INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: Architecture and Planning

1. Subject Code: **ARC - 103** Course Title: **Foundation Studio - 1**

2. Contact Hours: L: **1** T: **1** D: **4**

3. Examination Duration (Hrs.): Theory: **0** Practical: **7**

4. Relative Weightage: **CWS: 0** **PRS: 80** **MTE: 20** **ETE: 0** **PRE: 0**

5. **Credits: 4** 6. Semester: **Autumn** 7. **Subject Area: PCC**

8. **Pre-requisite:** Nil

9. **Objective**: To develop fundamental skills for architectural graphics, basic design and creative thinking

10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction to Architecture**: Definitions, distinct aspects; Interlinkages between architecture, nature and culture; Architectural education	2
2.	**Architectural Graphic Fundamentals:** Lines, lettering and dimensioning; Architectural graphic symbols for materials and architectural elements	2
3.	**Orthographic Projections:** Principles and methods for third angle orthographic projections of straight lines, planes, solids; Development of surfaces; Section of solids	4
4.	**Study of Basic Design Elements:** Lines, plane, solids, and their inter-relationship	2
5.	**Study of Space and Form**: Study of space, scale, proportion, light, colour, texture; Study of elementary two dimensional shapes and three dimensional forms	2
6.	**Spatial Organization:** Perception of spaces through design elements and their organization, interactions, abstraction and conception; Space composition; Models	2
	Total	14

11. Suggested Books:

S. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Bhatt, N.D. and Panchal, V.M. and Ingle, P.R. "Engineering Drawing – Plane and Solid Geometry", 53rd Ed., Jain Book Agency	2019

2.	Kieran, S. and Timberlake, J., "Elements of a New Architecture", Princeton Architectural	2008
3.	Dunn, N., "Architectural Model Making", Lawrence King Publishing Ltd., London	2010
4.	Ching, F.D.K., "Architectural Graphics", John Wiley, Standard Edition	2015
5.	Ching, F.D.K., "Architecture: Form, Space and Order", John Wiley	2015
6.	Van Verkel, Ben, Architectural Model lead to Design, Damdi Publishing	2010

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture & Planning

1. **Subject Code:** ARC-101 **Course Title:** Computer Programming for Architects

2. **Contact Hours:** **L:** 2 **T:** 0 **P:** 2

3. **Examination Duration (Hrs.):** **Theory:** 3 **Practical:** 0

4. **Relative Weightage: CWS:** 20-30 **PRS:** 20-30 **MTE:** 20-30 **ETE:** 20-30 **PRE:** 0

5. **Credits:** 4 **6. Semester:** Autumn **7. Subject Area:** PCC

8. **Pre-requisite:** Nil

9. **Objective:** To familiarise with fundamentals of computer programming using C++ and basics of data structure.

10. **Details of Course:**

S. No.	Contents	Contact Hours
1.	**Introduction:** Computer architecture, operating system and programming language; conversion between binary, octal and hexadecimal numbers.	**2**
2.	**Introduction to C++ programming:** the structure of a program files like including header, hash definitions, main and other functions like printf, scanf, cin, cout etc., function call, comments, compiling, linking and debugging a program. Good practices in programming in order to minimize bugs like appropriate tabs etc.	**4**
3.	**Variables, operators and statements:** Data types, operators, type conversion, variables naming convention and definition, local, global and static variables, static variables defined in another program file, multidimensional arrays and pointers, expressions and lvalue, statement, null statement	**4**
4.	**Decision making:** comparison operators, statement block, compound condition, if, else if, else, switch statements.	**4**
5.	**Looping:** while, do while, for, break, comtinue, goto statements	**2**
6.	**Functions:** function declaration, definition and call. Void function, inline function, function overloading, recursive function, default argument, variable argument, standard C++ library functions.	**6**
7.	**Arrays, pointers and references:** pointers, defining and initializing array, array index, multidimensional array, accessing array elements using pointers. Reference and dereference operators, references, dynamic memory allocation, argument passing and return values using pointers and references in functions, arrays of pointers, pointer to array, pointer to pointer, pointer to function, string handling standard library functions.	**8**

8.	**Object oriented programming using C++:** structure, class, object, access specifiers (public and private), constructor and initialization list, destructor, copy constructor, default constructor and destructor, friend function, static data members, static function members, pointer to objects, function overloading, operator overloading, composition and inheritance, access specifier (protected), overriding inherited members, virtual function and polymorphism, pure virtual function, virtual destructor, abstract classes, exception handling, templates, stream input/output and file processing	**8**
9.	**Data structure and algorithms:** stack, linked list, searching and sorting algorithms.	**4**
Total		**42**

