Module 4 Stupa Architecture 2 periods

Supreme sacred monument of Buddhism – Basic form and elements — Study of the Great Stupa, Sanchi.

Module 5 Rock-cut Architecture 6 periods

5.1 PILLARS: Plain circular shaft, campaniform capital, circular abacus, animal motif – Study of the Lion Capital, Sarnath.

5.2 EARLY ROCK-CUT ARCHITECTURE: Simple woodwork imitating forms – Study of the Lomash Rishi Caves, Barabar Hills.

5.3 ORISSAN GROUP (JAIN): Monastic retreats, plan and volumetric organizations, details.

5.4 HINAYANA PHASE: Responses to the need of congregation, no imagery, *chaityagriha* for congregation and worship, *viharas* as monasteries – Study of the basic elements of *chaityas* and *viharas* – Introduction of symbolic forms, translation of carpentry forms into stones – Study of the Chaitya Hall, Karli.

5.5 MAHAYANA PHASE: Influence of Hinduism, introduction of image, change in disposition of inner most cells of *vihara* serving as monastery as well as sanctuary.

5.6 BRAHMINICAL PHASE: Gradual elaboration of interior from primitive singular cell to isolated cell with ambulatory, culmination in emulation of structural temple – Study of the Kailasa Temples, Ellora.

Module 6 Earliest Temples 2 periods

Necessity, different philosophical interpretations, functions, nomenclature, forms, materials & constructions, iconography — Two main styles: South Indian (*Dravida*), and North Indian (*Nagara*).

Module 7 Temple Architecture of Southern India 6 periods

7.1 PALLAVA: Origin from rock-cut architecture, *mandapa* or pillared hall with a cell – Study of the monolithic Rathas, Mammallapuram.

7.2 Development of Dravida temples during CHOLA, PANDYA, VIJAYNAGAR and NAYAKA dynasties: Principles and functions of different parts of the temples through incremental growth (*vimana* over pillared *m*andapa, *Gopuram* enclosing *Prakarana*, *Amman* shrine, *Kalyan* mandapa, series of *gopuram* etc.), iconography, scale and proportion – Study of the Meenakshi Temple, Madura.

Module 8 Temple Architecture of Northern India 6 periods

8.1 ORISSA GROUP**:** Principles, functions and nomenclature of different parts, iconography, scale and proportion, through the study of enclosures, disposition of axes, surface treatment – Study of the Lingaraja Temple, Bhubaneswara.

8.2 KHAJURAHO GROUP**:** Principles, functions and nomenclature of different parts, iconography, scale and proportion through the study of plan forms, roof forms, and surface ornamentation – Study of the Kandarya Mahadeva Temple.

Module 9 Beginning of Islamic Architecture in India 6 periods

9.1 Persian origin, essentials of a typical Indian mosque, components of a typical tomb building and Rauza

9.2 Development of Delhi or Imperial Style under Slave, Khalji, Tughlaq, Sayyid and Lodi dynasties; understanding principles, scale & proportion, geometry, forms & functions, fusion elements, evolution of domes, arches, squinches etc. during Delhi or Imperial Style through study of Qutb Complex, Tomb of Ghias-ud-din Tughlaq, two representative tombs of Sayyid & Lodi dynasties (one single storied octagonal tomb with veranda and another two-three storied square tomb without veranda)

9.3 Culmination of the Lodi style in the Tomb of Sher Shah Suri, Sasaram.

Module 10 Mughal Period 6 periods

10.1 SANDSTONE PHASE during Akbar: beginning of garden tombs, study of the Humayun's Tomb, Delhi in terms of multi-axial symmetry in planning, materials, surface ornamentation, structural systems, visual experiences created – Study of the Fatehpur Sikri, Agra.

10.2 MARBLE PHASE during Jahangir and Shahjahan: transition from sandstone to marble leading to changes in methods of decoration, use of true double dome with Persian bulbous form, voluted bracket capital, foliated base of pillions, etc. – Formal Mughal Gardens – Study of the Red Fort, Delhi, and the Taj Mahal, Agra.

REFERENCE BOOKS

1. Satish Grover. Buddhist and Hindu Architecture in India. CBS.
2. Satish Grover. Islamic Architecture in India. CBS.
3. Percy Brown. Indian Architecture Vol.1 (Buddhist & Hindu). D. B. Taraporevala Sons & Co. Pvt. Ltd.
4. Percy Brown. Indian Architecture Vol.2 (Islamic Period). D. B. Taraporevala Sons & Co. Pvt. Ltd.
5. Sir Banister Fletcher's A History of Architecture. Ed. Dan Cruckshank. CBS, 1999.

AP2102 | Materials and Methods of Construction - III | 3 credits

Course Duration	Contact periods	Full Marks
13 weeks	3 lectures per week	100

COURSE OBJECTIVE

The objective of this course is to introduce a student to the materials and methods of construction related to floor, roof stairs, false ceiling, partition walls, and the modes of finishes with respect to flooring and internal & external surfaces.

COURSE OUTCOME

On successful completion of this course, the students will be**:**

(i) familiar with the construction materials, their physical properties and scope of application in real life situation;
(ii) able to select suitable material for construction- sensible use of earth's resources; and,
(iii) aware of the associated impacts of using the building construction material.

COURSE EVALUATION

(a) Internal Assessment: 50% [Mid-Semester Examination - 30%; Teacher's Assessment: 20%, having the components class tests, quizzes, assignments, viva-voce, presentations etc. as per teachers' discretion].
(b) End-Semester Examination: 50%.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	LECTURE PERIODS
1	Floors and Roofs	8
2	Stairs	6
3	Damp Prevention and Water Proofing	9
4	Partition Walls	3
5	False Ceiling	3
6	Finishes	10

DETAIL COURSE CONTENT

Module 1 Floors and Roofs — 8 periods

1.1 Timber Floor; Jack arch floor.
1.2 RCC Floor - Slab (one-way, two-way and cantilever), Flat Slab, Ribbed floor; Pre-cast concrete floors.
1.3 Reinforcement of beams, columns and slabs.
1.4 Steel Floor with joist and deck-plate.
1.5 PITCHED ROOF: nomenclature and types - Lean-to-roof, Coupled roof, closed couple roof, King Post Roof Truss, Queen Post Roof Truss, Steel trusses, Roofing materials with fixing details. Roof drainage systems and details.

Module 2 Stairs — 6 periods

2.1 Components and requirements.
2.2 Classification based on form.
2.3 Structural systems of stairs; Materials used.

Module 3 Damp Prevention and Water Proofing — 9 periods

3.1 Causes and effects of dampness in buildings
3.2 METHODS OF DAMP PREVENTION: membrane damp proofing, integral damp proofing, surface treatment, guniting

3.3 Water proofing techniques of Foundation, Plinth, Cavity walls, Projections, Expansion/seismic joints, Flat roofs and terraces, Parapet wall (details of coping and drip course), Window sill and chajja (detail of drip course), and any other relevant part of building.

3.4 Types of basements (deep, shallow), Waterproofing and water drainage of basements (tanked, integral, drained cavity).

Module 4 Partition Walls 3 periods

4.1 Usage of partition wall; Requirements for a good partition wall

4.2 Materials used in partition wall: brick, concrete, glass, metal, plaster board, wood wool, timber etc. – Comparison of partition walls of different materials

4.3 Typical details of different types of partition wall.

Module 5 False Ceiling 3 periods

5.1 Typical parts and materials: Gypsum, Plaster of Paris, Fibre, Wooden, Glass, Metal, PVC, Synthetic leather or cloth etc.

5.2 Other types (exposed, tightly-attached, acoustical, chilled, integrated service module etc.) – Only a brief overview.

Module 6 Finishes 10 periods

6.1 FLOORING: Brick, Stone, Concrete, Terrazzo, Tiled, Timber (parquet), Asphalt, Rubber, PVC, Linoleum, Cork, Magnesite, Glass and Acid-Proof.

6.2 INTERNAL WALL AND CEILING FINISHES: Cement plaster, Gypsum plaster, Wall putty, Gypsum, Plaster board.

6.3 EXTERNAL FINISHES: Cement plaster (smooth wood float finish, Pebble dash finish, Textured finish, Rough cast finish or Sponge finish), Pointing.

6.4 CLADDING (EXTERNAL & INTERNAL): Timber/timber product, Brick tiles, Ceramic tiles, Stone tiles, Metal, PVC, FRP, GFRC.

6.5 PAINTS: Constituents, functions, types; White washing and Colour washing.

REFERENCE READINGS

1. S.P. Arora and S.P. Bindra. (2010). A text book of building construction Dhanpat Rai Publications.
2. S. Bliss. (2005). Best practices guide to residential construction: Materials, finishes, and details. Wiley.
3. R. Chudley, and R. Greeno. (2014). Building construction handbook- 10th ed. Routledge
4. A.K. Jain and A.K. Jain. (2016). Building construction- 11th ed. Laxmi Publications.
5. S. Kumar. (2010). Building Construction. Standard Publisher.
6. P.C. Varghese. (2017). Building construction, 2nd ed. Prentice' Hall of India Private Limited.
7. E.C. Ozelton and J. A. Baird. "Timber Designers' Manual". Science
8. F.D.K. Ching. "Building Construction Illustrated". John Wiley & Sons, Inc.
9. S.K. Duggal "Building Materials". New Age International (P) Limited.
10. Mark Miller, Rex Miller and Eugene Leger. "Complete Building Construction". John Wiley & Sons, Inc.
11. Bjorn Berge. "The Ecology of Building Materials". Architectural Press.
12. P.C. Varghese. Building materials. PHI Learning Pvt. Ltd.

