MANIPAL UNIVERSITY JAIPUR

International Summer School- Manipal University Jaipur [ISSMUJ]-2025

[Hybrid Mode]

Course Overview

Name of Course- Smart Built Environments with AI BIM and Responsible Research

Name of instructor: Dr. Aditi Nag (MUJ), Ar. Apurv Ashish (BIT Mesra)

Session: May-July 2025

Language of instruction: English

Number of contact hours: 36

Credit awarded: 03

Prerequisite: NA

Objective of Course/Project:

The primary objective of **Smart Built Environments with AI BIM and Responsible Research** is to equip undergraduate and postgraduate students with the knowledge, practical skills, and ethical frameworks necessary to lead the digital transformation of the built environment. The course aims to:

O1. Empower students to integrate Artificial Intelligence (AI) and Building Information Modeling (BIM) into architectural design and planning, enabling them to create innovative, efficient, and sustainable solutions for real-world challenges.
O2. Develop advanced competencies in generative and computational design, leveraging AI algorithms for creative problem-solving, structural optimization, energy efficiency, and data-driven decision-making in architecture and urban planning.
O3. Foster critical understanding of ethical, social, and equity issues in the application of AI and BIM, ensuring responsible and transparent use of technology in the built environment.
O4. Enhance research and analytical skills by guiding students through the process of formulating, executing, and presenting a research project that addresses contemporary issues at the intersection of AI, BIM, and architecture, with the outcome being a publishable research paper.
O5. Prepare students to address industry challenges, such as sustainability, resource management, stakeholder collaboration, and risk mitigation, through the integration of AI-driven analytics and digital modeling tools.
O6. Promote interdisciplinary collaboration and innovation, encouraging students to work in teams and engage with real-world case studies to bridge the gap between theoretical knowledge and practical application.

Syllabus:

- **Week 1: Foundations of AI, BIM, and Digital Transformation**

  - Introduction to Artificial Intelligence in the Built Environment
  - Overview of Building Information Modeling (BIM) and its role in architecture and planning
  - Digital transformation in design, planning, and construction
  - Review of current trends and case studies (global and Indian context)
  - Research topic selection and literature review workshop
  - **Deliverable:** Research question and literature review draft

- **Week 2: Generative Design, Parametric Modeling, and AI Tools**
  - Principles of generative and computational design
  - Introduction to AI tools for design (e.g., Midjourney, Runway ML, Form Finder)
  - Parametric modeling in architecture using BIM platforms (Revit, Rhino)
  - Workshop: Creating AI-driven design solutions and visualizations
  - **Deliverable:** AI-optimized 3D model and dataset

- **Week 3: BIM Workflows, Collaboration, and Automation**
  - Advanced BIM modeling and data management
  - Collaborative BIM: Cloud workflows, interoperability, and project coordination
  - Automating BIM documentation and project management using AI
  - Workshop: Real-world BIM project integration with AI (e.g., clash detection, scheduling)
  - **Deliverable:** BIM-AI integrated workflow and project documentation

- **Week 4: Research Methods and Data Analytics in Architecture**
  - Fundamentals of research design in architecture and planning
  - Data collection, analysis, and visualization using BIM and AI outputs
  - Structuring a research paper (IMRaD format)
  - Workshop: Data analytics for design optimization and sustainability
  - **Deliverable:** Methodology and results section draft

- **Week 5: AI Ethics, Social Impact, and Peer Review**
  - Ethical considerations in AI for architecture and planning (bias, transparency, social responsibility)
  - Navigating privacy, copyright, and regulatory issues in digital design
  - Case studies: Ethical dilemmas in AI-driven projects
  - Peer review workshop: Reviewing and revising research papers
  - **Deliverable:** Peer-reviewed manuscript draft and ethics audit

- **Week 6: Capstone Project, Presentation, and Publication**
  - Finalizing research paper for publication
  - Oral defense and presentation to academic/industry panel
  - Guidance on journal selection and submission process
  - Portfolio and resume update with AI/BIM project highlights
  - **Deliverable:** Submission-ready research paper and final presentation

Assessment Breakdown

- Research Paper (IMRaD structure, Turnitin-checked): 40%
- BIM and AI Models/Workflows: 30%
- Ethics Audit and Peer Review: 20%
- Final Defense/Presentation: 10%

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Learning Outcomes

- Integrate AI and BIM in architectural and planning workflows
- Critically evaluate ethical and social implications of digital tools
- Conduct and communicate publishable research
- Develop collaborative, interdisciplinary solutions for the built environment

Note:

This syllabus is designed for an intensive, publication-focused experience, reflecting current international standards and best practices in AI, BIM, and ethical innovation in architecture and planning.

