5.6 INNOVATIONS BY THE FACULTY IN TEACHING AND LEARNING (10)

In the Department of Civil Engineering, much importance is given for incorporating innovative techniques in teaching. During the beginning of every semester, a refresher program is conducted to share the innovative practices followed by other faculties pertaining to a new/enriched course offered in the semester. Such brainstorming sessions help transfer the best practices amongst faculties in the department. Pedagogies, Innovative Assessments, Assignments, Content-out-of-Syllabus are typically discussed in the sessions. Faculty members use the LCD Projectors for their presentations. The faculty members use these aids to take the teaching learning process to the next level.

Lectures are presented by faculty members using a variety of teaching tools such as chalk and board, PowerPoint presentation, video lectures, models, charts, animation, and other teaching techniques such as lecture, group discussion, seminar, tutorials, guest lectures, and demonstration. Additionally, students are motivated to enroll in online courses, MOOCs. Apart from this, the following are the various innovative practices followed at Civil department to enhance Teaching- Learning.

Table 5.6.1 Summary of Innovative teaching techniques in teaching Learning Process

SL NO	ITEM	DESCRIPTION
1	Project based Learning	As part of their courses in each semester, students will complete a project-based learning and these will be graded using the rubrics. Open Day will be organized at the END of each semester; PROJECT EXHIBITIONS are held to display the project-based learning (PBL) work completed by students. The project demonstrates the students' capacity to put their knowledge of various real-world issues to use in solving them. Numerous initiatives in the burgeoning fields of Artificial Intelligence & Machine Learning, Various Advanced Design Methods, Using Advanced Software's like AUTO CAD, STAAD PRO etc. Link: https://bitswgl.ac.in/civil/best-civil-engineering-college
2	Modern Tools Usage (ICT)	LCD Projectors, Speakers, Systems with Keyboard and mouse, power point presentation, Laser Pointer, Slide changer, writing pads, Wi-Fi enabled classrooms and other student learning environments. Wi-fi enabled Tools.

		Link: https://bitswgl.ac.in/civil/best-civil-engineering-college
3	Innovative Learning practices	Various cutting-edge techniques, such as activity-based learning and project-based learning, were discussed throughout the lecture sessions. Like Role playing and brainstorming Assignments, Application Development, Poster Presentation, Mooc Course, Presentation, Poster Design, Partial Delivery, and Mini Project Review, Group Seminar, Collaborative Learning. Link: https://bitswgl.ac.in/civil/best-civil-engineering-college
4	Quality course materials	The digital library has expert video subject lectures given by a variety of notable resource people, which makes it easier for professors and students to use NPTEL's E-Tutorials, MOOCs, and other online resources. E-Studio. Link: https://bitswgl.ac.in/civil/best-civil-engineering-college
5	Industry Visits	Industry Visits will be organized once in a semester for delivering the practical exposure to the students during Industry Visit. Link: https://bitswgl.ac.in/civil/best-civil-engineering-college
6	Internship	Internship will be conducted during the semester end before the start of next semester. student will be trained on the industry-oriented skills some of the students will be sent to the industry/company/organization for conduction the internships Internship. Link: https://bitswgl.ac.in/civil/best-civil-engineering-college
7	Innovative Methods of Teaching Adopted	• **Mind mapping**- A visual thing used for disseminating complex information to the students is used for some of the subjects • **Role playing** - Students are asked to complete the task by role playing by interacting with their peers and try to complete the task assigned to them in their specific role.

8	Online platform	Faculty members use Google Drive, Google class rooms, Google forms and other platforms such as YOUTUBE.
9	Open/Industry Courses/Skill/Enhancement Courses	These activities are provided by the ISE department for a set time during the academic year. Here, the student's proficiency with tools and software used in industry was improved. Open courses.

a) Project based Learning

The Department of Civil Engineering (CE) actively promotes Project-Based Learning (PBL) to enhance students' problem-solving skills, creativity, and practical knowledge. PBL provides a hands-on, experiential learning approach where students work on real-world projects, integrating theoretical concepts with practical applications.

Project-Based Learning Activity: Site Visit

1. Engineering Sector: visited under construction Site

Description:

Students went to site which has been under construction like real time project work they directly get knowledge of seeing the construction work such as bar bending ,Slab ,Reinforcement etc

Tools and Technologies Used:

- AUTO CAD, STAAD PRO ,Plans Estimations Mix Proportion Mix design, etc

Learning Outcomes:

- Students gained hands-on experience by real time site work
- They developed a deep understanding of **Site work** and its applications in real-world scenarios.

