M.ARCH (BUILDING SERVICES)
SYLLABUS (w.e.f. session 2026-27)

Introduction

Modern architectural education involves far more than mastery of form and space. The discipline necessitates competency within the range of systems responsible for making a building inhabitable, energy-efficient, and sustainable. The Master of Architecture (Building Services) is a course tailored specifically to meet this necessity, targeting graduates of architecture wishing to pursue a career focused on the technical and environmental systems of buildings, including HVAC, plumbing, solar and renewable energies, fire safety, electrical services, and intelligent building automation. State-of-the-art MEPF services that promote sustainable environment through energy-efficient practices are covered throughout this programme.

The pedagogy underlying the programme is rooted in a fundamental belief: there is no separation between architecture and building physics. Envelope decisions, orientations, and materials have clear implications regarding thermal comfort, energy usage, and occupant health; training is provided to recognize these implications ahead of time.

Curriculum structure follows a progression towards competence. Introductory modules on concepts in thermodynamics, climate adaptive design and system components followed by application of knowledge through sizing and selection exercises based on actual building cases complemented with site visits, market surveys and real-world examples. The syllabus keeps abreast with current regulatory frameworks such as the National Building Construction Standards (NBCS), ECBC, ASHRAE and ISHRAE.

Upon completion of the program, the students will be able to regard buildings not just as mere receptacles for activities but as resource-efficient systems and implement this knowledge within their professional work.

Courses are now classified under Professional Core (PC), Skill Enhancement Course (SEC), Employability Enhancement Compulsory Course (EECC) and Open Elective (OE) categories, giving students greater flexibility while retaining the professional core of building-services education.

PROGRAMME STRUCTURE AT A GLANCE

The table for M.Arch (Building Services) course-scheme framework.

Semester I

Code	Course Name	Category	L	T/ST	IA	WR	VV	Total	Exam (Hrs)	Credits
MBS-101	HVAC Services	PC	2	1	30	45	–	**75**	3	**3**
MBS-102	Plumbing and Solar Services	PE	2	1	30	45	–	**75**	3	**3**
MBS-103	Digital Applications in Architecture-I	SEC	2	1	45	—	30	**75**	3	**3**
MBS-104	Project: Studio-I	PC	2	6	120	—	80	**200**	—	**8**
MBS-105	Research Methodology	OE	2	1	30	45	–	**75**	3	**3**
	Semester Total							**500**		**20**

Semester II

Code	Course Name	Category	L	T/ST	IA	WR	VV	Total	Exam (Hrs)	Credits
MBS-201	Electrical Services	PC	2	1	30	45	–	**75**	3	**3**
MBS-202	Lighting Services	PE	2	1	30	45	–	**75**	3	**3**
MBS-202	Dissertation-I	PC	2	1	45	—	30	**75**	—	**3**
MBS-204	Project: Studio-II	PC	2	7	135	—	90	**225**	—	**9**
MBS-205	Responsive Architecture and Environmental Systems	OE	2	1	30	45	–	**75**	3	**3**
	Semester Total							**525**		**21**

Semester III

Code	Course Name	Category	L	T/ST	IA	WR	VV	Total	Exam (Hrs)	Credits
MBS-301	Fire Services	PC	2	1	30	45	–	**75**	3	**3**
MBS-302	Architectural Building Acoustics	PE	2	1	30	45	–	**75**	3	**3**
MBS-303	Dissertation-II	PC	2	1	45	—	30	**75**	—	**3**
MBS-304	Project: Studio-III	PC	3	6	135	—	90	**225**	—	**9**
MBS-305	Sustainable Building Systems	OE	2	1	30	45	–	**75**	3	**3**
	Semester Total							**525**		**21**

Semester IV

Code	Course Name	Category	L	T/ST	IA	WR	VV	Total	Exam (Hrs)	Credits
MBS-401	Thesis-BS	PC	4	11	225	—	150	**375**	—	**15**
MBS-402	Project Management	PE	2	1	30	45	–	**75**	3	**3**
	Semester Total							**450**		**18**

Programme Grand Total: 80 Credits | 2000 Marks

ABBREVIATIONS

Abbreviation	Full Form
PC	Professional Core
PE	Professional Elective
SEC	Skill Enhancement Course
EECC	Employability Enhancement Compulsory Course
OE	Open Elective
L	Lecture (hours/week)
T/ST	Tutorial / Studio
IA	Internal Assessment (marks)
WR	Written Examination (marks)
VV	Viva-Voce (marks)

MBS-101 HVAC Services

Course Category: Professional Core (PC)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	30	45	–	**75**	3	**3**

OBJECTIVE:

- To understand the basic and advanced principles of HVAC Services in buildings and at site level, pertinent to HVAC design in buildings.

METHODOLOGY:

- The methodology of imparting information will be lectures and presentations citing examples, site visits, market analysis and case studies.

CONTENTS:

HVAC Services

- Basic working principle of an air conditioning system- vapour compression and vapour absorption cycles and their applications, components, working etc. Refrigerants: Classification, properties, environmental considerations and selection criteria.
- HVAC Systems & Components – Classification between centralised & decentralised HVAC systems, air-cooled & water-cooled systems. Different types of systems under each category, their operation, components involved, selection criteria, advantages & limitation compared to others, etc. Air Handling Units (AHU), Fan Coil Units (FCU), Chillers, Cooling Towers, Pumps, Diffusers & Grilles, and Variable Refrigerant Flow (VRF/VRV) systems.
- Thermal Comfort Principles – Understanding of thermal comfort in a building and factors involved. Introduction to psychometric chart. HVAC Components involved in Thermal Comfort and Indoor Air Quality; ASHRAE Standards and Guidelines. Physiological effects of air conditioning, mechanisms of heat transfer, climate-responsive building design, adaptive comfort concepts, building envelope design including wall insulation, roof insulation, fenestration systems, efficient glazing, Window-to-Wall Ratio (WWR), external shading devices, and the impact of envelope design on HVAC energy demand.
- HVAC System Design – HVAC system design considerations, components of cooling/Heating load, methods for calculation of cooling/ heating load, understanding & calculation of cooling load for a small building by any one of the prevalent methods. HVAC system selection criteria, design of system components based on cooling load, selection criteria, ASHRAE/ ISHRAE guidelines, market survey & case studies (min. one building).
- Advanced HVAC systems – Factors affecting the performance and efficiency of refrigeration plants, heating and cooling load reduction technologies (active and passive), energy-efficient and sustainable HVAC systems, renewable energy integration, and heat recovery systems.
- Integration of HVAC services with other building Services-Intelligent controls and system integration.
- Case Study of any one Building