AP2103 | Landscape Architecture and Site Planning | 3 credits

Course Duration	Contact periods	Full Marks
13 weeks	3 lectures per week	100

COURSE OBJECTIVE

The objective of this course is to introduce a student of architecture to the history and theory of landscape and garden design in the world, as well as to the technical aspects related to it so that the student may be ready to successfully undertake the corresponding studio course in the next semester.

COURSE OUTCOME

On successful completion of this course, the students will be familiar with**:**

(i) history and theory of landscape and garden design;
(ii) role of natural systems in shaping the regional landscape, the role of landscape ecology in understanding these systems, and the role of impact assessment and landscape management in assuring sustainable landscape conservation and development; and,
(iii) technical aspects of site planning and design and how these might be applied to the principles of sustainable design through observation, documentation, and critical appraisals of project design, readings, and the review of projects and case studies.

COURSE EVALUATION

(a) Internal Assessment: 50% [Mid-Semester Examination - 30%; Teacher's Assessment: 20%, having the components class tests, quizzes, assignments, viva-voce, presentations etc. as per teachers' discretion].
(b) End-Semester Examination: 50%.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	LECTURE PERIODS
1	Introduction to Landscape Architecture and Site Planning	3
2	Historical Overview	10
3	Techniques of Site Planning	6
4	Plants and Planting	6
5	Landscape Structures	6
6	Site Utilities	4
7	Codal Provisions and National Guidelines	4

DETAIL COURSE CONTENT

Module 1 Introduction to Landscape Architecture and Site Planning 3 periods

1.1 Landscape theory and heritage.
1.2 Site planning and sustainable landscape development.
1.3 Regional landscapes, landscape ecology.

Module 2 Historical Overview 10 periods

2.1 Landscapes of Central Asia and India.
2.2 Landscape architecture in China and Japan.
2.3 European landscape design: Italy, France, England, Spain.
2.4 Landscape design in the 20th and 21st centuries.

Module 3 Techniques of Site Planning 6 periods

3.1 Site grading.
3.2 Stormwater management.
3.3 CIRCULATION: pedestrian, bicycle, vehicular.

Module 4 Plants and Planting **6 periods**

4.1 Introduction to horticulture.
4.2 Plant palette (herbaceous, woody plants).
4.3 Assessing existing vegetation.
4.4 Planting strategies (interior and exterior).

Module 5 Landscape Structures **6 periods**

5.1 Retaining walls, fences, screens, walls.
5.2 Surfacing and paving.
5.3 Water features.

Module 6 Site Utilities **4 periods**

6.1 Water Supply.
6.2 Sewage Disposal.
6.3 Lighting.
6.4 Sound Control.

Module 7 Codal Provisions and National Guidelines **4 periods**

7.1 National Building Code 2016, Volume 2, Parts 10 and 11
7.2 National Urban Greening Guidelines.

REFERENCE READINGS

1. Kevin Lynch. Site Planning. The MIT Press.
2. C.W. Harris and N.T. Dines. Time-saver Standards for Landscape Architecture, 2nd Ed. McGraw-Hill Publishing Co.
3. E. Boults, and C. Sullivan. Illustrated History of Landscape Design (2010). John Wiley & Sons.
4. Urban Greening Guidelines, 2014. http://www.indiaenvironmentportal.org.in/content/388807/urban-greening-guidelines-2014.

ADDITIONAL READINGS

1. IRC 86-2018: Geometric Design Standards for Urban Roads and Streets (First Revision). The Indian Road Congress.
2. IRC 103-2012: Guidelines for Pedestrian Facilities (First Revision). The Indian Road Congress.
3. IRC SP-12-2015: Guidelines for Parking Facilities in Urban Roads" (First Revision). The Indian Road Congress.
4. IRC SP-21-2009: Guidelines on Landscaping and Tree Plantation. The Indian Road Congress.
5. IRC SP-103-2014: Guidelines on Tree Plantation along Rural Roads. The Indian Road Congress.
6. IRC SP-118-2018: Manual for Planning and Development of Urban Roads and Streets. The Indian Road Congress.
7. IRC SP-118-2018: Manual for Planning and Development of Urban Roads and Streets. The Indian Road Congress.

AP2104 | Plumbing Services | 3 credits

Course Duration	Contact periods	Full Marks
13 weeks	3 lectures per week	100

COURSE OBJECTIVE

The objective of this course is to familiarize a student of architecture to the water supply, sanitation and drainage requirements of a building situated within and outside a municipal area.

COURSE OUTCOME

On successful completion of this course, the students will:—

(i) be aware about water treatment processes and the systems of distributing treated water to a building unit,
(ii) be able to estimate the water requirements of buildings of different typologies and to design its storage facilities,
(iii) have a fair idea about the sanitary requirement of buildings of different typologies and be able to choose the appropriate pipe system for them,
(iv) have a fair idea about municipal drainage system and systems of disposing effluents in building units outside municipal area.

COURSE EVALUATION

(a) Internal Assessment: 50% [Mid-Semester Examination - 30%; Teacher's Assessment: 20%, having the components class tests, quizzes, assignments, viva-voce, presentations etc. as per teachers' discretion].
(b) End-Semester Examination: 50%.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	LECTURE PERIODS
1	Sources and Requirements of Potable Water	4
2	Civic Water Distribution	3
3	Water Storage and Conveyance within Building Premises	6
4	Sanitation Requirements	3
5	Pipe System	8
6	Design Considerations for Drainage System	3
7	Drainage for Isolated Buildings	6
8	Fittings, Materials, and Appliances	6

DETAIL COURSE CONTENT

Module 1 Sources and Requirements of Potable Water 4 periods

1.1 SOURCES OF WATER: Ground water, surface water
1.2 POTABLE WATER: Idea of physical and chemical processes involved with water treatment, Quality of water requirement as per WHO, Quantity of water requirements as per NBC.

Module 2 Civic Water Distribution 3 periods

2.1 WATER DISTRIBUTION SYSTEMS: General principles of water distribution system, Systems of conveyance of water, Service reservoirs, Layout of water supply distribution system
2.2 WATER SUPPLY: Hierarchy of water supply, Service pipe, Direct and indirect system, Constant and Intermittent supply.

Module 3 Water Storage and Conveyance within Building Premises 6 periods

3.1 STORAGE OF WATER: Requirements of Storage, Quantity to be stored, Materials used, Underground and overhead reservoirs
3.2 DESIGN OF DISTRIBUTION SYSTEM: Discharge computation, Gravity distribution system, Break pressure tank
3.3 DISTRIBUTION SYSTEMS IN MULTI-STORIED BUILDINGS: Pressurized distribution or hydro-pneumatic system, Pressure reducing valve.

Module 4 Sanitation Requirements 3 periods

4.1 SANITARY APPLIANCES: Wash basins, Cleaner's sink, Drinking water fountain, Water closets, Urinal for male and female, Flushing cisterns, Baths, Showers

4.2 Quantitative Requirements of Sanitary Appliances as per the NBC

4.3 Reading toilet and kitchen layout drawings.

Module 5 Pipe System 8 periods

5.1 HOUSE DRAINAGE PIPES: Soil pipes, Waste pipes, Soil-waste pipes, Ventilating pipes, Rain water pipes, Anti-siphonage pipes, Vent pipes, Junction pipes, Ventilation ducts and shafts

5.2 TRAPS: Water seal, Essentials of a good trap, Causes of loss or breaking of water seal, Classifications of traps based on shape and use/location

5.3 CLASSIFICATION OF PIPE SYSTEMS: Two-pipe system, One-pipe system, Single stack system, Partially ventilated single stack system, Choice of pipe systems

5.4 CHAMBERS: Invert, Collection chamber, Gully chamber, Inspection chamber, Manhole, Drop manhole, Inceptor/ Interceptor manhole, Manhole chamber.

Module 6 Design Considerations for Drainage System 3 periods

6.1 Aims of designing a drainage system and realization of the same — MUNICIPAL WASTES: Sewage (sludge, sullage and storm water) and Solid refuse — Drain, drainage, channel, sewer, sewerage

6.2 SEWAGE DISPOSAL: Dry or conservancy system (earth closets, trench latrines, bore-hole latrines, sanitary latrines) and Water carriage or drainage system — Sizing of rain-water pipes for roof drainage

6.3 RAINWATER HARVESTING SYSTEMS: On-site water reuse, Groundwater recharge, Opportunities and weakness, Downspout disconnection

6.4 SYSTEMS OF DRAINAGE: Separate system, Combined system, Partially separate system – Shape and size of sewers based on Dry Weather Flow.

Module 7 Drainage for Isolated Buildings 6 periods

7.1 SUSTAINABLE PRACTICES: Reduce, Reuse and Recycle — Segregation of wastes at source, on-site treatment of organic waste, centralized Garbage Collection System/ Garbage chute

7.2 SEPTIC TANK: Sludge and Scum — Design considerations: capacity (detention period, sludge removal, consumption of water), shape and dimensions, inlet and outlet, baffle wall, cover and manholes, ventilation, lining

7.3 DISPOSAL OF EFFLUENT: Soak Pit (lined and unlined), Dispersion Chamber and Dispersion Trench, Idea about Sewage Treatment Plant (STP), Reed Bed sewage treatment.

