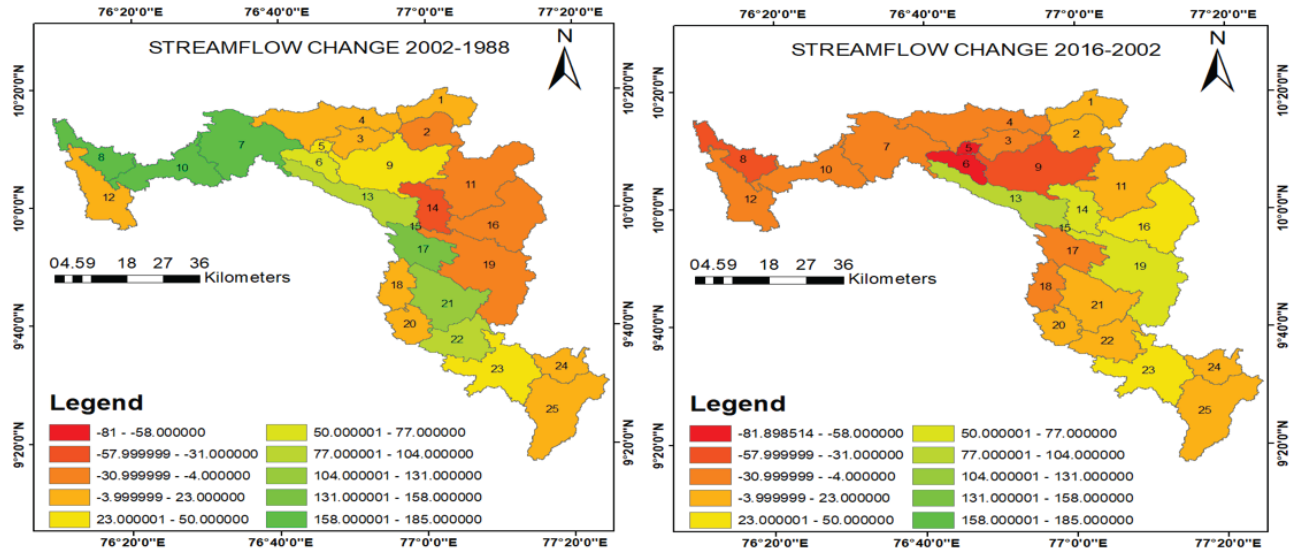


Fig2. change in streamflow from 1988 to 2002 and 2002 to 2016

(Reference: Kashish Sadhwani, Eldho T.I. and Karmakar S. (2019) "Climate Change and Land Use Change Impact Assessment on Stream Flow using SWAT Model – A Case Study of Periyar River Basin, India" Proc. HYDRO 2019 International conference Hydraulics, Water Resources and Coastal Engineering, 18-20 Dec. 2019, Osmania University, Hyderabad, India, Volume I, P1948-1957.)

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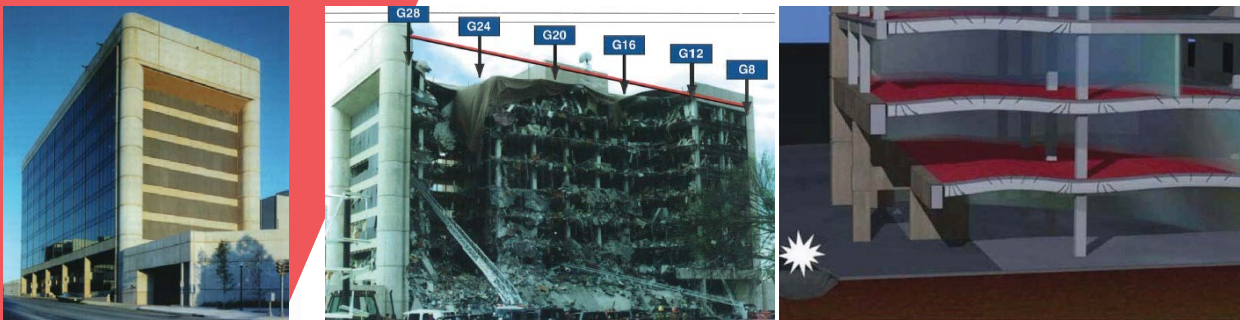


# Anti-terrorism and Blast-resistant Design of Critical Infrastructure

N Manoj Kumar<sup>1</sup>, Anjani KK<sup>2</sup>, and Manish Kumar<sup>3</sup>

## Introduction

High occupancy facilities and critical infrastructure in the dense urban environment of Indian cities (e.g., Mumbai, New Delhi) are the prime targets of terrorist attacks to inflict maximum casualties by inducing complete or partial collapse of the structure. The failure of a building during the Oklahoma City bombing is shown in Figure 1. It has become critical to design and construct blast-resistant structures to save lives and protect infrastructure against such threats. This research work focuses on developing analysis methods and design techniques to mitigate the structural damage and reduce the loss of lives from blast-induced structural failures of critical civil infrastructure vulnerable to explosions. The blast load due to far-field detonations is estimated accounting for near-field detonations in confined urban environment characterized by fluidstructure interaction (FSI). Experiments are conducted to estimate the capacity of reinforced concrete columns against varying amounts of explosives. A performance-based analysis and design approach is developed for blast-resistant design of RC column. The design approach is validated using experiments and verified using high-fidelity numerical simulations.



a) Pre blast (FEMA, 1996) b) Post blast (FEMA, 1996) c) Failure analysis (Osteraas, 2006)

Figure 1: Failure of Alfred P. Murrah Federal Building in Oklahoma City Bombing

## Estimation of blast load

The detonation of high-explosives generates blast waves that travel through the surrounding media and applies pressure on a structure or object in its path. The pressure history observed from experiments and its idealized representation are shown in Figure 2 and Figure 3, respectively.

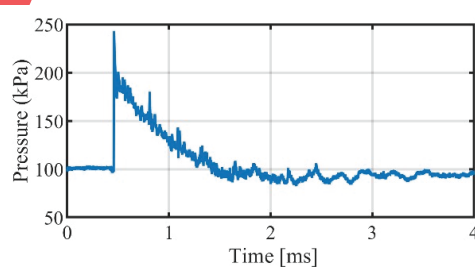


Figure 2: Experimental blast pressure history

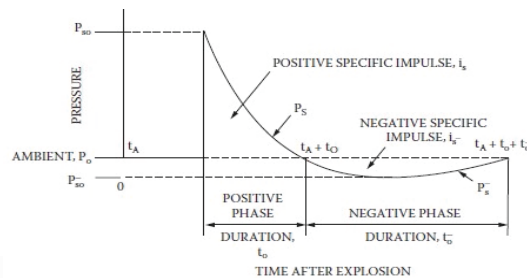


Figure 3: Idealized blast pressure history

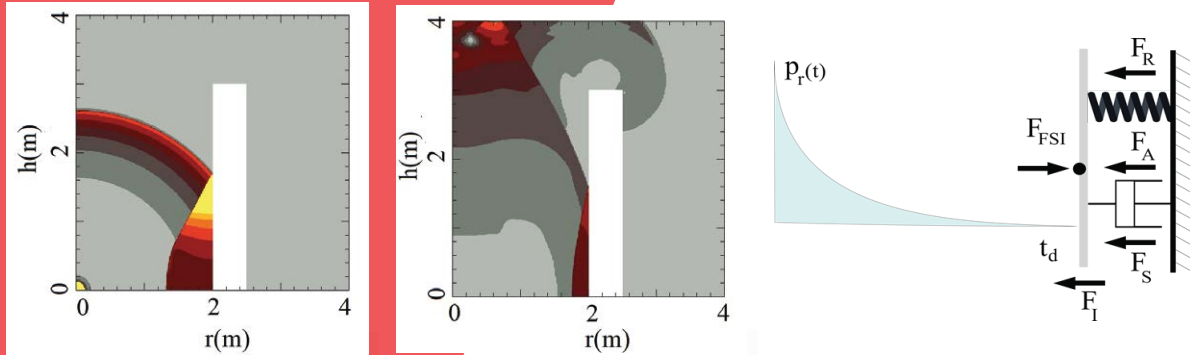
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The parameters of the idealized pressure history in Figure 3 can be obtained using experimental data available in the literature as the Kingery-Bulmash chart (Kingery and Bulmash, 1984). However, these charts are not valid for near-field explosions characterized by several complex phenomena that occur during an explosion, including the Fluid Structure Interaction (FSI). The interaction of blast wave with a column using computational fluid dynamics (CFD) and the schematic of a newly developed FSI model are shown in Figure 4.



(a) CFD analysis ( $t=t_1$ )      (b) CFD analysis ( $t=t_1+t_2$ )      (c) Idealized SDOF model  
Figure 4: Interaction of blast waves with a column

The mathematical formulation of the FSI for a single-degree-of-freedom system is given as:

$$m \ddot{x} + d_s \dot{x} + d_a + r = P_r F F F \quad (1)$$

where  $m$  is the mass,  $d_s$  is the damping force,  $d_a$  is the aerodynamic damping,  $r$  is the resistance function and  $P_r F F F$  is the pressure applied on the unit surface area that includes FSI effects.

### Blast-resistant Design of Structural Elements

The blast load (= pressure  $\times$  area) is applied to structural members that are idealized as a single degree of freedom systems (SDOF). The responses are evaluated, and the members are designed for stresses corresponding to the peak responses. This is conservative approach that is appropriate for preliminary design of structures. Experimental tests and Finite Element Analysis (FEA) are employed for reliable design and performance assessment of structural elements. As part of this research, full RC columns were tested subject to varying amounts of explosive to assess their blast performance and subsequently were tested at IIT Bombay to determine their residual capacities.



a) Contact blast      b) post-blast damage      c) Residual axial capacity test  
Figure 5: Field trial for blast performance and residual capacity test of RC column

A unified performance-based methodology was developed for analysis and design of RC columns for flexure, diagonal shear, and direct shear. The objective is to provide sufficient ductility to achieve flexural deformation corresponding to the permitted damage without premature failure due to other loads. The performance of the blast resistant column is compared with the ordinary column design as per IS456 (BIS, 2000) and seismically detailed column per IS13920 (BIS, 2016). The rebar detailing and damage state for the reported charge mass are shown in Figure 6.

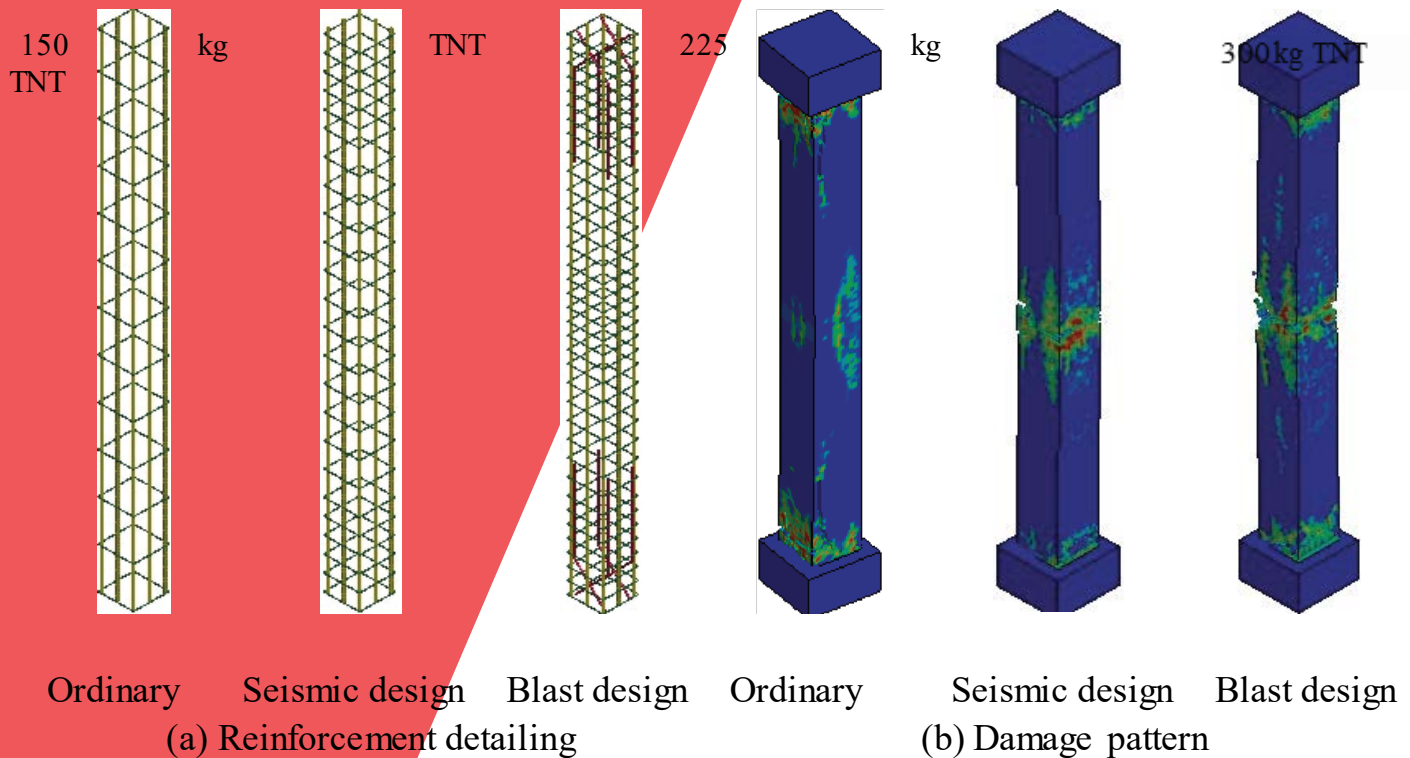


Figure 6: Reinforcement detailing and damage patterns obtained for different columns

### Conclusions and scope of research

Critical civilian facilities and military infrastructure in India have been a target of several terrorist attacks in last few decades. To address the risk of explosion threats, it has become critical to design and construct blast-resistant structures to save lives and protect infrastructure.

The existing practices in the design of blast-resistant structures do not address key issues related to estimation of blast load, response of structure members and efficient design and detailing. A concerted effort is needed through experimental and numerical studies to address these gaps to improve blast performance of critical structures. The complex analysis and design techniques need to be simplified for design practitioners for wider adoption and implementation of blast-resistant design techniques.

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## **An overview of reactive transport modelling in groundwater hydrology and hydrologic modelling for coupled (surface and groundwater) simulations**

**Ph.D. Students: Anshuman, A., S. Sreedevi**

**Advisor/PI: Prof. T.I Eldho**

- As most of the contaminants in the subsurface are reactive in nature, it is important to incorporate the reactions and possible multispecies interactions in the governing equation for contaminant transport modelling.
- New model parameterization approaches such as an elevation based soil properties variation can be effective to overcome the challenges in capturing both streamflow and depth to water table in a catchment lacking fully distributed field data.