Impact:

The real time site project helped the students to work easily in the construction works and they developed the skills .which is helpful in the site works

Integration with Curriculum

- PBL is incorporated into coursework through mini-projects, major projects, and capstone projects.
- Encouragement to participate in hackathons, technical competitions, and research-driven projects.

Fig 5.6.1: Calculation of Column Sizes, Column Bar Bending & Slab Area calculation

2. Hydraulic Bridge

Description:

These projects demonstrate the successful integration of Engineering principles with Hydraulic Bridge which is a bridge that uses a hydraulic system to help it move or lift. Hydraulic bridges can be used to carry more weight and allow ships and vehicles to pass underneath.

Key Features:

- A hydraulic system uses a fluid to transfer power.
- A syringe is used to pressurize the fluid, which moves the bridge.
- The bridge moves up when a ship needs to pass, and then moves back down when the ship has passed.

Learning Outcomes:

- More complex hydraulic components could be used for precise bridge control.
- Structural analysis could be used to optimize the bridge design.

- Alternative power sources could be used to make the hydraulic system more energy efficient.
- Sensors could be used to monitor the bridge's position, load, and environmental conditions.

Conclusion

- Bridge design engineers should consider the possibility of flooding and choose bridge types with fewer piers, such as suspension or cable-stayed bridges.

- **Bridge maintenance**

Old bridges are more likely to collapse and may not meet modern design standards.

- **Bridge alerts**

Hydraulic bridges can alert drivers when water levels rise, allowing traffic to be stopped.

- **Bridge innovation**

Hydraulic bridges are an example of human achievement and collaboration, and demonstrate our ability to innovate and use technology to overcome obstacles

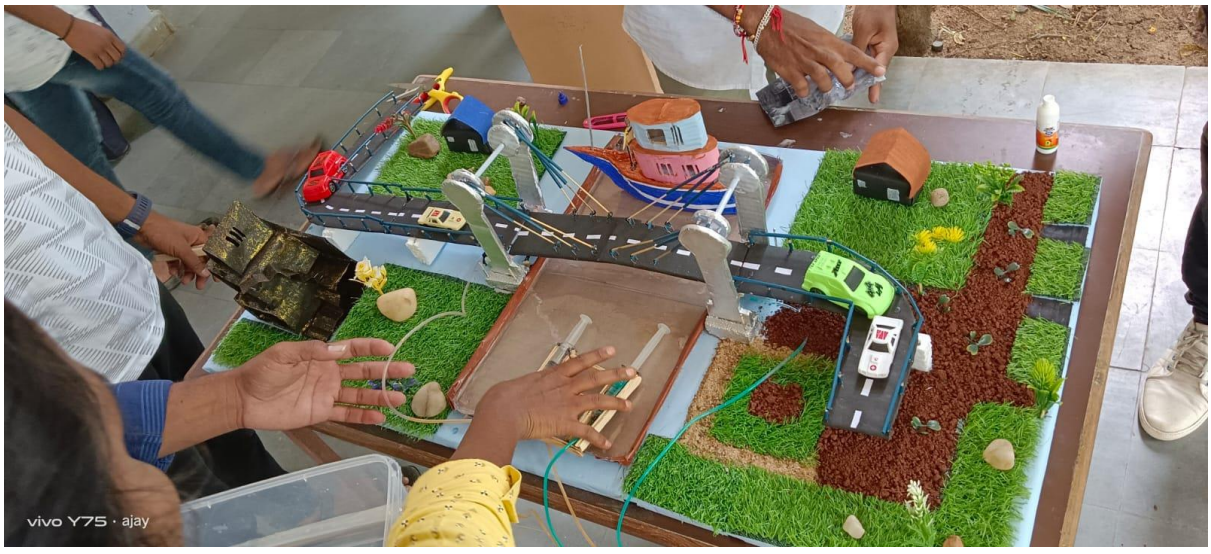

Fig 5.6.2: Hydraulic Bridge

3.Sewage Water Treatment Plant

Description:

A Sewage Water Treatment Plant (STP) is a facility that removes contaminants from wastewater (sewage) through a series of physical, chemical, and biological processes, making it safe to discharge back into the environment, typically involving stages like screening, grit removal, primary settling, secondary biological treatment, and sometimes a final tertiary treatment stage to further purify the water depending on local regulations.