- Energy-efficient and low-GWP refrigerants and the Kigali Amendment phase-down schedule relevant to Indian HVAC practice.
- IoT-based HVAC monitoring, sensors and predictive maintenance.
- Case Study of any one Building

SUGGESTIVE READING

- ASHRAE Handbooks (Latest Versions)
- ISHRAE Handbooks (Latest Versions)
- HVAC Design Sourcebook 1st Edition by W. Larsen Angel
- Comprehensive HVAC System Design: A Handbook on Practical Approach to Air Conditioning, Heating and Ventilation Systems by N.C. Gupta
- Refrigeration and Air Conditioning, by Ramesh Chandra Arora
- Refrigeration and Air Conditioning, by C.P. Arora
- Alexandra Dragan, HVAC for Architects and Architectural Engineers: A Practical Guide to HVAC Systems Design, Radius Book Group, USA, 2023.
- Energy Conservation Building Code (ECBC), Bureau of Energy Efficiency, Ministry of Power, Government of India (latest edition).

MBS-102 Plumbing and Solar Services

Course Category: Professional Elective (PE)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	30	45	–	**75**	3	**3**

OBJECTIVES:

- To provide students with thorough knowledge and critical appreciation of plumbing installation design and operation in modern, large high-rise buildings and complexes, and of solar energy technologies.

METHODOLOGY:

- The methodology of imparting information will be lectures and presentations citing examples, site visits, market analysis and case studies.
- The emphasis will be on design methodology for safe and economic system performance, and the troubleshooting of operational problems. A critical review of current practices with a view to developing a total systems design approach, with integration and coordination aspects, will be emphasised. The subject will place emphasis on efficient supply, distribution and utilisation of plumbing, and on learning the usages of solar services.

CONTENTS:

- Water Supply and Drainage – water supply, drainage and sanitation as per National Building Code (Part 9); water supply and drainage of a building; leakages and seepages.
- Green Building Parameters for Plumbing Design – methods of harvesting rainwater; conserving water for sustainable and resilient conditions; GRIHA and TERI standards.
- Design of Sewers – sanitary and storm-water sewers; factor of safety; self-cleaning velocity; calculation of sewer sizes (Crimp & Burge's Formula, Hazen William Formula); planning & design of sewage system.
- Treatment of Waste Water and Disposal – preliminary, primary, secondary, tertiary and advanced treatment; disposal by dilution and irrigation; sewage sickness and prevention.
- Solar Energy – photovoltaic generation, solar-thermal collectors, passive solar techniques, government policies and subsidies, solar roofs and solar cities; wind energy production, utility and constraints.
- Rainwater harvesting systems and relevant guidelines for buildings.
- Net-zero water strategies and greywater recycling systems for high-rise and campus-scale developments.

ISUGGESTED READINGS:

- Relevant part or chapter of Latest version of National Building Construction Standards (NBCS)
- Latest GRIHA Guidelines.
- A Guide to Good Plumbing Practices by the Indian Plumbing Association (IPA)
- Indian Plumbing association guidelines and publications.
- Plumbing Engineering Design Handbook, American Society of Plumbing Engineers (ASPE), USA.
- Bob Ramlow and Benjamin Nusz, Solar Water Heating—Revised & Expanded Edition:A Comprehensive Guide to Solar Water and Space Heating Systems, New Society Publishers, Canada.

MBS-103 Digital Applications in Architecture-I

Course Category: Skill Enhancement Course (SEC)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	45	—	30	**75**	3	**3**

OBJECTIVE:

- To understand digital technology and the way it is transforming our built environment.
- To develop working proficiency in parametric and BIM-based workflows as foundational tools for the studio and thesis stages that follow.

METHODOLOGY:

- Lectures and presentations based on field observations, surveys, web search and library studies and software practise.

CONTENTS:

Digital Applications

- Introduction, history and scope of digital technologies in architecture.
- Digital applications used in creating a built environment, from conception to construction, at micro and macro level.
- Presentation – raster & vector graphics, colour models, file formats and their usage, presentation techniques in architectural graphics and animation.
- Visualization as a tool for design – visualization of complex forms, digital architecture, parametric designing, programming and scripting as a tool for design.
- Designing, drawing & detailing – applications used for design processes; software used in the AEC industry: CAD, CAM & BIM applications.
- Digital applications used in planning – remote sensing, transport simulation applications etc.

Digital Technologies Transforming Our Built Environment

- Energy modelling applications .
- Recent trends – contemporary examples, role and need of digital applications in transforming society and the built environment.
- Artificial Intelligence and generative-design tools in contemporary architectural practice.
- Basic of Computational BIM workflows – Level of Development (LOD), interoperability (IFC) and common data environments (CDE).