### **Meshfree modelling of multispecies reactive transport modelling in a coupled flow environment**

Multispecies reactions are observed in subsurface involving nitrogenous species, chlorinated hydrocarbons, radioactive decay etc. Existing grid/mesh-based models are prone to instabilities in case of advection and reaction dominant cases. Here a coupled radial point collocation method (RPCM) based meshfree model is applied to a confined aquifer of 300m×100m as shown in Figure 1a. All boundaries except the north boundary are constant head boundaries with linearly varying heads. The north boundary is considered to be impervious. The flow in the aquifer is in steady-state. The hydraulic conductivity and porosity of the aquifer are 2.5 m/d and 0.3 respectively. A contaminant species  $c_1$  having decay rate of 0.0005 d<sup>-1</sup> is injected between (0m, 60m) and (0,100m) and yields a daughter species  $c_2$  (decay rate=0.0004 d<sup>-1</sup>) because of degradation. The number of nodes used for domain discretization in the coupled model is 1281. The longitudinal and lateral dispersivities ( $\alpha_L$  and  $\alpha_T$ ) are 1m. The parameters of multi-quadrics radial basis functions which are used for approximation of shape functions are given by radius of local support domain=3×nodal distance,  $q=0.98$  and  $\alpha=5$ . The RPCM transport model is run for 1 year simulation period with a time step of 5 days. The comparison of RPCM and Finite Element Method (FEM) based models are shown in



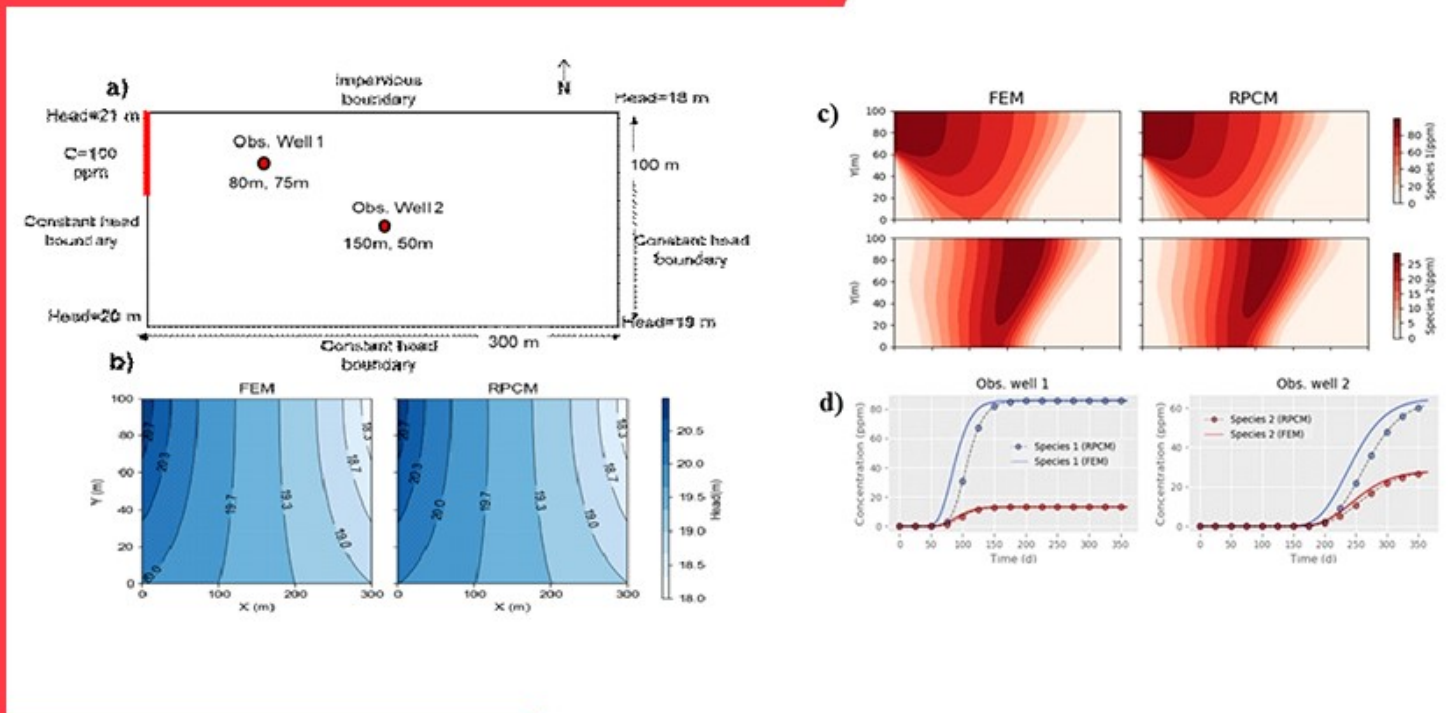


Figure 1a) Schematic diagram of study area b) Comparison of head contours obtained by RPCM and FEM models c) Spread of contaminant after 1 year d) Break through curves at the observation wells  
**Reference: Anshuman, A., & Eldho, T. I. (2020), "Meshfree radial point collocation-based coupled flow and transport model for simulation of multispecies linked first order reactions". Journal of Contaminant Hydrology, 229, 103582.**

### Coupled streamflow and groundwater table depth simulations using SHETRAN in a wet humid tropical catchment

Physically based Distributed Hydrological Models (PDHM) is complex and exhibits extreme challenges for simulating the dynamics of coupled streamflow and groundwater table depths. The capabilities of a PDHM, SHETRAN in capturing streamflow and depth to groundwater table to represent the hydrologic processes within a wet tropical humid catchment (Vamanapuram) are assessed in the present work. Figure 2a shows location of the study area. The most significant model parameters for the coupled simulations of streamflow and groundwater table depths are assessed through a multi objective sensitivity analysis using Morris screening method and local sensitivity analysis. In order to arrive at the optimal model parameters for simulating depth to water table and streamflow, the effect of three model parametrization approaches were analyzed: with no spatial variation in soil properties, elevation based variation of only middle and bottom soil layer saturated hydraulic conductivity and elevation based variation of horizontal ( $k_x$ ), vertical ( $k_z$ ) soil saturated hydraulic conductivities and specific storage ( $S_s$ ). Results indicate that for the studied watershed, the elevation based variation in  $k_x$ ,  $k_z$ , and  $S_s$  resulted in a better prediction of depth

to water table variations (in terms of correlation coefficient) with no significant improvements in streamflow simulation compared to the other two parameterization cases (Figures 2b and 2c). The study suggests incorporating preferential flows in SHETRAN model to improve prediction of the water table dynamics in catchments belonging to the humid tropical region.

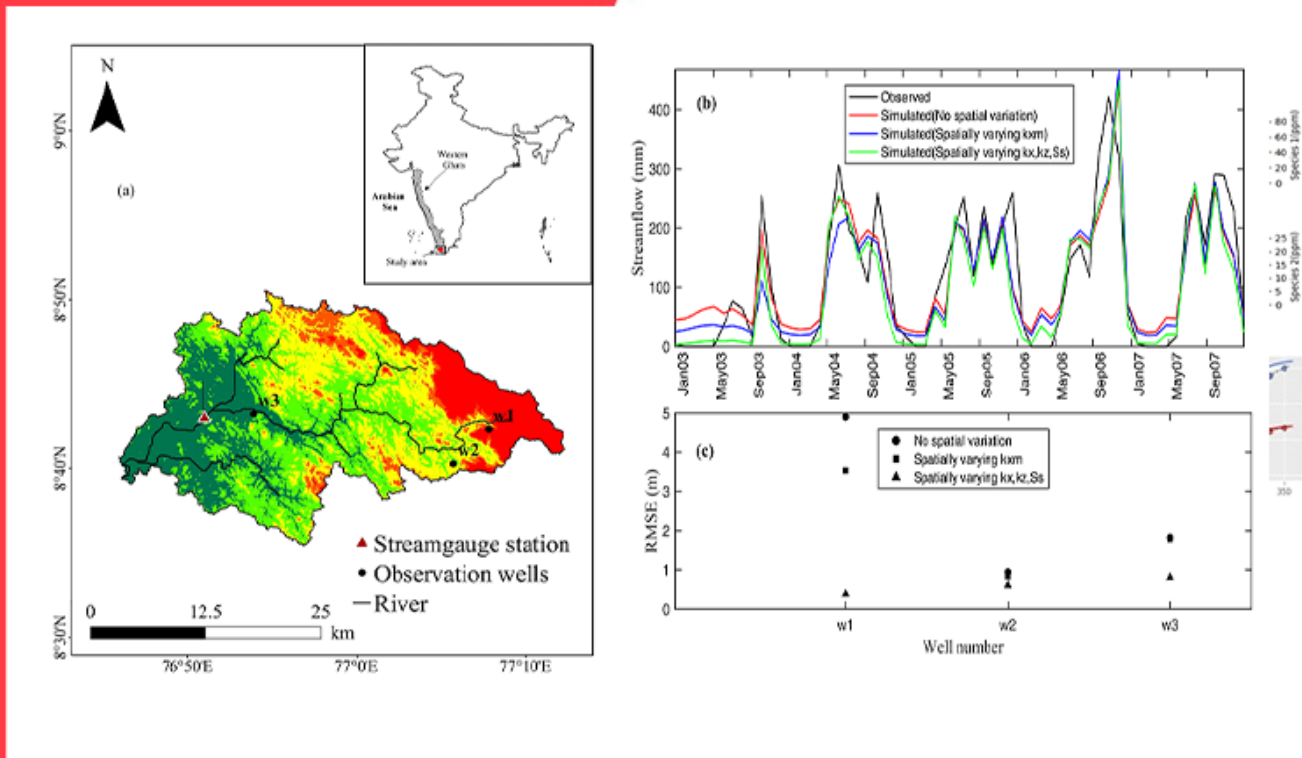


Figure 2 a) Location of the basin, observations wells and stream gauge along with elevation b) Observed and simulated monthly streamflow (c) Comparison of RMSE values of depth to water table for three wells W1 (high elevation), W2 (mid elevation) and W3 (low elevation) -with different cases such as no spatial variation and spatially varying soil properties.

(Reference: Sreedevi.S, T.I Eldho, C.G. Madhusoodhanan, T. Jayasankar (2019), “Multiobjective sensitivity analysis and model parameterization approach for coupled streamflow and groundwater table depth simulations using SHETRAN in a wet humid tropical catchment”, Journal of Hydrology , 579, 124217, doi.org/10.1016/j.jhydrol.2019.124217)

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## Why Corrosion & Its Control

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Prof. Muhammad Salman

Guide, Construction Technology

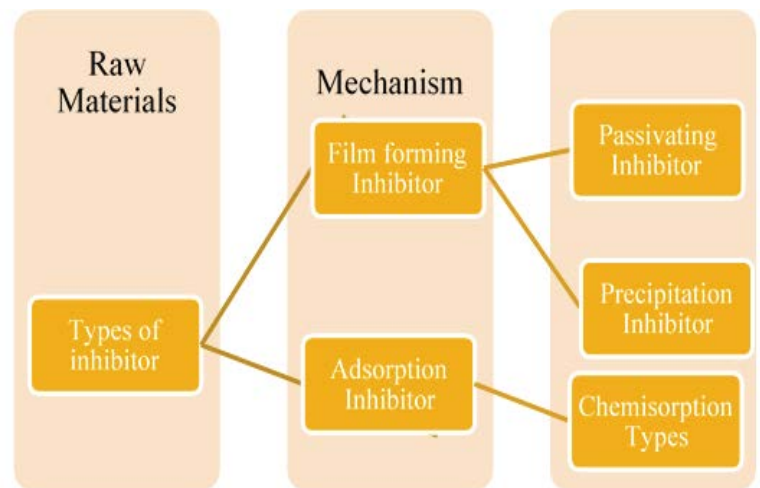
Corrosion is a big menace to the economy of the country. The loss due to corrosion has been estimated to be of the order of 2 - 5% of the GNP of any country. In India the losses have been estimated approximately at 25,000 crores rupees per year due to the impact of corrosion according to Newsletter NACE, India

Deterioration of a material, usually a metal, that results from a chemical reaction with its environment.- ACI Concrete Terminology

Corrosion occurs when the protective layer (passivation layer) in concrete steel reinforcement is destroyed. Steel in concrete is usually protected against corrosion by the high pH of the surrounding Portland-cement paste. Cement paste has a minimum pH of 12.5, and steel will not corrode at that pH level. If the pH is lowered (for example, to pH 10 or less), corrosion may occur if moisture, oxygen, and chloride ions are present.

Chloride ions destroy the protective layer on the steel reinforcement, making it prone to corrosion. The corrosion product (rust) occupies a greater volume than the steel and exerts destructive stresses on the surrounding concrete.

To avoid corrosion damages and durability of reinforced concrete, it's important to protect structure against corrosion. There are various methods are available to prolong service life of structure against corrosion.



Types of Inhibitor and working flow chart

## Corrosion Inhibitors

Chemical corrosion inhibitors are one of the methods for preventing and/or delaying corrosion of reinforcement in concrete. However, not only is it necessary to evaluate their effectiveness as a corrosion inhibitors, it is also essential that the mechanism of inhibition is understood

My research work on corrosion inhibition property of reinforced concrete evaluates the most effective inorganic vapour phase corrosion inhibitor and the working mechanism of its inhibitor property.



# Copper slag as a high value application material in concrete

Dhiraj

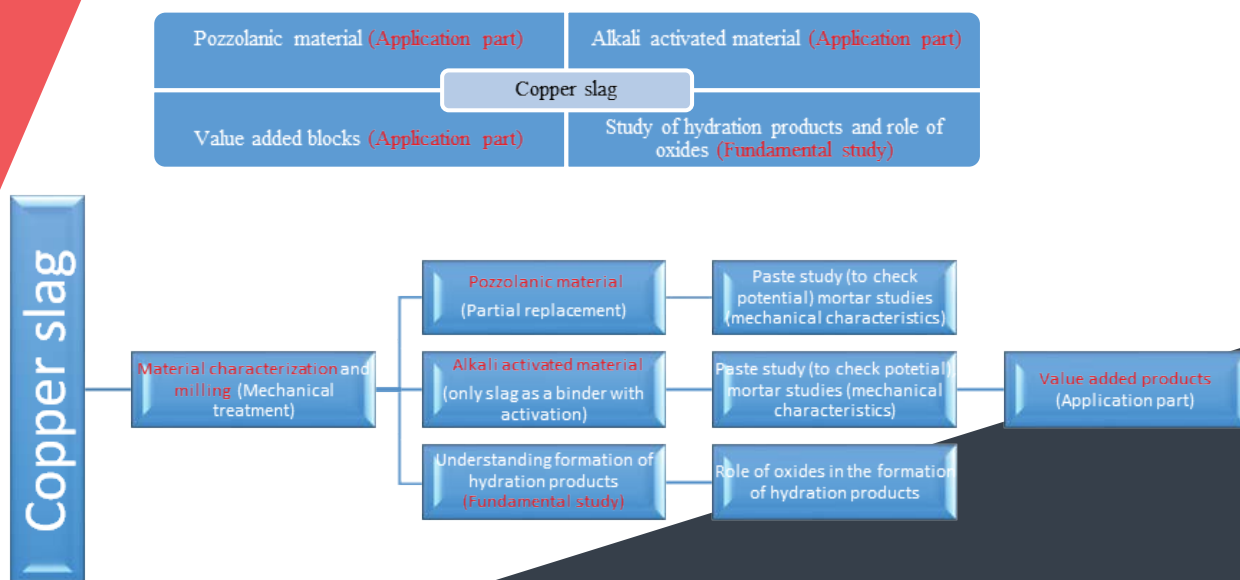
Concrete is the most common material used in construction industry which offers dimensional stability to the structure with low cost and high durability. Out of the main ingredients of concrete, sand and aggregate together make up around 60-70% part of concrete while remaining part includes cement, mineral admixture, chemical admixture, water etc. Taking in to consideration the high cost of cement than other ingredients, use of industrial by products as a cementitious material or binder in concrete can be considered as a high value application material in concrete which can help to reduce the cost of construction and to solve the environmental issues. One of such material is copper slag.