Module 8 Fittings, Materials and Appliances 6 periods

8.1 VALVES: Air Valves or Air Relief Valves, Reflux Valves or Check Valves or Non-return Valves or Flap Valves or Foot Valves, Safety Valves or Pressure Relief Valves, Sluice Valves or Gate Valves or Stop Valves, Scour Valves or Washout Valves or Blow-off valves, Mixing valves, Stop Cocks

8.2 TAPS: Bib Taps, Use of low-flow fixtures and systems, Self-closing taps

8.3 Fire Hydrants and Wet Riser

8.4 FITTINGS: Bends or elbows, Tees, Crosses, Wyes, Reducers, Increasers, Flanges, Caps, Plugs, Back Nuts

8.5 JOINTS: Different type of joints for different pipe materials with detail reference to Spigot and Socket joints, Flanged joints and cement mortar joints — Lagging of pipes

8.6 SUPPLY PIPES: Cast iron, steel, reinforced concrete, pre-stressed concrete, galvanized mild steel tubes, copper, brass, wrought iron, asbestos cement, lead, Polythene, UPVC

8.7 DRAINAGE PIPES: Salt glazed stoneware, cast iron, asbestos cement, lead, UPVC.

REFERENCE BOOKS

1. Bureau of Indian Standard. SP7 National Building code of India 2016, Volume 2 Part 9. BIS, New Delhi.
2. Text book of Water Supply and Sanitary Engineering, S K Hussain, Oxford and IBH Publishing Co.
3. Building Construction / Sushil Kumar / Standards Publishers Distributors, Delhi.

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CE2117 | Structural Analysis | 3 credits

Course Duration	Contact periods	Full Marks
13 weeks	**3 lectures per week**	**100**

COURSE EVALUATION

(a) Internal Assessment: 50% [Mid-Semester Examination - 30%; Teacher's Assessment: 20%, having the components class tests, quizzes, assignments, viva-voce, presentations etc. as per teachers' discretion].
(b) End-Semester Examination: 50%.

MODULAR DIVISION OF THE SYLLABUS

MODULE	MODULE NAME AND TOPICS	LECTURE PERIODS
1	INTRODUCTION TO STATICALLY DETERMINATE AND INDETERMINATE STRUCTURES: Degree of redundancy, degree of freedom, force and displacement methods, static and dynamic load.	4
2	FUNDAMENTALS OF ANALYSIS OF DETERMINATE STRUCTURE: Conjugate beam method, Strain energy method, Castigliano's theorem, calculation of force effect, rotation and deflection of beam and truss.	9
3	FUNDAMENTALS OF ANALYSIS OF INDETERMINATE STRUCTURE: Consistent deformation method, moment distribution method, slope deflection method, analysis of portal frames, elementary analysis of continuous beam curved in plan.	18
4	Introduction to matrix stiffness method	4
5	Introduction to finite element method	4

REFERENCE BOOKS

1. R.C. Hibbler. Structural Analysis. PHI.
2. S. Ramamruthan, and R. Narayan. Theory of Structures. Dhanpat Rai Publ.
3. S.K. Roy, and S. Chakraborty. Fundamentals of Structural Analysis. S Chand.
4. N.C. Sinha. Elements of Structural Analysis. NCBA.
5. T.S. Thandavamoorthy. Structural Analysis. Oxford Publ.
6. C.K. Wang. Intermediate Structural Analysis. McGraw Hill Education.

CE2118 | Surveying | 2 credits

Course Duration	Contact periods	Full Marks
13 weeks	2 lectures per week	50

COURSE EVALUATION

(a) Internal Assessment: 50% [Mid-Semester Examination - 30%; Teacher's Assessment: 20%, having the components class tests, quizzes, assignments, viva-voce, presentations etc. as per teachers' discretion].
(b) End-Semester Examination: 50%.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	LECTURE PERIODS
1	Basic Concepts of Surveying	4
2	Distance Measurement	3
3	Angle Measurement	3
4	Levelling	6
5	Conventional surveys	2
6	Total Station Surveying	4
7	GPS Surveys	4

DETAIL COURSE CONTENT

Module 1 Basic Concepts of Surveying 4 periods

Principles – Basic measurements – Control networks – Locating position - Errors in measurement

Module 2 Distance Measurement 3 periods

Principles and methods – Errors in taping and chaining – Electromagnetic Distance measurement (EDM) – measuring principles – errors, checking and calibration.

Module 3 Angle Measurement 3 periods

Measurement with compass and theodolite – methods of measurements – instrument adjustment – sources of error.

Module 4 Levelling 6 periods

Principles of levelling – equipment – effect of curvature and refraction – simple and differential levelling - adjustments – Contouring – methods of contouring.

Module 5 Conventional Surveys 2 periods

Traversing – plane rectangular coordinates – development of triangulation network – method of triangulation – traversing.

Module 6 Total Station Surveying 4 periods

Principles – classification – salient features of total station – adjustments

Module 7 GPS Surveys 4 periods

Concept of GPS - principles – errors – GPS survey methods - planning of GPS survey

SUGGESTED READINGS

1. J. K. Ghosh. Elementary Engineering Surveying. Studium Press (India) Pvt Ltd.
2. T. P. Kanetkar and S. V. Kulkarni. Surveying and Levelling (Vol. 1 and Vol. 2). Pune Vidyarthi Griha Prakashan.
3. S. K. Duggal. Surveying (Vol. 1 and Vol. 2). Tata McGraw-Hill Education India.
4. R. Subramanian. Surveying and Levelling. Oxford University Press.
5. S. K. Roy. Fundamentals of Surveying. Prentice Hall India Learning Private Limited.

AP2171 | Architectural Design Studio - II | 6 credits

Course Duration	Contact periods	Full Marks
13 weeks	9 studio classes per week	200

COURSE OBJECTIVE

The objective of this course is to facilitate the development of necessary skills in the student to create shelters of moderate complexity, schools up to secondary level, and small business buildings or professional's office, through a clear understanding of the interrelationships between circulation, functional uses of space (indoor as well as outdoor), area and proximity analyses, climatic and aesthetic considerations.

COURSE OUTCOME

On successful completion of this course, the students will acquire skills to fairly design a small residence, small school, and small office.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	STUDIO PERIODS
1	Design Assignment 1	54 (6 weeks)
2	Time Sketch	09 (1 week)
3	Design Assignment 2	54 (6 weeks)

DETAIL COURSE CONTENT

The students are required to undertake two architectural design assignments and one time-sketch (without repetition) from amongst the following broad topics representing three sub-occupancies of the National Building Code of India 2016:

- One-or two-family private dwellings, residence of a professional/ consultant etc.
- Different types of schools up to secondary level.
- Offices of professionals/ consultants like architects, engineers, doctors, lawyers and others; banks, post offices, police stations, etc.

The studio work undertaken shall emphasize behavioural, functional, climatic and aesthetic considerations in architectural design. The minimum duration of a design assignment, other than the time sketch, shall not be less than five weeks. The final submission of drawings will generally consist of site plan, different floor and roof plans, relevant elevations/sections, necessary details, model(s) and./or views.

EVALUATION SCHEME

Preferably 3 reviews shall be organized for each assignment excluding the time sketch. The reviews should preferably involve the practicing Architects and allied professionals as external examiners. Marks of each review shall be communicated to the students on regular basis as a part of continuous evaluation. Indicative evaluation scheme of an assignment may be as follows:

(a) Study and design programming (10-20%),
(b) Concept and design development (30-40%),
(c) Final Submission (30-40%), and,
(d) Studio performance (10-20%).

The marks allotted to each module may be as follows:

Module 1: 90 marks | Module 2: 20 marks | Module 3: 90 marks

However, the faculty-in-charge may change the marks allocated to different modules, if it is required to give more emphasis to one design assignment than the other.

REFERENCE BOOKS

1. Bureau of Indian Standards. National building Code of India 2016, Volume 1, Part 3. BIS, New Delhi.
2. J de Chiara and J. Callender. Time-Saver Standards for Building Types, 3rd Ed. McGraw-Hill.
3. D. Watson, M.J. Crosbie, and J. Callender. Time-Saver Standards for Architectural Design Data. McGraw-Hill.
4. Ernst and Peter Neufert. Architects' Data, 3rd Ed. Blackwell Science

AP2172 | Details of Construction Practice - II | 2 credits

Course Duration	Contact periods	Full Marks
13 weeks	3 studio classes per week	100

COURSE OBJECTIVE

The objective of the course is to expose a student to the practical aspects of the theoretical knowledge gathered from portions of the theoretical course AP1201 and that of the course AP2102.

COURSE OUTCOME

On successful completion of this course, the students will be:

(i) familiar with the construction techniques for foundation, floor and roof, stairs, and damp proofing and water proofing of building;
(ii) able to select suitable material for construction; and,
(iii) able to prepare details in Working Drawing which is included in forthcoming semester.