SUGGESTIVE READING

- Wassim Jabi, Parametric Design for Architecture, Laurence King Publishing, London, UK, 2013.
- Karen M. Kensek, Building Information Modeling (PocketArchitecture series), Routledge, UK/USA, 2014.
- Karen M. Kensek and Douglas Noble (eds.), Building Information Modeling: BIM in Current and Future Practice, John Wiley & Sons, USA.

MBS-104 Project: Studio-I

Course Category: Professional Core (PC)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	6	120	—	80	**200**	—	**8**

OBJECTIVE:

- To understand the basic and advanced principles of Building Services pertinent to simple and advanced design of building services.
- To design HVAC Services and Plumbing Services.

METHODOLOGY:

- The methodology of imparting information will be lectures, live case studies, field visits/ educational tours to understand Building services provision in different climatic zones of India and study of building codes.
- This course will be covered by students in group.

CONTENTS:

Studio Based on HVAC, Plumbing and Digital Documentation

- Studio exercises based on the theory taught in HVAC Services and Plumbing Services.
- Calculation of heat loads and selection of equipment (lower side); information regarding equipment (higher side) shall also be provided.
- Live case studies, field visits and application of building codes with reference to HVAC services and Plumbing Services.
- Integrated studio exercise for design of both HVAC and plumbing services and its coordination for a single design project.
- By the end of the semester, students must understand the design aspects of HVAC services and Plumbing Services.

SUGGESTED READINGS:

- ASHRAE Handbooks (Latest Versions)
- ISHRAE Handbooks (Latest Versions)
- Latest version of National Building Code. National Building Construction Standards (NBCS)
- Indian Plumbing association guidelines and publications.

MBS-105 Research Methodology

Course Category: Open Elective (OE)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	30	45	–	**75**	3	**3**

OBJECTIVE:

- To enhance the students' generic research and communication skills and their critical analytical ability.

METHODOLOGY:

- Lectures, project work and tutorials.

CONTENTS:

Part (A)

- Unit I: Introduction, types of research – foundation, nature and scope; plagiarism; scientific research and its scope in architectural research; qualitative research paradigm; pure and applied research in architecture.
- Unit II: Research methods – historical, survey, experimental, case study, ethnographic, visual research.
- Unit III: Research design – meaning and importance; sample and sampling design; tools and techniques of research (questionnaire, interview, observation, tests, scales).
- Unit IV: Preparation of research proposal – research problems, objectives, questions, hypothesis, operational variables, review of literature, research design, limitations, report writing.

Part (B): Branch Specific

- Unit V: Descriptive statistics – nature and types of data; normal probability curve, skewness and kurtosis; measures of central tendency, variability and correlation (Pearson's, Spearman's Rho).
- Unit VI: Inferential statistics (Parametric) – significance of statistics, null hypothesis, level of significance, T-Test.
- Unit VII: Inferential statistics (Non-Parametric) – Chi-Square Test, Median R Test, Mann-Whitney Test.
- Unit VIII: Analysis of qualitative data – editing, coding of data, content analysis.
- Unit IX: Research ethics, plagiarism policy (UGC norms) and citation-management tools (Zotero/Mendeley); responsible and permissible use of AI-assisted tools.

SUGGESTED READINGS:

- Linda N. Groat and David Wang, Architectural Research Methods, 2nd Edition, John Wiley & Sons, USA, 2013.
- John W. Creswell and J. David Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, SAGE Publications, USA (latest edition).
- Iain Borden and Katerina Rüedi Ray, The Dissertation: A Guide for Architecture Students, 3rd Edition, Routledge, UK.

MBS-201 Electrical Services

Course Category: Professional Core (PC)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	30	45	–	**75**	3	**3**

OBJECTIVES:

- To provide students with thorough knowledge and critical appreciation of electrical services design, its installation and operation in modern, large high-rise buildings and complexes.

METHODOLOGY:

- The emphasis will be on design methodology for safe and economic system performance. A critical review of current practices with a view to developing a total systems design approach, with integration and co-ordination aspects, will be emphasized. The subject will place emphasis on efficient supply, distribution and utilization of electrical energy in buildings.

CONTENTS:

- HV supply and distribution in buildings – HV switchgear, distribution, control, protection schemes, HV and LV co-ordinated protection.
- Electric safety and risk assessment – nature and mechanisms of electric shock, assessing electric shock risk, isolation, earthing and bonding principles and practices.
- Earthing for lightning protection, functional purposes and safety – integrated scheme for high-rise buildings; design of earth electrode systems; integration with building structure.
- Over-current protection for large plant, cabling systems, motor drives etc. – sizing electrical conductors, earth fault protection, selection of equipment.
- Standby generation – dynamic analysis of engine/generator; load profiles, regenerative power; generator selection, protection, reliability analysis; requirements for fire-services systems; co-generation schemes, economics.
- Uninterruptible power supplies – UPS dynamics, load profiles, battery sizing, protection, failure modes, MTBF; generator/UPS/load transient analysis; earthing of UPS systems.
- Electrical design considerations for EV-charging infrastructure in buildings.
- Renewable-energy integration – rooftop solar PV interconnection and net-metering as per Indian regulatory framework.

SUGGESTED READINGS:

- A.K. Mittal, Electrical and Mechanical Services in High-Rise Buildings: Design and Estimation Manual (Including Green Buildings), India.
- K.B. Raina & S.K.,Electrical Design, Estimating and Costing
- The Energy Conservation Building Code (ECBC)-Latest Version
- National Electrical Code of India (NEC), 2023 — BIS. Comprehensive electrical installation code; the 2023 revision added chapters for multi-storied buildings and EV-charging supply.
- Electrical Installation Design Guide: Calculations for Electricians and Designers by Institution of Engineering and Technology
- IEE Wiring Regulations: Design and Verification of Electrical Installations
- Barrie Rigby, Design of Electrical Services for Buildings.
- Institution of Electrical Engineers / Engineering Council– Power System Protection, Vols 1 & 2.
- Pradipta Kumar Tagg ,IEE Wiring Regulations , and Design of Earthing Systems (Current edition)
- EMSD & FSD code of practice.
- BS/IEC/VDE standards, publications and codes.

