

ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
REGULATIONS 2021

CHOICE BASED CREDIT SYSTEM

B. ARCH. FULL-TIME PROGRAMME
CURRICULUM AND SYLLABI FOR SEMESTER I & II

SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IP3151	Induction Programme	-	-	-	-	-	0
THEORY								
2.	AR3101	Introduction to Architecture	PCC	3	0	0	3	3
3.	AR3102	Introduction to Language and English Skills	SEC	3	0	0	3	3
4.	AR3103	Mathematics for Architects	BSC & AEC	3	0	0	3	3
THEORY CUM STUDIO								
5.	AR3121	Geometrical Understanding and Representation	PCC	1	0	3	4	4
6.	AR3122	Art as Cognition and Expression	PCC	1	0	3	4	4
STUDIO								
7.	AR3111	Foundational Design Studio	PCC	0	0	9	9	9
TOTAL				11	0	15	26	26

SEMESTER II

(Prerequisite - Pass in Foundational Design Studio)

S. NO.	COURSE CODE	COURSE TITLE	CATE- GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	AR3201	World Architecture and Urbanism: Early Civilisations to Renaissance	PCC	3	0	0	3	3
2.	AR3202	Structural Mechanics	BSC & AEC	3	0	0	3	3
3.	AR3203	Environmental Science for Architecture	BSC & AEC	3	0	0	3	3
4.		NCC Credit Course Level 1*	-	2	0	0	2	2
THEORY CUM STUDIO								
5.	AR3221	Building Components and their Representation	PCC	1	0	3	4	4
6.	AR3222	Thinking through Diagrams and Models	PCC	1	0	3	4	4
STUDIO								
7.	AR3211	Basic Space Design Studio	PCC	0	0	9	9	9
TOTAL				11	0	15	26	26

*NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. “

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don't's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:

Guide to Induction program from AICTE

AR3101

INTRODUCTION TO ARCHITECTURE

L T P / S C
3 0 0 3

OBJECTIVES

- To give understanding of architecture as an outcome of the act of design by human society across history and region.
- To give an introduction to the discipline of architecture and its various facets.
- To introduce importance of form and its relation to design through study of nature and manmade environment.
- To introduce the vocabulary of form and space in terms of elements, principles, attributes and organisation as giving cognitive experience in the realm of architecture.

UNIT I INTRODUCTION TO ARCHITECTURE

9

Origin and definitions of architecture as need based, cultural, environmental, social, psychological response of human society. Architecture as phenomenological mediation of nature. Components of architecture: use, means, site, shelter, relation to nature, structure, skin, materials, services,

circulation, typology, aesthetics, expression, character, symbolism, experience, etc., History and types of design in architecture- unself-conscious/ self-conscious design, design through craft/ design through drawing, pragmatic/ iconic/ canonic/ analogic design.

UNIT II FORM IN NATURE AND MANMADE ENVIRONMENT

9

Understanding form in all its attributes as the basis of creating architecture. Characteristics of form and its relationship with use/function/evolution as manifested in first hand examples from nature and everyday manmade environment including artefacts, objects buildings, cityscapes. Human body and sensory environment. Cognitive experience of form- ideas of Gestalt, visual perception, proxemics. Tactile, auditory, olfactory senses and human environment.

UNIT III FORM AS GEOMETRIC ELEMENTS AND THEIR EFFECTS

9

Form as embodied in and/or constituted by geometric elements such as point, line, plane, volumes. Attributes, generation and interrelationships among elements. Perceptual effects and use of specific manifestations of the elements- planes as shapes and volumes as geometric forms/space such as sphere, cube, pyramid, cylinder, cone and their sections/ derivatives. Architectural use of elements. Exercises and architectural case studies.

UNIT IV ATTRIBUTES AND PRINCIPLES OF FORM

9

Form as manifesting attributes such as pattern, light, colour, surface, texture. Effects of these attributes. Form in its basic state, in combinations, composite organisations and configurations as manifesting characteristics such as proportion, scale, balance, symmetry, asymmetry, rhythm, axis, hierarchy, datum, unity, harmony, dominance, climax, focus. Characteristics acting as principles to generate architectural design. Exercises and architectural case studies.

