Department of Civil Engineering
Jamia Millia Islamia

(A Central University by an Act of Parliament)

NAAc Accredited A^{++} Grade

Magazine Vol. 6 2022

Taameer تعمیر

جامعہ کا ترانہ

دیار شوق میرا دیار شوق میرا
شہر آرزو میرا شہر آرزو میرا

ہوئے تھے آکے یہیں خیمہ زن وہ دیوانے — اٹھے تھے سن کے جو آواز رہبران وطن
یہیں سے شوق کی بے ربطیوں کو ربط ملا — اسی نے ہوش کو بخشا جنوں کا پیراہن
یہیں سے لالۂ صحرا کو یہ سراغ ملا — کہ دل کے داغ کو کس طرح رکھتے ہیں روشن

دیار شوق میرا، شہر آرزو میرا

یہ اہل شوق کی بستی یہ سر پھروں کا دیار — یہاں کی صبح نرالی، یہاں کی شام نئی
یہاں کی رسم و رہ مے کشی جدا سب سے — یہاں کے جام نئے، طرح رقص جام نئی
یہاں پہ تشنہ لبی مے کشی کا حاصل ہے — یہ بزم دل ہے یہاں کی صلائے عام نئی

دیار شوق میرا، شہر آرزو میرا

یہاں پہ شمع ہدایت ہے صرف اپنا ضمیر — یہاں پہ قبلہ ایماں کعبہ دل ہے
سفر ہے دین یہاں، کفر ہے قیام یہاں — یہاں پہ راہ روی خود حصول منزل ہے
شناوری کا تقاضہ ہے نو بہ نو طوفاں — کنار موج میں آسودگی ساحل ہے

دیار شوق میرا، شہر آرزو میرا

Jamia Millia Islamia

Jamia was established in 1920 by a group of nationalist Muslim intelligentsia at Aligarh, Uttar Pradesh during the khilafat and Non-Cooperation Movement in response to Gandhiji's cell to boycott governmentsupported educational institutions. Among those who enthusiastically responded to this call were Shaikhul Hind Maulana Mahmud Hasan, Maulana Mohammed Ali Jauhar, Hakin Ajmal Khan, Dr. Mukhtar Ahmad Ansari, Abdul Majeed Khwaja and Dr. Zakir Husain and others. In 1925, its campus shifted from Aligarh to Delhi and the foundation stone of the present campus was laid on 1st March 1930. Since then, it has been continuously growing, always refurbishing its methods and branching out from time to time to meet new needs. True to the ideals of its founders, it has, over the years, tried to enhance the physical and mental development of its students, and has become known as a premier educational institution of the country. Recognizing its contributions in the field of teaching, research and extension work Jamia Millia Islamia was declared a Deemed University under Section 2 of University Grants Commission (UGC) Act in 1962. Jamia was declared a Central University, as per Jamia Millia Islamia Act 1988, which was passed by the Parliament on 26th December 1988.

Jamia Millia Islamia is an ensemble of a multi layered educational system which covers all aspects of schooling, undergraduate and postgraduate education and research. The University recognizes that teaching and research are complementary activities that can advance its long-term interests. It has Natural Sciences, Social Sciences, Engineering & Technology, Education, Humanities & Languages, Architecture & Ekistics, Fine Arts, Law and Dentistry Faculties. It also has the well-known Centre namely the AJK Mass Communication Research Centre besides several other research Centers that have given an edge to Jamia in terms of critical research and programmes that can offer opportunities to its students and teachers to expand the horizons. Jamia Millia Islamia conducts Undergraduate, Postgraduate, M. Phil. and Ph.D. as well as Diploma and Certificate courses.

Jamia Millia Islamia has been declared a "Minority Institution" by National Commission for Minority Educational Institutions on February 22, 2011 under Article 30 (1) of the Constitution of India read with Section 2 (G) of the National Commission for Minorites Institutions Act.

जामिया मिल्लिया इस्लामिया
(केन्द्रीय विश्वविद्यालय)
मौलाना मोहम्मद अली जौहर मार्ग, नई दिल्ली-११००२५

JAMIA MILLIA ISLAMIA
(Central University)
Maulana Mohammad Ali Jauhar Marg, New Delhi-110025
(ACCREDITED "A" GRADE BY NAAC)

جامعہ ملیہ اسلامیہ
(مرکزی یونیورسٹی)
مولانا محمد علی جوہر مارگ، نئی دہلی۔۱۱۰۰۲۵

Tel. : 011 - 26984650, 26985180, Fax : 0091-11-26981232 | Email: vc@jmi.ac.in | Web: jmi.ac.in

प्रोफेसर नजमा अख़्तर
कुलपति

Professor Najma Akhtar
Vice Chancellor

پروفیسر نجمہ اختر
شیخ الجامعہ

Vice Chancellor's Message

It gives me immense pleasure to present, TA'MEER, a magazine brought out by Department of Civil Engineering, Jamia Millia Islamia. It opens a window of opportunity for the students to express their creativity, perceptions, innovations and scholarly appreciation of innovative activities and works, enumerating the impressive strides made by Department of Civil Engineering. It aspires to showcase the latest growth, development and innovations, engaging the students pursuing their curriculum, researches and investigations, reflecting the ethos and aspirations of Department of Civil Engineering, its students and faculty members.

With its spectacular performance in NIRF Rankings, Jamia Millia Islamia figures among top six Universities of India. It has been providing accessible and affordable quality education since its inception. Committed to delivering the best experiential education and keeping abreast of changing trends and paradigm shift in pedagogy, technology and innovation, it fosters creativity, inspires critical thinking and pursuit of excellence.

I congratulate the Head, Department of Civil Engineering, the Editor, editorial team, students and faculty members on bringing out such a wonderful issue of TA'MEER.

Wishing a resounding success!

Najma Akhtar

(Prof Najma Akhtar)

JAMIA MILLIA ISLAMIA जामिया मिल्लिया इस्लामिया
(A Central University Accreditted Grade 'A++ by NAAC))

Faculty of Engineering and Technology

Maulana Mohammad Ali Jauhar Marg, New Delhi-110025
Phone No.: 26985831 Extn.: 2201, 2202, 2203 & 2204
Email:fet@jmi.ac.in

Prof. Mini Shaji Thomas
Dean

Message from the Dean

I Congratulate the Department of Civil Engineering for bringing out another edition of the magazine. This magazine serves not only as a platform to showcase the academic and extracurricular accomplishments but also as a reflection of the collective spirit, dedication, and passion that define our community.

I appreciate the efforts of the faculty members who have continued to set high standards with their outstanding work, while our students have shown exceptional creativity and resilience in their endeavours, whether in the classroom, laboratory, or on the stage of competitions.