MBS-202 Lighting Services

Course Category: Professional Elective (PE)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	30	45	–	**75**	3	**3**

OBJECTIVE:

- To provide students with up-to-date knowledge of lighting technologies and practice. Photometrics of lamps and luminaires and characteristics of lamp and ballast systems are examined. Lighting objectives of various types of buildings and outdoor spaces are identified and design techniques and calculations are examined. The balance between performance, comfort and energy consumption is also examined, along with the importance of lighting to health, safety, well-being, economics, energy conservation, and human productivity and creativity.

METHODOLOGY:

- In addition to lectures and guided reading, students are required to do an evaluation of a lighting scheme, a case study, or a literature review, and present their work in seminars and/or reports.

CONTENTS:

- **Photometry and colorimetry** – photometric quantities, standards and measurements; colorimetric quantities and systems; production and processing of photometric data.
- **Lighting equipment and systems** – incandescent, discharge and fluorescent lamps; luminaires and control gear; conventional and electronic ballasts; new light sources and emerging lighting systems.
- **Lighting calculations** – direct luminance due to point, line and area sources; inter-reflections; lumen method; utilisation factors; point-by-point and flux-transfer methods.
- **Daylighting** – benefits, availability, sky models, design techniques and calculations, daylight-linked control systems.
- **Human and environmental factors** – vision, visual performance, comfort, glare, non-visual effects of light, lighting quality.
- **Lighting design** – design objectives and criteria; choice of system, lamp and luminaires; integration of electric light and daylight; energy conservation; maintenance; cost analysis; lighting energy code.
- **Computer-aided lighting design** – electronic transfer of photometric data; overview of lighting-design software.
- LED and solid-state lighting systems, drivers and controls.
- Human-centric and circadian lighting design.

SUGGESTED READINGS:

- The Lighting Handbook: Reference and Application, 10th Edition, Illuminating Engineering Society (IES), New York, USA.
- CIBSE Code for Lighting (2002).
- SLL Code for Lighting (2022) by Society of Light and Lighting (SLL)
- Coaton, J.R. and Marsden, A.M., Lamps and Lighting, 4th Edition.
- IESNA Lighting Handbook (2000); ISO/CIE 8995-1:2025 Light and lighting — Lighting of work places.

MBS-203 Dissertation-I

Course Category: Professional Core (PC)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	45	—	30	**75**	—	**3**

OBJECTIVE:

- To understand the fundamental principles of Building Services relevant to the design of both simple and advanced building systems.
- To enable each student to formulate a research hypothesis or design proposition within the domain of Building Services, and to choose the mode of investigation best suited to their interest and career direction.
- To offer flexibility between two tracks: a Literature Research Track, in which the hypothesis is examined through critical review, comparative analysis, and synthesis of existing knowledge; and a Design Research Track, in which the hypothesis is tested and demonstrated through the design of a multistoried commercial, institutional, or residential building, supported by case studies.
- To ensure that the building service explored, whether studied analytically or applied, incorporates state-of-the-art technologies relevant to contemporary practice
- To establish a research topic sufficiently focused and substantiated to be carried forward into Dissertation-II.

METHODOLOGY:

- **Track Selection:** At the commencement of the course, each student shall select either the **Literature Research Track** or the **Design Research Track** in consultation with the assigned guide. Once the synopsis has been approved, a change of track shall not be permitted.
- Literature Research Track: a purely research-based investigation involving critical review, comparative analysis, and synthesis of existing knowledge, codes/standards, and secondary data, culminating in a well-substantiated research report without a design output.
- Design Research Track: research validated through design, where a building-service hypothesis is tested and demonstrated through the design of a multi-storeyed commercial, institutional, or residential building, supported by case studies and preliminary design proposals.
- Information is imparted through studio exercises and presentations grounded in the theory subjects of the semester, common to both tracks.
- Each student submits two synopses; one is approved by the review panel and taken forward for research, irrespective of track.
- The dissertation topic may align with one of the Professional Core or Open Elective courses of the semester.
- A documented literature review of at least fifteen recent sources (published within the preceding ten years) is mandatory for both tracks.
- Periodic desk critiques and jury reviews assess progress on both tracks using track-appropriate evaluation criteria.

- Final submission is a report comprising the approved synopsis, literature review, methodology, and preliminary findings or design proposals, as applicable to the chosen track.
- The approved topic, track, and body of work are carried forward into Dissertation-II.

CONTENTS:

Items 1–5 and 7–10 are common to both tracks. Item 6 is where the two tracks diverge in studio work.

1. Introduction to research methods in architecture and building services: qualitative, quantitative, and mixed methods; distinguishing pure research from design research.
2. Fundamentals of building services — HVAC, electrical systems, plumbing and fire safety, vertical transportation, acoustics, lighting, and water/energy management — with emphasis on their relevance to automated and smart systems.
3. Introduction to Building Automation Systems (BAS), smart-building concepts, and IoT integration in building services.
4. Formulating a research hypothesis or design proposition.
5. Literature review methodology, source evaluation, and citation standards.
6. Track-specific studio development (student works on only one, per chosen track):

   Literature Research Track: comparative studies, review of codes and standards, case-study analysis methodology, and synthesis of secondary data toward a research framework or set of findings.

   Design Research Track: site and building-typology selection, case-study analysis, and preliminary integration of automated building services into design massing and planning.
7. Synopsis writing and structuring of a research report.

Preparation and submission of the final Dissertation-I report.