Key points about Sewage Water Treatment Plants:

- **Function:**

To clean wastewater from homes, businesses, and industries by removing solids, organic matter, and harmful bacteria.

- **Stages of treatment:**
    - **Preliminary treatment:** Removes large debris like sticks, rags, and plastics through a screen.
    - **Primary treatment:** Removes settleable solids in a sedimentation tank, where heavier particles sink to the bottom as sludge.
    - **Secondary treatment:** Biological process using bacteria to break down organic matter in the wastewater, often through activated sludge or trickling filter systems.
    - **Tertiary treatment (optional):** Further removes pollutants like nutrients (nitrogen and phosphorus) through advanced filtration or chemical processes, depending on required water quality.

    Different stages of sewage treatment can influence the final outcome:

- **Primary treatment:** Removes large solid particles through settling and screening.

- **Secondary treatment:** Uses biological processes like bacteria to break down organic matter.
- **Tertiary treatment:** Further removes nutrients, chemicals, and other contaminants through advanced filtration and disinfection processes, allowing for higher quality treated water.

Conclusion

In conclusion, The importance of Sewage Treatment Plants (STPs) are crucial for our communities, the environment, and our future. They ensure a clean water supply, protect the environment, and offer economic advantages for businesses.

Fig 5.6.3: Sewage Water Treatment

b) Modern Tools Usage (ICT)

The Department of Civil Engineering (CE) integrates **Information and Communication Technology (ICT)** tools to enhance teaching and learning, making education more interactive, engaging, and effective.

Smart Classrooms & Digital Infrastructure

- All classrooms are equipped with **projectors, blackboards, and whiteboards** for an enriched learning experience.
- Faculty use projectors for **video lectures, simulations, and online expert talks** to improve conceptual understanding.

Fig 5.6.4: Digital classroom

Learning Management Systems (LMS)

- Platforms like **Moodle, Google Classroom, and Microsoft Teams** are used for sharing study materials, assignments, and assessments.
- Students can access lecture notes, quizzes, and recorded sessions anytime for **self-paced learning**.

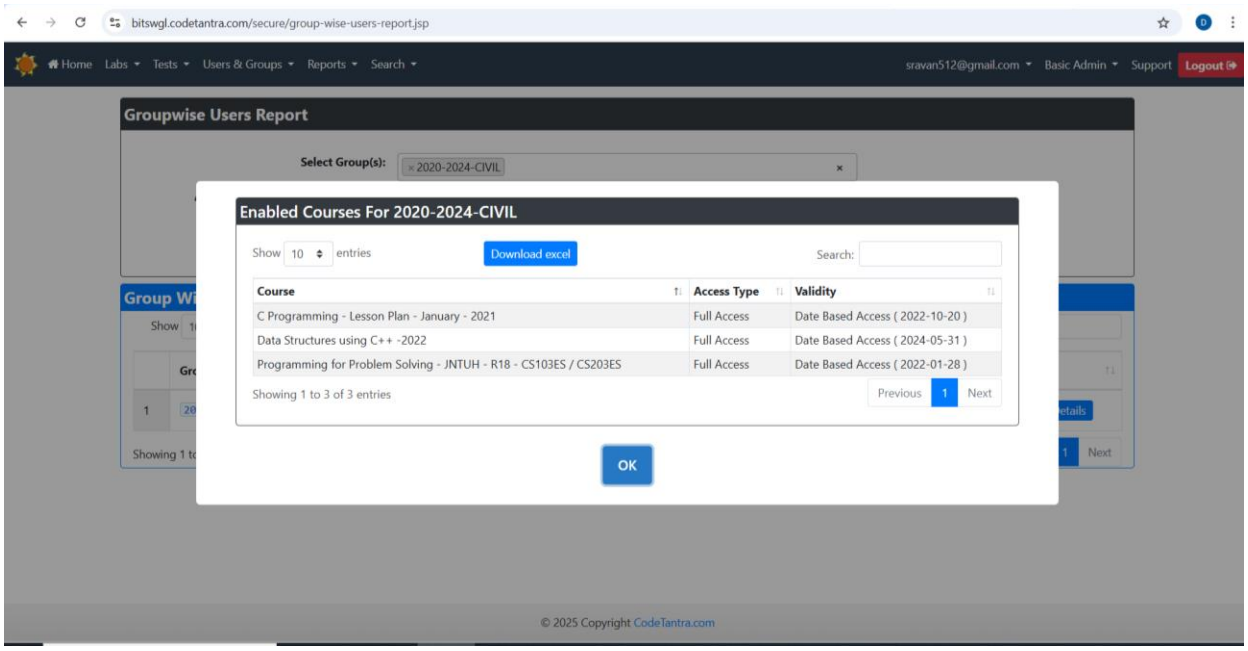

Fig 5.6.5: LMS Platform -Code Tantra

Online Learning & MOOCs

- Faculty and students actively participate in online courses through **NPTEL, Coursera, Udemy, and edX**.
- Platforms like **Tech Transform and SWAYAM** are utilized to upskill students with emerging technologies.

