

B.TECH CIVIL ENGINEERING – R22

3D Printing Technology in Civil Engineering

SEMESTER V

L/T/P/C

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Unit 1: Fundamentals of 3D Printing

- Introduction to additive manufacturing
- Evolution of 3D printing in engineering
- Types of 3D printing technologies (FDM, SLS, SLA, Binder Jetting, etc.)
- Materials used in civil engineering applications
- Advantages and limitations compared to conventional construction methods

Unit 2: Applications in Civil Engineering

- 3D printing in construction (houses, bridges, pavements)
- Case studies of 3D-printed structures worldwide
- Sustainable construction practices with 3D printing
- Integration with Building Information Modeling (BIM)
- Challenges in large-scale implementation

Unit 3: Design and Process Workflow

- CAD modeling for civil projects
- Structural design considerations for printed components
- Workflow: design → slicing → printing → post-processing
- Quality control and testing of printed structures
- Safety standards and regulatory aspects

Unit 4: Materials and Innovations

- Cementitious materials for 3D printing
- Geopolymer concrete and eco-friendly alternatives
- Reinforcement techniques in printed structures
- Hybrid construction methods (3D printing + traditional techniques)
- Innovations: smart materials, self-healing concrete

Unit 5: Future Trends and Industry Applications

- Automation and robotics in construction
- 3D printing for disaster relief and affordable housing
- Role in smart cities and infrastructure development
- Economic feasibility and scalability
- Future research directions and career opportunities

Course Outcomes (COs):

CO1: Explain the fundamentals of 3D printing and its relevance to civil engineering.

CO2: Analyze real-world applications and evaluate the sustainability benefits of 3D-printed structures.

CO3: Apply CAD modeling and workflow processes to design civil engineering components for 3D printing.

CO4: Assess the suitability of different materials and reinforcement techniques for printed structures.

CO5: Evaluate future trends, industry applications, and economic feasibility of 3D printing in construction.