SUGGESTED READINGS:

- Linda N. Groat and David Wang, Architectural Research Methods, 2nd Edition, John Wiley & Sons, USA, 2013.
- Iain Borden and Katerina Rüedi Ray, The Dissertation: A Guide for Architecture Students, 3rd Edition, Routledge, UK.

MBS-204 Project: Studio-II

Course Category: Professional Core (PC)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	7	135	—	90	**225**	—	**9**

OBJECTIVE:

- To provide students with enhanced knowledge of advanced building services; understanding and designing of building services with the help of consultants. Live examples may be taken so that students learn the latest in building-services design.

METHODOLOGY:

- The methodology of imparting information will be lectures, live case studies, field visits/ educational tours to understand Building services provision in different climatic zones of India and study of building codes.
- This course will be covered by students in group.

CONTENTS:

- Electrical Services – calculation of the load of the building and its estimated load, accounting for all safety factors; design of the substation and layout of the wiring system.
- Fire Services Load– accounting for the fire load in the electrical load, including smoke detectors, alarms and the public-address system.
- Lighting Services Load– lighting loads depending on the selection of lamps, and design of the lighting layout.
- Preparation and coordination of electrical and lighting service drawings for a multi-storey building, with systematic cross-checking to ensure conformity with applicable codes and standards.
- Client/consultant-style jury presentation of the completed services-design package.

SUGGESTED READINGS:

- Barrie Rigby, Design of Electrical Services for Buildings.
- The Lighting Handbook: Reference and Application, 10th Edition, Illuminating Engineering Society (IES), New York, USA.
- A.K. Mittal, Electrical and Mechanical Services in High-Rise Buildings: Design and Estimation Manual, India.
- Relevant part or chapter of Latest version of National Building Construction Standards (NBCS)

MBS-205 Responsive Architecture and Environmental Systems

Course Category: Open Elective (OE)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	30	45	–	**75**	3	**3**

OBJECTIVES:

- To position environmental performance as a driver of architectural form, space and tectonics, rather than a technical system added onto a completed design.
- To develop students' ability to translate building-physics and services knowledge into architectural decisions of envelope, section, structure and material.
- To build design fluency with smart materials, kinetic envelopes and responsive geometries as expressive, spatial and tectonic elements of architecture.

METHODOLOGY:

- Lectures, seminars and precedent studies will examine built examples of responsive architecture primarily through architectural drawings, sections, models and design intent, rather than mechanical specification.

CONTENTS:

Architectural Theory and Design Paradigms of Responsiveness

- Evolution from static enclosure to responsive form – reading Reyner Banham's environmental tectonics and Nicholas Negroponte's responsive architecture as design positions, and their relevance to decarbonisation and climate-resilient design.
- Material and surface as architecture – smart materials (shape-memory alloys, thermo-bimetals, electrochromic glass, phase-change materials) treated as expressive, tactile design elements of facade and interior surface.

Envelope, Section and Form as Environmental Instrument

- Designing kinetic facades and operable envelopes as primary architectural moves for ventilation, shading and daylight, rather than applied mechanical retrofits.
- Thermo-active structural surfaces and their architectural consequences for ceiling articulation, acoustics, floor-to-floor height and spatial planning.

Light, Water and Energy as Architectural Elements

- Daylight as a design medium – kinetic shading, light scoops and anidolic systems conceived as sculptural and spatial devices rather than lighting-engineering add-ons.
- Photovoltaic surfaces as architectural skin – BIPV integrated into facade composition, shading design and roofscape.
- Water and landscape within the building envelope – living walls and bio-filtration atria designed as architectural and experiential features.
- Fire-responsive architecture – motorised louvers, smoke curtains and atrium geometry designed as part of the building's spatial and circulation strategy.

Building Intelligence, AI-Assisted Design and Adaptive Reuse

- Post-occupancy adaptability and adaptive reuse – responsive architecture as a strategy for extending a building's life through reconfigurable space and systems, in place of demolition and rebuilding.
- Artificial intelligence and generative design – machine-learning and generative algorithms used to explore architectural form, massing and facade options against environmental performance criteria, positioning AI as a design collaborator rather than a replacement for architectural judgement.
- Building intelligence and automation as architecture – the spatial and material presence of sensor networks, control systems and AI-based building-management systems within the designed envelope and interior, rather than as concealed infrastructure.

Responsive and Adaptive Architecture

- Principles of responsive architecture: kinetic and climate-adaptive building envelopes/facades.
- Sensor-actuator feedback systems and building-integrated automation for environmental responsiveness.
- Biomimicry and nature-inspired strategies in responsive building-systems design.

Case Studies

- Case studies of responsive and environmentally adaptive buildings, both international and Indian.

SUGGESTED READINGS:

- Banham, R., The Architecture of the Well-Tempered Environment.
- Addington, M., & Schodek, D., Smart Materials and Technologies: For the Architecture and Design Professions.
- Hensel, M., Menges, A., & Weinstock, M., Emergent Technologies and Design: Towards a Biological Paradigm for Architecture.
- Kwok, A. G., & Grondzik, W. T., The Green Studio Handbook: Environmental Strategies for Schematic Design.
- Moloney, J., Designing Kinetics for Architectural Facades: State Change.
- Arvind Krishan and Nick Baker, Climate Responsive Architecture: A Design Handbook for Energy Efficient Buildings, McGraw Hill, India/UK.
- Michael Fox, Interactive Architecture: Adaptive World, Princeton Architectural Press, USA, 2016.
- Milli Majumdar (ed.), Energy Efficient Buildings in India, TERI Press, New Delhi, India.

MBS-301 Fire Services

Course Category: Professional Core (PC)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	30	45	–	**75**	3	**3**

OBJECTIVES:

- To equip students with an in-depth and up-to-date knowledge of fire-engineering systems associated with the building-services industry, based on a rational and critical analysis of the systems.