Fig 5.6.5 : Sample NPTEL Certificate

Simulation Software

- Students gain hands-on experience through **virtual labs** for experiments that are costly or hazardous in real-world scenarios.
- **Simulation tools like AutoCAD, STAAD Pro** help students visualize and analyze complex engineering concepts.

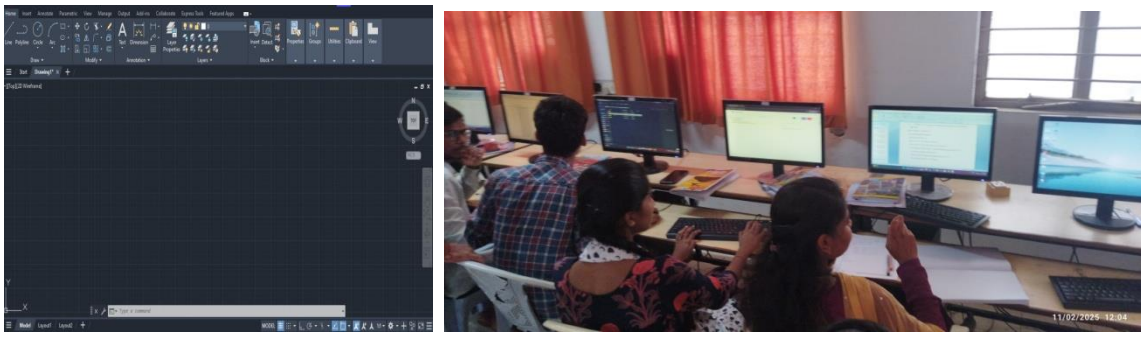

Fig 5.6.6: AUTO CADD SOFTWARE LABORATORY

C) **Innovative Learning practices**

The Department Civil Engineering (CE) adopts **innovative learning practices** to enhance student engagement, foster critical thinking, and bridge the gap between theoretical knowledge and real-world applications. These methods create a dynamic and interactive learning environment, preparing students for future challenges.

Fig 5.6.7: Double Decker road & Hydraulic Bridge

D) **Quality Course Materials**

The digital library has expert video subject lectures given by a variety of notable resource people, which makes it easier for professors and students to use NPTEL's E-Tutorials, MOOCs, and other online resources. E-Studio.

Fig 5.6.8: Course file

Fig 5.6.9: Digital Library

e) Industry Visits

Industry Visits will be organized once in a year for delivering the practical exposure to the students during Industry Visit.

1. <u>Mallana Sagar Pump House</u>

The visit to **Mallana Sagar** is highly beneficial for civil engineering students. It provides hands-on exposure to thermal, hydro, power generation processes, including

turbines, boilers, and cooling systems. Students gain practical insights into energy conversion, efficiency, and maintenance, bridging theoretical knowledge with real-world applications and enhancing their understanding of mechanical systems in energy production.

Fig 5.6.10: **Industry Visits: Mallana Sagar**

2. **YWRP Madikonda Site**

An industrial visit to a construction site is a great opportunity to gain hands-on experience and insights into real-world construction processes. During such a visit, you can observe the following aspects

1. **Site Layout**: How the site is organized, including storage areas, work zones, and safety measures.

2. Types of Construction: Whether it's residential, commercial, industrial, or infrastructure development.

3. **Project Stages**: See which stage the construction is in, such as planning, foundation work, framing, finishing, etc.

Post-Visit Reflection

- Opportunities to ask questions from experts on the site.
- Comparing theoretical knowledge from lectures with real-world practices.
- Notes on safety, quality control, and methods employed by construction teams.

Fig 5.6.6: Industry Visits: YWRP Manikonda Site

f) Internship

In civil engineering, internships serve as a crucial stepping stone to career success by offering students hands-on experience in real-world projects. During an internship, civil engineering students work with professionals in the field, gaining exposure to tasks such as site planning, structural analysis, construction management, and project design. These experiences help interns apply theoretical knowledge to practical situations, learn industry standards, and develop technical skills. Additionally, internships foster valuable professional connections, enhance resumes, and can often lead to full-time job opportunities with the same companies, providing a strong foundation for a successful civil engineering career.