UNIT V ORGANISATION OF FORM AND SPACE

9

Cognitive experience of form and space in architecture –enclosure, internal and external spaces, continuous spaces, hierarchy of spaces, spatial organisation (centralised, linear, radial, clustered, grid), built form- open space relationships. Relationship of movement/ circulation/ path with reference to architectural form and space. Haptic experience. Exercises and architectural case studies.

TOTAL:45 PERIODS

OUTCOMES

- Ability to recognise different facets of architecture.
- Basic understanding of form and design in all aspects and scales.
- Ability to discern the relationship between manifestations of form and its effects on humans.

REQUIRED READING

- Geoffrey Broadbent, 'Design in Architecture - Architecture and the Human Sciences', D.Fulton, 1988.
- Francis D.K. Ching, 'Architecture-Form, Space and Order', Van Nostrand Reinhold Company, New York, 2007.
- Simon Unwin, 'Analysing Architecture', Routledge, London, 2003.
- V.S. Pramar, 'Design Fundamentals in Architecture', Somaiya Publications Private Ltd., NewDelhi, 1973.
- Yatin Pandya, 'Elements of Space Making', Mapin, 2008.
- Francis D.K. Ching, James F. Eckler, 'Introduction to Architecture', Wiley, 2012.
- Robert McCarter, JuhaniPallasmaa, 'Understanding Architecture', Phaidon 2012.
- Anthony C. Antoniadis, 'Poetics of Architecture: Theory of Design', John Wiley and Sons,1992.

REFERENCES

1. Pierre von Meiss, 'Elements of Architecture: From Form to Place', Routledge, 1990.
2. Rudolf Arnheim, 'The Dynamics of Architectural Form', University of California Press 2009.
3. NeilsPrak, 'The Language of Architecture', De Gruyter Mouton,2017.

4. Leland M. Roth, 'Understanding Architecture, its Experience, History and Meaning', Routledge, 2018.
5. Hazel Conway, 'Understanding Architecture: An Introduction to Architecture and Architectural History', Routledge, 2005.
6. Paul Alan Johnson, 'The Theory of Architecture – Concepts and Themes', Van Nostrand Reinhold Co., New York, 1994.
7. Kumar Vyas, 'Design and Environment- A Primer', National Institute of Design, 2009.

AR3102 INTRODUCTION TO LANGUAGE AND ENGLISH SKILLS

L T P / S C
3 0 0 3

OBJECTIVES

- To give an introduction to the concepts and evolution of language in human society including its various expressions and functions
- To give basic skills of English language in everyday situations involving speaking, listening, reading, writing, presenting.
- To enable the use of language to think, express experience and communicate larger meaning.

UNIT I INTRODUCTION TO LANGUAGE AND LINGUISTICS

9

Communication in humans and animals. Language in humans– definition, function and hypotheses of evolution. Some concepts of language- Phonetics, Phonology, Morphology, Syntax, Semantics, Pragmatics.

UNIT II ENGLISH- SPEAKING AND LISTENING

9

Everyday communication and human interaction through language. Speaking and listening. Simple class exercises.

UNIT III ENGLISH- READING, WRITING, PRESENTING

9

Reading and writing. Language comprehension skills through reading and writing. Presenting information and ideas. Simple exercises.

UNIT IV LANGUAGE AS EXPRESSION AND COGNITION

9

Language as expression – poetry, prose, literature, etc., Cognitive function of language. Cognitive role of language in constructing reality, abstracting, projecting the future. Simple exercises.

UNIT V LANGUAGE AS DISCOURSE

9

Thinking, talking and writing about ideas and situations within a social context and conveying broader meaning and abstraction. Discourse, dialectic. Simple class exercises.

TOTAL: 45 PERIODS

OUTCOMES

- An understanding of basic role of language in humans.
- Skill and confidence in everyday requirements of the English language.
- Ability to express experience, explore meaning and construct reality through language.

REQUIRED READING

- Sharon Hendenreich, 'English for Architects and Civil Engineers', Springer, 2014
- www.cambridgescholars.com
- www.robertdwatkins.com/Englishworkbook.pdf
- N. Chomsky, 'Reflections on Language', Fontana, 1975.