METHODOLOGY:

- The instructional methodology combines visual media and empirical observations to build a strong theoretical foundation in fire dynamics and Fire services. Learners translate statutory guidelines into practical applications through quantitative workshops and spatial planning exercises. Collaborative building audits and structural evaluations ultimately synthesize these technical skills into comprehensive formal presentations.
- The emphasis will be on design methodology for safe and economic system performance.

CONTENTS:

Fundamentals of Fire Science and Statutory Framework

- Physics and chemistry of fire: fire triangle/tetrahedron, stages of fire growth (ignition, growth, flashover, fully developed, decay/backdraft), and heat transfer by conduction, convection and radiation.
- Classification of fires (Class A, B, C, D, K) and appropriate extinguishing media.
- Causes of fire in buildings; fire load and fire load density; fire statistics in India and globally.
- Smoke generation and movement, stack effect, and toxicity of combustion products.
- Statutory framework overview: Pertaining codes; classification of buildings by occupancy (residential, educational, institutional, assembly, business, mercantile, industrial, storage, hazardous) and fire hazard/fire zones.

Architectural Planning for Fire Safety: Passive Protection and Egress

- Site planning and fire tender access: setbacks, turning radii, open spaces, and access requirements for high-rise buildings.
- Means of egress: exit width, number of exits, travel distance, occupant load calculation, and dead-end corridor regulations.
- Design of staircases, fire escapes, ramps, refuge areas, and horizontal/vertical exits; pressurized staircases and fire lifts in high-rise buildings.
- Compartmentation and fire zones: fire walls, fire doors, fire dampers, fire stops, fire-rated construction, and fire resistance ratings (FRR) of structural elements.
- Fire safety planning for atria, basements, parking, and large assembly spaces.

Active Fire Protection Systems

- Water infrastructure: static water storage (underground and terrace tanks) based on occupancy and hazard classification; fire pump rooms, jockey/main/standby pumps, and basics of pumping head calculations.

- Hydrant systems: wet risers, dry risers, down-comers, yard hydrants, and hose reels.
- Sprinkler systems: types (pendent, upright, concealed), hazard classification (light, ordinary, high hazard), and basics of layout and pipe sizing.
- Fire detection and alarm systems: smoke, heat and flame detectors; conventional vs addressable panels; manual call points and public-address systems.
- Special protection systems: clean-agent/gaseous suppression (FM200, Novec 1230, inert gas) for server rooms and electrical panels; portable fire extinguishers; water mist and high-velocity water spray systems.

Smoke Management, Systems Integration and Computational Fire Engineering

- Smoke management: natural vs mechanical ventilation; staircase and lift-lobby pressurization; smoke extraction in basements and atria; zoned smoke control.
- Coordination and integration: interlocking fire alarms with HVAC (AHU tripping), access control and elevators (fireman's lift grounding); coordination of fire protection systems with architectural, structural and MEP drawings.
- Emerging fire hazards in modern infrastructure: electric vehicle and lithium-ion battery fires in basements/charging zones, Battery Energy Storage Systems (BESS), rooftop solar PV and DC isolator risks.

Fire Safety Audit, Statutory Approvals and Management

- Fire safety audit methodology: assessing existing buildings, identifying code violations, and proposing remedial/retrofit measures.
- Statutory approvals: the Fire NOC (No Objection Certificate) process, role of the Chief Fire Officer and local fire authorities, and periodic compliance requirements.
- Fire drills, evacuation planning and emergency response plans; human behaviour in fire (the “incredulity response”) and crowd management in dense Indian public spaces.
- Guest lecture/site visit: local fire station and/or the fire pump room and fire control centre of an operational high-rise or commercial complex.

Case Studies

- Case study for Fire services of existing buildings.
- Major building fire disasters in India and internationally, and their lessons for design.
- Specialized typologies: high-rise mixed-use buildings, hospitals (horizontal evacuation and patient-lift requirements), data centres (pre-action sprinklers, VESDA), automated multi-level car parking, underground metro/large assembly spaces, and heritage building retrofits.

SUGGESTED READINGS:

- Bureau of Indian Standards . NATIONAL BUILDING CONSTRUCTION STANDARDS 2026,NATIONAL BUILDING CONSTRUCTION STANDARDS PART F FIRE AND LIFE SAFETY.
- Basic Course in Fire Prevention, Life Safety & Fire Protection Measures in Buildings, Handbook Developed & Designed by: Gujarat Institute of Disaster Management Gujarat, India.
- Fire Protection Handbook, 21st Edition – NFPA
- Current Relevant NFPA codes
- Current Relevant IS codes.
- Fire Protection Handbook, 21st Edition by NFPA
- Fire Safety In Buildings by V. K. Jain
- Principles of Fire Safety Engineering: Understanding Fire And Fire Protection by Akhil Kumar Das
- Fire Protection and Prevention - The Essential Handbook by Barendra Mohan Sen

MBS-302 Architectural Building Acoustics

Course Category: Professional Elective (PE)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	30	45	–	**75**	3	**3**

OBJECTIVE:

- To extend students' knowledge of acoustics, noise and vibration control to the acoustical design of special rooms and the practice of noise and vibration control, enabling graduates to become specialists in their design office.
- To train students in greater breadth and depth to achieve a satisfactory acoustical environment.
- Instrumentation, measurement techniques and acoustic application software will be examined, discussed and demonstrated.

METHODOLOGY:

- Seminars will be used to introduce concepts and fundamentals. Tutorials will supplement the lectures for application and better understanding of complex engineering theories. Students are required to read and discuss course materials and relevant publications at seminars and to prepare alternative solutions to problems.