COURSE EVALUATION

Continuous evaluation of students' work executed through drawing sheets etc. will be undertaken by the course teacher, who will inform the students about the weightages of evaluation for different assignments at the start of the semester.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	STUDIO PERIODS
1	Details of Foundation	12
2	Details of Flat and Pitched Roofs	12
3	Details of RCC Stairs	9
4	Damp Prevention and Water Proofing	6

DETAIL COURSE CONTENT

Module 1 Details of Foundation — 12 periods

1.1 Details of typical foundations up to plinth levels
1.2 Skin sections in brickwork showing typical damp-proof treatments in foundation and plinth in minimum 1:25 scale
1.3 Skin sections in RCC showing typical damp-proof treatments in foundation and plinth in minimum 1:25 scale.

Module 2 Details of Flat and Pitched Roofs — 12 periods

2.1 Flat Roof- One way, Two Way Slabs
2.2 Reinforcement of roof slab
2.3 Beams and their reinforcement, Clear Cover, Stirrup distancing
2.4 Columns and their reinforcement, Clear Cover, Stirrup distancing
2.5 Types of Pitched roof as per materials and construction techniques, Scope of application and related building regulations, their advantages and disadvantages

Module 3 Details of RCC Stairs — 9 periods

Details of a typical RCC staircase showing fixing details of:

3.1 Balusters (metal & wood)
3.2 Nosing to steps in suitable scale

(Minimum scale being 1:25)

Module 4 Damp Prevention and Water Proofing — 6 periods

4.1 Water Proofing Treatment on Flat Roofs & Terraces (using lime concrete, bitumen etc.):

Details of water proofing treatments to flat roofs and terraces showing rain water pipe. Drawings are to be drawn in suitable scale, minimum scale being 1:25.

4.2 Water Proofing Treatment to Parapet Wall, Window Sill & Chajja:

Details of waterproofing treatments to parapet walls, window sills and chajja showing coping, drip course, moulds etc. Drawings are to be drawn in suitable scale, minimum scale being 1:25.

4.3 Waterproofing and water drainage of basements (tanked, integral, drained cavity)

4.4 Explanation through hands-on and/or installation video.

REFERENCE READINGS

1. S.P. Arora and S.P. Bindra. (2010). A text book of building construction Dhanpat Rai Publications.
2. S. Bliss. (2005). Best practices guide to residential construction: Materials, finishes, and details. Wiley.
3. R. Chudley, and R. Greeno. (2014). Building construction handbook- 10th ed. Routledge
4. A.K. Jain and A.K. Jain. (2016). Building construction- 11th ed. Laxmi Publications.
5. K.N. Jha. (2012). Formwork for concrete structures. Tata McGraw Hill Education Private Limited.
6. S. Kumar. (2010). Building Construction. Standard Publisher.
7. A.J. Macdonald. (2018). Structure and architecture, 3rd ed. Routledge.
8. R.C. Peurifoy, J. Schexnayder, and A. Shapira. (2010). Construction planning, equipment and methods, Indian Ed. McGraw Hill Education.
9. P.C. Varghese. (2017). Building construction, 2nd ed. Prentice' Hall of India Private Limited.
10. A. Watts. (2014). Modern construction envelopes. Birkhäuser / Springer
11. E.C. Ozelton and J. A. Baird. "Timber Designers' Manual". Science
12. F.D.K. Ching. "Building Construction Illustrated". John Wiley & Sons, Inc.
13. S.K. Duggal "Building Materials". New Age International (P) Limited.
14. Mark Miller, Rex Miller and Eugene Leger. "Complete Building Construction". John Wiley & Sons, Inc.
15. Bjorn Berge. "The Ecology of Building Materials". Architectural Press.
16. P.C. Varghese. Building materials. PHI Learning Pvt. Ltd.

AP2173 | Computer Aided Design and Drawing | 2 credits

Course Duration	Contact periods	Full Marks
13 weeks	3 laboratory classes per week	100

COURSE OBJECTIVE

The students will be introduced to 2d and 3d software so that they are prepared for carrying out architectural design exercises in digital media in the forthcoming semesters.

COURSE OUTCOME

On successful completion of this course, the students will be able to:

(i) understand the advantages of creating digital drawings and graphics in computer as well as their limitations;
(ii) create simple and complex 2-dimensional drawings and editing them;
(iii) annotate the drawings;
(iv) render digital graphics for presentation to clients; and,
(v) create and optimize building designs using Building Information Modelling.

COURSE EVALUATION

Continuous evaluation of students' work will be undertaken by the course teacher, who will inform the students about the weightages of evaluation for different assignments at the start of the semester.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	LAB. PERIODS
1	Introduction to 2d Graphics	3
2	Creating Simple and Complex 2d Objects	3
3	Modifying and Editing Objects	3
4	Writing Text, Dimension and Hatching	3
5	Organizing and Plotting Drawing	3
6	Rendering of 2d Drawings	6
7	Introduction to 3d Modelling	9
8	Introduction to Building Information Modelling	9

DETAIL COURSE CONTENT

Module 1 Introduction to 2d Graphics — 3 periods

1.1 Introduction to various CAD Software and their Modules.
1.2 Starting AutoCAD and understanding the user interface, modifying interface, saving a file.
1.3 Using ortho mode, object snaps.

Module 2 Creating Simple and Complex 2d Objects — 3 periods

2.1 Drawing lines, circles, arcs, ellipses, point objects.
2.2 Construction line, Multiline and Polylines.
2.3 Drawing rectangles, polygons, splines, curves.
2.4 Closed and Open Polygons.
2.5 Creating boundary and regions.

Module 3 Modifying and Editing Objects — 3 periods

3.1 Redrawing and regenerating a drawing.
3.2 Selecting, erasing, duplicating, rearranging, resizing, breaking and grouping objects.
3.3 Editing polylines, multiline and splines.
3.4 Exploding objects, chamfering and filleting objects.

Module 4 Writing Text, Dimension and Hatching 3 periods

4.1 Creating a line text, paragraph text; inserting text from outside AutoCAD.
4.2 Working with text style; editing and changing text.
4.3 Understanding dimension styles and variables, managing dimension styles.
4.4 Dimensioning multiple objects.
4.5 Adding hatch objects, modifying hatch objects.

Module 5 Organizing and Plotting Drawing 3 periods

5.1 Concept of layer, visibility, printability and locking of layers.
5.2 Concept of lineweight in architectural drawing.
5.3 Working with blocks, attributes, external references, editing references in place.
5.4 Creating plot Layout and Plotting.

Module 6 Rendering of 2d Drawings 6 periods

6.1 Introduction to Adobe Photoshop user interface - Raster and vector image.
6.2 Concept of layers, folder of layers, linked layers, blending modes.
6.3 Use of editing tools, managing exposure, colour balance etc.
6.4 Publishing final output.

Module 7 Introduction to 3d Modelling 9 periods

7.1 Drawing 3D from 2D shapes and objects: Extrusion of lines and surfaces.
7.2 3D Solids: Properties, Draw, Edit, Join, Change Attributes.
7.3 Use of Components library, Plugins.
7.4 Rendering: Use of Camera, Lights and View. Various rendering techniques.

Module 8 Introduction to Building Information Modelling 9 periods

8.1 User Interface and File Management.
8.2 View control and properties, View Types.
8.3 Levels, Walls, Doors, Windows, Component, Columns and Grids, Stairs, Roofs and Floors.
8.4 Annotations, Schedules, Rendering.

REFERENCE READINGS

1. James Leach, Shawna Lockhart, Eric Tilleson. 2019. AutoCAD 2020 Instructor. SDC Publications.
2. Aidan Chopra. 2010. Google SketchUp 8 for Dummies. John Wiley & Sons.
3. Steve Johnson. 2012. Adobe Photoshop CS2. Que Publishing.
4. Eric Wing. 2019. Revit 2020 for Architecture: No Experience Required. John Wiley & Sons.

FOURTH SEMESTER

AP2201 | Evolution of Architecture – II | 3 credits

Course Duration	Contact periods	Full Marks
13 weeks	3 lectures per week	100

COURSE OBJECTIVE

The objective of this course is to introduce a student to the evolution of Western architecture from the ancient to the pre-industrial times through the medieval ages.

COURSE OUTCOME

On successful completion of this course, the students will**:—**

(i) have a fair idea about the evolution of settlements and architecture in the Ancient World with reference to West Asia (Ancient Mesopotamia) and Ancient Egypt;

(ii) have a reasonable idea about the birth and development of classical western architecture with reference to Classical and Hellenistic Greece, and the architectural developments of Republican and Imperial Rome, in terms of new typologies, new materials and architectural forms and expressions;

(iii) gain an understanding of the influence of Christianity on the architecture of Western Europe starting from humble beginnings involving adaptive reuse of pre-existing buildings to Byzantine architecture in the eastern part of the Roman empire through medieval times and the evolution of grand cathedrals and novel structural systems;

(iv) understand the nuances of Renaissance Art and Architecture and the celebration of humanism;

(v) understand the transition from the ethos of Renaissance to the absolutism of Baroque in terms of architecture and the socio-political climate of the times; and,

(vi) gain an understanding of revival of the classical and its representation in Neoclassicism.

COURSE EVALUATION

(a) Internal Assessment: 50% [Mid-Semester Examination - 30%; Teacher's Assessment: 20%, having the components class tests, quizzes, assignments, viva-voce, presentations etc. as per teachers' discretion].