S. No	Internship offered by	No. of students enrolled	Duration
1	MRF MANUFACTURING COMPANY	15	05 months
2	SDVVL Survey and Construction Pvt. Ltd.	07	08 months
3	TVS SUNDRAM FASTENERS LIMITED	09	05 months

Fig 5.6.12: Theodolite survey

Fig 5.6.13: Levelling Survey

g) Innovative Methods of Teaching Adopted

Innovative teaching methods like mind mapping and role-playing are becoming increasingly popular in civil engineering education to enhance student learning and engagement.

Mind Mapping: This technique helps students visualize complex concepts, such as structural systems, project workflows, or construction processes. By creating diagrams that link ideas and show relationships, students can better understand how different components of a project fit together. Mind mapping encourages critical thinking, problem-solving, and a more structured approach to understanding engineering topics.

1. **Design Process of a Bridge**: Students can create a mind map to break down the steps involved in designing a bridge. Starting with the central idea (the bridge), they can branch out to different stages such as feasibility studies, environmental considerations, material selection, structural analysis, construction methods, and safety assessments. This helps students understand how each phase connects to others and the complexity of the design process.
2. **Construction Project Management**: Students could create a mind map to outline the key components of managing a construction project. Key branches could include budgeting, scheduling, resource allocation, safety management, and team coordination. By visualizing these interconnected tasks, students gain a clearer understanding of how to approach a construction project from start to finish.
3. **Soil Mechanics Concepts**: For topics like soil properties, foundation types, or soil testing methods, students can use mind maps to connect various concepts like soil classification, compaction, shear strength, and permeability. This visual approach can make abstract concepts more concrete.
4. **Fluid Mechanics:** Use a mind map to connect topics like fluid properties, Bernoulli's equation, and applications in turbines and pumps, making it easier to understand the flow of concepts.

Quality Control: Role-play as quality inspectors and production engineers to identify and resolve defects in a manufacturing process, highlighting the importance of precision and standards.

Construction Site Conflict Resolution: Students can role-play as different stakeholders on a construction site (e.g., project manager, contractor, engineer, and client) and simulate a scenario where there is a dispute over project timelines or costs. This allows students to practice communication, negotiation, and problem-solving skills in resolving real-world issues.

5. **Building Design Process**: In a role-playing exercise, students might take on roles such as structural engineer, architect, and environmental consultant to work together on designing a sustainable building. Each role has specific responsibilities, and students must collaborate, negotiate, and address different considerations like safety, cost, and environmental impact. This gives students insight into interdisciplinary teamwork and the complexity of large-scale projects.

- **Mind mapping**- A visual thing used for disseminating complex information to the students is used for some of the subjects

- **Role playing** - Students are asked to complete the task by role playing by interacting with their peers and try to complete the task assigned to them in their specific role.

- Seminar: Encouraging students to present on recent advancements, research papers, or innovative projects. Improves communication, research, and public speaking skills.