- Steve Pinker, 'The Language Instinct', Penguin, 2015.
- R.L. Trask, 'Language and Linguistics: The Key Concepts', Routledge, 2007.
- R.L. Trask, 'Language: The Basics', Routledge 1999

REFERENCES

1. Chris Mounsey, 'Essays and Dissertation', Oxford University Press, 2005.
2. Sidney Greenbaum, 'The Oxford English Grammar', Oxford University Press, 2005.
3. Krishna Mohan and Meera Banerji, 'Developing Communication Skills', 2nd edition, Laxmi Publications, 2009.

AR3103

MATHEMATICS FOR ARCHITECTS

L T P/S C
3 0 0 3

OBJECTIVES

- To help derive solutions involving trigonometric and exponential functions in practical problems.
- To inform about three dimensional analytical geometry.
- To enable understanding of functions of more than one variable.
- To give information to solve differential equation of certain type.
- To enable data analysis and interpretation of results using statistical tools.

UNIT I TRIGONOMETRY AND MENSURATION

9

Trigonometric (sine, cosine and tan functions) and exponential functions. De- Moivre's theorem. Area of plane figures. Computation of volume of solid figures.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY

9

Direction cosines and ratios. Angle between two lines. Equations of a plane. Equations of a straight line. Coplanar lines. Shortest distance between skew lines. Sphere, Tangent plane, Plane section of a sphere.

UNIT III INTEGRATION AND FUNCTIONS OF TWO VARIABLES

9

Integration of rational, trigonometric and irrational functions. Properties of definite integrals. Reductions formulae for trigonometric functions. Taylor's Theorem - Maxima and Minima (Simple Problems).

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS

9

Linear equations of second order with constant coefficients. Simultaneous first order linear equations with constant coefficients. Homogeneous equation of Euler type. Equations reducible to homogeneous form.

UNIT V BASIC STATISTICS AND PROBABILITY

9

The arithmetic mean, median, mode, standard deviation and variance. Regression and correlation. Elementary probability. Laws of addition and multiplication of probabilities. Conditional probability. Independent events.

TOTAL: 45 PERIODS

OUTCOME

- Ability to understand the mathematical properties of geometric figures and objects.
- Skill in solving mathematical problems that would be useful for the field of architecture.
- Ability to analyse and interpret data.

REQUIRED READING

- Grewal B.S., 'Higher Engineering Mathematics', Khanna Publishers, New Delhi, 44th Edition, 2011.

REFERENCES

- Bali N., Goyal M. and Watkins C., 'Advanced Engineering Mathematics', Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
- Ramana B.V., 'Higher Engineering Mathematics', Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
- Greenberg M.D., 'Advanced Engineering Mathematics', Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
- Gupta S.C and Kapoor V.K., 'Fundamentals of Mathematical Statistics', Sultan Chand and Sons, New Delhi, 9th Edition, 1996.

AR3121	GEOMETRICAL UNDERSTANDING AND REPRESENTATION	L T P/S C
		1 0 3 4

OBJECTIVES

- To introduce geometrical understanding as one of the bases of architecture.
- To give an understanding of basic and derived geometry of form in terms of their generation and attributes.
- To give skills of representation of forms in terms of technical drawing and projections.

UNIT I

10

Relation between geometry and form. Introduction to point, line, plane, solid. Definition of geometrical drawing. Drawing lines and angles. Drawing shapes/ planar surfaces - triangle, square, rhombus, rectangle, polygon, hexagon, etc). Drawing of circles, tangents, curves, conic sections (hyperbola, parabola, ellipse).

Construction of physical planar models of all the above. Viewing the physical planar models from different angles and sketching them with light and shade, shadow as a prelude to understanding the concepts of different types of projections and sciography. Introduction and explanation of terminologies - orthographic, isometric, axonometric, perspective projections and sciography.

UNIT II

20

Drawing problems on orthographic, isometric and axonometric projections of lines and planes of different types in different positions. Sciography for the same.

Types of perspective projections- one point, two point, three point. Terminologies- picture plane, stationary point, vanishing point, cone of vision, eye level, etc., Methods of constructing perspectives.

Drawing perspective projections of simple planar surfaces/ shapes. Sciography for the same.

UNIT III

20

Introduction to geometric solids- cube, prism, pyramids, cones, cylinders. Generation of geometric solids through construction of physical models from lines and planar surfaces (including concept of development). Construction of block models of solids. Viewing the models from different angles and sketching them with light and shade, shadow in order to understand them in different types of projections.