(b) End-Semester Examination: 50%.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	LECTURE PERIODS
1	Architectural Development in Ancient Mesopotamia	3
2	Architectural Development in Ancient Egypt	3
3	Classical Greek and Hellenistic Architecture	6
4	Architecture of Imperial Rome	6
5	Early Christian and Byzantine Architecture	3
6	Architecture of Medieval Europe	6
7	Renaissance Art and Architecture	6
8	Baroque Architecture	3
9	Neo-Classicism	3

DETAIL COURSE CONTENT

Module 1 Architectural Development in Ancient Mesopotamia 3 periods

Tigris and Euphrates basin – The contextual factors influencing the architecture – building techniques and processes – three dimensional articulation of spaces – architectural elements – external finishing techniques – building services – introduction of the arch – temples and palaces as the chief building typologies – principles of architectural organization – symbolism and meaning – social underpinnings – Early Mesopotamian Architecture, Assyrian Architecture, Babylonian Architecture and City Planning – Study of (a) the Ziggurat of Ur-Nammu, Ur (Sumerian), and (b) the City of Babylon, Mesopotamia (Nebuchadnezzar II's reconstruction).

Module 2 Architectural Development in Ancient Egypt 3 periods

Belief in after-life, powerful priesthood, abundant labour – Evolution of tomb architecture: Mastabas to the Step Pyramid to the Bent Pyramid to the True Pyramids, study of the Great Pyramid of Cheops, Gizeh — Temple architecture: Typology, study of the Great Temple of Amun, Karnak, Thebes – Pylons, Obelisks and Sphinx.

Module 3 Classical Greek and Hellenistic Architecture 6 periods

Classical (Hellenic) Greece: city states, use of high quality limestone and marble, columnar and trabeated architecture, human scale, extrovert space – Typical Greek Temple: parts, columniation, intercolumniation – Orders**:** Doric, Ionic, Corinthian – Elements of Urban Architecture: agora, stoa, bouleutorion, theatre, Odeon, stadium, hippodrome and gymnasia – Study of the Parthenon at Acropolis, Athens – Hellenistic Architecture.

Module 4 Architecture of Imperial Rome 6 periods

Roman art and architecture: continuity of Greek architecture or an unique style – Imperial Rome: nation state, use of new materials, arcuated architecture, monumental scale, introvert space – Orders added: Tuscan and Composite (Roman) – Comparative proportions of the Classical Orders – Elements of Urban Architecture: temples, forum, basilicas, thermae & balneae, theatre, amphitheatre, circuses, triumphal arches & columns, aqueducts & bridges – Study of the Pantheon, Rome.

Module 5 Early Christian and Byzantine Architecture 3 periods

5.1 Adaptive reuse of existing unused buildings – Basilican Churches – Significance of Clerestory Lighting – Study of the Old Basilica of St. Peter, Rome.

5.2 Developments after acceptance of Christianity as state religion – Orthodox Churches and Greek cross – Pendentives for domes over square compartments – Radiant church interiors – Study of the Hagia Sophia, Constantinople.

Module 6 Architecture of Medieval Europe 6 periods

6.1 Medieval age – Episcopal cities – Development of stone vaulting into groined systems – Church plan as a Latin Cross – Study of the Pisa Cathedral with Baptistery and Campanile.

6.2 Further consolidation of Papal hierarchy, creation of lofty cathedrals – Progressive lightening and heightening of structure – Rectangular church plans – Introduction of structure as a framework with pointed arches, flying buttresses and rib vaults – Reduction of structural function of the wall enabling new articulation with tracery – Study of the Notre Dame de Paris.

Module 7 Renaissance Art and Architecture 6 periods

7.1 Re-birth of classical ideals in Europe: age of humanism, reformation movement – Artists and architects as important personalities: Vinci, Michelangelo, Raphael – Renaissance Art: Brunelleschi's linear perspective, renaissance sculpture, renaissance painting

7.2 Italian Renaissance architecture: characteristics, principal phases – Quattrocento (Early Renaissance): development of double shell ribbed dome, study of the *Duomo* of Florence Cathedral by Filippo Brunelleschi – High renaissance: development of compositional arrangement after classical ideals, study of *Tempietto* at St. Pietro, Montorio, Rome by Donato Bramante – Mannerism (Late High Renaissance): Study of the plan of the Basilica of St. Peter's, Rome by Michelangelo Buonarroti.

Module 8 Baroque Architecture 3 periods

Counter-reformation movement – Architecture as a statement of the wealth and power of the church – Spatial invention, drama and freedom of detail – Study of (a) Piazza of the Basilica of St. Peter's, Rome by Gian Lorenzo Bernini, and (b) St. Paul's Cathedral, London by Sir Christopher Wren.

Module 9 Neo-Classicism 3 periods

Age of Enlightenment – Departure from absolutism – Study of (a) *Monticello*, Virginia, USA by Thomas Jefferson, (b) the *Writers' Building*, Kolkata, India by Thomas Llyon, and (c) the Cenotaph to Newton (unbuilt) by Étienne-Louis Boullée.

REFERENCE BOOKS

1. M. Trachtenberg and I. Hyman. Architecture: From Prehistory to Postmodernity. Prentice Hall.
2. M Moffett, M Fazio and L Wodehouse. A World History of Architecture. McGraw-Hill.

3. Jan Gympel. The Story of Architecture from antiquity to the present. Könemann.
4. Encyclopaedia of Architectural Technology: Ed. Pedro Guedes / McGraw-Hill
5. Sir Banister Fletcher's A History of Architecture. Ed. Dan Cruckshank. CBS.

AP2202 | Materials and Methods of Construction - IV | 3 credits

Course Duration	Contact periods	Full Marks
13 weeks	3 lectures per week	100

COURSE OBJECTIVE

The objective of this course is to introduce a student to the domain of advanced building materials and its components.

COURSE OUTCOME

On successful completion of this course, the students will be able to:

(i) use different facade systems;
(ii) propose various structural forms and building systems for designing a building; and,
(iii) understand the construction feasibility of their design proposal.

COURSE EVALUATION

(a) Internal Assessment: 50% [Mid-Semester Examination - 30%; Teacher's Assessment: 20%, having the components class tests, quizzes, assignments, viva-voce, presentations etc. as per teachers' discretion].
(b) End-Semester Examination: 50%.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	LECTURE PERIODS
1	Structures in Architecture	9
2	Facade System	6
3	Pre-Engineered Building System	6
4	Joints in Structure	6
5	Formworks and Temporary Support Structure	6
6	Construction Equipment	3
7	Thermal and Acoustic Materials	3

DETAIL COURSE CONTENT

Module 1 Structures in Architecture — 9 periods

1.1 Domes and Vaults, Shell structures, Folded plate structures, Tensile structures, Space frames, Pneumatic structures etc.
1.2 STRUCTURAL SYSTEM FOR HIGH RISERS: braced frame, rigid frame, wall frame, shear wall, outrigger, unfilled frame, flat plate, tube, coupled wall etc.
1.3 Fundamental principles and examples.

Module 2 Facade System — 6 periods

2.1 CURTAIN WALL: Fixing methods (unitized, semi unitized, stick, point fixing etc.)
2.2 Structural glazing.
2.3 METAL FACADE: panel and cladding, rain-screen mesh, louver etc.

Module 3 Pre-Engineered Building System — 6 periods

3.1 PRECAST CONCRETE: pros and cons, pre-stressing (pre and post tensioning), casting operation (job pre-cast, yard pre-cast)
3.2 Typical precast concrete components and other prefab elements
3.3 BUILDING SYSTEMS: Large-panel systems, Frame systems, Slab-column systems with walls, Mixed systems.

Module 4 Joints in Structure — 6 periods

4.1 TYPES OF JOINTS: Expansion joints, Construction joints, Sliding joints, Isolation joints, Seismic joints, Settlement joint etc.

4.2 Details of treatment and finishing.

Module 5 Formworks and Temporary Support Structure 6 periods

5.1 Materials and components used for formwork, supports and scaffolds, shoring, underpinning.
5.2 FORMWORK FOR TYPICAL COMPONENTS: slab, beam, column etc.
5.3 FORMWORK FOR SPECIAL STRUCTURES: precast concrete, shell, dome, folded plate etc.
5.4 FORMWORK FOR HIGH-RISE CONSTRUCTION: slipform, jumpform, table / flying form.

Module 6 Construction Equipment 3 periods

6.1 Excavation equipment; Compaction equipment; Hauling equipment; Hoisting equipment; Pumping equipment.
6.2 Applications and brief overview.

Module 7 Thermal and Acoustic Materials 3 periods

Types, Properties, Applications, and Details of construction.