## Copper slag generation

6-6.5 MT generation in India (2010)

Our research includes both application part as well as fundamental study. Currently we are working on pozzolanic reactivity part. Results showed that it has a potential to use it as a binder in concrete which is beneficial to construction industry as it is difficult to find quality material at particular site. Flow chart of the research work is shown below. Also, we are trying to develop a Guarded hot plate apparatus (ASTM C 177) in our lab which can measure the thermal conductivity of blocks, bricks etc. which is a part of our study.



## Smart FRP Bars with Embedded Fiber Bragg Grating Sensors

Prashant Motwani and Arghadeep Laskar

### Introduction

Fibre reinforced polymer (FRP) composite materials are being increasingly used in advanced engineering structures, replacing homogeneous conventional materials (e.g. metal alloys). However, the failure mode of a single FRP layer is rather brittle. Even though a multi-layered laminate might allow for a pseudo-ductile moment-curvature relationship, FRP lacks the ductility as compared to other construction materials. Thus, the complicated degradation mechanisms demand high safety factors for composite materials leading to uneconomical design, thereby limiting its application within primary structural elements only. An alternate approach to utilize the full capacity of FRP is through continuous structural health monitoring (SHM). SHM technique aims to monitor the behaviour of structures, detect damage, estimate current health status and even predict future failure during service. The most widely investigated SHM technique is the use of fibre optic sensors (FOS). This is due to its immunity to electromagnetic fields, multiplexing capability, linear response and the ability to be embedded into structural systems. Fibre Bragg Grating (FBG) based FOS are quasi-distributed sensing areas written on a single fibre line which can be interrogated from either end of the optic sensor (Fig. 1). The discrete strains obtained from FBG sensors can be used to generate a full strain map using high-end computer algorithms and extrapolation techniques

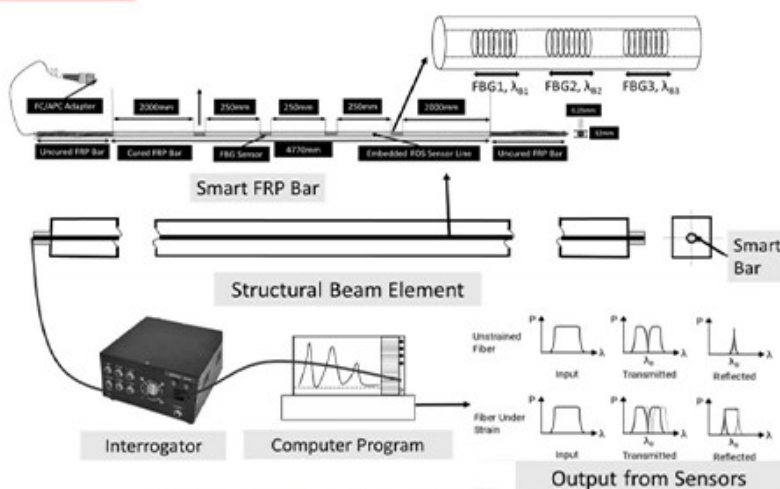


Fig. 1 Working Mechanism of FBG-Based Smart FRP Bar

1 Doctoral Student, Department of Civil Engineering, IIT Bombay, Mumbai, Maharashtra.  
2 Assistant Professor, ee

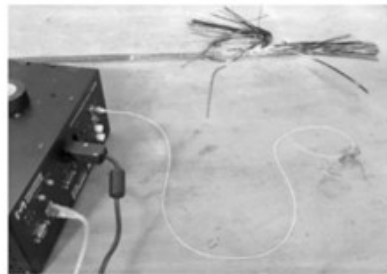


## 2 Development of a New Self-Sensing FRP Bar

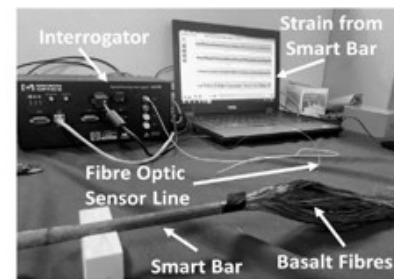
A novel manufacturing technique has been developed for the embedment of FBG sensors inside a basalt FRP bar through a collaborative research between IIT Bombay and Queen's University Belfast, UK. The technique has been validated by embedding a single FOS with four FBGs among 160,000 other continuous reinforcing basalt fibres impregnated with epoxy resin. The developed self-sensing FRP bar and its connection with a data logging system is shown in Fig. 2. The bar was first developed at the production line of a company called ZAORPP located in Russia.



(a) Splicing



(b) Logging



(c) Data-Retrieving

Fig. 2 Basalt Smart FRP Bar and its Connection to Data Logging System

### Mechanical Characteristics of Smart Bar

The perturbation of the surrounding field in the host due to the presence of the sensor is termed as 'obtrusivity' of the sensor. Excessive obtrusivity can perturb the values of the field variables being measured and affect the integrity of the host material. Quality evaluation of the embedding technique was carried out using optical microscopy. Fig. 3 shows that FOS and basalt fibres physically combine without any sign of obtrusivity. The embedded FBG sensors were able to survive an average peak strain greater than 0.6% in laboratory tests, as shown in Fig. 3. This amount of strain is more than the serviceability limit to which these bars would be typically subjected in their field applications. The behaviour of smart bar with embedded sensors and normal FRP bars without sensors showed similar behaviour. Thus, the characteristics of the developed smart bar are like a normal



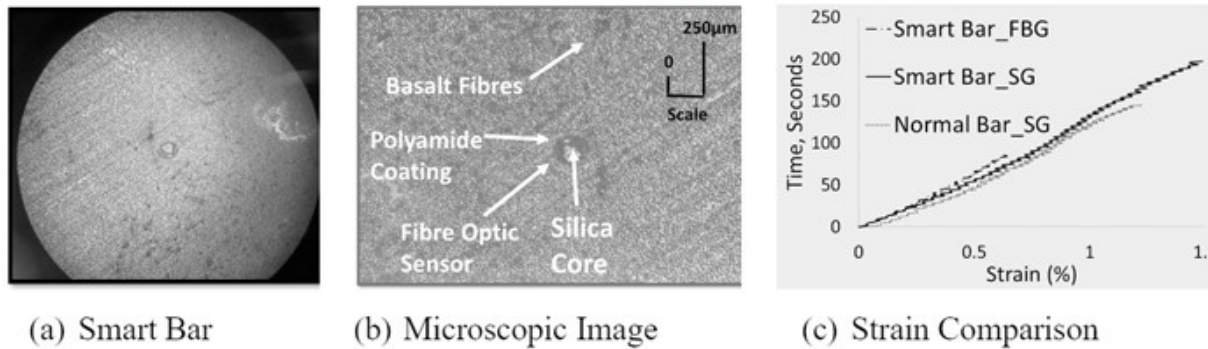


Fig. 3 Optical and Mechanical Characteristics of Smart Bar

### Usage and Future Prospects of Smart Bars

Smart bars used in real-life structures can be simultaneously utilised for in-situ real-time monitoring of the structures to generate the health information of the structures and minimise dependency on structural auditing and manual inspections. The use of smart bars would overcome impediments associated with the monitoring of previously unmeasurable internal strains stemming from accessibility limitations. The structural components fabricated using smart bars can have in-built sensing devices for serviceability assessment of the structures and can provide a suitable representation of the health of the entire structural system such as a building. Additionally, finished smart housing products like smart balconies, walls or windows can also be fabricated using these smart bars. The quasidistributed sensing technique adopted for the smart bars developed in the present research gives the flexibility of choosing the number and location of the sensing areas.

The excellent sensing performance and the ease of implementation of the novel smart bars

into structural systems indicate that these bars have a great potential to build a smart

infrastructural society. It would be possible to undertake timely maintenance or

rehabilitation of structural systems with these bars, resulting in considerable saving of life

and economy. This vision can be achieved through a two-fold process.

The present research unequivocally solves the first-fold of the problem by disclosing the fabrication technique of the smart bars to the manufacturer (ZAORPP) using a simple yet sophisticated model to convert any production line into a smart bar production line. The finished product is now available for purchase from Magmatech Pvt. Ltd. ([www.magmatech.co.uk](http://www.magmatech.co.uk)), a distributor company of ZAORPP. The second fold of the problem is regarding the general awareness and codal implementations of the smart bars. Currently, there are no enforcing guidelines to monitor the health of structural systems over their life-span. SHM of engineering structures should be a mandatory regulation for every construction to ensure the safety of the end-users. Thus, as a second step towards the development of a smart infrastructure society, it is crucial to introduce guidelines to use these smart bars as in-built real-time data monitoring devices into construction projects. This can be achieved by building prototype smart colonies which will serve as an exemplar for the construction industry and provide enough data for its implementation in the upcoming BIS codes.

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## Litigation Proneness of Construction Contracts

### Murali Jagannathan, Venkata Santosh Kumar Delhi

Disputes in construction projects have been a topic of research for many decades. The construction industry, owing to its uncertain and stakeholder-intensive nature, is prone to disputes. In fact, in addition to being a thorn in the working relationship between the parties to a contract, disputes and their long-drawn resolution process have been major contributors for project delays (PMI&KPMG, 2019). The focus of researchers has, therefore, been to find out factors responsible for such disputes and devise mechanisms to eliminate them (Sun and Meng, 2009). Various dispute resolution mechanisms that have evolved over years have focussed on time and cost-effective dispute resolution along with procedures that sustains working relationship between parties. However, disputes continue to plague construction projects even to this day (Zhang, Fenn and Fu, 2019), with certain disputes getting escalated as long drawn legal battles in the court of law (Sinha and Jha, 2020). Existing research in this direction largely focuses on the conditions leading to the choice a particular dispute resolution method (Chan, Suen and Chan, 2006; Haugen and Singh, 2015). Haugen and Singh (2015), for instance, concluded that negotiation and mediation were the two most adopted methods for construction dispute resolution, when parties consider factors such as preservation of relationship and confidentiality, among others as beneficial to them. However, when parties do not consider relationship and confidentiality as important, for instance, does it mean that parties automatically adopt litigation to resolve disputes? Specifically, are there any other reasons, spanning across multiple disciplines of study, that the parties consider important when they find litigation to be beneficial? The focus of this research, therefore, will be on finding out the conditions that can escalate a construction dispute to the stage of litigation, notwithstanding efforts to resolve such disputes amicably through negotiation or mediation or even conciliation

Before delving into the research methodology. It is important to evaluate if litigation in construction is really an issue bothering the construction industry. While the number of instances that turn into a case in arbitration or litigation may be small (Tazelaar and Snijders, 2010), the value (of claim or dispute) associated with those few instances are too large high to ignore. For instance, in the project pertaining to six laning of Panipat-Jalandhar section of National Highway 1, due to the stay order by the court by the High Court regarding a dispute (which was later reversed by the Supreme Court), there was a cost escalation of INR 1054 Crore (till February 2018) (PMI&KPMG, 2019). Recently, an article was published in the newspaper revealed that as on March 2018, out of 426 projects of worth INR 1.2 lakh crores that were carried out by road developers, 740 arbitration claims worth INR 1.7 lakh crores were raised by the developers and further INR 37200 crore counterclaims were lodged by the employer NHAI (Dash, 2019). This observation, to an extent explains the seriousness of the ‘few’ transactions that land up as a matter of arbitration or litigation. It is a well-documented fact that courts in India are grappling with the problem of huge backlog of pending cases. With reference to the infrastructure sector the problem is two-fold. Firstly, the value of projects that are stayed are huge and secondly the prolonging duration of the stay owing to the mounting backlog and a strained court-infrastructure (MinistryofLawandJustice, 2015; Ministry of Finance, 2018). The escalating costs and inflation result in projects becoming costlier to execute due to delays in the resolution of cases. The Economic Survey report 2018, observes that the actual estimate of the financial burden caused due to the delays in the judiciary is “to colossal” to comprehend. On the other hand, It was observed by (Chemin, 2010) that the court speed affects economic activity. Specifically, slow courts result in increased contract breaches, unchecked post-contractual breaches and opportunistic behaviour of borrowers resulting in costlier credit and slower economic activity (Chemin, 2010). The practice of filing frivolous cases especially



The research underway, based on the research question, is guided by the following objectives:

1. To theoretically understand the decision to litigate in the context of construction disputes
2. To list down all possible conditions under which a dispute may escalate to litigation, notwithstanding the efforts to amicably resolve them
3. To develop contractual remedies to mitigate the conditions that can breed litigation amongst parties to a contract

Considering the research question, which is exploratory in nature, we propose a case study approach to meet the research objectives. Firstly, through a comprehensive review of literature from economics, sociology, contract, organization and behavioural theory domains, the basis for the decision to litigate is gathered and through a process of theorizing and attempts will be made to borrow them to the current context (objective 1), that is, construction. Parallely, expert interviews and review of court judgements from India and abroad will be undertaken to choose a sample of cases which will further be studied for conditions that lead to the stage of litigation, in spite of attempts to resolve the disputes through amicable means, if any (objective 2). Depending on the number of cases that we will be able to collect, we may even think of mixed methods (both qualitative and quantitative) to meet the objectives. The observed litigation-supporting conditions will be validated by confirming the absence of such litigation-promoting conditions in cases of amicably resolved disputes. Finally, the role of construction contracts in disputes getting escalated to litigation, is evaluated to recommend contractual procedures that can minimize litigation (objective 3).

At present, the research is in the stage of attending to the first objective of theorizing. It is proposed that the remaining objectives would be fulfilled in a span of next two years.

Research related peer-reviewed journal articles published

Jagannathan, M. and Delhi, V. S. K. (2019) ‘Litigation Proneness of Dispute Resolution Clauses in Construction Contracts’, *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 11(3), pp. 1–8.

Jagannathan, M. and Delhi, V. S. K. (2020a) ‘Litigation in Construction Contracts: Literature Reveiw’, *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 12(1), pp. 1–9.