CONTENTS:

- **Acoustic fundamentals:** Need for study of acoustics, development of acoustics through different periods including the historical development of amphitheaters, concert halls and auditoria. Fundamental characteristics of sound, behavior of sound in enclosed spaces, sound intensity, sound pressure, sound level meter, factors influencing hearing, noise, echo, reverberation, resonance and Sabine's Formula with numerical applications. Fundamental properties of sound and waves, sound sources, sound field in enclosures, sound propagation and transmission inside buildings, external impact, room acoustics, sound generation and transmission in air ducts. Effects of noise on human beings.

- **Interaction of sound and people:** The different phenomena with which sound interacts with people in different acoustically enhanced buildings. Interacting phenomena affecting the design of these buildings, STC/IIC.

- **Acoustic design and planning:** Acoustic design requirements for auditorium, lecture theatres, plant rooms etc. Requirements for speech and music: loudness, directional and special impression, reverberation, echo, clarify and etc., silencers, active noise control. Prediction methods for building acoustics and flow generated noise.

- **Architectural Acoustics:** Room acoustics, urban soundscape, sound isolation.
- **Environmental impact and local legislation:** Noise control ordinance, product noise control ordinance, environmental administration, environmental impact assessment, practical noise control strategy, Noise-control provisions under Indian environmental regulations (CPCB Noise Pollution Rules).

- **Vibration:** Fundamentals of vibration, vibration sources and their control, acoustically driven vibration, vibration transmission, flow-induced vibration, statistical energy method and modal analysis.
- **Problem investigations:** Instrumentation, noise and vibration measurement and data analysis techniques, signal processing, problem identification and assessment, software packages.

SUGGESTED READINGS:

- M. David Egan, Architectural Acoustics, J. Ross Publishing, USA.
- Relevant current BS EN ISO acoustic standards for building design, British Standards Institution / International Organization for Standardization.
- ARCHITECTURAL ACOUSTICS by K.B.Ginn, Briiel & Kjaer
- ACOUSTICS IN INTERIOR DESIGN, Mindfulness Workbook ,A Handbook By Sumaiya Sultana
- Master Handbook of ACOUSTICS Fourth Edition, F. Alton Everest, McGraw-Hill
- Building Acoustics by Tor Erik Vigran, Taylor & Francis
- ACOUSTICS An Introduction to Its Physical Principles and Applications Allan D. Pierce, McGraw-Hill Book Company
- Relevant part or chapter of Latest version of National Building Construction Standards (NBCS)
- Acoustic Design of Concert Halls and Theatres. V. L. Jordon (1980).
- Acoustic Noise Measurement. J. R. Hassall (1979.
- Active Control of Sound. P. A. Nelson and S. J. Eillott (1993).
- An Environmental Assessment for Existing Office Buildings. BRE (1993).
- An Environmental Assessment for New Office Design. BRE (1993).
- Applied Acoustics Journal.
- BS and ISO standards.
- Community Noise Rating. T. J. Schultz (1982).
- Concert Halls and Theatres: How they sound. L. L. Beranek (1996).
- Effects of Noise on Man. K. D. Kryter (1985)

MBS-303 Dissertation-II

Course Category: Professional Core (PC)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	45	—	30	**75**	—	**3**

OBJECTIVE:

- To deepen and extend the research or design work initiated in Dissertation-I into a complete and rigorous body of work, on the same topic and track approved at the close of Dissertation-I.
- For students on the Literature Research Track: to conduct comprehensive analysis, comparative evaluation, and synthesis so as to arrive at validated conclusions, frameworks, or guidelines that address the research question.
- For students on the Design Research Track: to complete the detailed design of the multi-storeyed building, demonstrating the researched automated or smart building-service hypothesis, supported by technical drawings, specifications, and simulation or performance analysis.
- To validate the hypothesis established in Dissertation-I through appropriate evidence — comparative data, simulation results, expert consultation, or design detailing, depending on the track.
- To equip students to communicate research outcomes to professional and academic audiences, including preparation of the work for possible publication as a research paper.

METHODOLOGY:

- Continuation of the same topic and track approved at the end of Dissertation-I; a change of track or topic is permitted only with approval by the course teacher and written justification by the student.
- Regular studio exercises, desk critiques, and jury presentations to monitor progress, structured to suit the chosen track.
- Literature Research Track: expanded literature synthesis, application of analytical frameworks, expert interviews or surveys where relevant, and development of guidelines, recommendations, or a conceptual/analytical framework as the primary output.
- Design Research Track: full design development of the multi-storeyed building — drawings, integration of automated systems, specifications, and validation through simulation or analysis tools (such as energy modelling or daylight analysis) demonstrating the smart-building hypothesis.
- Mid-term and pre-final juries conducted with internal and external examiners.
- Final submission is a comprehensive dissertation report integrating the Dissertation-I synopsis with the Dissertation-II outcomes — literature synthesis and findings, or design documentation and validation, as applicable to the track.
- Students are encouraged, though not mandated, to develop the dissertation into a manuscript for submission to an academic journal or conference.
- Final jury presentation and viva-voce defense of the completed dissertation.

CONTENTS:

Items 1–2 and 4–8 are common to both tracks. Item 3 is where the two tracks diverge in studio work.

1. Recap and refinement of the Dissertation-I hypothesis or synopsis based on jury feedback.
2. Advanced research methods relevant to the chosen track — analytical frameworks for the Literature Research Track, or design-validation and simulation tools for the Design Research Track.
3. Track-specific studio development (student continues on the same track chosen in Dissertation-I):

   Literature Research Track: extended critical literature synthesis, comparative and analytical frameworks, and formulation of guidelines or models, validated through secondary data and/or expert input.

   Design Research Track: detailed design development of the building integrating automated and smart building services, complete drawing sets, specifications, and simulation-based performance analysis.
4. Documentation standards for the final dissertation report.
5. Draft submission for internal review.
6. Compilation of the final dissertation report- The project output will primarily be presented as a report and may also be developed into a research paper for publication in academic journals or presentation in conferences.
7. Final jury presentation and viva-voce defense.