Fig 5.6.14: Role plays on construction Site

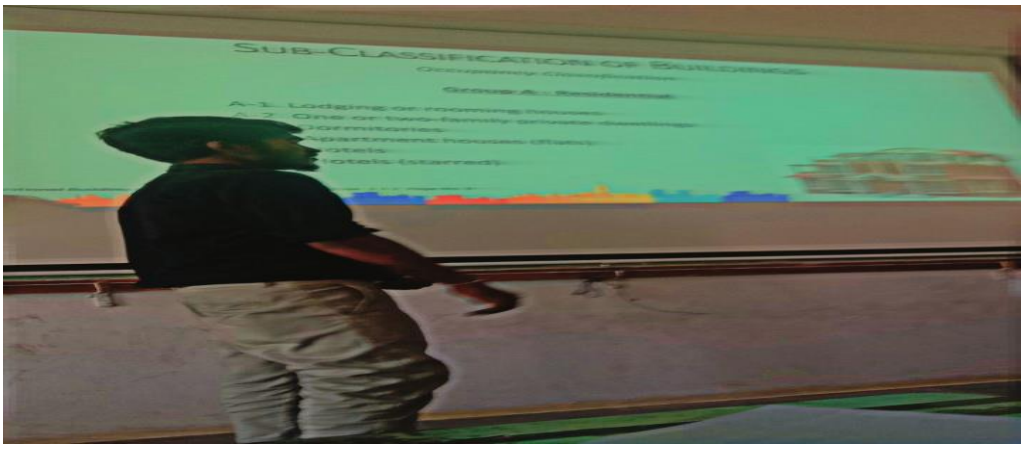

Fig 5.6.15: Seminar on Bitumens and Types

h) Online platform

In the modern educational landscape, leveraging online platforms has become essential for effective teaching and learning. Faculty members utilize a suite of Google tools, including Google Drive, Google Classroom, and Google Forms, to create a seamless and interactive learning environment. Google Drive serves as a centralized repository for storing and sharing course materials, ensuring easy access for students. Google Classroom streamlines communication, assignment distribution, and grading, fostering collaboration between faculty and students. Google Forms enables the creation of quizzes and surveys, allowing educators to assess student understanding and gather feedback efficiently.

https://bitswgl.codetantra.com/secure/group-wise-users-report.jsp

Fig 5.6.16: Explore platform

g) Open/Industry Courses/Skill/Enhancement Courses

The Department of Civil Engineering offers Open Courses, Industry-Oriented Programs, and Skill Development Initiatives as part of its commitment to bridging the gap between academia and industry. These courses are strategically designed and conducted throughout the academic year to provide students with hands-on experience in industry-relevant tools, software, and technologies.

Through these programs, students gain proficiency in structural analysis and design software (AutoCAD, STAAD. Pro, ETABS, Revit), Building Information Modeling (BIM), geotechnical and environmental engineering tools, surveying technologies (GIS, Total Station), and construction management software (Primavera, MS Project). Additionally, courses on smart infrastructure, sustainability, IoT in civil engineering, and AI-driven design analysis ensure students stay ahead in the evolving construction and infrastructure landscape.

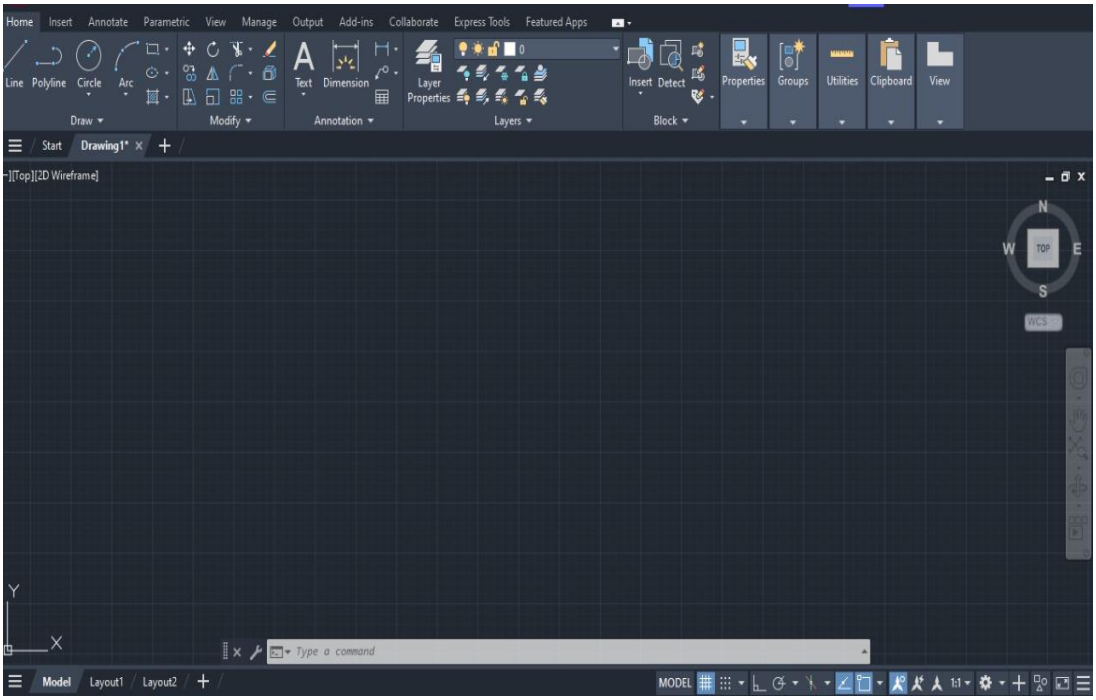

Fig 5.6.17: AUTO CADD Software