Jagannathan, M. and Delhi, V. S. K. (2020b) ‘Perceptions of Stakeholders on the “Redraftability” of Construction Contracts’, *IIM Kozhikode Society & Management Review*, pp. 1–10. doi: 10.1177/2277975219885285.

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Chan, E. H., Suen, H. C. and Chan, C. K. (2006) ‘MAUT-Based Dispute Resolution Selection Model Prototype for International Construction Projects’, *Journal of Construction Engineering and Management*, 132(5), pp. 444–451. doi: 10.1061/(ASCE)0733-9364(2006)132:5(444).

Chemin, M. (2010) ‘Does Court Speed Shape Economic Activity? Evidence from a Court Reform in India’, *Journal of Law, Economics, & Organization*, 28(3), pp. 460–485. doi: 10.1093/jleo/ewq014.

Haugen, T. and Singh, A. (2015) ‘Dispute Resolution Strategy Selection’, *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 7(3), p. 05014004. doi: 10.1061/(asce)-la.1943-4170.0000160.

# CIVIL ENGINEERING ASSOCIATION EVENTS AND UPDATES







# CIVIL ENGINEERING ASSOCIATION 2019-20

**Head Of Department**



Prof. T.I. ELDHO

**Faculty-In-Charge**



Prof. Venkata Santosh Kumar

**Faculty-In-Charge**



Prof. Meera Raghunandan

**Faculty-In-Charge**



Prof. Albert Thomas

**Department General Secretary**



Onkar Kanthale

**CEA General Secretary**



Yash Agrawal

**CEA Secretary**



Harshil Agrawal

**CEA Secretary**



Ankit Sharma

**Web Secretary**



Bhushan Misal

**Design Secretary**



Piyushi Hinge

**Class Representative  
3rd year(S1)**



Shantanu Samarth

**Alumni Secretary**



Swastik Dasgaonkar

**Class Representative  
3rd year(S2)**



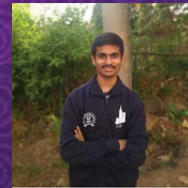
Pankaj Gupta

**Class Representative  
2nd year(S1)**



KPS Srinivas

**Class Representative  
2nd year(S2)**



Samkit Mehta

**M.Tech Representative**



Manish Yadav

**PG Sports  
Representative**



Anas Abdul  
Rahiman PM

**PG Cultural  
Representative**



Rajiv Kumar Saw

**PhD Representative-**



Sahana V



## Civil Engineering Association

The Civil Engineering Association (CEA) at IIT Bombay, was established with a prime objective to proliferate knowledge & address industrial issues by bringing corporates, professors and students on a common platform. CEA, having students as well as faculty as its members, is one of the most active organizations of civil engineers students in the country. The association aims to promote civil engineering by providing the much-needed practical exposure to the community members through its regular activities like technical seminars, research symposium, talks on ongoing research practices throughout the globe and many other related topics from distinguished practitioners of the trade. Collaboration between the school and industry is important for the advancement of engineering teaching and research. With this aim, to give the students some practical insight into civil engineering, CEA organizes several visits throughout the year to ongoing construction sites thus giving them a chance to interact with key personnel of the industry. Apart from the technical aspects, it also undertakes the responsibility of proper nurturing of students by organizing some social events as a part of extracurricular. Here is a brief description of the events organized by CEA throughout the year.

### Traditional Day

Each year, Traditional Day is organised with enthusiasm by the association twice a year, one in each semester, where all the students, from UG fresher year to PhD students, gather together to have a fun-filled and healthy interaction with each other. Importantly, it is for freshers to get a chance to meet and interact with the seniors. As the name suggests, all the students wear traditional attire on this day. Different students from different cultural backgrounds come dressed in their native outfits, giving a diverse touch to the occasion and the civil department of IIT Bombay. During this get together, the students share their experiences, academic as well as non-academic, have delightful snacks, create memories through photoshoots, participate in some fun activities and take back a few prizes and a handful of memorable experience.



## Students Trip

CEA organizes trips for students every year, first in the autumn semester and the other in the spring semester. Since the last three years, CEA has organised trekking and night camping tours, but last year breaking the trend CEA organized a trip to Essel World Amusement park, which was a huge success owing to the amazing rides, adrenaline boosting activities and fun games of the park. There is a lot of excitement among the students for the trips, for hundreds of them go on these treks and tours, have a chance to connect with their fellow batchmates outside the institute walls and explore wonderful places around Mumbai. The night camps include overnight stay in tents, bonfire, fun games and food. The first trip is focused on sophomores and freshies bonding while the second trip is focused on the graduating students.



## Know Your Department

Know Your Department is a one day event where the students, especially sophomores and freshmen, get an opportunity to explore the specialization fields of Civil Engineering. The department professors talk about their research work and projects under their respective specializations. The speakers are not only professors but also successful industrialists. This event holds a crucial role in shaping the career foundation of the students.



## ***CORE TALKS:***

It is a series of interactive sessions between the alumni and the students. As the name suggests, these are aimed at giving the students insights on career opportunities in the core industry and the scope of higher studies in their parent department.

### ***1) Core Talk on Higher Studies***

For this session, Mr. Gopal Rai, Ph.D. alumni from the batch of 2007, was invited. He is presently the CEO of Dhirendra Group of Companies (DGC), a leading structural rehabilitation company, and is also the Hon. Secretary of the Indian Institute of Bridge Engineers (IIBE). He recently became a member of the Indian Standards Codes Formation Committee for repairs and rehabilitation. He not only shared his vast experience with the students but also motivated them to pursue higher studies and to get involved in the various research projects. This session was conducted in the last week of August 2019. Over 150 students were benefitted.



### ***2) Core Talks on Industrial Opportunities***

This session had Mr. Vipin Mittal, B.Tech from the batch of 1993, as the speaker. He is currently the Head of Operations at Peninsula Land Ltd., a Real Estate firm across India & having more than 25 years of experience in managing measure projects in the FMCG field and real estate industry. During the session, he shared his journey and experience with the audience. Conducted in the first week of September, this session gave the students insights on the core job opportunities and also into the professional lives of the alumni. Over 150 students attended the talk.





### ***3) A Talk on Indian Engineering Services (IES)***

An interactive session with Mr. Namit Jain, B.Tech alumni of IIT Guwahati (batch of 2015), was arranged in the last week of August. He had secured AIR 1 in the prestigious UPSC Engineering Services Examination (Civil) in 2017. Currently, he is posted in the Indian Railway Service of Engineers (IRSE). Not only did he talk about his journey from his B.Tech. days to joining the Indian Engineering Services, but also encouraged our students to prepare for this examination. More than 50 students benefited from this session.





## Sports Weekend

This is a two-day event, organised at the beginning of the spring semester. The sports weekend includes tournaments in various sports like cricket, badminton, table tennis, volleyball, chess and football. This weekend is eagerly waited by the sports enthusiasts. Not only this, the department staff also participates in the tournaments, playing alongside the students. The teams are divided on the basis of S1 and S2 batches, leading to a healthy competitive vibe among the participants. At the end of the sports weekend, the winners are honored with certificates and medals.



**T-Shirt and Hoodie Design Competition** The department merchandise consists of t-shirts and hoodies or jackets. Each year, a different and innovative design is made for t-shirts and hoodies. To explore students creativity , a t-shirt and hoodie competition is organised by the CEA. This competition gives a platform to the design enthusiasts to get their vision printed on the merchandise. Once the best design is finalised, it gets printed and official merchandise is released by the association. Wearing the department t-shirts and hoodies gives the students a feeling of oneness and belonging to the big family of civil engineering department.



### Seminars, Workshops and webinars

CEA has been offering many in-depth, high quality seminars and talks each year covering a wide range of technical, management and career-oriented topics. These seminars include both formal and informal sessions being delivered by alumni, industry professionals, international faculties and research scholars. Along with this CEA also organizes software workshops covering all important aspects of software that are used in civil engineering. Due to the COVID-19, CEA faced challenges while organizing events, overcoming them CEA has recently organized a webinar on road technology in collaboration with the oil giant Indian Oil. The aim of the program was to introduce students to the core sector of our department.



## **CEA Seminars**

CEA seminars organized throughout the year have witnessed talks delivered by global experts from the University of Cambridge, NASA Goddard, ETH Zurich, Cornell University, LafargeHolcim Foundation, Walter P. Moore, and many more, on an array of topics ranging from flood management, decision analysis and the search for habitable worlds to remote sensing, soil stabilization and sustainable construction. These talks provided insights into the current state-of-art as well as industry practices across multiple fields of civil engineering.

### **The future of sustainable buildings**

Buildings are becoming more energy efficient, i.e., sustainable, but the limits to their energy efficiency are not well known. Following an overview of building energy trends in the USA and worldwide, Prof. Patrick Phelan from Arizona State University's Mechanical & Aerospace Engineering presented an analysis of an ideal, all-electric residential home in the USA that defined the ultimate minimum energy consumption of an 'ideal' house, akin to the Carnot efficiency of an engine or the Carnot coefficient of a refrigerator's performance. He concluded with a discussion on heating, ventilation, and air conditioning (HVAC) systems that are becoming crucial with ongoing global warming.

### **Mixing through dispersion in subsurface plumes and gravity currents**

Dr. Chunendra K. Sahu, a Postdoctoral Research Associate at the University of Cambridge illustrated his experimental findings which led to a new theoretical framework for solving a fallacy associated with most studies on gravity currents flowing in porous media. His work showed that gravity currents, in contrast to what was previously believed, do mix with the ambient fluid even more so when the medium is heterogeneous. His work in plumes also highlighted false assumptions regarding plumes in subsurface porous media. In contrast to the previously assumed dominant molecular diffusion process, his similitude experiments showed that mechanical dispersion truly governed. He found the rate of entrainment into a plume from the ambient fluid several orders of magnitude greater than previously predicted.

### **Current Research at Center for Nuclear Energy Facilities and Structures (CNEFS) at NC State University**

Prof. Abhinav Gupta, a Professor of Civil Engineering at NC State University and the Director of the premier research consortium 'Center for Nuclear Energy Facilities and Structures (CNEFS)' provided a broad discussion about CNEFS, its mission, research areas and recent work. Supported by a partnerships of industry and US Government, the Center performs research on innovative but rigorous solutions to problems in nuclear facilities while attempting to transfer this technology to the industry. These solutions are formed using statistical methods for uncertainty quantification and decision making within the engineering context for increasing safety and reducing the cost of operation of existing plants and of building new ones. He mentioned that the center's current projects have a strong emphasis on conducting research in the areas of using Artificial Intelligence and Machine Learning for applications in structural engineering and construction management.

### **Remote sensing of terrestrial hydrology**

Dr. Rajat Bindlish from NASA Goddard Space Flight Centre discussed the applications of NASA's AMSR series of instruments (AMSR-E and AMSR2) which use microwave observations to provide long term soil moisture data record. Soil moisture information is critical for crop yield forecasting, early warning of floods and droughts, irrigation scheduling and reservoir management. He also talked about NASA's plans to develop a high resolution soil moisture product using NISAR observations in future.

### **Systems thinking approach for vulnerability assessment, adaptation and environmental change impacts on plants and water**

Florida, A&M University's Dr. Avudhai Anandhi Swamy discussed the use of modelling frameworks relying on systems thinking to help answer the question "how to adapt" our ecosystems to environmental change. Multiple factors shape adaptive responses and vulnerability assessments in an altered climate, because of the complexities and multi-disciplinary nature of the three key interconnected systems: ecosystems, climate systems and adaptive management and planning systems. The talk focused on the development of two conceptual modeling frameworks (CISTA-A and WR-VISTA), the former addressing the question "how to adapt", and the latter translating theoretical concepts into an operational framework.

### **Flood risk management – Best practices**

Recent rainfall pattern changes have increased flood risk impacts on humans, property, environment, etc. Dr. Andres Salazar, Principal / Managing Director of Water Resources Engineering, Walter P. Moore, Texas and Mr. Hrushikesh Sandhe, Senior Associate and Head of Civil and Water Resources Engineering in Walter P Moore's Pune office provided a holistic view of the multiple factors involved in flood risk analysis. These include land-use changes, change in flows, velocity, increase in water surface elevations, soil conditions, geomorphology, and changes to the floodplain, banks and channel. They also discussed current industry practices in the area which involve looking at the impacts of multiple parameters independently and giving due consideration to regionally varying standards and regulations.

### **Intelligent planning and capacity building for resilient cities of the future**

Different types of infrastructure and their interdependencies play an important role in post disaster recovery and community resilience. Effective coordination between cyber-physical-social systems is crucial throughout the phases of emergency, short- and long-term recovery. Prof. Makarand Hastak from Purdue University, USA discussed (i) the interdependencies and associated capacity needs of infrastructure systems for improving community resilience, and (ii) the concept of Intelligent Planning Units (IPUs) for developing smart construction solutions for resilient cities of the future. He also presented example scenarios elaborating IPU concept for reducing complexities in built environment. The discussion concluded by identifying possible challenges and opportunities for the IPU concept.



# AAKAAR

सिविल अभियांत्रिकी विभाग CIVIL ENGINEERING DEPARTMENT

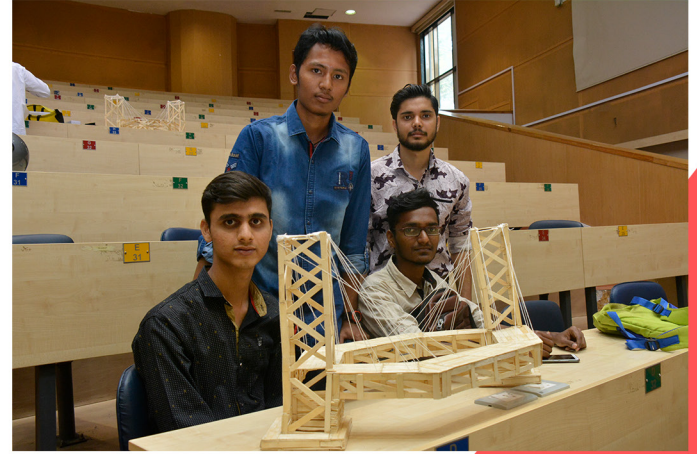
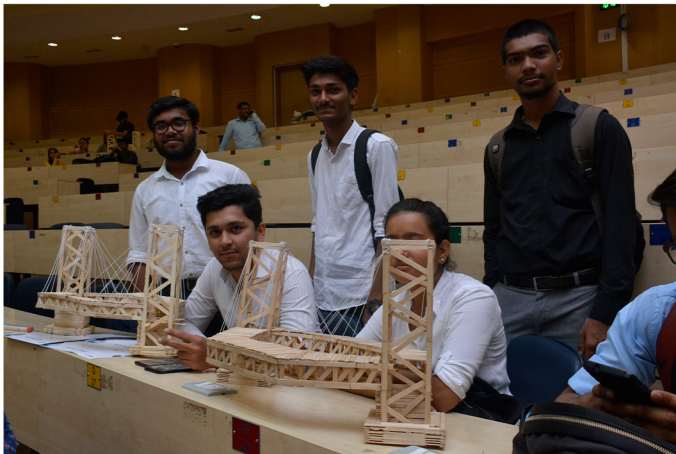


# AAKAAR

Aakaar is the annual technical festival of department of civil engineering, IIT Bombay. It is held in the month of March. Aakaar has been a great platform for students all across the country to showcase and enhance their skills at the highest level. Established in 2009, Aakaar is now Asia's largest civil engineering festival. There are numerous competitions held in Aakaar such as Civil Engineering Symposium, Civil Engineering National Exhibition, Bridge-It, Conquer-It, Smart Pitch which help the students strengthen their practical knowledge as well as allow them to partake in contests and competitions. As a part of knowledge sharing endeavour, many software workshops are conducted viz, Etabs, Autodesk Civil 3D, StaadPro, BIM, Revit etc. A national level civil engineering quiz named CiviQ is also conducted every year. Several fun events make Aakaar an enjoyable learning experience

## Bridge-It

Bridge-It is a popsicle bridge making competition. It is held every year with unique and challenging problem statements. Last year it brought the challenge acquired from the bridges having the nonlinear decks supported by cables. These kinds of bridges are often used to construct large and complex highway interchanges into densely populated areas to avoid traffic congestion and to increase the aesthetics of the structure. Due to the curvature effect, the dynamic behaviour of such a bridge is more complicated than a straight bridge, thus inherently creating challenges for engineers to deal with the increased bending moment and the arrival of the torsional moment due to horizontal curvature. The task provided for the competitors from all over INDIA is to design a cable-stayed bridge with popsicle sticks, fevicol as adhesive and cotton strings that can sustain maximum possible load with minimum deflection. The competitors come up with their bridges with the mentioned specifications in the problem statement of the bridge and also with their own creativity.