I encourage everyone to continue embracing a culture of curiosity, inclusivity, and excellence. Let us remain committed to learning, growing, and contributing to the world in meaningful ways. Together, we can make a difference, and together, we will achieve greatness.

I extend my appreciation to the editorial team for their hard work and dedication in bringing this publication to life.

With best wishes,

Prof. Mini S. Thomas
Dean

जामिया मिल्लिया इस्लामिया
(संसदीय अधिनियमानुसार केन्द्रीय विष्वविद्यालय)
मौलाना मोहम्मद अली जौहर मार्ग, नई दिल्ली.११००२५
JAMIA MILLIA ISLAMIA
(A Central University by an Act of Parliament)
Maulana Mohammed Ali Jauhar Marg, New Delhi-110025
सिविल इंजीनियरिंग विभाग
Department of Civil Engineering

दूरभाश : 26985227, 26981717
एक्सटेंषन : 2310, 2312,
ई-मेल : civil@jmi.ac.in
वेबसाइट : www.jmi.ac.in

Message from the Head

Transformation and developments in technology is posing new challenges for the civil engineers in the twenty first century. “Tameer” is a platform dedicated to highlight the new developments and modernization in the field of civil engineering. Each issue is a testament to the hard work, technical expertise, and problem-solving spirit that defines our department.

Our collective knowledge is one of our greatest assets, and this magazine serves as a vital tool for fostering collaboration, sparking new ideas, and keeping us at the forefront of industry trends. As we continue to face new challenges in our field, I encourage you to explore the articles, engage with the research, and share your feedback.

Let’s continue to innovate, inspire, and drive progress in civil engineering together. Thank you to everyone who contributed to this issue.

Best regards,

Farhan Ahmad Kidwai
Head, Department of Civil Engineering

जामिया मिल्लिया इस्लामिया
(संसदीय अधिनियमानुसार केन्द्रीय विष्वविद्यालय)
मौलाना मोहम्मद अली जौहर मार्ग, नई दिल्ली.११००२५
JAMIA MILLIA ISLAMIA
(A Central University by an Act of Parliament)
Maulana Mohammed Ali Jauhar Marg, New Delhi-110025
सिविल इंजीनियरिंग विभाग
Department of Civil Engineering

दूरभाश : 26985227, 26981717
एक्सटेंषन : 2310, 2312,
ई-मेल : civil@jmi.ac.in
वेबसाइट : www.jmi.ac.in

Message from Editor

It is with great excitement and pride the latest edition of Civil Engineering Departmental magazine is presented. This publication represents the collective efforts, creativity, and passion of our vibrant students. Each page tells a story, reflects a perspective and celebrates the talent that thrives within our department.

Our goal with this magazine has always been to provide a platform for voices to be heard, ideas to be shared, and accomplishments to be celebrated. In this issue many insightful articles and creative expressions that reflect the dedication and enthusiasm of our students, faculty, and staff.

I would like to express my heartfelt gratitude to everyone who contributed to making this edition a reality.

Best regards,

Prof. Nazrul Islam
Editor

About Civil Engineering Department

Department of Civil Engineering the Department of Civil Engineering (DCE) offers two undergraduate courses in Civil Engineering and Master's program with specializations in Environmental Engineering and Earthquake Engineering. More than 80 Ph. D. scholars including foreign students from different countries are currently working in the Department on emerging research areas. DCE also renders technical advice to various Government and Private Sector companies on consultancy basis. DCE has many collaboration programs with foreign universities including University of Applied Sciences, Erfurt, Germany; Wessex Institute, UK; University of Waterloo, Canada; Asian Institute of Technology, Bangkok. DCE regularly organizes international and national conferences, seminars and workshops on current themes. This international conference is a sequel to the earlier conferences held on the themes of sustainability and development and is an endeavor of the DCE to focus on the emerging areas of smart city development.

Today, Jamia Millia Islamia is "A" grade Central University accredited by NAAC. Jamia Millia Islamia Continues to cater to the interests of students from all communities, but also aims to meet the particular needs of the disadvantaged sections of the Muslim society. True to the legacy of its founders, it continues to support measures for affirmative action and foster the goals of building a secular and modern system of integrated education.

1

WALI NAIM

B.Tech (Civil) 8th Sem

Jamia Millia Islamia, New Delhi

Building the Future: How 3D Printing is Revolutionizing Construction

The construction industry, known for its reliance on traditional methods, is undergoing a remarkable transformation thanks to the emergence of 3D printing technology. Imagine a world where buildings can be created layer by layer, like assembling intricate puzzles. This article delves into the exciting realm of 3D printing in construction, exploring its benefits, challenges, and the potential it holds for reshaping the way we build.

3D Printing in Construction : A New Frontier

3D printing in construction, also called "contour crafting" or "additive construction," involves using large-scale 3D printers to create building components or entire structures layer by layer. Instead of bricks, concrete, and steel beams being manually assembled, 3D printing uses specialized concrete mixes and other building materials to create structures according to computer-aided design (CAD) models.

Benefits of 3D Printing in Construction

1.Speed and Efficiency: 3D printing significantly accelerates the construction process. Complex structures that would take months or even years to build conventionally can be completed in a matter of days using 3D printing.

2.Cost Savings: Reduced labor, less waste, and efficient material usage lead to cost savings in construction projects.

3.Design Flexibility: 3D printing enables architects and designers to create structures with intricate geometries that were previously challenging to construct using traditional methods.

4.Reduced Environmental Impact: 3D printing can minimize waste by using only the required amount of material and optimizing construction processes.

How 3D Printing Works ?

3D printing in construction is a transformative technique that creates structures by layering materials based on digital designs. Architects use CAD software to develop detailed models, which are then printed using methods like extrusion, where concrete is deposited through a nozzle in precise patterns. This additive approach allows for rapid construction of complex shapes and reduces material waste compared to traditional methods. After printing, structures typically undergo curing and finishing to enhance durability and aesthetics. Overall, 3D printing is revolutionizing construction by offering faster, cost-effective, and more sustainable building solutions.

Applications of 3D Printing in Construction

1.Housing Solutions: 3D printing is being explored to address housing shortages in various parts of the world. Entire houses can be 3D printed, providing affordable and rapid shelter solutions.
2.Complex Structures: The technology allows for the creation of complex architectural designs that push the boundaries of traditional construction methods.
3.Customization: 3D printing enables customization on a whole new level. Buildings can be tailored to specific requirements, incorporating unique features and adaptations.
4.Disaster Relief: In the aftermath of natural disasters, 3D printing can quickly produce temporary shelters and other structures to assist affected communities.