Drawing problems on orthographic, isometric and axonometric projection of solids of different types in different positions. Sciography for the same.

Perspective projection of simple solids. Sciography for the same.

UNIT IV

10

Understanding sections of solid and true shape of sections through cutting of block models, viewing them from different angles and sketching them. Understanding simple intersection of solids and composite forms through making block models and viewing them from different angles and sketching them.

Simple drawing problems on orthographic, isometric and axonometric projection of the above.

TOTAL: 60 PERIODS

OUTCOME

- Ability to understand the relationship between geometry and architectural form.
- Understanding of various attributes of geometric forms and skill in their creation and dissection.
- Ability to represent geometric forms through technical drawings.

REQUIRED READING

- Morris I.H., 'Geometrical Drawing for Art Students', Orient Longman, Madras, 2004.
- Francis D. K. Ching, 'Architectural Graphics', John Wiley and Sons, 2012.
- Natarajan K.V., 'A Textbook of Engineering Graphics', Dhanalakshmi Publishers, Chennai, 2006

REFERENCES

1. Leslie Martin C, 'Architectural Graphics', The Macmillan Company, New York, 1978.
2. Fraser Reekie, 'Reekie's Architectural Drawing', Viva Books Private Limited, 1999.
3. Roger Burrows, '3D Thinking in Design and Architecture', Thames and Hudson, 2018.

AR3122

ART AS COGNITION AND EXPRESSION

L T P / S C
1 0 3 4

OBJECTIVES

- To give understanding of the role and importance of art as a means of understanding the world.
- To give skills in techniques and media of art.
- To enable expression of ideas, thoughts and experience through various visual modes both in terms of realism and abstraction.

UNIT I INTRODUCTION TO ART

10

Origin and evolution of art as human cognition, representation, expression. Role of art. Understanding representation in art - naturalistic, realistic, symbolic, stylistic, abstract, non-objective art, etc., through study of important works across history from different cultures of the world. Simple studio exercises in basic modes of representation through observation or thought.

UNIT II ART AS OBSERVATION AND RECORDING OF HUMAN EXPERIENCE

20

Properties and uniqueness of different media for art. Studio exercises to observe and record the nature of simple indoor and outdoor subjects through techniques of line, colour, light and shade, texture, etc., using different media- drawing, sketching, painting, sculpture, watercolour, tempera, oil, acrylic, pencils, pastels, crayons, paper, canvas, brush, airbrush, pen and ink, mixed media, clay, Plaster of Paris, wire, papiermache.

UNIT III ART AS HEIGHTENED REPRESENTATION OF REALITY

15

Understanding role of art in heightening reality through accentuation of line, colour, light and shade, texture, emphasis, contrast, balance, etc., by the study of examples from world of art. Studio exercises to understand and bring out the essential characteristics of landscapes, people, places, built environment, situations and objects by heightened reality through appropriate ideas/tools/techniques.

UNIT IV ART AS ABSTRACTION OF REALITY

15

The power and role of abstraction as a way of expressing experience and reality through understanding exemplary artists' works and art movements. Studio exercises in abstract expression of real environment, thoughts and emotions through any appropriate media and technique.

TOTAL: 60 PERIODS

OUTCOME

- Sensitivity and knowledge of art as basic human endeavour.
- Ability and skill to record experience through art.
- Ability to abstract thought, observation and experience through art.

REQUIRED READING

- E.H. Gombrich, 'Art and Illusion', Phaidon, 2002.
- E.H. Gombrich, 'The Story of Art', Phaidon, 2002.
- ParthaMitter, 'Indian Art', Oxford University Press, 2001.
- Nathan Cabot Hale, 'Abstraction in Art and Nature', Dover, 2003.
- Robert L. Solso, 'Cognition and the Visual Arts', MIT Press, 1994.
- Webb, Frank, 'The Artist Guide to Composition', David and Charles, U.K., 1997.
- Francis Ching, 'Drawing a Creative Process', Van Nostrand Reinhold, New York, 1990.
- Lucy Watson, 'Complete Painting and Drawing Handbook', DK Adult, 2009.
- JuhaniPallasma, 'The Thinking Hand', John Wiley, 2009.