## Conquer-It

Conquer-it is another challenging competition where participants have to make concrete and its mix design based on a unique problem statement. Last year Aakaar decided to investigate the maximum stiffness of lightweight concrete. The challenge was to come up with a mix design and the best possible model which adhered to the given set of regulations which demanded an optimization between the stiffness and the weight of the structure. The model was used to measure Young's modulus.



## MSE Wall

MSE Wall is one of Aakaar's many competitions. Its objective is to design and build a mechanically stabilized earth retaining wall model which serves as a temporary wall, using paper reinforcement, taped to a paper wall facing. This competition tests promptness of ideating the design, teamwork, productivity in a constrained time period, etc.



## CIVIQ

National Civil Engineering Quiz

CIVIQ is the most exciting and brain-twisting competition of Aakaar. It comprises of quizzes and games related to the field of Civil engineering. It's a national level open civil quiz competition. The competition comprises of three rounds with 4 teams who are selected from a general quiz round with 2 participants each. Round 1 is a sliding tackle in which each team gets a question that can rotate between teams bounding some rules. Round 2 is the picture round in which a team gets a picture that contains the details to tackle it. Round 3 is Dumb Charades arranged for fun





## Panel Discussion

A panel of fabled dignitaries is set to discuss and debate on a particular topic and they share with us all the details from their perspective. Words from these renowned and experienced personalities gives the audience a good view of the topic selected. Last year the topic for the panel discussion was 'Career Conclave' which guided several young civil engineers of India to choose the right career for their future.



## Workshop

Workshop is the right platform to connect theoretical knowledge to practical knowledge. Through workshops, leading professional softwares being used in the field of construction are introduced. Gaining knowledge about these softwares from some of the best experts in the field will definitely help in delving deeper into the subject. It also provides a chance to interact with people sharing the same interests and to clarify doubts from the professionals. In the year 2019, we conducted BIM-AECOSim, STAAD Pro, Dynamo and Bridge Design workshops.



## CENEx

### Civil Engineering National Exhibition

CeNEx provides an opportunity for civil engineering students all across India to showcase their research projects incorporating new technology via different models, prototypes, simulation models or samples in front of eminent professors and professionals. It aims to shower light on technological advancements by the youth of this country. Students in groups are supposed to display their models and give a brief description about the same. Best models are given prize money





## Lab Visits

Lab visits have been introduced to Aakaar for the very first time. It was an initiative taken up by the events managers this year. More than 300 students from various colleges came to visit various labs in our Institute like Hydraulics labs, Heavy Structures lab, Transportation lab, Construction Management and Technology lab, Heavy Structures Lab, etc. Students were given booklets which contained information about the experiments. Lab assistants gave an overview on experiments







# WORLD CONFERENCE ON TRANSPORT RESEARCH



## **World Conference on Transport Research (WCTR) held at IIT Bombay**

The 15th WCTR conference was at the Indian Institute of Technology Bombay, India, during 26-31 May 2019. For the last 40 years, WCTR has been organised every three years by the WCTR Society. The conference aimed to bring together academics, practitioners, managers, and policymakers from all parts of the world, to share cutting-edge research and advanced state-of-practice. The conference also included special sessions, technical tours, an exhibition and social events. This knowledge event provided an unique opportunity for experts to exchange ideas in all areas of transport research.

The keynote lectures were a highlight of the conference. Experts and eminent Scientists/Engineers were invited from all major disciplines and presented problems faced in practical real world problems, highlighting possible avenues for future research in transportation engineering





WCTR 2019  
Director K V Krishna  
Rao Speaking at the  
Opening Ceremony

Deputy Director of IIT  
Bombay A K Suresh  
delivering his welcome  
address



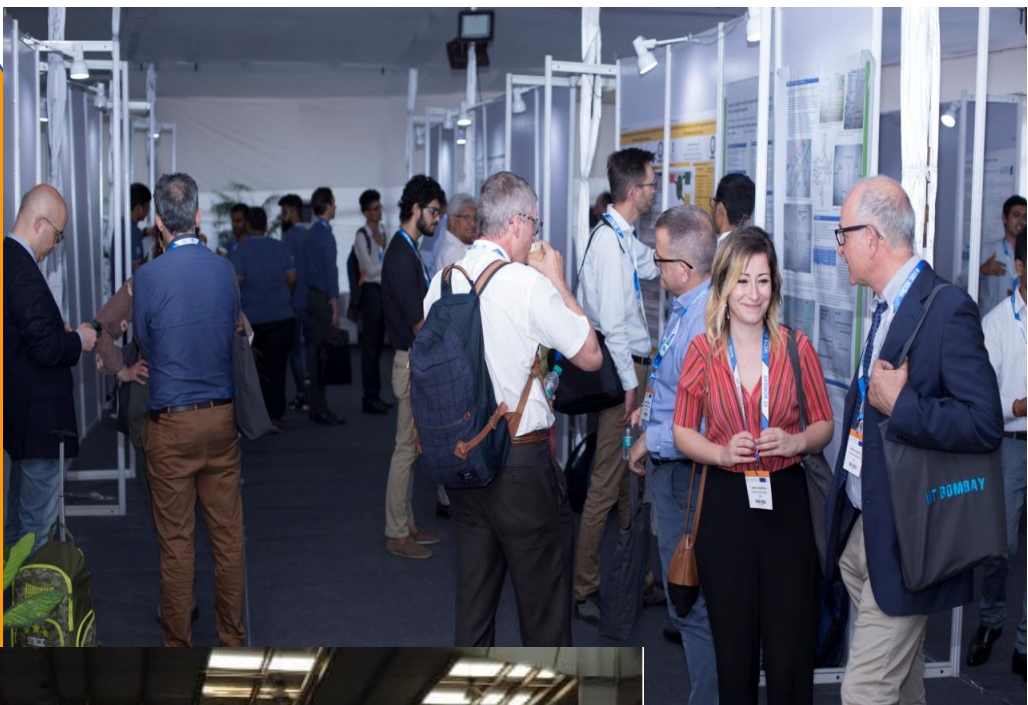


WCTRS President Yoshi Hayashi delivering his opening address

Chair of WCTRS Scientific Committee Lóri Tavasszy introducing the conference programme











# RENDEZVOUS with Professors



PROF. T I ELDHO  
(HEAD OF DEPARTMENT)



*The unprecedented scenario of COVID-19 has forced IIT Bombay to conduct the Autumn semester 2020-21 in the online mode. The institute has made a lot of efforts in planning for the semester. Prof. Manjunath committee was set-up by the institute to come up with the guidelines to achieve the goal of effective online instruction. The Civil Engineering Department has also done significant planning to conduct the online semester in the best possible way. The CIVIL INSIGHTS 2020 team talked to Prof. T. I. Eldho, Head of the Department, to know about different challenges and the department plans for the semester. Here is an excerpt from the interview:*

## **How does the department plan to make online instruction effective during the semester?**

The main concern was the internet connectivity with the students. Around 60-65 percent of the students have good connectivity but for the remaining of those, it's a concern. As per institute directions, we shall be uploading pre-recorded lectures for all the courses which the students can download and go through. During the assigned slots of the courses, the instructors shall explain important portions and facilitate discussions. All the online courses will be monitored, in particular the UG courses, in which large number of students have registered. The department has also set up a committee comprising Prof. Dasaka Murthy, Prof. Jaydipta Ghosh and Prof. Venkata Delhi to continuously review how the semester proceeds. The institute is also preparing to accommodate a few resource-constrained students at the campus itself.



**One of the main elements of attending classes physically is the interaction of the students with their peers. Also, some students find it more comfortable to communicate through the course TAs. How can these interactions be incorporated in the online mode?**

The instructors shall emphasize on class participation and discussion during the assigned slots as the pre-recorded lectures have already been shared with the students. For interaction with the course TAs, some informal groups can be created. Students should be encouraged to reach-out to their TAs and instructors.

**In a regular semester, the students' performance is assessed through continuous evaluations, usually the two quizzes, the mid-semester and end-semester exams. Will this continuous assessment be affected now?**

Evaluation is not a point of concern as it can be easily conducted through online quizzes via Moodle. Some training has also been conducted for the same. Students can also be evaluated through the assignments and projects. Open book examination might be a good option to test their learning. The evaluations would be faculty dependent and Institute is going to put few guidelines for that.

**In most of the semesters some lab courses are conducted which supplement the ideas learnt in particular theory courses. Is the department exploring alternatives to fill this gap in the online semester?**

A We have made some plans for the lab courses. The laboratory manuals would be provided to the student and the instructors would record the experiment in the laboratory which would be shared with the students. It can also be shown during the assigned slots. If things tend to be normal in a couple of months and students are back on the campus, the experiments can be demonstrated during the weekends.

**The progress of some research students (Masters/PhDs) has been disrupted in this period. What would you suggest to them to keep up with their work in the coming months?**

Actually the department was very productive in terms of PhD students in this period. The thesis submission and review processes went smoothly. Almost fifteen students of our department have defended their doctoral work in this period. We are planning to bring back the willing PhD students to the campus by August end or September. As far as their progress assessment is concerned, we are discussing the plans like extending their seminar due dates.

## **In these difficult times the graduating students may find to pursue their career plans more challenging. Any advice for them?**

True, there is uncertainty but it is not for any one person or community. The pandemic is spread all over the globe (and can be thought of in a philosophical way). However, the issues will be sorted out in few months time and I am sure that the students career plans will be met, the way they wish. I advise them to take care of themselves and the people around them. They must keep good physical and mental health. I wish them best in achieving their career goals.

*(As told to Awanish Kumar and Ritveek Mahajan)*

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# RENDEZVOUS with Professors



PROF. SUBIMAL GHOSH

## *How did you find yourself suitable for this field and what motivated you to keep exploring further?*

I joined Water Resources Engineering by chance. Like many of our undergraduate students, I was initially interested in Structures. This is not because the subject is more interesting. I think our undergraduate curriculum of Civil Engineering in the majority of the colleges all across the country are biased towards Structures. Usually, there are nine to ten courses in Structural Engineering while only around two courses for Water Resources. It is generally the subject that you spend more time on that you tend to find yourself more interested in. Water Resources Engineering is normally taught with a set of empirical equations at an undergraduate level and this makes the subject boring. So at the outset, I also was interested in Structural Engineering. However, my rank in the GATE exam did not allow me to join Structural Engineering at the Indian Institute of Science (IISc), Bangalore. I got a chance to pursue Water Resources Engineering at IISc and so I joined there because I wanted to join IISc. In my first semester at IISc, there were two professors whose teaching had a very motivating influence on me – Prof. P.P. Mujumdar, who finally was also my Masters and Ph.D. supervisor, and Prof. Muddu Sekhar. Their way of teaching got me interested in Water Resources Engineering. I realized that there were a lot of things in this specialization that could be done which were more interesting than Structural Engineering. I started exploring new areas and realized that research in Water Resources and Hydrology is similar to exploring nature. The thought of improving our understanding of its trajectory, exploring its various processes, and the way they evolve was captivating. These thoughts along with the beautiful research environment at IISc got me motivated to start working in the area.

## **Tell us more about your Ph.D. journey – your experiences with the people at IISc and the challenges you faced.**

Ph.D. was an interesting period. After completing my Masters, I joined for Ph.D. under the same supervisor whom I had for the Masters. I had worked on water quality management problems during my Master's. It was based on developing an optimization model. I began loving the experience of exploring different optimization methods and visualizing the decision variable space. I was interested in exploring this area which is mathematical to some extent. My supervisor is a stalwart himself in the subject of Water Resources System. Thinking that my Ph.D. work would be on Water Resources System, I started my coursework. I started planning my research work on crop water management. After completing my coursework, I went to my supervisor and told him that I wanted to work on Systems. He said that I have to explore newer areas, and cannot continue with the same area, and so I have to work on hydrometeorology, hydroclimate, climate change impacts assessment, and associated topics. But I had not undergone any course on climate per se and neither were there any courses on hydrometeorology. So, the initial phase of my Ph.D. was very challenging. During this phase, I had to read a lot of papers and textbooks. I remember I used to read continuously and it was very difficult and challenging. But once you accept the challenge and start reading lots of papers in the same area, you begin to understand the topic. This is what has helped me sustain the habit of reading papers even after my Ph.D. and designing research problems and Ph.D. problems from them. My supervisor always wanted me to design my problem after reading papers. I designed my Ph.D. problems and designed the solutions. When I was doing my Ph.D., researchers there were not fully aware of the General Circulation Model and the associated uncertainties



During my comprehensive exam, one of the examiners asked many questions on that topic and I could only answer a few of them. It resulted in a scientific debate, which was helpful. I continued working in the area and once I completed my first work, my Supervisor asked me to write a paper for Water Resources Research (WRR). Getting a WRR paper is always difficult and at that time, it was an outstanding journal in Water Resources. The paper finally got accepted after two rounds of rigorous reviews. I learned a lot from the reviews and that helped me to design the other problems of my Ph.D. which was also a very exciting process. My message is that you will face a lot of problems during your Ph.D. but those things help and strengthen you to be able to explore newer areas and newer problems. And for solving a problem nowadays you need interdisciplinary knowledge.