Challenges and Future Prospects

While 3D printing in construction holds immense promise, several challenges need to be addressed:

1.Material Development: Developing suitable and durable construction materials for 3D printing is crucial for ensuring the longevity and stability of printed structures.
2.Regulations and Standards: As 3D printing technology evolves, regulatory frameworks and construction standards need to be adapted to ensure safety and quality.
3.Scalability: Scaling up 3D printing for larger structures while maintaining precision and efficiency remains a challenge.
4.Skill Development: The construction workforce needs to be trained in using and maintaining 3D printing equipment.

Conclusion

3D printing is introducing in a new era in construction, transforming the industry's landscape with its speed, efficiency, and design possibilities. While challenges exist, the potential benefits are undeniable. From creating affordable housing to enabling unprecedented architectural feats, 3D printing has the power to reshape the way we build, making construction faster, more sustainable, and ultimately more innovative. As technology continues to advance, we stand on the brink of a construction revolution that promises to change the skylines of our cities and the lives of people around the world.

2

SHREEJA KACKER

PhD Scholar, CED

Jamia Millia Islamia, New Delhi

Pioneering Urban Transformation: A Technical Insight into Smart City Construction

In the dynamic realm of urban development, smart cities have emerged as beacons of innovation, integrating technology with urban infrastructure. This article embarks on a technical exploration of smart city construction, uncovering its core components, highlighting technical advancements, addressing challenges, and delving into an illuminating Indian case study that underscores the potential of smart urbanization.

Demystifying Smart City Construction: Smart cities represent an evolution beyond traditional urban areas. They embody a fusion of technology, infrastructure, and innovative design, redefining the urban experience through connectivity, sustainability, and efficiency.

Key Technical Aspects:

- **Data-Driven Infrastructure:** Smart cities hinge on data integration, fostering real-time management and informed decision-making through interconnected systems.
- **IoT-Powered Connectivity:** The Internet of Things (IoT) forms the digital backbone, interconnecting devices, sensors, and systems for monitoring and control.
- **Sustainable Energy Management:** Smart cities prioritize renewable energy sources, energy-efficient buildings, and intelligent energy distribution.
- **Innovative Mobility Solutions:** Cutting-edge transportation, from autonomous vehicles to intelligent traffic management, redefine urban mobility.
- **E-Governance and Services:** Centralized platforms facilitate efficient public service delivery, improving resource allocation and response times.

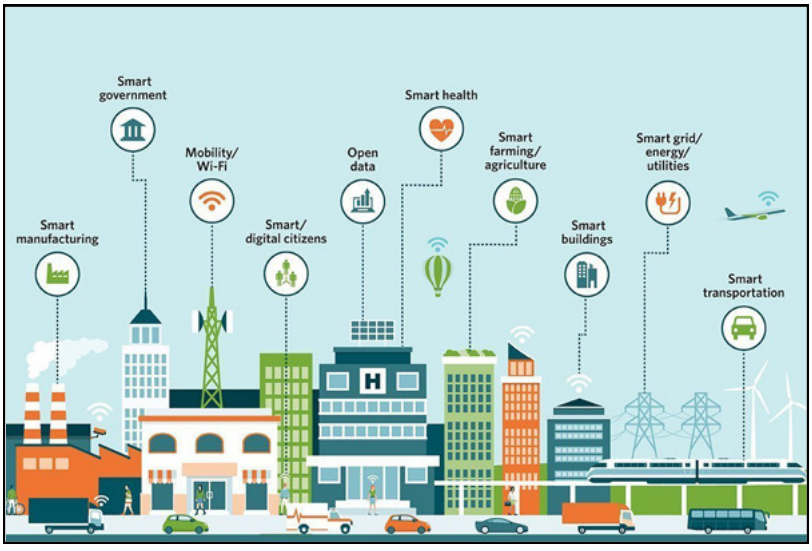

Figure 1: Components of a Smart City *(source: Constro Facilitator)*

Technical Advancements:

- **Big Data Analytics:** Smart cities leverage big data to uncover patterns, optimize urban planning, and predict citizen needs.
- **AI and Machine Learning:** These technologies enable predictive maintenance, enhance security, and drive data-informed decision-making.
- **Blockchain for Transparency:** Blockchain ensures secure transactions, property management, and transparent governance.
- **Renewable Integration:** Smart grids and solar solutions optimize energy generation, distribution, and consumption.

Challenges and Mitigation:

- **Data Security:** Protecting citizen data in the era of connectivity necessitates robust cyber-security measures.
- **Interoperability:** Seamless communication between various systems demands standardized protocols.
- **Initial Investment:** Transitioning to a smart city requires substantial funding for technology implementation and infrastructure upgrades.
- **Community Engagement:** Success hinges on educating and involving citizens in the smart city journey.

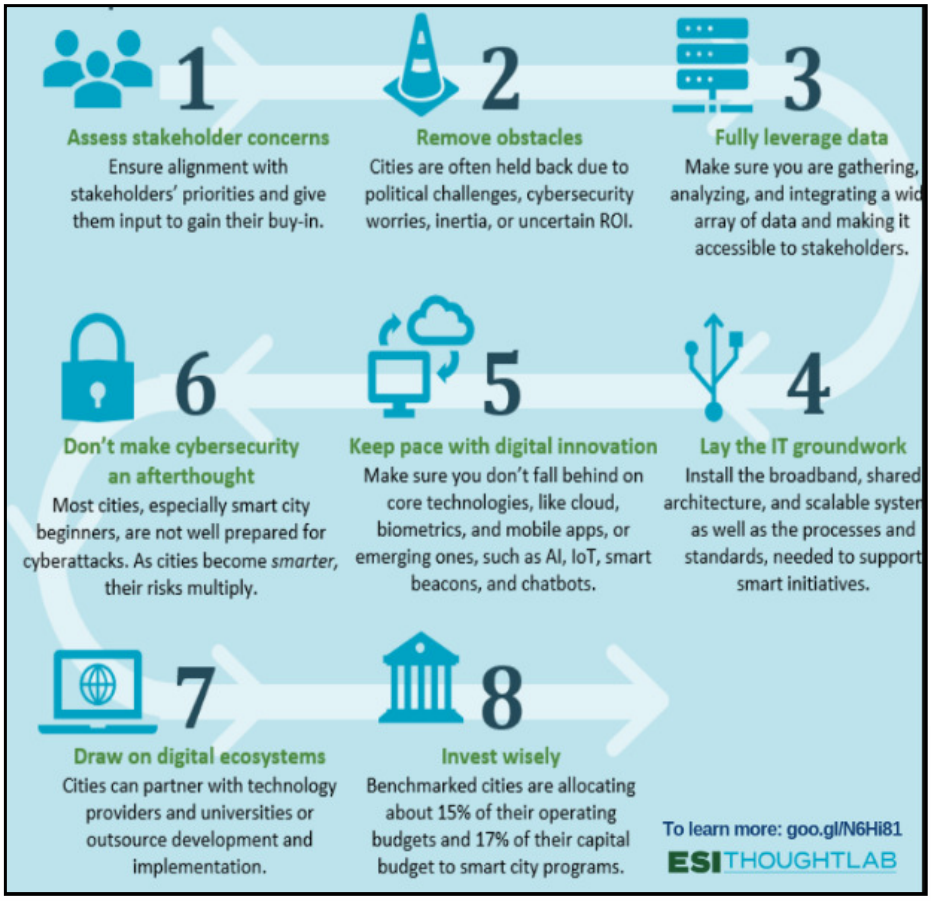

Figure 2: Road Map of a Smart City Construction *(source: pennoni.com)*

Case Study: Surat's Smart City Transformation:

The Indian city of Surat, Gujarat, embarked on a remarkable smart city journey, emphasizing sustainability, efficiency, and citizen-centric services:

- **Integrated Traffic Management:** IoT-enabled traffic sensors optimize traffic flow and reduce congestion, enhancing mobility.
- **Smart Water Management:** Advanced systems monitor water quality and consumption, minimizing wastage.
- **Renewable Energy:** Solar panels power public infrastructure, contributing to energy self-sufficiency.
- **E-Governance Hub:** The Surat Smart City Operations Center integrates city services and enables real-time monitoring.

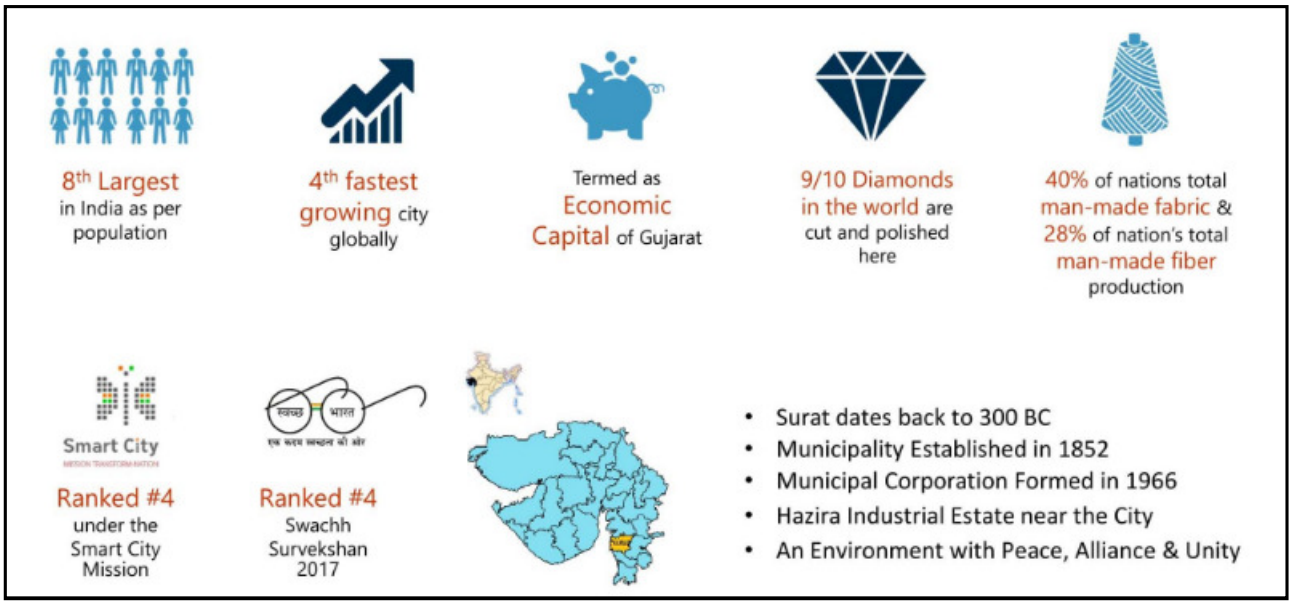

Figure 3: Features of Surat Smart City *(source: www.suratsmartcity.com)*

Engineering Tomorrow's Urban Spaces:

Smart city construction symbolizes the synergy between technology and urban development. As urban landscapes evolve, the marriage of innovation and infrastructure paves the way for cities that are efficient, sustainable, and technologically advanced.

Surat's transformation serves as an inspiring Indian example, demonstrating the tangible benefits of smart city construction. By integrating technology with urban planning, cities like Surat create environments that enhance citizen experiences, optimize resource allocation, and shape a blueprint for future urban centers. The journey towards smart cities is an ode to human ingenuity, utilizing technology to craft cities that are resilient, intelligent, and sustainable

3

MS. ZOHA JAFAR

PhD Scholar, CED

Jamia Millia Islamia, New Delhi

AN INNOVATIVE APPROACH FOR WATER RESOURCE DEVELOPMENT IN GURUGRAM

Gurugram, being a rapidly urbanizing city, has seen a significant increase in water demand, leading to a water crisis. The depletion of groundwater resources due to excessive extraction and inadequate replenishment has contributed to water scarcity. The city relies heavily on groundwater and water supplied from various sources mostly non-indigenous, to meet its water needs.

In addition, the Najafgarh Drain plays a significant role in the hydrological system of Gurugram, connecting the Sahibi River and the Yamuna River. The Najafgarh Lake acts as a catchment area for the Sahibi River. The 57 km long, Najafgarh Drain originates from this Najafgarh Lake and carries the excess water from the lake towards the east. The Najafgarh Drain ultimately discharges the excess water into the Yamuna River. In the rainy season, sometimes this discharge can go up to 7000 cusec thus this unused water can be utilized to meet the soaring water demand of the city.

Figure 1: Anon 2011, 71-City Water-Excreta Survey, Centre for Science and Environment, New Delhi

The city of Gurugram requires 135 liters per day per person of water in residential areas as per National Building Code and IS 1172 and out of which only 10.2 liters per day per person is used for drinking and cooking purpose. Generally, the packaged water bottles/ RO is used by the residence to fulfill this drinking water demand.

Other than this, the major amount of non-portable water can be replenishment through the hydro-abstraction wells, which can be proposed alongside the Najafgarh drain to facilitate the seepage of water from the drain into the underground aquifers, replenishing the groundwater reserves and mitigating the depletion of water tables in the surrounding areas. The water abstracted from the hydro abstraction wells along the Najafgarh drain can be utilized for non-drinking purpose after the primary treatment and used to augment the existing water supply systems. This can help address a requisite amount of water scarcity issues in the region, especially during periods of high demand or low groundwater levels.

The amount of water abstracted throughout the year by the hydro-abstraction wells will be replenished by the Najafgarh Drain during rainy season. This will also help to mitigate the Yamuna flooding.