REFERENCES

1. Bernard S. Myers, 'Understanding the Arts', Holt Rinehart and Winston Inc, 1964.
2. Fred, S. Kleiner, 'Gardener's Art through Ages', Wadsworth Publishing, 2012.
3. John Dewey, 'Art as Experience', Penguin, 2005.
4. Wassily Kandinsky, Point and Line to Plane, Dover, 2013.
5. Alan Swann, Graphic Design School, Harper Collins, 1997.

AR3111

FOUNDATIONAL DESIGN STUDIO

L T P/S C
0 0 9 9

OBJECTIVES

- To give an understanding of design as creating form towards a purpose at various scales.
- To enable exploration of the universal visual, experiential and cognitive aspects of design through engaging elements and principles of form.
- To give an insight into the ways in which form/ morphology and use/effect can come together.

CONTENT

Architecture as a discipline starts with morphology as the answer to questions and needs of human society. While the needs are multifarious, including shelter and comfort, social and psychological wellbeing, culture and meaning, expression of time and context, etc., the means are negotiated through the fundamentals of form in its various attributes. In the foundational studio, the exploration would be on understanding these fundamentals as universals as well as in terms of particular manifestations in specific cultural and temporal contexts. The word form here means all physical manifested aspects.

The explorations in the foundational studio would be of two types. One would be to understand and break down form to its component elements and principles in order to get insight into the most important aspects that give a totality of cognitive effect(perceptive, behavioural, cultural etc.) or use (anthropometrics, activities, scale, etc.).Design exploration would continue after this to create a form for use/effect. Another would be to explore component elements like point, line, planes, volume, shape, colour, texture light, pattern, etc., using principles such as balance, unity, dominance, transparency, proportion, scale, solid, void, fluidity, movement, fractal, order, chaos, gestalt, etc., This exploration could be an end in itself or could lead to the creation of a higher level of or composite form/design through using elements and principles in conjunction towards human need/ use (perceptive, behavioural, cultural, anthropometrics, activities, scale, etc.).

The whole studio would be conducted through a series of related design exercises with multiple stages as well as standalone independent exercises. Observational/ analytical study and design exploration could go hand in hand or one could precede the other, based on the specific project. The exercises would be mediated through situations and contexts, historic and contemporary references, local or global character, aesthetics, basics of human response and behaviour, etc., Different media would be explored in 2D and 3D. The final exercise(s) would be focussed towards small product/ furniture/ architectural design/ component design in urban context, etc.,

TOTAL: 135 PERIODS

OUTCOME

- Awareness of the totality and components of form in the creation of design.
- Ability to explore the visual/ cognitive language and grammar of the universal elements and principles of design.
- Ability to understand needs as encompassing functional, behavioural, cultural, experiential, etc.,
- Ability to engage awareness towards creating a morphology that fulfils stated intents and needs.

REQUIRED READING

- Kumar Vyas, 'Design and Environment- A Primer', National Institute of Design, 2009.
- Pierre von Meiss, 'Elements of Architecture: From Form to Place', Routledge, 2014.
- James F. Eckler,' Language of Space and Form: Generative Terms for Architecture', Wiley, 2012.
- Owen Cappleman and Michael Jack Jordon, 'Foundations in Architecture: An Annotated Anthology of Beginning Design Project', Van Nostrand Reinhold New York, 1993.
- Charles Wallschlag and Cynthia Busic-Snyder, 'Basic Visual Concepts and Principles for Artists, Architects and Designers', McGraw Hill, New York 1992.
- Victor Papanek, 'Design for the Real world, Human Ecology and Social Change', Chicago Review Press, 2005.

REFERENCES

1. Taiji Miyasaka, 'Seeing and Making in Architecture: Design Exercises', Routledge, 2013.
2. V.S. Pramdar, 'Design Fundamentals in Architecture', Somaiya Publications, New Delhi, 1997.
3. Francis D. K. Ching, 'Architecture: Form Space and Order', Van Nostrand Reinhold Co., (Canada), 1979.

OBJECTIVES

- To introduce the timeline and geography of evolution of human society in order to set the context for the study of architecture and urbanism across the ages.
- To give knowledge about early civilisations and their productions.
- To enable an understanding of the contributions of Classical Greece and Rome.
- To enable understanding of the intersecting forces in Europe such as religion, trade, technology, etc from the decline of Roman empire to the Medieval period and the resultant architecture and urbanism.
- To create awareness of the emergence of Renaissance and humanism in Europe and the resultant architecture and urbanism.