11. Suggested Books:

S. No.	**Name of Authors/Book/Publisher**	**Year of Publication/Reprint**
1.	Hubbard J.R., Programming with C++, Tata McGraw Hill	2009
2.	Stroustrup B., The C++ programming language, AT&T	1997
3.	Malik D.S., Data structure using C++, Cengage Learning	2010

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-102 **Course Title:** Foundation Studio - II

L-T-P: 1-1-4 **Credits:** 4 **Subject Area:** PCC

Course Outline: Isometric and Axonometric Views; Perspectives; Sciography; Architectural plans, elevations and sections, Colour fundamentals and colour psychology; Visual Art and three-dimensional forms

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-201 **Course Title**: Architectural Design Studio-I

L-T-P: 1-2-4 **Credits:** 5 **Subject Area:** PCC

Course Outlines: Study of anthropometry and its association with built environment; Understanding space and its volumetric sense through various configurations; Exploring form alternatives with a sense of visual appeal; Interrelationships of form and function; Expressing design idea/s through presentation drawings/sketches/models.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-203 **Course Title:** Building Materials & Construction-II

L-T-P: 1-0-4 **Credits:** 3 **Subject Area:** PCC

Course Outlines: Fundamentals of building foundation- shallow foundation and deep foundation; Temporary structures- shoring, scaffolding, centering; Damp-proofing and Water proofing of buildings - contemporary materials and technologies; Construction of staircase-types, materials and detailing; Construction of openings - Doors and Windows, typologies, materials and detailing; construction site visits and case studies.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-205 **Course Title:** History of Architecture-I

L-T-P: 2-1-0 **Credits:** 3 **Subject Area:** PCC

Course Outlines: Introduction to history of architecture; narratives of global architectural history; understanding of buildings and built environments as products of landscape; culture; material and construction technology; development of shelters and funerary architecture in primitive times; architecture of ancient civilizations – Egypt; Mesopotamia; Classical architecture – Greek; Roman; Medieval Architecture – Early Christian, Romanesque, Byzantine and Gothic; Architecture in Renaissance; Baroque and Rococo; Oriental architecture – Chinese and Japanese.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

1. **Subject Code:** ARC-104 **Course Title:** Building Materials & Construction-I
2. **Contact Hours:** **L:** 1 **T:** 0 **P:** 4
3. **Examination Duration(Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 0 **PRS:** 60 **MTE:** 20 **ETE:** 0 **PRE:** 20
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** To introduce building materials, their properties and applications, alongwith related construction techniques.
10. **Details of the Course:**

S.No.	Contents	Contact Hours
1.	**Introduction**: Basic building materials and components such as foundation, plinth, wall, sill, lintel, roof, doors, windows, ventilators, staircases and sunshades etc; Construction terminologies	3
2.	**Masonry construction**: Constituents and properties of soil, brick and stone; Preparation, manufacturing and dressing of masonry units; Application in masonry construction	3
3.	**Masonry wall**: Wall construction in brick and stone; Types and joints; Hollow concrete and glass block construction; Light weight panel walls, pre-cast and stone panel walls; Decorative brick work and jali work	2
4.	**Lime and cement**: Sources, classification, properties, hydration, method of manufacture, testing, mixing and application.	2
5.	**Concrete**: Composition, properties and uses; Water cement ratio; Grade of concrete; PCC, RCC, light weight concrete, autoclaved aerated concrete, hollow concrete blocks; Admixtures	2
6.	**Timber:** Varieties of Indian timbers, characteristics and suitability for different uses, defects and decay, seasoning and preservation; Manufactured timber products and their application as insulation and decorative materials	2
Total		**14**

Suggested Exercises:

- Construction details of different components of a building
- Construction techniques of masonry bonds
- Construction techniques of corners and junctions
- Timber joinery

Site visits to ongoing construction project/s and masonry structures

Market surveys

11. Suggested Books:

S.No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	Mckay, W.B., "Building Construction- Vol. I", Longman	2005
2.	Simmons H. L, "Olin's Construction Principles, Materials and Methods", John Wiley and Sons	2007
3.	Ching F.D.K., "Building Construction Illustrated", 3rd Ed., John Wiley and Sons	2001
4.	Goyal, M.M., "Handbook of Building Construction", Thomson Press	2004
5.	Mehta, M., Scarborough, W. and Armpriest, Diane, "Building Construction: Principles, Materials and Systems", Pearson Prentice Hall	2008