REFERENCE READINGS

1. S.P. Arora and S.P. Bindra. (2010). A text book of building construction Dhanpat Rai Publications.
2. S. Bliss. (2005). Best practices guide to residential construction: Materials, finishes, and details. Wiley.
3. R. Chudley, and R. Greeno. (2014). Building construction handbook- 10th ed. Routledge
4. A.K. Jain and A.K. Jain. (2016). Building construction- 11th ed. Laxmi Publications.
5. K.N. Jha. (2012). Formwork for concrete structures. Tata McGraw Hill Education Private Limited.
6. S. Kumar. (2010). Building Construction. Standard Publisher.
7. A.J. Macdonald. (2018). Structure and architecture, 3rd ed. Routledge.
8. R.C. Peurifoy, J. Schexnayder, and A. Shapira. (2010). Construction planning, equipment and methods, Indian Ed. McGraw Hill Education.
9. P.C. Varghese. (2017). Building construction, 2nd ed. Prentice' Hall of India Private Limited.
10. A. Watts. (2014). Modern construction envelopes. Birkhäuser / Springer
11. E.C. Ozelton and J. A. Baird. "Timber Designers' Manual". Science
12. F.D.K. Ching. "Building Construction Illustrated". John Wiley & Sons, Inc.
13. S.K. Duggal "Building Materials". New Age International (P) Limited.
14. Mark Miller, Rex Miller and Eugene Leger. "Complete Building Construction". John Wiley & Sons, Inc.
15. Bjorn Berge. "The Ecology of Building Materials". Architectural Press.
16. P.C. Varghese. Building materials. PHI Learning Pvt. Ltd.

AP2203 | Climatology | 2 credits

Course Duration	Contact periods	Full Marks
13 weeks	2 lectures per week	50

COURSE OBJECTIVE

The objective of this course is to introduce a student to the aspects of climatic issues that are to be considered generally during any architectural design.

COURSE OUTCOME

On successful completion of this course, the students will be:

(i) able to understand the climatic factors that contribute to human comfort inside a building;
(ii) able to arrange a building or organize groups of buildings in a climate sensitive manner;
(iii) able to use architectural elements like shading devices, light shelves, wind scoops etc. to control the influence of outside environment inside the building;
(iv) able to optimize energy usage and minimize the need of artificial techniques to enhance human comfort; and,
(v) prepared for using passive techniques of ensuring natural ventilation and illumination.

COURSE EVALUATION

(a) Internal Assessment: 50% [Mid-Semester Examination - 30%; Teacher's Assessment: 20%, having the components class tests, quizzes, assignments, viva-voce, presentations etc. as per teachers' discretion].
(b) End-Semester Examination: 50%.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	LECTURE PERIODS
1	Introduction to Climatology	4
2	Comfort: The Desirable Conditions	4
3	Principles of Thermal Design	4
4	Means of Thermal Control: Natural Ventilation	4
5	Means of Thermal Control: Structural Controls	4
6	Principles of Lighting	3
7	Thermal Design for Urban Areas	3

DETAIL COURSE CONTENT

Module 1 Introduction to Climatology — 4 periods

1.1 Climate and weather.
1.2 Basic climatic zones: hot & arid, hot / warm & humid, composite and cold.
1.3 Climatic parameters: solar radiation, temperature, relative humidity, prevailing wind, clouds.
1.4 Measuring instruments and units.
1.5 Features of dwellings in tropics: aspects of daylighting, plantation of trees.

Module 2 Comfort: The Desirable Conditions — 4 periods

2.1 Requirement of ventilation.
2.2 Heat balance of body.
2.3 Sun path diagram, comfort zone & bio-climatic chart, comfort range.
2.4 Air change per hour: recommended ACH values for different occupancies as per the NBC.
2.5 Methods of ventilation.

Module 3 Principles of Thermal Design — 4 periods

3.1 Thermal quantities – Heat flow, heat flow rate, density of heat flow rate.
3.2 Sol-air temperature and Solar gain factor.

3.3 Heat Exchange Process: Conduction, Convection, Radiation.
3.4 Evaporation, Calculation of heat loss & heat gain, Cooling & heating by air.
3.5 Transmittance of Composite Walls, Thermal Gradient.
3.6 Thermal Comfort Indices: ET, SET, Wind Chill Factor, MRT, WBGT.

Module 4 Means of Thermal Control: Natural Ventilation 4 periods

4.1 Principle of nature ventilation in buildings.
4.2 Cross-ventilation: position of openings, size of openings.
4.3 Control of openings: sashes, canopies, louvers, wind shadow.
4.4 Humidity control: wind scoop, Earth Air Tunnel.

Module 5 Means of Thermal Control: Structural Controls 4 periods

5.1 Solar control: internal blinds & curtains.
5.2 Heat absorbing glasses: SHGC, Nanomaterial.
5.3 Sun's position: effects of angle of incidence, stereographic projection, shadow angles.
5.4 Shading devices: vertical & horizontal, Design of shading devices.

Module 6 Principles of Lighting 3 periods

6.1 Aims of good lighting and realization of the same.
6.2 Planning the brightness pattern considering the visual task, the immediate background of the task (central field & visual field) and the general Surroundings (peripheral field).
6.3 Glare: direct, reflected & veiling.
6.4 Recommended values of illumination level for different occupancies as per the NBC.

Module 7 Thermal Design for Urban Areas 3 periods

7.1 Outdoor thermal comfort.
7.2 Sky View Factor.
7.3 Albedo: Albedo of different building materials, Cool paints.
7.4 Role of evapotranspiration.

REFERENCE READINGS

1. O.H. Koenigsberger, T.G. Ingersoll, A. Mayhew, S. V. Szokolay. (1974). Manual of tropical housing and building. Climatic design. Universities Press (India) Private Limited, Hyderabad.
2. B. Givoni. (1976). Man, Climate and Architecture. Applied Science Publ.
3. Mark DeKay, and G.Z. Brown. (2013). Sun, Wind, and Light: Architectural Design Strategies. John Wiley & Sons.
4. B. Givoni. (1998). Climate Considerations in Building and Urban Design. John Wiley & Sons.

AP2204 | Building Services I: Illumination and Electrical Installations | 3 credits

Course Duration	Contact periods	Full Marks
13 weeks	3 lectures per week	100

COURSE OBJECTIVE

This course provides an exploration of building environmental systems and their integration into architectural design by introducing the students to concepts of one of the basic services and its applications. It further provides by evolving understanding in students to choose appropriate electrical installation systems and application and integration of this knowledge in their design projects.

This course provides understanding and use of daylight as an architectural determinant, explore daylighting influences on building occupants, understand the impact of natural lighting strategies on building energy efficiency and on sustainable design, Integrate natural and artificial illumination systems within building design, providing an introduction to the fundamentals of illumination engineering and architectural lighting design by familiarising them with calculation procedures for predicting daylight performance within buildings, lighting precedents studies as tools for research and spatial programming, designing with electric light as a form and material in space, light sources, light distribution, and electric lighting programming, understanding the implications of electric lighting on place making, spatial ordering, health, and human activities in indoor spaces. This course will introduce Principle of schematic lighting design and energy codes, qualitative and quantitative lighting design tools. Simulate natural lighting conditions through use of architectural models or computer analysis

COURSE OUTCOME

On successful completion of this course, the students will**:**

(i) use the techniques, skills, and modern engineering tools necessary for engineering practice of contemporary issues.
(ii) examine daylight in buildings and its effect on lighting design;
(iii) apply engineering principles to illumination engineering problems;
(iv) identify the criteria for the selection of lamps and lighting systems for an indoor or outdoor space by evaluating different types of lighting designs and applications by performing calculations on photometric performance of light sources and luminaries for lighting design;
(v) design the lighting scheme for landscaped spaces;
(vi) acquire a working knowledge of the wide range of lighting control systems available to a lighting design professional and the ability to select an appropriate control system and equipment for a specific application;
(vii) use computer software simulation for designing a simple lighting project and rendering the final design effects.

COURSE EVALUATION

(a) Internal Assessment: 50% [Mid-Semester Examination - 30%; Teacher's Assessment: 20%, having the components class tests, quizzes, assignments, viva-voce, presentations etc. as per teachers' discretion].
(b) End-Semester Examination: 50%.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	LECTURE PERIODS
1	Introduction to Electricity and its distribution	2
2	Elements of electrical wiring system in buildings	4
3	Schematic layout of electrical installations for different building types	6
4	Introduction to Light and its characteristics	3
5	Daylighting	3
6	Light sources and luminaires	6
7	Lighting calculations and energy codes	6
8	Lighting designs for interior and exterior spaces	9

DETAIL COURSE CONTENT

Module 1 Introduction to Electricity and its distribution 2 periods

1.1 Fundamentals of electricity, current, voltage;

1.2 Distribution of electric power in towns / cities and house hold connections;

Module 2 Elements of electrical wiring system in buildings 4 periods

2.1 Elements of building wiring system – feeders, panel board, circuit breakers' fuses, switches etc.

2.2 Electrical symbols;

Module 3 Schematic layout of electrical installations for different building types 6 periods

3.1 Installations from meter board to individual point;

3.2 Electrical wiring system; Distribution boards and layout of points;

3.3 Different materials and specification;

3.4 Earthling agreements; Lighting conductors;

3.5 Fixtures and accessories used in electrical installation;

3.6 Schematic layout of installations and points for different building types;

Module 4 Introduction to Light and its characteristics 3 periods

4.1 What is light, Electromagnetic wave theory, Ultraviolet light, Visible light, Colour models, Infrared light.

4.2 The power of light, Quantum theory, Flat response, Visible light, Effective irradiance.

4.3 How light behaves, Reflection, Transmission: Beer-Lambert or Bouger's law, Refraction: Snell's law, Diffraction, Interference, Manipulating light (diffusion, collimation, transmission losses, focusing lenses, mirrors, concave mirrors, internal transmittance, prisms, diffraction gratings).