UNIT I PREHISTORY TO RIVER VALLEY CIVILISATIONS**6**

Different ages of human history. Time line and geography of human civilisations. Elements and determinants of human settlements. Prehistoric habitats and art. River Valley civilisations of Nile, Indus, Tigris/Euphrates and Yellow river; their geographical context; their political, social, religious, cultural and economic systems; settlement patterns, dwellings and other buildings.

UNIT II PERSIA, GREECE AND ROME**10**

Early Persian empire, its cities and architecture.

Origin of Greek civilisation. Nature of settlements and dwellings. Political, social, religious, cultural and economic systems. Greek philosophy. Greek polis and democracy. Evolution of the Greek temple and the building of the Acropolis. Public architecture - Theatre and Agora. Other building types. Optical illusions in architecture

Origin of Roman civilisation. Nature of settlements and dwellings. Political, social, religious, cultural and economic systems. Republic and Empire. Urban planning. Domestic architecture. Architecture as imperial propaganda. Forums and basilicas. Other building types. Structural forms: materials and techniques of construction spanning large spaces.

Political empires of Persia, Greece and Rome and their larger effects.

UNIT III JUDAISM, CHRISTIANITY AND ISLAM**9**

Judaism and Christianity- Birth and geographic spread. Transformation of the Roman Empire. Early Christian worship and burial. Church planning-Basilican concept. Byzantine empire. Centralised plan concept in churches. Birth and spread of Islam in the first millennium. Outline of building types of Islam. Commonality in forms and ideas across Southern/ Eastern Europe and Western/ Central Asia.

UNIT IV MEDIEVAL EUROPE**10**

Outline history of medieval Europe- Population explosion, feudalism and rural manorial life, development of trade/ commerce and medieval cities, rise of nation states and technology of warfare, religious aspects- papacy, monasticism and crusades. Art and architecture in Medieval Europe. Craft and merchant guilds. Domestic Architecture. Romanesque and Gothic architecture including development of vaulting. Late medieval Europe and its problems.

UNIT V RENAISSANCE IN EUROPE**10**

Renaissance and Humanism in Europe, its causes and its various facets in society. Trade and exploration. Protestant Reformation. Cities and their transformation. Character and building types of Early Renaissance, High Renaissance, Mannerism, Baroque and Rococo. Renaissance in different nations. Works of Brunelleschi, Michelangelo, Christopher Wren, Andrea Palladio, Inigo Jones.

TOTAL: 45 PERIODS

OUTCOME

- An overall understanding of the timelines and early history of civilisations and their contributions across the world.
- Knowledge about the contributions of Greece and Rome to architecture and urbanism.
- Familiarity with the intersecting forces in Europe from decline of Roman empire to Medieval times and their manifestation in cities and architecture.
- An understanding of Renaissance and humanism and the resultant architecture and urbanism.

REQUIRED READING

- Ching, F. D. K., Jarzombek, M. and Prakash, V, 'A Global History of Architecture', 2nd Ed. John Wiley and Sons, 2010.
- Sir Banister Fletcher, 'A History of Architecture', CBS Publications (Indian Edition), 1999.
- Spiro Kostof, 'A History of Architecture – Setting and Rituals', 2nd Ed, Oxford University Press, 1995.
- Leland M Roth, 'Understanding Architecture: Its Elements, History and Meaning', Westview Press, 2013.

REFERENCES

1. David Watkin, 'A History of Western Architecture', Laurence King Publishing, 2015.
2. Pier Luigi Nervi, General Editor, 'History of World Architecture Series', Harry N. Abrams, New York, 1972.
3. S. Lloyd and H.W. Muller, 'History of World Architecture – Series', Faber and Faber, London, 1986.
4. Gosta, E. Samdstrom, 'Man the Builder', McGraw Hill Book Company, New York, 1975.
5. Vincent Scully, 'Architecture – The Natural and the Man Made', Harper Collins, 1991.

AR3202

STRUCTURAL MECHANICS

L T P/S C
3 0 0 3

OBJECTIVES

- To give familiarity about structural resolutions and its important in realisation of architectural design concepts
- To give exposure to forces, moments and resolution of forces.
- To give understanding of geometrical properties such as centroid, moment of inertia, etc of sections of different shapes.