## **After completing your Ph.D., what inspired you to become a professor?**

I should mention the name of Prof. Deepankar Choudhury, our “Deep-da” from Geotechnical Engineering in our department. When I joined IISc Bangalore, he was almost completing his Ph.D. and after that, he joined IIT Kanpur and then moved to IIT Bombay. He was a great motivator, he used to motivate all the juniors in IISc Bangalore and that helped me a lot. He was our role model; he still is. He does exceptionally good research and keeps motivating his younger colleagues as myself even today. Having him as a role model during my IISc days made me think that a career in research and teaching could be great. Secondly, my supervisor played a major role. He was a fully dedicated researcher and I was fortunate to have him as my Ph.D. supervisor. Seeing him enjoying research helped me enjoy my research, which is very important. When I was doing my Master's project, I realized that I wanted to

be in the field of research. Even in research, you can either be in the Industry or Academia. I wanted freedom in doing research. This is only possible when a researcher is in Academia and where he/she can work with younger people. The best way to be a teacher, as well as a researcher, is to become a professor in one of the IITs and that's what I tried.

## **How has been your journey since you joined as a faculty member in the Civil Engineering Department of IIT Bombay?**

It is a wonderful and great learning experience. However, during my initial first five years at IITB, it was not a smooth sail because of the huge teaching load. It was not like how it is at the moment. During recent years, the former and the present Head of the Department, Prof. Krishna Rao, and Prof. Eldho have introduced the rules to reduce course loads for newly joined faculties. This is necessary for the growth of the department as it allows the newer young faculties to have less course load permitting them the time to get Ph.D. students to develop their research groups. It was not like this thirteen years back when I joined. I had a lot of course load after I joined and I had to wait for four years to get my first Ph.D. student. I was getting frustrated. I was not getting time for my research. I still remember that in one of the semesters I had to teach three courses with each course having around eighty students. It was extremely difficult for me to spend time on research and neither was I getting any student. I had to work with some of the Master's students and some of the undergraduates, which was very difficult. That period was not at all smooth but it taught me how to multitask which is very important in my opinion. It helped me to be an active researcher. An active researcher, even after becoming a professor, has to follow new exciting papers

in good journals and has to design science questions. During the tough period from 2007 to 2011, my rate of publication was not as good as I would have wanted it to be but the period certainly helped me in its way. I must say that now the department is in extremely good shape and there are a lot of opportunities for the younger colleagues to get new students. They have fewer teaching loads allowing them to spend more time on research. This is the practice in almost all the good universities around the world this is the practice and I am thankful to Prof. Krishna Rao and Prof. Eldho who brought these transformations in place.

## **How good is your collaboration of research activities with the international scientific community?**

International collaboration is very important to continue good research because it gives a lot of exposure. Immediately after my Ph.D., I joined IIT Bombay without a PostDoc experience abroad. My international collaboration started with the BOYSCAST Fellowship by DST through which I spent six months at the Oak Ridge National Laboratory (ORNL), USA, working with Prof. Auroop Ganguly (who is now in Northeastern University). It was a fantastic collaboration and I still collaborate with him. Our first collaborative paper got published in Nature Climate Change. It was a very successful collaboration. While I was in ORNL, I also started collaborating with many of the other researchers. One of them is Moetasim Ashfaq who works for the South Asian Monsoon or the Indian Monsoon. Though he is from Pakistan (and settled in the US) he contributes a lot in terms of research in the area of the Indian monsoon. I still collaborate with him as well. When I was in ORNL, Prof. Praveen Kumar from the University of Illinois at Urbana Champaign, who is an alumnus of



IIT Bombay, visited ORNL. I met him and we had a long discussion following which we decided to jointly supervise a student, Amey Pathak. We worked together on land-atmosphere interactions which had not got sufficient attention from the Indian Monsoon community at that time. Praveen and I started working on this and it was a great collaboration indeed. Among my many collaborations, one of the most successful collaborations is with Prof. Raghu Murtugudde of the University of Maryland. He keeps visiting IIT Bombay. He taught me a lot of things. He cleared many of my concepts on the meteorology-related aspect of the Indian Monsoon. It was a great collaboration and I always consider him to be my friend, philosopher, and guide. He has helped me in shaping my research career. I am now a lead author of IPCC Assessment Report 6, and this also gives me a lot of exposure. I have been interacting with many stalwarts in this area. This has further opened up avenues for me to explore new areas. It is not only International collaborations that matter. Even within the institute, one should have a very good team to work with. I am fortunate to have Prof. Subhankar Karmakar from the Centre for Environmental Science and Engineering as one of my collaborators. We have developed many proposals together. I am the co-supervisor of many of his students and he is the co-supervisor of many of mine. We have developed a good team together and we are working on solving many problems. This has been fruitful to both of us. Good collaboration and a good team help to explore new areas and solve new problems and this is very important in research.

## How has been your experience in doing consultancy projects and how have this impacted society?

I am not a consultancy guy. I am more on research projects. Consultancy projects are lucrative because of the monetary advantage they offer, but I am biased towards research projects because of my supervisor, Prof. Mujumdar. Before joining IITB, he advised me not to go into consultancies but to remain focused on research projects. I believe that when you start loving money more compared to your research then your research career takes a back seat. I followed my supervisor's advice and it has helped me a lot.

It is not true that only consultancy projects have an impact on society. Both consultancy and research and projects have their impacts on society. I wasn't quite eager to take consultancy projects though I did a few and they have impacted the society. Of the two-three consultancy projects I did, one of them was a mega consultancy project which was with Prof. Subhankar and Prof. Pradipta Banerjee. It was on how you can reduce climate risks and design climate-resilient policies. The Government of India has introduced the MNREGA program which is essentially a 100 days employment plan for the rural people. The government can give jobs for 100 days to people who are unable to earn. Our objective was to design those jobs so that they might reduce climate risks. For example, a region that is drought-affected where farmers are unable to do agricultural activities, the 100 days program for them may be on water harvesting that will help to have agricultural activities in the future. We had to design jobs similarly for many of the villages and I have enjoyed this part. It was not the money but the impact this project had that made me go for it. I thoroughly enjoyed the research component of it.

## **How effectively do you think the research carried out by the scientific community reaches the relevant stakeholders and necessary changes in the policy are adopted?**

One such impactful research was on the development of the Chennai real-time flood forecasting system. In December 2015, there was a huge flood in Chennai following which the principal scientific advisor to the Government of India, Dr. Chidambaram, met our then Director, Prof. Devang Khakhar. A discussion took place for the design of a real-time urban flood forecasting system that can help people and save lives. We had many discussions over emails. Dr. Chidambaram visited us with Dr. Swati Basu, the then scientific secretary and also the former director of the National Centre for Medium-Range Weather Forecasting. They asked me to take the lead. We developed a team of thirty scientists from eight institutes, namely, IIT Bombay, IISc Bangalore, IIT Madras, Anna University, IMD, National Centre for Coastal Research, INCOIS, and NRSC. I was asked to lead the team of all the collaborators from these institutes and I had to complete the design of a real-time urban flood forecasting system in one and a half years, which was the first of its kind in India. Real-time flood forecasting system has multiple components, namely weather forecasting, coastal modeling, data assimilation, upstream hydrologic modeling, coupled urban flood modeling, and 3D visualization. It was quite a mammoth task and it was my first experience in leading such a big team. We started from scratch. There were project review committee meetings every three months led by Dr. Shailesh Nayak who was the former secretary of the Ministry of Earth Sciences. His guidance helped us a lot along the way. I am happy to say that we could develop the model in one and a half years. I am thankful to my team members



that we could finally develop it and give it to the National Centre for Coastal Research. They have currently made it operational for Chennai. I think it was one of the major projects done for the first time in India and has a direct implication for society.

## **Q8. How does it feel to have received the prestigious Shanti Swarup Bhatnagar award and what message do you have for the young researchers?**

Of course, Shanti Swarup Bhatnagar is a huge award but it is just an award and your research life continues as it was even after having received it. The award will not increase or decrease your research activities. It rather adds a lot of responsibilities in ways that people will start expecting more from you, which is important. It is now not just your research but you also have to start motivating, interacting, and helping your younger colleagues. So all these also become a very important part and is also something the award committee expects. Path-breaking research works are also expected in the future rather than routine research. These days I find many of my younger colleagues to be brilliant and much more mature compared to me when I was at their age. I would like to mention the names of Prof. Indu, Prof. Arpita, Prof. Jay Ghosh, Prof. Meera, Prof. Basudev, Prof. Riddhi, Prof. Velaga, and many more. When I see their work, I feel good as they are the future of our department and hopefully will bring many more awards and recognition to it than me. It's good to see my younger colleagues working exceptionally well and I learn a lot from them.

## What are your hobbies and how you keep up with your work-life balance?

I have a sweet family. My wife works outside IIT so I have to spend a lot of time with my little daughter. She keeps me so busy at my house that I cannot think of any other hobby. Work-life balance is essential and one cannot work 24x7. At IIT Bombay, I have a very good circle of friends. One of my collaborators Prof. Subhankar also happens to be my family friend. Also, Prof. Deepankar Choudhury is my very good family friend. One of my cousin sisters, Prof. Arpita Sinha (a faculty at Systems and Control at IITB) also stays inside the campus and we meet quite frequently. Such things keep me relaxed and I feel are also very important for life.

## What is your message for someone who wants to pursue further research (Ph.D.) in the department?

My message would be to enjoy your work and keep exploring nature. The dots are in front of you, and you have to join them. I often tell my students that when we were kids many of us have come across a fun activity in the newspaper where we have to connect the numbers in sequence. As kids, we were asked to join these numbers, and when you finally did that you would get a dinosaur in front of you. Essentially, in research also the dots from different literature are in front of you, and doing good research means how good are you in connecting the dots to get a correct picture of the thing you are trying to explore. The only difference is that here the numbers are not there. So you have to decide the numbers and then connect the dots yourself. The person who does it accurately is a good researcher. The most important thing in every research work is that it should convey a strong scientific message. The purpose of scientific research is to create a scientific message.

*(As told to Abdulmuttalib and Anushriya)*



# **INTERNSHIP EXPERIENCE**





**Love Kush Tak**  
UG 4th year

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**Consulting Engineerings Group (WFH)**

**Introduction:** I always had a desire to work on real-life projects. In my second year, I was the convener of Electronics and Robotics Club where I got a chance to work on some projects, and also participate in the International Robotics Competition which is organized by Techfest. I am sharing this information because these were the places where I found that I have interests in working on projects but still I was unclear about which type of projects and particularly in which category I have interests. Is it automation, robotics, controls or electronics etc.? I found our branch i.e., Civil Engineering very interesting as you get a chance to work on million-dollar projects where you should have a basic knowledge of everything.

I would like to give you insight more on my experience before getting an intern as this is where everyone especially guys like me who wants to do something new apart from the existing cloud of coding, consulting, finance, etc.

Now moving on to 3rd year I was looking for interns in the field of embedded systems, IoT (hardware specific), or related to Civil Engineering where I can get the field experience. Initially, I also applied for few companies like P&G, Goldman Sachs as they pay a huge stipend, as well as they, may offer you PPO. But soon I felt that I am just wasting my time in giving exams for this as I was barely interested in the type of work they offer. Then I contacted last year's Internship Coordinator and I got to know that except a few interns from Civil there were no interns from the other field (Embedded systems, IoT) which will open for our branch. So, the only option for me was to apply for Core intern.

As time passed CEG came and I signed for the JAF and got selected. CEG (Consulting Engineering Group) works on projects in various sectors related to Civil Engineering like Highways, Structure, etc. There were no interviews for it, we (me and a 2nd-year student) were directly selected with a stipend of 10,000 which was reduced further to 5,000 due to lockdown. I know the stipend is pretty low but let's take a break here.

**Money in Civil Engineering:** My cousin-brother is a contractor in the same place where I live. I asked him if I could come to the site for field experience and he agreed. He was building government school boundaries under the CSR fund of Nuclear Power Corporation of India Limited, Rawatbhata, Rajasthan. The contract was of around 98 lacs. He has no background in Civil Engineering and started working on a small contract of 4 lacs. He has been working for 6 years and now his financial condition has exponentially improved. Once I along with the Project Supervisor were calculating the profit which my brother makes on a daily basis. From a set of three labour, he can earn a profit of 2,500 rupees per day and there were four such sets of labour working on. So, that means in a day he earns 10,000 rupees which means if you are a contractor then you can earn more than 30 lacs per year. And currently, he has started working on a 14 crore project. I think after being a graduate from IIT Bombay with a degree in Civil Engineering we can do much better if we take the guts to work on our own and know the right place. In any project of Civil Engineering if you are the owner/contractor then at least 10% of the profit is yours and this may go up to 30-40% even if you use good material for construction.

**Internship experience:** Now coming back to my experience in CEG. I was working as a trainee at CEG. Due to Covid-19, it became impossible for us to work at the place of posting Jaipur, Rajasthan. But still, I got a chance to work on Bundelkhand Expressway project where our task was to find if the design has any issues. In this project, I learnt how to understand Highway drawings, P&P, TCS drawings and calculate the values for different variables to be used for constructing Highways e.g. super-elevation, gradient, etc. Other tasks were also given which introduced me to various new terms in Transport Engineering. During the internship I read a lot of IRC codes, giving an overview of factors that are included while designing from a simple road to Expressways. Even working from home was a good experience in a field like Civil where everything is done on-site.

**Suggestion:** If you want to do something new and do not know what the path you should follow to achieve your aim, you should start hammering on different things related to your interests and contact people who are already working in the field you are interested in, ask your professors, seniors etc about the path you should follow.

Also, I would suggest if you are not doing anything in 2nd-year summer then work on a project or do an internship.



## Ram Prasad Gardas UG 4th Year

Summer Internship at Agami Engineering Consultants, Mumbai (WFH)

### Introduction

Hey all! My name is Ram Prasad and I have recently completed my third year of Civil Engineering. As everyone knows, while pursuing civil engineering, one can make his/her career both in the core or non-core field. After completion of my second year, I made my mind to continue in civil core as I felt our core courses to be very interesting. After this summer intern, I developed interest in Structural Engineering and hence I decided to make my career in structural engineering. I have recently converted into a dual degree (B.Tech+M.Tech in five years) as well.

### Selection process

I had applied for this internship through PT cell and selection was done in two steps. First was a test covering all the structural, GeoTechnical and some Hydraulics basics and questions are theoretical which was conducted around November start and interviews were conducted in January. Due to lockdown, my intern was changed into Work from home.

### Intern Experience

Coming to my intern at Agami Engineering Consultants, it was altogether a pretty awesome three-month experience. Including me two interns got selected as a Trainee for an 12 weeks long internship program. Due to lockdown, the two month internship was extended to 3 months but I actually enjoyed it. For the first 15 days, I worked on Rhino Software. Rhinoceros, also known as Rhino or Rhino3D, is a 3D CAD modeling software package that enables you to accurately model your designs ready for rendering, animation, drafting, engineering, analysis, and manufacturing. Later, we worked on Monopole steel structure design and major problems that are involved with these structures. I got to write an article on wind pressures acting on structures. Lastly, we investigated different roofs and its failures. As it was work from home intern, Intern work was halved but it was a good experience.