4.4 Non-visual effects of light

Module 5 Daylighting 3 periods

5.1 Points to remember about daylighting, Integrating daylighting and electric lighting.

5.2 Top lighting, Side lighting, Basic principles of daylighting design and awareness.

5.3 Daylight Factor: Components of daylight factor – SC, ERC, IRC; Daylight penetration.

5.4 Solar Heat gain Coefficient (SHGC) of glass, VLT of glass, low e-glass and smart glass.

Module 6 Light sources and luminaires 6 periods

6.1 Qualities of light sources, how light is generated, the spectrum of light, Colour classification of light sources, Point source, Line source, or Area source;

6.2 Ballast or transformer, lamp size, voltage, bulb temperature, operating temperature, operating position, starting, warming up, and restarting, dimming characteristics, energy efficiency,

6.3 Lamp types – incandescent, halogen, fluorescent (standard straight and u-bent lamps), compact fluorescent, metal halide, sodium lamps, mercury vapour lamps; other light sources (induction lamps, light-emitting diodes, neon and cold cathode lamps).

6.4 How to choose basic luminaire types, Styles of luminaire – downlights, troffers, commercial fluorescent fixtures, industrial luminaires, linear lighting systems, architectural lighting fixtures, wall washers, wall grazing fixtures, accent fixtures, cove lights, task lights, decorative lighting.

Module 7 Lighting calculations and energy codes 6 periods

7.1 Basic theory – lamps, luminaires and directional lamps, initial versus maintained light levels

7.2 Predicting lighting results in design -- predicting general and ambient light levels, predicting task lighting and focal lighting levels.

7.3 Rough calculations for architects and interior designers -- the watts-per-square-foot method, a very simple lumen method, a very simple point method.

7.4 Energy Code Structure, Lighting Power Limits, Outdoor Lighting Power Limits, Calculation of Installed Lighting Power, Mandatory Switching Requirements, Mandatory Control Specifications, Optional Lighting Control Credits, Compliance Documentation.

Module 8 Lighting designs for interior and exterior spaces 9 periods

8.1 Sequential steps to successful lighting design solutions, determination of lighting design criteria, recording of architectural conditions and constraints, determination of visual functions and tasks to be served,

8.2 Selection of lighting systems to be used, selection of luminaire and lamp types, determination of number and location of luminaires, Placement of switching and other control devices, consideration of aesthetics and other intangibles

8.3 Documenting lighting design: drawings and contract documents, base plans (floor plans, reflected ceiling plans, combined ceiling/floor plans), creating a lighting plan (lighting symbols, lighting tags, circuits, switching and dimming, details, legends, schedules and specifications).

8.4 Residential lighting design: living room lighting, dining room lighting, small kitchen lighting, lighting the larger kitchen, bathroom lighting, bedroom lighting,

8.5 Outdoor and landscape lighting design.

REFERENCE BOOKS

1. S.L. Uppal, and G.C. Garg. (2011). Electrical Wiring, Estimating and Costing. Khanna Publishers.
2. Surjit Singh. (2011). Electrical Estimation and Costing. Khanna Publishers.
3. Rajiv Shankar. (2010). Energy Auditing in Electrical Utilities. Viva Books.
4. Amlan Chakrabarti. (2011). Energy Engineering and Management. PHI Learning Pvt Ltd.
5. B.L. Theraja. A Text Book of Electrical Technology, Volume I. S. Chand & Co., New Delhi.
6. Philips. (2008). Basics of light and lighting. Koninklijke Philips Electronics N.V.
7. Rüdiger Ganslandt, and Harald Hofmann. (1992). Handbook of Lighting Design. ERCO Leuchten GmbH, Lüdenscheid.
8. Mark Karlen, and James Benya. (2004). Lighting design basics. John Wiley & Sons, Inc.
9. Alexander D Ryer. (1997). The Light Measurement Handbook. Technical Publications Dept., International Light, Inc.
10. DDC Architecture and Engineering Division. Manual for Quality, Energy Efficient Lighting. NYC Department of Design and Construction.
11. Bureau of Indian Standards. (1972). Indian Standard Code of Practice for Industrial Lighting. BIS, New Delhi.
12. L. Halonen, E. Tetri, and P. Bhusal. (2010). Guidebook on energy efficient electric lighting for buildings. Espoo, Finland: Department of Electrical Engineering, Aalto University.
13. Bureau of Indian Standards. (2016). SP 7 : National building code of India 2016, Vol. 2, Part 8 Building Services, Section 1 Lighting and Natural Ventilation. BIS, New Delhi.
14. Bureau of Energy Efficiency. (2017). Energy Efficiency Building Code. ECBC.
15. The California State University. (2018). Outdoor lighting design guide.
16. ZUMTOBEL (n.d.) Light for Outdoor and Architecture.

CE2217 | Design of Reinforced Concrete Structures | 3 credits

Course Duration	Contact periods	Full Marks
13 weeks	3 lectures per week	100

COURSE EVALUATION

(a) Internal Assessment: 50% [Mid-Semester Examination - 30%; Teacher's Assessment: 20%, having the components class tests, quizzes, assignments, viva-voce, presentations etc. as per teachers' discretion].
(b) End-Semester Examination: 50%.

MODULAR DIVISION OF THE SYLLABUS

MODULE	MODULE NAME AND TOPICS	LECTURE PERIODS
1	Introduction to various loading on structures; design philosophies of working stress method and limit state method.	5
2	Design and detailing of singly reinforced and doubly reinforced beam, concept of development length, anchorage, lintel and chajja, Use of SP-16.	7
3	Design and detailing of one-way and two-way slab, concept of torsion steel in two-way slab, deflection criteria.	6
4	Design and detailing of axially loaded column, Introduction to long column and bi-axial bending, use of SP-16.	4
5	Design and detailing of isolated footing under axial and eccentric load, combined footing.	5
6	Introduction to design of pile, pile-cap, raft, grid slab, shells.	6
7	Introduction to pre-stressed concrete.	3
8	Ductile detailing provisions for design under earthquake.	3

RELEVANT IS CODES

1. IS: 456: 2000, Plain and Reinforced Concrete - Code of. Practice, BIS.
2. SP 16: Design Aids for Reinforced Concrete to IS 456:1978, BIS.
3. IS: 875 Part I and II, Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures. Part 1: Dead Loads, Part 2: Live load.
4. SP: 34(1987): Handbook on Concrete Reinforcement and Detailing, BIS.

SUGGESTED READINGS

1. Devdas Menon and S. Pillai. Reinforced Concrete Design. Mc Graw Hill.
2. N. Subramaniam. Design of Reinforced concrete Structures. Oxford University Press.
3. J N Bandyopadhyay. Design of Concrete Structures. PHI.
4. Verghese. Limit State Design of Reinforced Concrete. PHI.
5. IS 1893-Part 1: 2016 on CRITERION FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES, Part 1 General Provisions and Buildings, (Sixth Revision), BIS, New Delhi.
6. IS 13920: 2016. (Reaffirmed 1998). Edition 1.2. (2002-03). Indian Standard. DUCTILE DETAILING OF REINFORCED. CONCRETE STRUCTURES. BIS, New Delhi.

AP2271 | Architectural Design Studio - III | 6 credits

Course Duration	Contact periods	Full Marks
13 weeks	9 studio classes per week	200

COURSE OBJECTIVE

The objective of this course is to facilitate the development of necessary skills in the student to be able to design lodging facilities and assembly buildings, both at their moderate hierarchy, incorporating interrelationships between internal and external spaces, functional uses of space, climatic and aesthetic considerations, and volumetric study of built form and building materials and their applicability in design. Understanding of plumbing services is to be incorporated conceptually.

COURSE OUTCOME

On successful completion of this course, the students will acquire fair skills to design medium sized lodging-rooming facilities, and moderately complex assembly spaces.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	STUDIO PERIODS
1	Design Assignment 1	54 (6 weeks)
2	Time Sketch	09 (1 week)
3	Design Assignment 2	54 (6 weeks)

DETAIL COURSE CONTENT

The students are required to undertake two architectural design assignments and one time-sketch (without repetition) from amongst the following broad topics representing four sub-occupancies of the National Building Code of India 2016:

- Lodging and rooming houses like inns, clubs, motels, guest houses etc.
- Dormitories like school and college dormitories, students' and other hostels, youth hostels, military barracks etc.
- Hotels, resorts up to 3 star category.
- Medium sized assembly buildings like socio-cultural facilities (club, community halls etc.), art galleries, places of worship, museums, lecture halls, intra-city bus terminus, sports facilities (swimming pool, billiard parlour, bowling alleys, gymnasiums, indoor tennis court etc.

The studio work undertaken shall emphasize behavioural, functional, climatic and aesthetic considerations in architectural design. The minimal duration of a design assessment, other than the time sketch, shall not be less than five weeks. The final submission of drawings will generally consist of site plan, different floor and roof plans, relevant elevations/sections, necessary details, model(s) and./or views, along with a sheet showing plumbing services provided for one of the assignments.