UNIT I FORCE SYSTEM

9

Principles of statics. Forces and their effects. Types of force systems. Resultant of concurrent and parallel forces. Lami's theorem. Principle of moments. Varignon's theorem. Principle of equilibrium.

UNIT II SUPPORTS AND REACTIONS

6

Types of supports and reactions-Bending moment and Shear forces-Determination of reactions for simply supported beams. Relation between bending moment and shear force.

UNIT III SECTIONAL PROPERTIES

10

Properties of section – Centre of gravity, Moment of Inertia, Section modulus, Radius of gyration for various structural shapes. Theorem of perpendicular axis. Theorem of parallel axis.

UNIT IV ELASTIC PROPERTIES AND CONSTANTS**12**

Elastic properties of solids. Concept of stress and strain. Deformation of axially loaded simple bars. Types of stresses. Concept of axial and volumetric stresses and strains. Elastic constants. Elastic Modulus. Shear Modulus. Bulk Modulus. Poisson's ratio. Relation between elastic constants.

UNIT V COMPLEX STRESSES**8**

Principal stresses and strain. Numerical and Graphical method. Mohr's diagram.

TOTAL: 45 PERIODS**OUTCOME**

- Ability to apply the concepts of action of forces on a body and should be able to apply the equilibrium concepts.
- Understanding the concept of bending moment and shear force of beam.
- Understanding of the basic geometrical properties of sections.
- Knowledge about elastic properties of solids.
- Ability to solve problems of principal stresses and strains using numerical and graphical method.

REQUIRED READING

- R.K. Bansal, 'A Text book on Engineering Mechanics', Lakshmi Publications, Delhi, 2008.
- R.K. Bansal, 'A textbook on Strength of Materials', Lakshmi Publications, Delhi 2010.
- Paul W. McMullin, 'Jonathan S. Price, 'Introduction to Structures', Routledge, 2016.

REFERENCES

1. P.C. Punmia, 'Strength of Materials and Theory of Structures; Vol. I', Lakshmi Publications, Delhi 2018.
2. S. Ramamrutham, 'Strength of Materials', Dhanpatrai and Sons, Delhi, 2014.
3. W.A. Nash, 'Strength of Materials', Schaums Series, McGraw Hill Book Company, 1989.
4. R.K. Rajput, 'Strength of Materials', S.K. Kataria and Sons, New Delhi, 2017.

AR3203**ENVIRONMENTAL SCIENCE FOR ARCHITECTURE****L T P/S C
3 0 0 3****OBJECTIVES**

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasise on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarise about influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

Introduction to the design of built environment with consideration of environment, ecosystems and biodiversity.

UNIT II ENVIRONMENTAL POLLUTION

8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

Built environment and its relation to environmental pollution, both as a cause and as a response.

UNIT III NATURAL RESOURCES

10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

The use of natural resources in architecture and the built environment through principles and case studies.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

Socially and environmentally sensitive design of built environment through case studies.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies. Architectural design and density.

TOTAL: 45 PERIODS

OUTCOME

- Understanding of the functions of environment, ecosystems and biodiversity and their conservation.
- Ability to identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
- Understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- Familiarity with different forms of energy and apply them for suitable applications in for technological advancement and societal development.
- Knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.
- An understanding of the design of built environment with due consideration of environmental implications.

REQUIRED READING

- Anubha Kaushik and C. P. Kaushik, 'Perspectives in Environmental Studies', 6th Edition, New Age International Publishers (2018).
- Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2016).
- Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).

REFERENCES

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice Hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005).
5. ErachBharucha, 'Textbook of Environmental Studies for Undergraduate Courses', Orient Blackswan Pvt. Ltd, 2013.