Hydro abstraction wells can be proposed on either side of the Najafgarh Drain at an interval of 500 meters from each other. The capacity of a single proposed hydro abstraction well can be proposed between 1-3 MLD thus making the total capacity between 100 to 300 MLD. The area required for a single hydro abstraction well will be 1500 square meters in a linear fashion along the bank of Najafgarh drain.

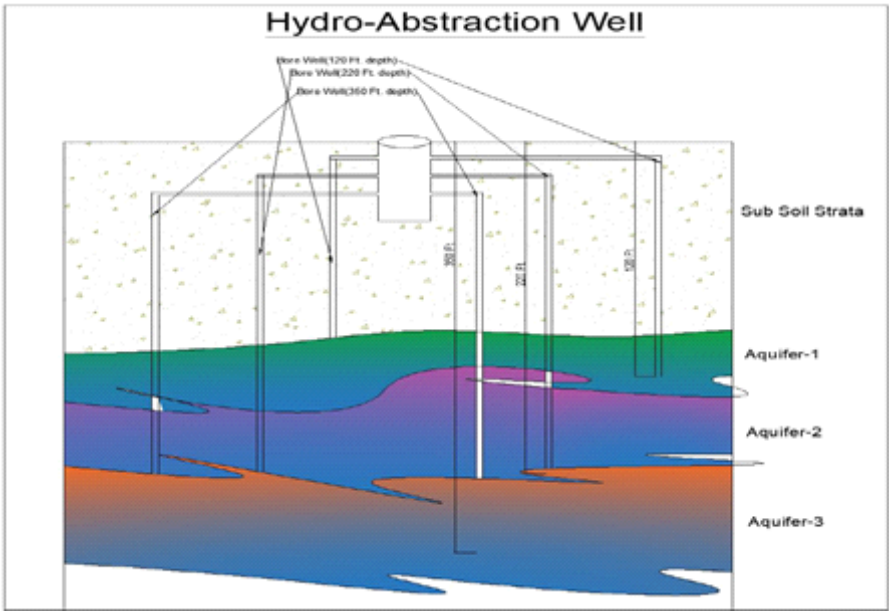

Figure 2: Layout of Hydro Abstraction System

Along with water crisis, water logging issue in Gurugram is also a very acute problem during monsoon seasons. Micro-injection wells can be a solution to this issue. These wells are designed to facilitate the recharge of groundwater aquifers by allowing rainwater or excess surface water to percolate into the ground. This helps replenish the depleting groundwater levels in the region.

These wells are typically shallow, narrow structures that are drilled or dug into the ground. They are equipped with a geo-membrane for proper filtration before it is injected into the aquifer. During heavy rainfall events, these wells can help reduce the risk of water logging and urban flooding by facilitating the drainage of excess water into the ground. Also, by capturing and utilizing rainwater, micro-injection wells contribute to water conservation efforts and reduce the reliance on other water sources. These micro-injection well will be also helpful for the proper ground water recharging in the waterlogged areas thus it is a good source for the ground water resource development. These Injection wells can be proposed in the entire water logged areas of Gurugram especially alongside NH-8 to reduce the flooding.

Emphasis should be given to utilize the Najafgarh drain and Badshahpur drain to their optimum potential, which may solve the major problem of water crisis in the city using hydro abstraction system. The micro-injection wells on the other hand can replenish the ground water and reduce water log conditions.

Fulfilment of these objectives will require thorough research through R&D projects.

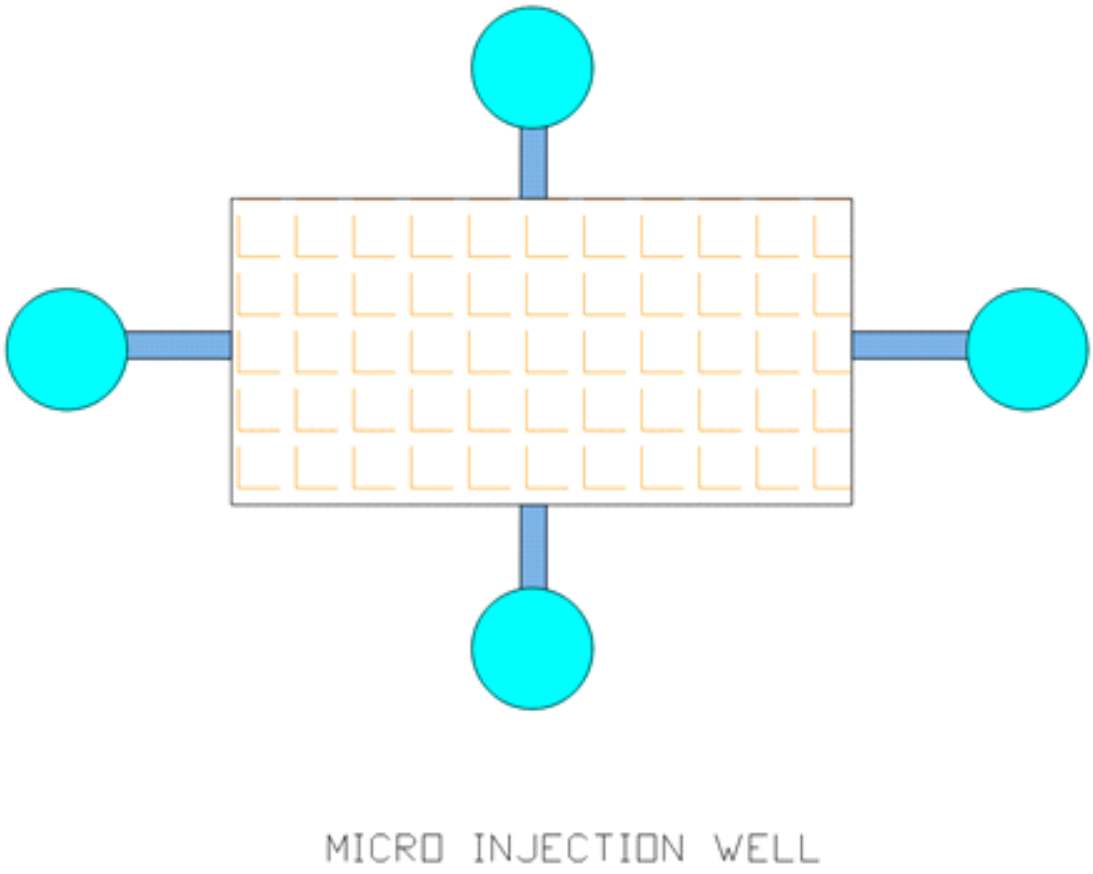

Figure 3: Layout of Micro injection well

4 JAWED ASLAM
(M.Tech Earthquake Engg.)
Jamia Millia Islamia, New Delhi

India's First offshore oil production platform: Bombay high

Bombay High (now Mumbai High) field is an offshore oilfield located in the Arabian Sea, approximately 160km west of the Mumbai coast, India. This offshore oilfield located in the Arabian Sea, approximately 160km west of the Mumbai coast, India. Discovered in 1974, the field commenced production in 1976 and is operated by the Oil and Natural Gas Corporation (ONGC).