Organization of Course/Project:

Total contact Hours: 36		
1st week:	6 hrs (classes)	4 hrs (self-study/project) + 2 hrs (assessment/discussion)
2nd week:	7 hrs (classes)	5 hrs (self-study/project) + 2 hrs (assessment/discussion)
3rd week:	7 hrs (classes)	5 hrs (self-study/project) + 2 hrs (mid-term exam/assessment/discussion)
4th week:	7 hrs (Classes)	5 hrs (self-study/project) + 2 hrs (assessment/discussion)
5th week:	7 hrs (Classes)	5 hrs (self-study/project) + 2 hrs (assessment/discussion)
6th week:	2 hrs (Classes)	2 hrs (end term exam)

Mode of lectures: Hybrid

Course/Project Plan:

Lecture no.	Topic	Lecture mode	Instructor
L: 1-3	Introduction to AI, BIM, and Digital Transformation in Architecture and Planning	Hybrid lecture/case study	Dr. Aditi Nag & Ar. Apurv Ashish
L: 4-5	Fundamentals of Research Methods in Digital Built Environment	Hybrid lecture/discussion	Dr. Aditi Nag
L: 6-7	Generative Design and AI Applications in Architecture/Planning	Hybrid lecture/workshop	Dr. Aditi Nag

L: 8-9	BIM Basics: 3D Modeling, Data Management, and Collaboration	Hybrid lecture/hands-on	Ar. Apurv Ashish
L: 10-11	Advanced BIM: Automation, Clash Detection, and Workflow Integration	Hybrid workshop/hands-on	Ar. Apurv Ashish
L:12-13	AI for BIM: Automation, Optimization, and Predictive Analytics	Hybrid lecture/workshop	Ar. Apurv Ashish
L:14-15	Case Studies: AI and BIM in Real-World Projects	Hybrid case study/discussion	Ar. Apurv Ashish
L: 15-19	Research Project Development: Topic Selection, Literature Review, and Methodology	Hybrid discussion/workshop	Dr. Aditi Nag
L:20-21	Ethics and Social Impact of AI in Architecture and Planning	Hybrid lecture/discussion	Dr. Aditi Nag
L: 22-25	Data Analytics, Visualization, and AI Tools for Design Optimization	Hybrid workshop/hands-on	Dr. Aditi Nag & Ar. Apurv Ashish
L: 26-30	Collaborative Studio: BIM-AI Integrated Project Work	Hybrid studio/hands-on	Dr. Aditi Nag & Ar. Apurv Ashish
L: 31-34	Research Paper Writing, Peer Review, and Publication Process	Hybrid workshop/discussion	Dr. Aditi Nag
L: 35-36	Final Presentations, Capstone Defense, and Course Wrap-up	Hybrid presentation/discussion	Dr. Aditi Nag & Ar. Apurv Ashish

Notes:

- "Hybrid" indicates a mix of live (in-person/online) and asynchronous (recorded/video) modes, with hands-on and discussion components as appropriate.
- Ar. Apurv Ashish leads all BIM and technical AI modules; Dr. Aditi Nag leads research, planning, ethics, and architectural theory modules.
- Collaborative sessions and final presentations are co-conducted.

Brief profile of the instructors:

Dr. Aditi Nag

Assistant Professor, School of Architecture and Design, Faculty of Science, Technology and Architecture (FoSTA), Manipal University Jaipur (NIRF 33)

Dr. Aditi Nag specializes in heritage conservation, urban planning, and sustainable tourism management, with a strong focus on the responsible integration of AI and BIM in the built environment. A former DST Inspire

Fellow, she has authored 36 publications and holds an h-index of 7, reflecting a significant research impact. At ISSMUJ-2025, Dr. Nag will lead modules on research methods, ethical frameworks, and digital innovation, guiding students in producing publication-ready research and developing actionable solutions for the future of the built environment.

Ar. Apurv Ashish

Assistant Professor, Department of Architecture and Planning, Birla Institute of Technology (BIT) Mesra, Ranchi (NIRF 20)

Ar. Apurv Ashish is a practicing architect and academic specializing in Building Information Modeling (BIM), computational design, and AI-driven innovation for the built environment. As Assistant Professor at BIT Mesra, he focuses on advancing digital workflows, automation in project delivery, and interdisciplinary collaboration. At ISSMUJ-2025, he will deliver hands-on technical modules on BIM integration, AI-based design optimization, and real-world digital project management, empowering students to lead the next wave of digital transformation in architecture and planning.