SSUGGESTED READINGS:

- Linda N. Groat and David Wang, Architectural Research Methods, 2nd Edition, John Wiley & Sons, USA, 2013.
- John W. Creswell and J. David Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, SAGE Publications, USA (latest edition).
- Relevant part or chapter of Latest version of National Building Construction Standards (NBCS)

MBS-304 Project: Studio-III

Course Category: Professional Core (PC)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
3	6	135	—	90	**225**	—	**9**

OBJECTIVE:

- To synthesise the fire-services knowledge gained in Semester III into a single integrated design studio for a large-scale building.
- To build professional competence in coordinating multiple specialist-services consultants on one project, as practised in the industry.

METHODOLOGY:

- The methodology of imparting information will be lectures, live case studies, field visits/ educational tours to understand Building services provision in different climatic zones of India and study of building codes.
- This course will be covered by students in group.

CONTENTS:

- Integrated design of firefighting system, fire-protection and detection systems for the studio project.
- Fire Services: Accounting for the fire load in the electrical load. The fire loads would include smoke detectors, alarms, Public addressal system etc.
- Final jury presentation and portfolio documentation of the integrated services design.

SUGGESTED READINGS:

- Relevant NFPA.
- Relevant part or chapter of Latest version of National Building Construction Standards (NBCS)

MBS-305 Sustainable Building Systems

Course Category: Open Elective (OE)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	30	45	–	**75**	3	**3**

OBJECTIVE:

- To inform students of the importance of energy efficiency and its conservation.
- To learn the basic techniques and processes involved in energy efficiency and energy conservation, and the application of software used in the process.

METHODOLOGY:

- The methodology of imparting information should be lectures and presentations citing examples and case studies.

CONTENTS:

Green Building Rating and Certification

- Introduction to green-building rating systems: LEED – benefits and advantages, incentive programmes, certification process, professional accreditation, current LEED version.
- Green building concept; Indian Green Building Council (IGBC) and GRIHA rating; case study of at least one certified green building.

Indian Codes and Institutions

- Role of TERI; Energy Conservation Building Code (ECBC) and its application to Indian buildings, with analysis of resultant energy savings; role of the Bureau of Energy Efficiency (BEE) in controlling India's energy scenario.

Energy-Modelling Software

- Introduction to important software for energy modelling of buildings.
- Application of current energy-modelling software (e.g. DesignBuilder or EnergyPlus or IES-VE or any other) in modelling a building.

Sustainable Building Systems

- Circular economy and material reuse in building systems.
- Net-zero energy and net-zero water buildings.
- Life-Cycle Assessment (LCA) and embodied carbon of building services and materials.

SUGGESTED READINGS:

- Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery, 5th Edition, John Wiley & Sons, USA.
- Sam Kubba, Handbook of Green Building Design and Construction: LEED, BREEAM and Green Globes, 2nd Edition, Elsevier, USA.
- GRIHA Manual, GRIHA Council (The Energy and Resources Institute (TERI) and Ministry of New and Renewable Energy, Government of India), New Delhi.
- Current IGBC rating system documents, reference guides, templates, or submittals
- Current LEED Credit Templates, LEED Scorecards, and Reference Guides.

MBS-401 Thesis-BS

Course Category: Professional Core (PC)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	**T/ST**	**IA**	**WR**	**VV**	**TOTAL**		
4	11	225	—	150	**375**	—	**15**

OBJECTIVE:

- To understand the basic and advanced principles of Building Services pertinent to simple and advanced design of building services. Students must be able to design the building services at this level; they may take up any one service and design for any one contemporary building.
- The idea is to present a final design of a building-service and to prove its validity through case studies.

METHODOLOGY:

- Students must submit three synopses for approval; one of these will be approved. Progress will be monitored regularly at various stages.
- Final submission would be in the form of a final design presentation and report, which would include the final synopsis.

SUGGESTED READINGS:

- Latest version of National Building Construction Standards (NBCS)
- Latest version of relevant Codes.

MBS-402 Project Management

Course Category: Professional Elective (PE)

CLASSES PER WEEK	CLASSES PER WEEK	MARKS			MARKS	EXAM (HOURS)	CREDITS
L	T/ST	IA	WR	VV	TOTAL		
2	1	30	45	–	**75**	3	**3**

OBJECTIVE:

- The intent of the course is to disseminate the application of project management in the construction industry during the different phases of a project.

METHODOLOGY:

- Lectures and presentations to sensitise the students.
- Students to study project-management procedures followed by organisations.
- Case studies to be taken up by students (in consultation with the concerned teacher) for understanding through critical appreciation.

CONTENTS:

- Project life cycle – processes from inception to post-construction.
- Application of cost-benefit analysis, feasibility report, value engineering etc.
- Project planning.
- Project monitoring and control.
- Project Procurement and Management-Application of project-management processes (communication and integration, scope, time, cost, health, safety and environment, risk management, human-resource management etc.).
- Project procurement and management.
- Study of procurement guidelines of international institutions such as FIDIC, World Bank, ADB etc.

SUGGESTED READINGS:

- Project Management, Planning and Control: Managing Engineering, Construction and Manufacturing Projects to PMI, APM and BSI Standards by Albert Lester
- Construction Project Management A Practical Guide to Field Construction Management, S. Keoki Sears Glenn A. Sears Richard H. Clough, John Wiley & Sons, Inc.
- A Project Manager's Book of Tools and Techniques, Cynthia Snyder Dionisio,Wiley, Project Management Institute
- Fundamentals of Project Management by JOSEPH HEAGNEY, AMACOM, American Management Association