### End Note

I think this internship was a huge learning experience for me. It not only helped me in learning civil engineering related stuff but also in improving my skills. Making a proper report, presenting the work, interacting with different people eventually helped me in building my enthusiasm for learning new and interesting things. I really hope that next year guys feel and enjoy the work more than me during this internship.



**Shashanka Katta**  
**UG 4th Year**  
**Purdue University (WFH)**

### **Introduction**

I enjoyed the Structural Engineering courses offered by the department in my sophomore year. This, coupled with research projects in the institute, helped me gear up to land a University Research Internship in the internship season. After months of uncertainty, disappointments, dis-alarmingly low number of replies to e-mails, I was thrilled along with a sense of relief to finally receive an offer from the PURE (Purdue Undergraduate Research Experience) program through the PT Cell, which I readily accepted.

### **Uncertain Times**

Unaware of what the world had in store for us in the coming months, nine of us from the institute who were selected by the PURE program, were jubilant and keen to explore the US. We planned on how we would spend our time and mapped out our time. When the institute closed and commenced the virtual segment, we were still hopeful. It was only when the visas and international travel to the States were cancelled, we begrudgingly accepted our fate.

### **Intern Experience**

I was fortunate that my professor agreed to carry out the internship in Virtual Mode. We met twice a week, once with the entire team and the other on a one-to-one basis. In the group meeting, every member of the team briefed on the results obtained in the past week and put forth their tentative plan for the forthcoming week. This enabled us to be in the loop and helped me gain a deeper understanding of the field. My research was on Finite Element Analysis of Liquid Storage Tanks using ABAQUS. I was privileged to have an alumnus of our department, Mr Harsh Bohra as a mentor, to guide me in my research. I am currently co-authoring a research paper on my findings.

### **Last Note**

Virtual research was overall, an exciting and stimulating experience. But, missing out on international travel and experiencing the university campus life was a heavy blow, which was softened over time by the daily dosage of home-cooked food, ambient home environment and fruitful online interactions with the professor and his team.



# PLACEMENT STATISTICS



Program	Participated	Placed	Percentage Placed (%)
B.Tech	76	66	86.84
M.Tech	45	29	64.44
PhD	2	1	50
Dual Degree (B.Tech + M.Tech)	4	4	100
<b>Total</b>	<b>127</b>	<b>100</b>	<b>78.74</b>

The placement statistics of students include all domains of jobs offered during the placement season of the years shown.

# WORD BY ALUMNI



## Kirtesh Gadiya

### Aspiration

Union Cabinet Minister

### Memorable Moments

Everyday was memorable

### Message To Juniors

Do interdisciplinary research. Learn each and every component. Learn core and non-core both . Doing some breakthrough work requires overall knowledge. Keeping supporting each other every time. At the end of the day be happy even if it is a loss.



## Potlapally Saikishor

### Aspiration

To become a successful civil engineer.

### Memorable Moments

Back bench fun with friends. Working in Aakaar. Playing pubg during classrooms .

### Message To Juniors

Don't ever neglect studies ( atleast CPI), it matters a lot during placements.And also enjoy to your fullest extent during this college life because you won't get another chance. Finally try to get a girlfriend .



## Shubham Jain

### Aspiration

Dream as if you will live forever and aim higher in case you fall short.

### Memorable Moments

Participation in various institute competitions, whether they be related to technological, sports, cultural,core or even non core, were always cherishable and proved to be great fun. Bridge it was definitely memorable for past 3 years that I had participated apart. Then their was INSDAG competition, if you want to get into core, you have to work, but it provided one hell of a learning and fun experience. Not to forget the moments when all us friends sit together to have discussions on random topics or when we have to study at the last moment before an exam were definitely some memories to treasure.

### Message To Juniors

"Begin your each day with a new life and end it with a new lesson, and explore as well as enjoy every aspect of your college experience, whether it is good or bad. Either you complain about it or enjoy it, just keep in mind that nothing is permanent and life will smoothly move on. Always remember that ""it's today that you cherish tomorrow"". In the end it is going to assist you in becoming the best you can possibly be, and that is worth every bit of struggle and strife. And yes, don't forget to create memories while you are here at institute as they will ultimately strengthen and provide constant support towards your future journey. And to end with an important learning of life; "It's easy to reach heights, but it's very difficult to stay there. " So whatever heights you reach in life be humble, and give your best at whatever task you undertake."





# WORD BY ALUMNI

## Lavish

### Aspiration

To be very honest, I am still struggling to figure out what I aspire to be. Although the institute has so much to offer and has already provided me so many options to try and placement was one of them. So as of now I am going out to work in a corporate setup but I am figuring out what I really aspire to be. So let's see where life takes me.



### Memorable Moments

These four years are full of beautiful memories and department Kurta day is one of them. It was really nice to meet everyone and click pictures with your squad. Also I can't forget my freshie year department trip to Lohagad. The so called "intro" in bus was awesome. On the trip I started climbing that mountain with so many known faces but unknown people (the so called batchmates) but I climbed down with a lot of friends that I believe now gonna stay with me for the rest of my life.

### Message To Juniors

During your stay in this campus, each day will have so many different things to offer that most of you haven't experienced before. Freedom of taking decision is one of them. Although you will be surrounded with experienced people all the time like your faculty, seniors, mentors but you have to take your decisions yourself. And it's very important that you take every decision carefully. Each new day will offer you a new activity to try so you have to prioritize your work, keeping your academics on top (this includes attending lecturer, lol). Also each day will be different from other as you will be having a plenty of things to do and it's very likely that you'll make mistakes. So don't ignore your mistakes, learn from them and don't repeat them. Not learning from mistakes sometimes bring you in a position where you have to compromise with your aspirations and it really hurts because it's nobody's fault but only ours. So prioritize your work, take your decisions carefully and keep learning, rest everything will fall in place. Last advice, make friends, some really really good friends (trust me, you gonna need them here). All the best everybody.

## Jatin Chandawat

### Aspiration

Construction Management

### Memorable Moments

"There are a lot of them!  
Dept Treks specially the 1year one Lohagal Fort  
Fun at our department terrace before it was closed be it Kurta day or Aakaar prep,  
also I have a written a lot of lab reports there :p  
Then all those exam preparations at Comp Lab whole day long"



### Message To Juniors

"Just explore guys as much as possible, interacts with your seniors or juniors.  
Our institute provides a lot opportunities whatever may be you interests.  
Cult tech sports acads we are excellent in every aspect.  
Don't ever wait for right time or right condition. The moment you want to act on your plan is the right moment and everything will automatically adjust accordingly.  
Good Luck guys..!  
Ye din vapas laut k nhi aayenge :("

# WORD BY ALUMNI

## Arya Garg

### Aspiration

I wish that that I get a job that I am happy to work for, earn decent enough to take care of trips once in a month, nothing else :P

### Memorable Moments

I was lucky to have an amazing group of friends and so going on trips, planning them, trying to persuade them will be the thing that is most memorable. I have always loved that I had good wing culture, even though we had placements in the 7th semester, I remember us doing anything but preparing.

### Message To Juniors

It's not a race is all I want that you guys understand. Everyone out there will give you advice on how to advance and do well to in the end get a well paid job. I just want you to know that we all have gone through a rat race before (JEE), do you think you friends who are not in IITs have achieved less? I don't think so, even they get good placements and go for foreign internships. So enjoy your life at our insti, it will be the only thing that you will remember when you are bored with your jobs years later and it is the only thing that matters.



## Ujjwal

### Memorable Moments

Looking back everything seems memorable. Be it running to reach lecture on time, running for early morning quizzes, last minute assignment completion, department trips, kurta day, sunny, main gate early morning dosa. Even the dreadful placement semester now seems like a beautiful exciting semester that went by. The list is infinite. The each and every second of 4 years was as beautiful and previous as anything in the world could be.

### Message To Juniors

Life college life to your fullest. Enjoy each and every moment. Interact with people, join clubs, take part in events. The more you increase your group the more you learn and grow. Keep trying new stuffs, if you like it continue with it, if you don't like it atleast you made sure this is not what you want to do ahead. A cliché line you all must have heard, 1 is your acad and rest everything is 0. Make sure your 1 comes first, then keep on adding as many 0 as you can.



## Apoorv Srivastava

### Aspiration

I don't know it yet

### Memorable Moments

Insti Wali Holi 2019

### Message To Juniors

With so many talented people all around us, it is very easy to fall in despair and feel that all our efforts are futile, but small consistent efforts go a long way and, I believe, they are the key to great achievements. Everything has different importance for different people and one should strive for the balance that one is most content with. And at the risk of sounding orthodox, I'll say that CPI is important.



# WORD BY ALUMNI

## Yash Lakade

### Aspiration

Well a great man once said never reveal your goals to anyone and work hard in silence

### Memorable Moments

The nonsensical experiments in labs and last night preps before the exams

### Message To Juniors

This may sound cheesy but most people I've seen don't really understand it, so here it goes: "Just follow what your heart says, don't try to fit in with the crowd". Sometimes you will hate the coursework, you might question your decisions but there is a reason why people say "Civil is chill", not completely a lie. Four years will pass like a breeze, I hope after this online sem it will dawn upon you that acads is not the most important thing but your experience apart from acads, be it sports, extra currics, or interactions with your friends and the insti brethren, that's what will make your insti life memorable. Enjoy it to the fullest!



## Ankit Kumar

### Aspiration

My aspirations are not that big, I just want to make my family proud. Achieving this, for now, will be enough for me.

### Memorable Moments

I would say all the time spent with the people at IIT Bombay will be cherished by me for the rest of my life. Whether it be spending late nights at hostels or last moment lab submission, all these things will have a special place in my heart. I just hope all the relationships that I have fostered here stay with me for the rest of my life.

### Message To Juniors

Enjoy your time here. This time will never come back. Be enthusiastic towards both academic as well as other social opportunities presented to you here. These are the things that will define you and allow you to figure out what you want or not want to do going ahead in your lives. Treat everyone with respect, whether it be your friends or your teachers, and always be helpful.





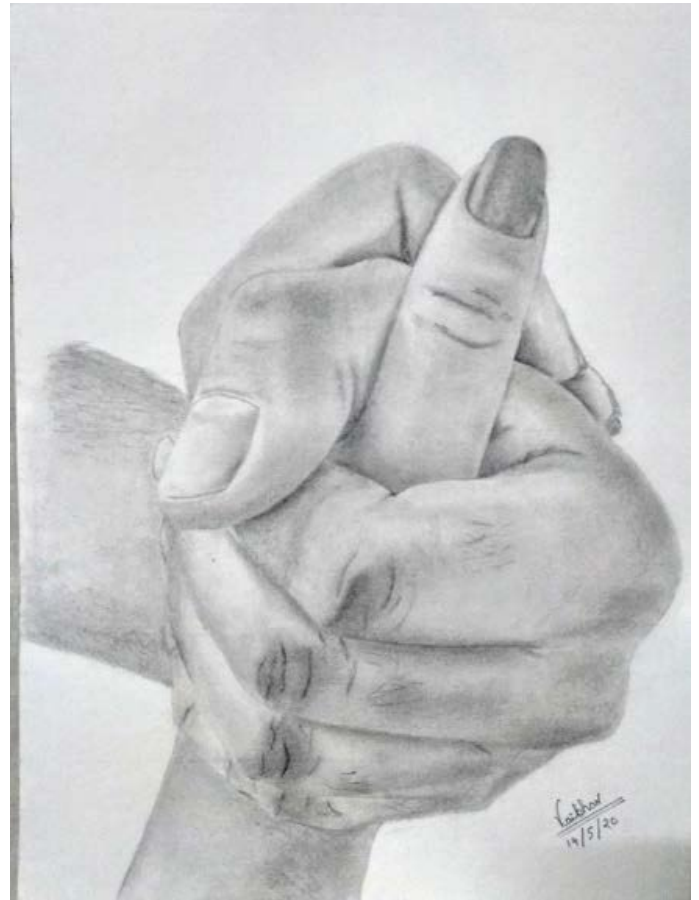
# MISCELLANEOUS



# ARTWORKS



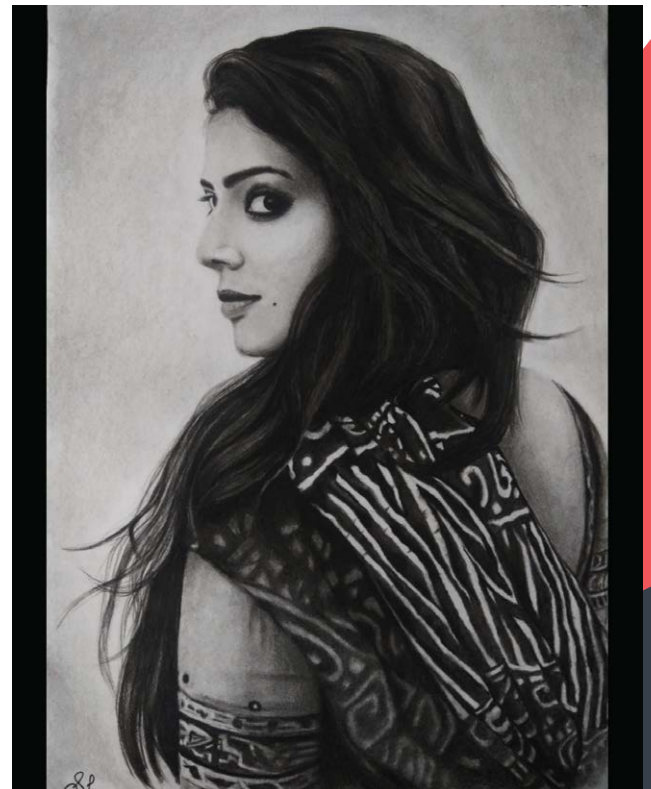
Mitali Badwe  
(2nd Year B,Tech)



Vaibhav Kumar Singh  
(4th Year)



Rutuja Dhore  
(1st Year M.Tech)



Shahana A  
(PhD)



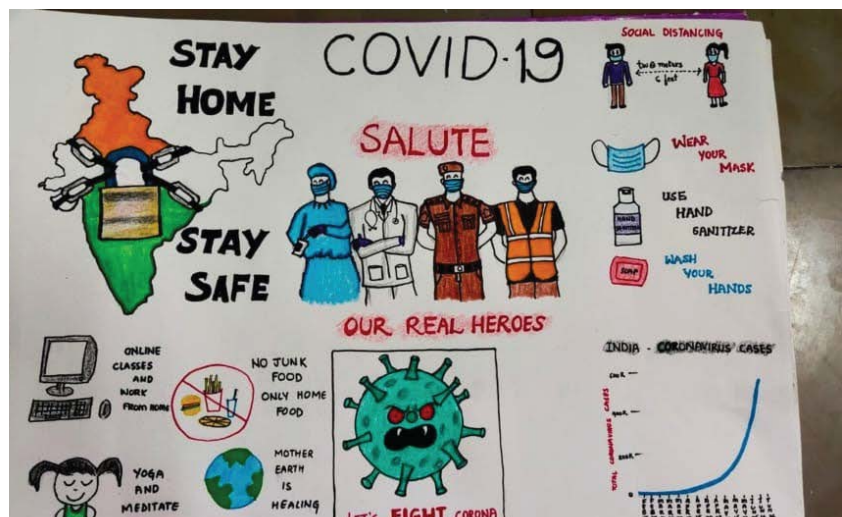
# ARTWORKS



Yash Vinayak Patil  
(2nd Year B.Tech)