The oil field consists of two blocks named Mumbai High North (MHN) and Mumbai High South (MHS). The blocks were divided based on shale barrier, assisting in independent exploitation of reserves at both sites.

Mumbai High field currently holds 1,659 million metric tonnes (MMt) of oil and is producing approximately 12MMt a year.

ONGC's board granted approval for the second phase of MHN Redevelopment project in January 2009, followed by the third phase in June 2014.

Mumbai High field discovery details

Mumbai High field was discovered in February 1974 by the Russian and Indian team from seismic exploration vessel Academic Arkhangelsky while mapping the Gulf of Cambay between 1964 and 1967.

The discovery of Mumbai High field and subsequent other discoveries of other oil and gas fields in the western offshore area has changed the oil industry in India.

In 2018, a major oil discovery was made from well WO-24-3, which indicated a potential of approximately 29.74 million metric tonnes of oil equivalent (MMtoe) in the area.

ONGC plans to invest more than 500 million dollars in Mumbai High Field

Geology and oil reserves at Mumbai High field

Different oil and gas reservoirs, such as L-I, L-II, L-III, L-IV, L-V, basal clastics and fractured basement from top to bottom, are present in Mumbai High field. L-II and LIII are primarily limestone oil reservoirs dating from the Miocene age, further classified into several layers.

Mumbai High field has approximately 1,659Mt of total reserves in place.

Mumbai High field development details

ONGC announced its plan for the redevelopment of Mumbai High field in 2000. It planned to spend approximately Rs90bn ($200m) in five years for the project. The plan was divided into two phases. The first phase started in 2000 and was completed in December 2006.

Phase one is expected to yield an additional crude oil production capability of 23.25MMt and 6.10 billion cubic metres (bcm) of gas by 2030 from 73 new wells and ten sidetrack wells.

“The new MHN process platforms organise gas lift pipelines and oil exports lines of MHN field.” The cumulative oil production from phase one redevelopment wells was 9.34MMt and cumulative gas production was 2.89bcm until March 2008.

Mumbai High field reached its peak production rate of 400,000 barrels of oil per day (bopd) in 1985 and continued at the same rate until 1989.

A decline in oil and gas production led to the need for a redevelopment plan. Production declined gradually, sinking to 220,000bopd and ten million metric standard cubic metres of gas per day (Mmscmd) in 2001.

ONGC invested approximately Rs80bn ($178.4m) during phase one for better efficiency and controlling the decline in oil and gas production. During phase one, 29% of the 1,659MMt of total reserves were improved.

Mumbai High North phase two redevelopment details

Phase two redevelopment, announced in 2009, will result in additional crude oil production of 17.354MMt and 2.987bcm of natural gas, totalling to 20.34MMt of oil equivalent by March 2030.

Phase two of the MHN redevelopment plan aimed to further enhance the recovery rate from Mumbai High field by drilling 73 new wells and sidetracking 38 poor producers. Small reservoirs such as L-II and L-I were combined with major reservoir L-III to strengthen its oil production and development programme. Phase two was estimated to cost approximately Rs71.33bn ($153.43m).

Mumbai High North phase three redevelopment details

ONGC approved phase three of redevelopment for MHN in June 2014. Phase three redevelopment is expected to add 6.997MMt of crude oil and 5.253bcm of gas capabilities by 2030.

It will involve the installation of five wellhead platforms, modifications at 13 platforms, one clamp-off facility for wells at an existing platform and the construction of associated pipelines. It will also involve the drilling of 52 new wells and 24 sidetrack wells. A contract for phase three of the redevelopment was awarded to L&T in September 2014. Phase three redevelopment is expected to cost approximately Rs58.13bn ($955m).

Mumbai High South phase three redevelopment details

MHS phase three redevelopment is also in progress with an estimated investment of Rs60.68bn ($855.77m). SapuraKencana Petroleum subsidiary Kencana HL was awarded a $273m contract for the same work in July 2015. It subcontracted OHCS India and Param Offshore Services for topside hook-up, modification and the pre-commissioning of nine wellheads and a process platform.

The project will increase production by 7.547MMt of oil and 3.864bcm of gas till 2030. The redevelopment project involves the drilling of 70 new wells.

Mumbai High field infrastructure details

ONGC began construction of the new process complex for MHN near the old Bombay High North (BHN) platform in 2007. The platform was completely destroyed in a major fire in July 2005, which affected oil production. Along with the field's redevelopment plan, the new MHN complex was also developed to have a handling capability of approximately 270,000 barrels of liquid and 6.9 Mmscdm of compressed gas, as well as an oil pumping capacity of 50,000 barrels a day.

The MHN process complex consists of a process-cum-riser platform, living quarters, a subsea-connected flare structure, subsea pipelines and adjoining topside modifications, such as facilities for handling sour gas from B series marginal fields. The new MHN complex ensures optimised and safe operations at the field.

L&T secured a $1.18bn contract from ONGC during August 2009. The contract included an order for the MHN processing platform and living quarter projects, along with additional order for the supply of three process gas compression modules, also to be installed in MHN complex. The three compression modules constitute a total of 80,000t of structures. The work included surveying, engineering, procurement, fabrication, installation and commissioning of the facilities by L&T.

The new MHN process platforms organise the gas lift pipelines and oil exports lines of MHN field. The former BHN platform was replaced with a new MHN process platform that created additional facilities for gas processing from future platforms. To facilitate the interconnectivity of the power generating system, high-voltage submarine composite electrical cable was installed in 2007. The installation was completed in 2012.

The installation involved laying submarine electrical cable to interconnect 26 wellhead platforms, electrical submersible pumps (ESP), 81 wells and associated surface. The ESP assists in oil production from high-water cut (90-95%) wells in Mumbai High field. The board of the company approved a proposal for an investment of Rs39.9bn ($101.3m) in the C series development project in 2007. The investment would facilitate MHN to handle additional 3Mmscmd of gas from C series wells.

Pipelines

ONGC approved the construction of seven pipelines with risers and associated top-side facilities in MHN in April 2007. These pipelines are vital for maintaining optimum efficiency from Mumbai High.

Production from Mumbai High Field

Mumbai High Field reached its peak production level in 1998 with 20MMt a year. Along with its adjoining fields, it produced at a rate of 12.8Mmscmd of gas prior to the recent redevelopment projects. The production was approximately 265,000bopd with an average of 63% of water cut and an average production of 1,200 barrel of liquid a well during 2007.