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

1. **Subject Code:** ARC-106 **Course Title:** Climatology in Architecture
2. **Contact Hours:** **L:** 2 **T:** 1 **P:** 0
3. **Examination Duration(Hrs.):** **Theory:** 3 **Practical:** 0
4. **Relative Weightage:** **CWS:** 20-35 **PRS:** 0 **MTE:** 20-30 **ETE:** 40-50 **PRE:** 0
5. **Credits:** 3 **6. Semester:** Spring **7. Subject Area:** PCC
8. **Pre-requisite:** Nil
9. **Objective:** To impart knowledge of climatic elements, their influence on building design and passive design strategies.
10. **Details of the Course:**

S.No.	Contents	Contact Hours
1.	**Climatology**: Climatic zones, macro and micro climate; Climate elements; Heating and cooling of land and sea; Effect of topography; Climate Change	2
2.	**Climatic Elements:** Air temperature, Humidity, Solar Radiation, Wind and Precipitation; Diurnal and seasonal variations; Graphical representation of climatic elements; Tools for measurement; Interpreting climate data for design of buildings; Architectural design response to climate	4
3.	**Sun and Solar Radiation:** Apparent movement of sun; Solar radiation and intensity on surfaces and buildings; Sun path diagram; Design of shading devices; Tools and techniques for measurement and analysis	4
4.	**Site Climate:** Microclimate, site climate data, local factors, presence of water body and vegetation, topography, special characteristics, urban climate; Design response to site climate	2
5.	**Human Comfort**: Human heat balance and comfort; Thermal Stress; Design of buildings for human comfort; Bioclimatic Analysis	2
6.	**Thermal performance of Buildings**: Heat exchange through conduction, convection and radiation; Opaque systems and heat transfer through multi-layered envelope; Transparent systems; Thermal properties and thermal performance metrics; Energy demand in buildings and energy efficiency	4
7.	**Natural Ventilation and Air Movement:** Air movement in and around buildings; Cross ventilation, influence of opening size and positions, wind eddies; Consideration of wind movement in site planning	3
8.	**Daylighting:** Metrics for lighting quality; Effective utilization of daylight; Fenestration design for harnessing daylight; Tools and techniques for daylight evaluation	3
9.	**Passive and Low Energy Design:** Passive design strategies; Low energy cooling and heating technologies; Eco-friendly building materials; Case studies.	4
Total		**28**

11. Suggested Books:

S.No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
1.	Koenisberger, O.H., Ingersoll, T.G., Mayhew A., and Szokolay, S.V, "Manual of Tropical Housing and Building- Part I: Climatic Design", Orient Longman	2004
2.	Givoni, G., "Climatic Considerations in Building and Urban Design", Van Nostrand Reinhold	1998
3.	Hausladen, G., "Climatic Design: Solutions for Buildings that can do more with less Technology", Birkhauser	2005
4.	Bansal, N.K., Hauser, G. and Minke G., "Passive Building Design: A Handbook of Natural Climate Control", Elsevier Science.	1994
5.	Drake, S., "The Third Skin: Architecture, Technology and Environment", UNSW Press	2007
6.	Krishan, A., "Climate Responsive Architecture: A Design Handbook for Energy Efficient Buildings", Tata McGraw-Hill	2001
7.	Szokolay, S.V., "Introduction to Architectural Science: The Basis of Sustainable Design", Elsevier/Architectural Press	2008
8.	Bureau of Indian Standards (BIS)., "SP41: Handbook of Functional Requirements of Buildings"	1987

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-201 **Course Title**: Architectural Design Studio-I

L-T-P: 1-2-4 **Credits:** 5 **Subject Area:** PCC

Course Outlines: Study of anthropometry and its association with built environment; Understanding space and its volumetric sense through various configurations; Exploring form alternatives with a sense of visual appeal; Interrelationships of form and function; Expressing design ideas through presentation drawings/sketches/models.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-203 **Course Title**: Building Materials & Construction-II