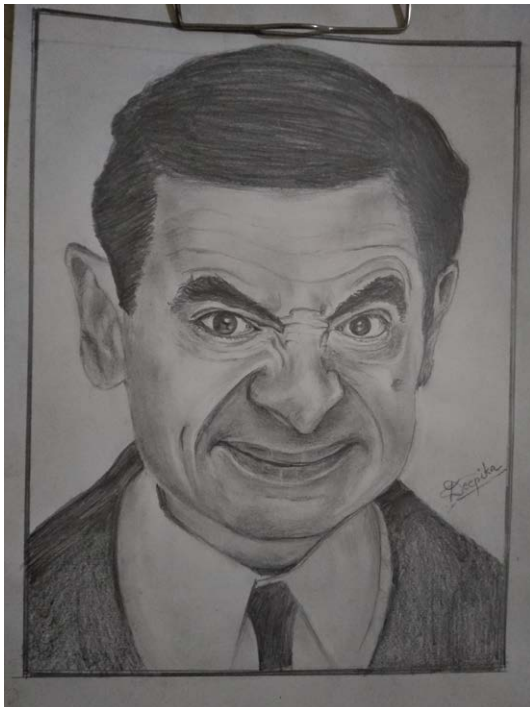
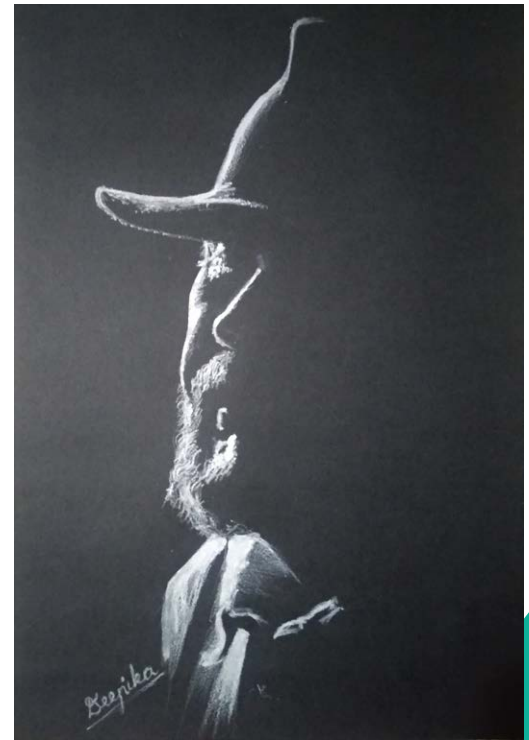
Vaibhav Kumar Singh  
(4th Year)



Kurnool Sai Nikhila



# SKETCHES

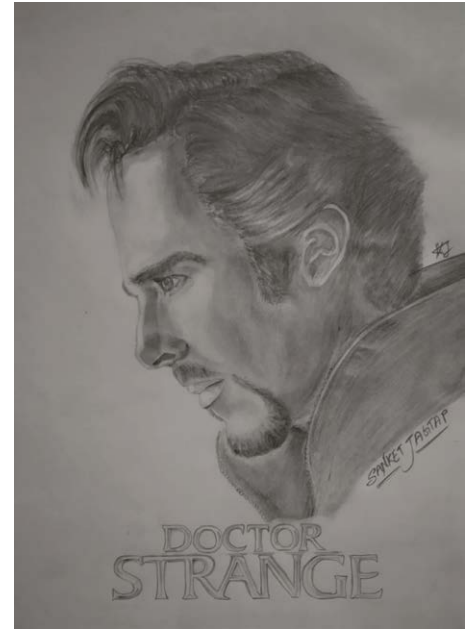


Dipika Balkrishan Rathod

# SKETCHES



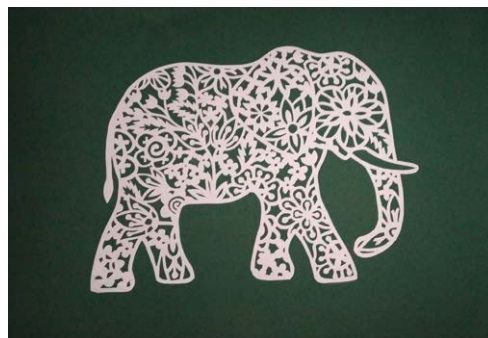
Sanket Jagtap  
(UG 3rd Year)



Rutuja Avinash Dhore  
(M.Tech 1st Year)



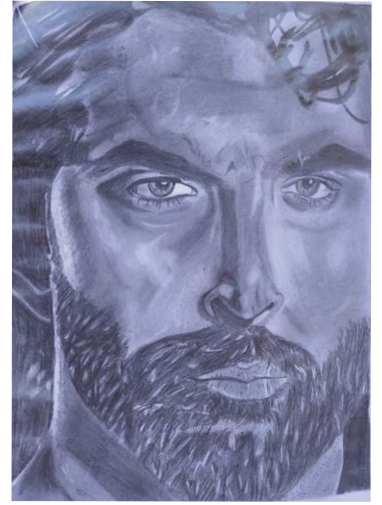
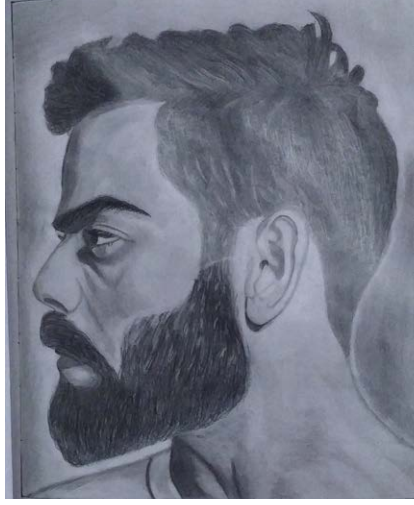
# SKETCHES



B.Neeraj Kumar  
(M.Tech)



# SKETCHES



Sarika  
(B.Tech 2nd Year)

# SKETCHES



Amar Kant Jaiswal  
(M.Tech 2nd Year)

# POEMS

This poem is about the infinite corridor. After the closure of the institute I used to walk through the corridor to my lab in VMCC and, I penned this down during this period.

## The corridor to the infinity

Walking through the infinity,  
a doubt resonating through me.  
Will you follow me to darkness?

A mellifluous voice echoed,  
“show me the light”!

But I like the way as was,  
at the beginning of the ends.

Like before those days,  
when darkness was not dark.  
Adagio of memories loomed,  
as I neared the very edge,  
ebbing infinite sentience,  
cravings stood still there,  
waiting for me, without limits.

Rays of light falling slowly,  
like the leaves of the autumn.

Hasping the doors to the mortality,  
rain comes without any thunder.

Then the voice echoed,  
“Where is the darkness you uttered”!

It is dead, though very much live,  
and commenced a new journey,  
to embrace eternity in no time.

- Dr. Renjith VishnuRadhan



# POEMS

## Enchantments

Lately I've been  
Having eager thoughts  
About you.  
Ruminating about your  
Winsome ways  
And  
My defeated demeanour.  
Your eyes,  
The colour of baked clay  
Drown me  
In your depths,  
Leaving traces of my  
Inadequacy  
At your shore.  
Siting close to a light  
Of a burning log fire,  
Conclusively concealing  
My thoughts of  
Burning desire.  
Coalescing my emotions,  
Growing into my passion  
Take today for example.  
While the music sets my heart  
On fire,  
You take my heart  
As I try not to fall apart,  
I admire  
Your alluring enchantments

- Nyaamo Jini  
(2nd Year M.Tech)

# POEMS

तुझसे कॉलेज में वो पेहली मुलाकात,  
तुझसे की हर वो पेहली बात  
मुझे पसंद है।

तेरे लेहराते वो खुले बाल,  
और होठो पे वो प्यारी मुस्कान  
मुझे पसंद है।

संग तेरे वो बारिश का एहसास,  
मक्को के साथ हमारी वो शुरुआत  
मुझे पसंद है।

तुझे चिढ़ाना, तेरा गुस्से में लाल हो जाना,  
और तुझपे चढ़ा हुआ वो रंग लाल  
मुझे पसंद है।

मेरा तुझसे रुठना और तेरा मुझको मनाना,  
फिर चाय की प्याली संग सब शिकवे मिटाना  
मुझे पसंद है।

तेरी बड़ी बड़ी आंखोंकी शरारतें,  
तेरी चेहरे की वो चंचल मुस्कान  
हां मुझे पसंद है।

@अमरकान्त जैस्वाल

- Amar Kant Jaiswal  
(2nd Year M.Tech)

# POEMS

## I can't believe 4 years went by

I can't believe 4 years went by:

The first day at IITB, a dream place, all clean lush and green,  
with rain pouring so hard as if the rain was happier than me.

I was proud, my parents were proud and seeing them I was even more proud,  
though the sky was completely dark it was definitely a happiness cloud.

It all seems like yesterday.

I can't believe 4 years went by:

The running for tumtums, the swapping of umbrellas,  
the late-night gaming and the spending of LA hours like vellas.

The exciting insti tours, the first wing outing,  
the night out at marine drive and the college life seemed sprouting.

The first year naiveness, the unfathomable excitement,  
the polt in general election and an honest attempt at incitement.

It all seems like yesterday.

I can't believe 4 years went by:

The shift of life to senior hostels, the fight for good rooms,  
the corridors were messy and juniors will stay at ground floor is what every senior assumes.

The inspirational seniors, the inspiration seeking juniors,  
the rivalry of H3 vs H4 and the fight with roomie about why you didn't close the door.

The clubs, the POR and the ever-lasting intro,

Apan challenge na yaar gym bs pehle mera plan sun toh.

It all seems like yesterday.

I can't believe 4 years went by:

The bond of sorcerers, the first highs of life,

the never happening goa plans where my wingies thought they will get their wife.

The dredging resume deadlines, the seniors proving out to be lifelines.

The joys of selection, the tears of rejection,

the exciting summer plans and the first time travelling to another land.

The late-night walks and the canteen wali stops,

when it was time for payment except one everybody eloped.

It all seems like yesterday.

I can't believe 4 years went by:

The showering of placement tips, the infinite loop of resume blips,

the rush for PPT's, the goodies and pizzas were a bliss.

The hope for PPO, the confidence turning quite low,

the non-ending placement prep, the 1st December is almost here and I was like whoa.

The new suit, the new tie,

the new shoes because we needed to look bright.

The tiring days, the self-doubting nights,

the tears of joy when it finally came by.

Goa, lonavala it all finally happened,

the aim for physical fitness finally awakened.

New trips got planned and it all seemed perfect heaven,

but alas we got hit by covid, had completed all bucket list except those last eleven.



# GALLERY



# GALLERY



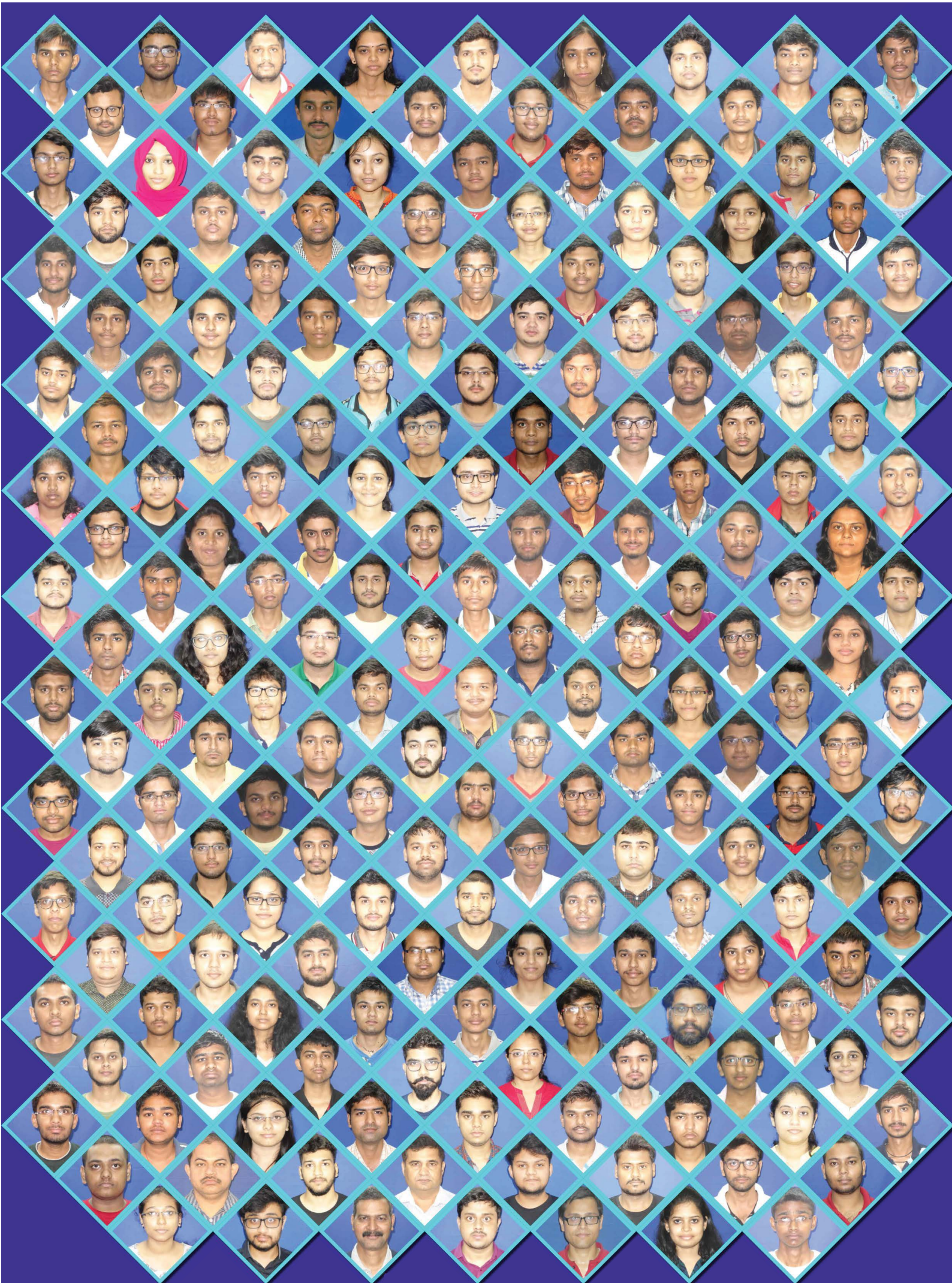












**BATCH OF 2020**