The cumulative production of crude oil, including oil generated as a result of phase one development, was 140.25MMt until January 2009.The field is operated using the gas lifts method, which is a major artificial lift method used for oil production. Several gas compressors spread over a number of process complexes in the field to support the broad gas lift network.As of 2018, the average daily crude oil production at Mumbai High field was 16.9MMt and gas production was approximately 52.32 Mmscmd.

ASCE-JMI June-2022

5

KAMRAN ALI KHAN
B.Teech 6th Semester
Jamia Millia Islamia, New Delhi

Geothermal Energy: A renewable source of power

Introduction

In the quest of sustainable energy solutions, geothermal energy stand as a remarkable contender. Harnessing the earth's natural heat, this renewable energy source offers a range of benefits that position it as an integral part of the transition towards cleaner and more efficient power generation. In this article, we'll explore the concept of geothermal energy, its advantages, challenges, and its potential role in shaping a greener future. Also,we will take one or two real world examples where we have successfully harnessed or going to harness this valuable source of energy.

Understanding Geothermal Energy

Geothermal energy is derived from the heat stored beneath the Earth's surface. This heat originates from the planet's formation and the radioactive decay of minerals. The Earth's interior temperature increases as you descend deeper into its crust, and this heat can be harnessed for various purposes, including electricity generation and direct heating.

How it Works

Geothermal power plants tap into this heat reservoir by drilling wells into the Earth's crust to reach geothermal reservoirs. These reservoirs contain hot water and steam. The steam is used to drive turbines, generating electricity, while the hot water can be directly used for heating applications in homes, industries, and even greenhouses. The two primary types of geothermal power plants are dry steam plants, flash steam plants, and binary cycle power plants.

Real World Example Where Geothermal Energy is Harnessed or Potential to Harness

- **The Geysers, California, USA:** It is one of the world's largest geothermal power plant located here. It taps into underground steam reservoirs to generate electricity, providing power to thousands of homes.

- **Puga Valley, Ladakh, India** Puga Valley in Ladakh is one of the potential region in India , which showed significant potential for geothermal energy. This zone shows evidence of geothermal activity in the form of hot springs, muds pools, Sulphur and borax deposits. It is estimated that over 5000 MWh of hot geothermal energy is available at Puga at current depths which could be used for heating greenhouse and electricity generation.

Applications of Geothermal energy

- Electricity Generation: Geothermal power plant converts the Earth's heat into electricity, supplying power to communities and industries.
- Heating & Cooling: Geothermal heat pumps use the stable temperatures found just below the Earth's surface to provide efficient heating and cooling for residential, commercial, and industrial buildings.
- Agriculture $ Aquaculture: Geothermal energy can be harnessed for greenhouse heating, fish farming and crop drying, enhancing crop production.
- Low Environmental Impact: Geothermal power plants produce minimal greenhouse gas emission and have a smaller environmental footprint compared to fossil fuel based power plants.

Future Prospects

As technology advances and research continues, the efficiency and cost effectiveness of geothermal power generation are likely to improve. Innovation in drilling techniques, heat extraction, and energy conversion could make geothermal energy even more accessible and attractive.

Conclusion

Geothermal power stands as a renewable and reliable sources of energy that holds immense potential for contributing to a sustainable future. Its low environmental impact, consistent power generation, and localized benefits make it a compelling choice in the transition to cleaner energy sources. As we continue to explore & invest in geothermal energy, we take a significant step toward reducing our reliance on fossil fuels and mitigating the effects of climate change.

References

Articles: Sustainable Utilization of low Enthalpy Geothermal Resources to electricity generation.
Paper titled " Assessmentof subsurface temperature distributionfrom the gouged wells of Puga Valley" .
Websites: www.thinkgeoenergy.com, www.sciencedirect.com.

6
MANISH SHARMA
PhD Scholar, CED
Jamia Millia Islamia, New Delhi

Study of Concrete Filled UPVC Tubes as Column Under Axial Loading

1. Introduction

Concrete filled tube is a type of composite column that consists of a tubular encasing of any shape with concrete filled into it. the tube may be made up of different material like steel, fibre reinforced plastic (FRP) and Poly vinyl chloride (PVC)/Unplasticised PVC. Plastics have remarkable qualities such as low cost, excellent resilience to severe environmental attack, and a high strength-to-weight ratio. The behaviour of UPVC bounded reinforced columns with polypropylene fibers exposed to axial compression is investigated in this study.

2. Methodology and Results

To make this model, 3, 4, and 5 class pipes with diameters of 160, 200, and 225 mm and lengths of 800 mm were used, with nominal/working pressures of 0.6, 0.8, and 1.0 MPa, and M30 and M40 concrete grades were used to fill the tubes. a concrete filled UPVC pipe (CFUT)with different geometric properties samples were tested. A Servo-hydraulic Universal Testing Machine (UTM) with a loading capacity of 25000 KN was used for the test . So, sample identificated as 200P5PC40; where 200 indicates the outer diameter of the pipe, PC40 is that the plain concrete of grade M40, P5 is used for class 5 pipe with nominal pressure of 1.0 MPa.

Figure 1 **Casting & Testing of specimens**

The influence of each variable on the samples' ultimate strength, ductility, and confinement efficiency was examined. To acquire load-displacement variations and the appropriate deformation mode, all specimens were compressed by applying load exclusively to the concrete core. All of the specimens failed due to the formation of shear fractures and slightly bulging macrocracks. To simulate axial compression of CFUT specimens, a finite element model was developed utilizing the suggested stress-strain variation of confined concrete with UPVC tubes.