L-T-P: 1-0-4 **Credits:** 3 **Subject Area:** PCC

Course Outlines: Fundamentals of building foundation- shallow foundation and deep foundation; Temporary structures- shoring, scaffolding, centering; Damp-proofing and Water proofing of buildings - contemporary materials and technologies; Construction of staircase-types, materials and detailing; Construction of openings - Doors and Windows, typologies, materials and detailing; construction site visits and case studies.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-205 **Course Title**: History of Architecture-I

L-T-P: 2-1-0 **Credits:** 3 **Subject Area:** PCC

Course Outlines: Introduction to history of architecture; Narratives of global architectural history; Understanding of buildings and built environments as products of landscape; Culture; Material and construction technology; Development of shelters and funerary architecture in primitive times; Architecture of ancient civilizations – Egypt; Mesopotamia; Classical architecture – Greek; Roman; Medieval Architecture – Early Christian, Romanesque, Byzantine and Gothic; Architecture in Renaissance; Baroque and Rococo; Oriental architecture – Chinese and Japanese.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-202 **Course Title**: Computer Aided Architectural Design Studio-II

L-T-P: 1-2-4 **Credits:** 5 **Subject Area:** PCC

Course Outlines: Computational tools for conceptual design, data analysis and representation during design process; 2-D, 3-D modeling, visualisation and rendering in different stages of design; Effective design presentation.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-204 **Course Title**: Building Materials & Construction-III

L-T-P: 1-0-4 **Credits:** 3 **Subject Area:** PCC

Course Outlines: Formwork; Beams and Columns; Slabs; False ceilings; Modular Kitchens; Quality check methods; Types of contracts; Methods of Estimation - Bill of Quantities; Analysis of Rates; Market survey; Preparation of Abstract estimates; Site visits; Advanced construction materials such as steel, aluminum, and glass - their properties and applications; Industrialized windows and doors; Various wall types; Suspended ceiling systems; Mild Steel (MS) frame structures, trusses, staircase construction principles; Building materials such as wood, stone, and steel.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-206 **Course Title**: History of Architecture-II

L-T-P: 2-1-0 **Credits:** 3 **Subject Area:** PCC

Course Outlines: Architecture of Indus Valley Civilization; Buddhist Architecture; Architecture of Gupta period; Early Chalukyan Architecture; Rashtrakuta Architecture; Hoysala Architecture; Orissan Architecture; Jain Architecture; Provincial Architecture - Kathiawari, Hemadpanthi, Khajoraho, Jaunpur, Malwa, Rajputana and Bijapur; Dravidian Architecture- Pallava, Chola, Pandyas, Nayaks,Vijayanagara; Indo-Islamic Architecture- Slave dynasties- Maluk, Tughlaq, Lodhi, Sayyed, Suri; Mughal Architecture in India.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-208 **Course Title**: Principles of Architecture

L-T-P: 2-1-0 **Credits:** 3 **Subject Area:** PCC

Course Outlines: Theories of Architecture and Design; Architecture as a systems concept; Form and function; Form and meaning; Visual perception; Gestalt law; Concepts of space; Spatial configurations and interrelationships; Abstraction in space; Theory of Proxemics and aesthetics; Elements of space design; Light, color and texture in design; Surface articulation; Types of forms and their visual properties; Volumetric compositions; Visual Principles of Design; Scale and proportioning systems; Culture and space; Social and environmental sustainability; Universal Design theory and principles; Ethnographic studies in design.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARC-210 **Course Title:** Landscape Design and Site Development

L-T-P: 2-0-2 **Credits:** 3 **Subject Area:** PCC

Course Outlines: Introduction to Landscape; Relationship between humans and nature; Experience of a landscape; Elements of designed landscape; Principles of landscape design; Landscape through the ages; Garden design – Chinese, Japanese, Italian, French, English and Islamic; Site inventory and appraisal; Site planning and landscape design process; Introduction to landform; Watershed; Grading; Planting techniques.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Architecture and Planning

Subject Code: ARL-304 **Course Title:** Industrialized Construction and Technology

L-T-P: 2-1-0 **Credits:** 3 **Subject Area:** OEC

Course Outlines: Basic terminology about Prefabrication, Precast, Pre-assembly, Modular Construction; Introduction to Industrialized construction, Automated systems and Manufacturing Environments; Large scale Construction Equipment; Basics of Construction Project management; Digitized Business models; Computer Integrated design; Digital Fabrication, 3D Building methods; Design Optimization and Planning; Component of Transportation and Inventory; Onsite Erection process; Health and Safety procedures.