EVALUATION SCHEME

Preferably 3 reviews shall be organized for each assignment excluding the time sketch. The reviews should preferably involve the practising Architects and allied professionals as external examiners. Marks of each review shall be communicated to the students on regular basis as a part of continuous evaluation. Indicative evaluation scheme of an assignment may be as follows:

(a) Study and design programming (10-20%),

(b) Concept and design development (30-40%),

(c) Final Submission (30-40%), and,

(d) Studio performance (10-20%).

The marks allotted to each module may be as follows:

Module 1: 90 marks | Module 2: 20 marks | Module 3: 90 marks.

However, the faculty-in-charge may change the marks allocated to different modules, if it is required to give more emphasis to one design assignment than the other.

REFERENCE BOOKS

1. Bureau of Indian Standards. National building Code of India 2016, Volume 1, Part 3. BIS, New Delhi.
2. J de Chiara and J. Callender. Time-Saver Standards for Building Types, 3rd Ed. McGraw-Hill.
3. D. Watson, M.J. Crosbie, and J. Callender. Time-Saver Standards for Architectural Design Data. McGraw-Hill.
4. Ernst and Peter Neufert. Architects' Data, 3rd Ed. Blackwell Science

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AP2272 | Details of Construction Practice - III | 2 credits

Course Duration	Contact periods	Full Marks
13 weeks	3 studio classes per week	100

COURSE OBJECTIVE

The objective of this course is to understand the construction details of advanced building components learnt in the corresponding theoretical course.

COURSE OUTCOME

On successful completion of this course, the students will be able to:

(i) have a fair idea of various alternate detailing of building components such as facade system, partition wall, cladding, false ceiling etc.;
(ii) prepare details in Working Drawing which is included in forthcoming semester; and,
(iii) propose innovative details for interior finishes.

COURSE EVALUATION

Continuous evaluation of students' work executed through drawing sheets etc. will be undertaken by the course teacher, who will inform the students about the weightages of evaluation for different assignments at the start of the semester.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	STUDIO PERIODS
1	Partition Walls	9
2	False Ceilings	6
3	Curtain Walls	9
4	Wall Cladding	6
5	Joints in structures	9

DETAIL COURSE CONTENT

Module 1 Partition Walls **9 periods**

1.1 Different types of partition walls showing typical openings in suitable scale, minimum scale being 1:25.
1.2 Suggested types are: Brick, Hollow block, Metal, Glass, Drywall etc.

Module 2 False Ceilings **6 periods**

2.1 Details of suspended type false ceilings in suitable scale, minimum scale being 1:25.
2.2 Explanation through hands-on and/or installation video.

Module 3 Curtain Walls **9 periods**

3.1 Details of curtain wall showing typical openings in suitable scale, minimum scale being 1:25.
3.2 Suggested types are: Stick or unitized or semi-unitized.
3.3 Explanation through hands-on and/or installation video.

Module 4 Wall Cladding **6 periods**

4.1 Details of wall cladding in suitable scale showing edges, openings etc. in suitable scale, minimum scale being 1:25.
4.2 Suggested materials: timber, metal, tiles etc.
4.3 Explanation through hands-on and/or installation video.

Module 5 Joints in Structures **6 periods**

5.1 Suggested list: Expansion Joints, Construction Joints, Sliding Joints, Isolation joints, Seismic joints, Settlement joints etc.
5.2 Details of treatment and finishing.

REFERENCE READINGS

1. S.P. Arora and S.P. Bindra. (2010). A Text Book of Building Construction. Dhanpat Rai Publications.
2. S. Bliss. (2005). Best Practices Guide to Residential Construction: Materials, finishes, and details. Wiley.
3. R. Chudley, and R. Greeno. (2014). Building Construction Handbook- 10th ed. Routledge
4. A.K. Jain and A.K. Jain. (2016). Building Construction- 11th ed. Laxmi Publications.
5. K.N. Jha. (2012). Formwork for Concrete Structures. Tata McGraw Hill Education Private Limited.
6. S. Kumar. (2010). Building Construction. Standard Publisher.
7. A.J. Macdonald. (2018). Structure and Architecture, 3rd ed. Routledge.
8. P.C. Varghese. (2017). Building Construction, 2nd ed. Prentice' Hall of India Private Limited.
9. A. Watts. (2014). Modern Construction Envelopes. Birkhäuser / Springer.

ADDITIONAL RESOURCES

Site visits or online videos of installation work.

AP2273 | Landscape and Site Planning Practice | 2 credits

Course Duration	Contact periods	Full Marks
13 weeks	**3 studio classes per week**	**100**

COURSE OBJECTIVE

The objective of this course is to introduce a student to the practical aspects of the theoretical course AP2103 learnt in the previous semester.

COURSE OUTCOME

On successful completion of this course, the students will be:

(i) familiar with approaches for handling a landscape project in specific cases in connection with planning, management and financial involvement; and,

(ii) able to develop landscape solutions for residential/commercial/recreational uses.

COURSE EVALUATION

Continuous evaluation of students' work executed through drawing sheets etc. will be undertaken by the course teacher, who will inform the students about the weightages of evaluation for different assignments at the start of the semester.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	STUDIO PERIODS
1	Documentation and Design Solution for an Existing Landscape	9
2	Design of a Roof Garden	10
3	Landscape Design for a Commercial Setting	10
4	Landscape Design for a Recreational Setting	10

REFERENCE READINGS

1. C.W. Harris and N.T. Dines. Time-saver Standards for Landscape Architecture, 2nd Ed. McGraw-Hill Publishing Co.
2. Urban Greening Guidelines, 2014. http://www.indiaenvironmentportal.org.in/content/388807/urban-greening-guidelines-2014.

ADDITIONAL READINGS

1. IRC 103-2012: Guidelines for Pedestrian Facilities (First Revision). The Indian Road Congress.
2. IRC SP-12-2015: Guidelines for Parking Facilities in Urban Roads" (First Revision). The Indian Road Congress.
3. RC SP-21-2009: Guidelines on Landscaping and Tree Plantation. The Indian Road Congress.

CE2287 | Surveying Practice | 2 credits

Course Duration	Contact periods	Full Marks
13 weeks	**3 practical classes per week**	**100**

COURSE EVALUATION

Continuous evaluation of students' work by the course teacher, who will inform the students about the weightages of evaluation for different components at the start of the semester.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	NO. OF WEEKS (ONE CLASS OF 3 PERIODS DURATION PER WEEK)
1	Introduction - surveying equipment - basic measurement	1
2	Types of Surveys – Chaining – Compass – Levelling - Theodolite surveying - Surveying through Total Station equipment	8
3	Setting out building - Setting out highway curve	4

REFERENCE READINGS

1. C.W. Harris and N.T. Dines. Time-saver Standards for Landscape Architecture, 2nd Ed. McGraw-Hill Publishing Co.
2. Urban Greening Guidelines, 2014. http://www.indiaenvironmentportal.org.in/content/388807/urban-greening-guidelines-2014.

ADDITIONAL READINGS

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3. RC SP-21-2009: Guidelines on Landscaping and Tree Plantation. The Indian Road Congress.

AP2291 | Educational Tour – I | 2 credits

Field Trip	Full Marks	Credit
12 days	50	2

COURSE OBJECTIVE

Educational Tour is an integral part of architectural education in India and abroad. By undertaking the Tour in different parts of the country, the course is able to make the students, coming from different geographical and socio-economic backgrounds of India and abroad, aware of the architectural styles, materials used, and the context for the architectural developments of different buildings of historical and contemporary interest through first-hand experience.

COURSE OUTCOME

On successful completion of this course, the students will have a fair idea of translation of design philosophies to actual projects and thereby supplement the theoretical lectures to some extent.

MODULAR DIVISION OF THE SYLLABUS

MODULE	TOPIC	DURATION
1	Field work	During Field Trip
2	Tour Report	After returning from Field Trip
3	Seminar and Viva-Voce	After returning from Field Trip

DETAIL COURSE CONTENT

Module 1 Field Work

The students are required to undertake an Educational Tour in places of architectural interest of approximately 12 days duration including the days of journey, under the supervision of faculty-in-charge(s) nominated by the Departmental Faculty Committee (DFC). The Tour is to take place immediately after completion of the Third Semester Examinations and to be completed preferably before the starting of the Fourth Semester. The tour itinerary, as adopted by the DFC on the recommendation of the faculty-in-Charge(s), needs to be approved by the competent authority.

The students are to undertake field trips under supervision of Faculty-in-Charge(s) at places of historic and contemporary architectural interest. They are required to carefully observe, analyse and document what they study through mapping, hand-sketching, measured-drawings, photography etc. The Field Work will be assessed based on the participation, background study, quality of primary documentation etc.

The itineraries of the fieldwork may be framed by the faculty-in-charge in an otherwise suitable manner, in case of any exigency, force majeure, affecting the participants of the tour.

Module 2 Tour Report

The students are required to submit a Tour Report after returning from Field Trip. It will be assessed on the basis of exhaustiveness of the documentation, quality of the submission in terms of content, presentation, references, originality etc.

Module 3 Seminar and Viva-Voce

The students will present a Seminar based on the Tour Report that they have submitted. They will be evaluated through viva-voce after the Seminar presentation.

EVALUATION SCHEME

The marks may be allotted to each module as follows:

Module 1 (Field Work): 20-30 marks
Module 2 (Tour Report): 10-15 marks
Module 3 (Seminar and Viva-Voce): 10-15 marks.