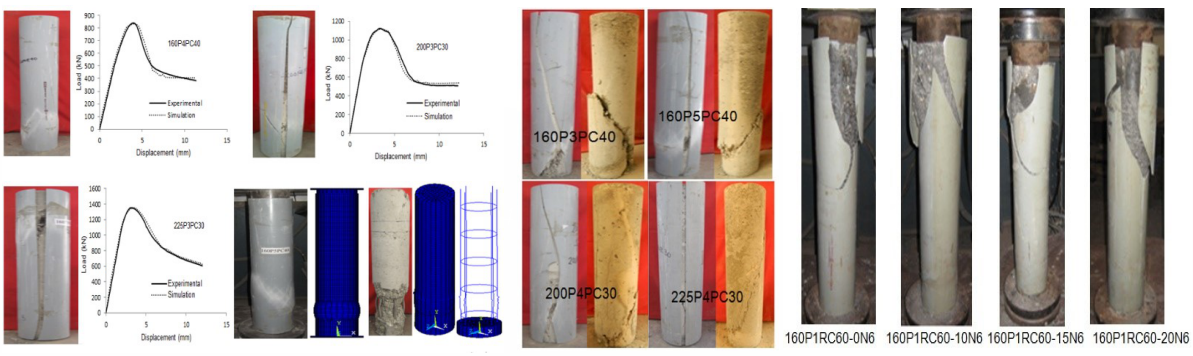

Figure 2 **Experimental Results**

Table 1 Experimental and FEM Modeling Results

Specimen	Ultimate Load (kN)		Constraining parameter $\alpha=A_p f_u/A_c f_c$	Confinement ratio $\beta=(fi/f_c)$	Mode of failure	Failure load	Max. strain at failure
	Experimental	FEM Modeling					
160P3PC30	758	752	0.067	0.034	Shear cracks with slight bulge	348.28	0.0169
160P4PC30	769	763	0.089	0.045		350.70	0.0150
160P5PC30	793	789	0.123	0.062		372.08	0.0149
200P3PC30	1123	1128	0.081	0.041		509.40	0.0151
200P4PC30	1142	1135	0.114	0.057		656.69	0.0149
200P5PC30	1182	1177	0.125	0.063		614.16	0.0140
225P3PC30	1352	1354	0.107	0.053		607.22	0.0150
225P4PC30	1420	1412	0.119	0.059		695.44	0.0146
225P5PC30	1491	1482	0.125	0.062		772.05	0.0138
160P3PC40	816	812	0.060	0.030		324.59	0.0155
160P4PC40	839	832	0.080	0.040		383.80	0.0142
160P5PC40	850	844	0.111	0.055		456.14	0.0132
200P3PC40	1231	1222	0.073	0.036		564.15	0.0138
200P4PC40	1245	1239	0.102	0.051		598.87	0.0138
200P5PC40	1280	1276	0.113	0.056		650.86	0.0130
225P3PC40	1486	1472	0.096	0.048		693.89	0.0143
225P4PC40	1550	1539	0.107	0.054		759.42	0.0134
225P5PC40	1610	1598	0.112	0.056		806.35	0.0128

3. Conclusions

A series of experiments on UPVC-confined columns were carried out in this study. The Finite element and experiments-based analysis of UPVC-filled concrete tubes results obtained and the following conclusions can be derived.

- The concrete was complete with shallow cracks and cracking occurred in the UPVC tube. If the tube was quite strong, the concrete navel had deep and wide cracks whereas the tubes maintained their stability without cracking and damage to the surface. All specimens fail due to the formation of shear cracks and macrocracks with slight bulging.
- This study used to elevate the model to predict the ultimate strength of the closed concrete columns of the UPVC.
- The strain at break ranged from 1.25 percent to 1.70 percent for small height specimens evaluated.
- The load-compression curve's behaviour is determined by the pipe's ambient pressure and the concrete's compressive strength. The absolute value of the curve's slope increases as concrete strength increases and decreases as ambient pressure rises.

References:-

1. Yu, F., Xu, G., Niu, D., Cheng, A., Wu, P. and Kong, Z., 2018. Experimental study on PVC-CFRP confined concrete columns under low cyclic loading. *Construction and Building Materials*, *177*, pp.287-302.
2. Gao, C., Huang, L., Yan, L., Jin, R. and Kasal, B., 2019. Strength and ductility improvement of recycled aggregate concrete by polyester FRP-PVC tube confinement. *Composites Part B: Engineering*, *162*, pp.178-197.

FACULTY / EXPERTISE

Dr. Farhan Ahmad Kidwai
Professor & HoD
Transportation Engineering

Dr. Khalid Moin
Professor
Structural Engineering

Dr. Mehtab Alam
Professor & DSW
Structural Engineering

Dr. Mohammad Shakeel
Professor
Water Resources Engineering

Dr. Gauhar Mehmood
Professor
Engineering Geology

Dr. Shamshad Ahmed
Professor
Remote Sensing & GIS

Dr. Nazrul Islam
Professor
Structural Engineering

Dr. Quamrul Hassan
Professor
Water Resources Engineering

Dr. Mohammad Sharif
Professor
Water Resources Engineering

Dr. Sirajuddin Ahmed
Professor
Environmental Engineering

Dr. Syed Mohammad Abbas
Professor
Geotechnical Engineering

Dr. Asif Husain
Professor
Structural Engineering

Dr. Naved Ahsan
Professor
Environmental Engineering

Dr. Azhar Husain
Professor
Water Resources Engineering

Mr. Ziauddin Ahmad
Associate Professor
Soil Mechanics

Dr. Sayed Mohammad Muddassir
Associate Professor
Urban Planning

Dr. Akil Ahmed
Professor
Structural Engineering

Dr. Syed Shakil Afsar
Assistant Professor
Environmental Engineering

Dr. Mohammad Umair
Assistant Professor
Structural Engineering

Dr. Abid Ali Khan
Assistant Professor
Environmental Engineering

Dr. Ibadur Rahman
Assistant Professor
Structural Engineering

CONTRACTUAL FACULTY

Dr. Md. Imteyaz Ansari
Assistant Professor
Structural Engineering

Mohd Izharuddin Ansari
Assistant Professor
Water Resources Engineering

Ms. Zoha Jafar
Assistant Professor
Structural Engineering

Vision of the Department

To emerge as centre of excellence for education and research in civil engineering and to produce professionally competent and ethically sound engineers of global standards, ready to serve the community and the nation with dedication.

Mission of the Department

M1 To provide rigorous hands-on civil engineering education through learner centric teaching pedagogy.

M2 To establish state-of-the art facilities for teaching and research in civil engineering domain.

M3 To motivate students to develop low-cost and sustainable ethical solutions to problems faced by the society.

M4 To provide opportunities to students to enable them to develop leadership and interpersonal skills.

Program Educational Objectives

PEO 1: Graduates shall apply professional skills for successful careers dealing with analysis, design and management of infrastructural projects, both in India and abroad.

PEO 2: Graduates shall use civil engineering concepts so as to formulate, analyse, and solve civil engineering and allied problems using the principle of mathematics and science.

PEO 3. Graduates shall deliver a comprehensive and balanced understanding of several branches of civil engineering such as structural engineering, geotechnical engineering, transportation engineering, hydraulic and water resources engineering, environmental engineering, and interdisciplinary areas.

PEO 4. Graduates shall demonstrate high ethical standards, effective oral and written communication skills, and ability to work as part of teams on multidisciplinary projects in diverse professional environments, and should be able to relate engineering issues to the society and nation.

PEO 5. Graduates shall acquire academic excellence, leadership, and management skills, and engage in life-long learning to be successful in the professional and entrepreneurial world.

Department of Civil Engineering

Faculty of Engineering & Technology
Jamia Millia Islamia, New Delhi - 110025
Tel: 011-26985227
Email: civil@jmi.ac.in