NCC Credit Course Level 1*

NX3251 (ARMY WING) NCC Credit Course Level - I		L	T	P	C
		2	0	0	2
NCC GENERAL					6
NCC 1	Aims, Objectives & Organization of NCC				1
NCC 2	Incentives				2
NCC 3	Duties of NCC Cadet				1
NCC 4	NCC Camps: Types & Conduct				2
NATIONAL INTEGRATION AND AWARENESS					4
NI 1	National Integration: Importance & Necessity				1
NI 2	Factors Affecting National Integration				1
NI 3	Unity in Diversity & Role of NCC in Nation Building				1
NI 4	Threats to National Security				1
PERSONALITY DEVELOPMENT					7
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving				2
PD 2	Communication Skills				3
PD 3	Group Discussion: Stress & Emotions				2
LEADERSHIP					5
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code				3
L 2	Case Studies: Shivaji, Jhansi Ki Rani				2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT					8
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth				3
SS 4	Protection of Children and Women Safety				1
SS 5	Road / Rail Travel Safety				1
SS 6	New Initiatives				2
SS 7	Cyber and Mobile Security Awareness				1

TOTAL: 30 PERIODS

NCC Credit Course Level 1*

NX3252 (NAVAL WING) NCC Credit Course Level - I		L	T	P	C
		2	0	0	2
NCC GENERAL					6
NCC 1	Aims, Objectives & Organization of NCC				1
NCC 2	Incentives				2
NCC 3	Duties of NCC Cadet				1
NCC 4	NCC Camps: Types & Conduct				2
NATIONAL INTEGRATION AND AWARENESS					4
NI 1	National Integration: Importance & Necessity				1
NI 2	Factors Affecting National Integration				1
NI 3	Unity in Diversity & Role of NCC in Nation Building				1
NI 4	Threats to National Security				1
PERSONALITY DEVELOPMENT					7
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving				2
PD 2	Communication Skills				3
PD 3	Group Discussion: Stress & Emotions				2
LEADERSHIP					5
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code				3
L 2	Case Studies: Shivaji, Jhansi Ki Rani				2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT					8
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth				3
SS 4	Protection of Children and Women Safety				1
SS 5	Road / Rail Travel Safety				1
SS 6	New Initiatives				2
SS 7	Cyber and Mobile Security Awareness				1

TOTAL : 30 PERIODS

NCC Credit Course Level 1*

NX3253 (AIR FORCE WING) NCC Credit Course Level - I		L	T	P	C
		2	0	0	2
NCC GENERAL					6
NCC 1	Aims, Objectives & Organization of NCC				1
NCC 2	Incentives				2
NCC 3	Duties of NCC Cadet				1
NCC 4	NCC Camps: Types & Conduct				2
NATIONAL INTEGRATION AND AWARENESS					4
NI 1	National Integration: Importance & Necessity				1
NI 2	Factors Affecting National Integration				1
NI 3	Unity in Diversity & Role of NCC in Nation Building				1
NI 4	Threats to National Security				1
PERSONALITY DEVELOPMENT					7
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving				2
PD 2	Communication Skills				3
PD 3	Group Discussion: Stress & Emotions				2
LEADERSHIP					5
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code				3
L 2	Case Studies: Shivaji, Jhasi Ki Rani				2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT					8
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth				3
SS 4	Protection of Children and Women Safety				1
SS 5	Road / Rail Travel Safety				1
SS 6	New Initiatives				2
SS 7	Cyber and Mobile Security Awareness				1

TOTAL : 30 PERIODS

OBJECTIVES

- To introduce the components of a typical building and their nomenclature.
- To introduce the concept of scale and enable understanding of a building through measured drawing.
- To give skills of representing physical characteristics of materials.
- To give skills in isometric and perspective projections of the measured building.

UNIT I INTRODUCTION TO BUILDING COMPONENTS AND THEIR NOMENCLATURE 12

Building as act of construction for human use layered over the earth - foundation, structural systems, enclosures, weather protection. Understanding building components and their nomenclature using historic and contemporary examples from literature study, site visits, sketches. The nomenclature to include 1) basic types of construction such as load bearing/framed/space structure 2) basic components in a building such as foundation, plinth, walls, floors, roofs(flat, sloped, vaulted), roof covering, ceilings, staircases (principles and different geometric types), doors, windows and ventilators, lintel, sunshade, coping, cornice, stringcourse, parapet, waterproofing, finishing, mortar, decoration, paving 3) basic materials for the components.

UNIT II MEASURED DRAWING AND PROJECTIONS OF BASIC COMPONENTS 16

Introduction to concept of scale and measured drawing through basic components such as handrails, furniture, arches, etc., Orthographic (plan, elevation, section) and isometric projection of the simple components. Representation of different materials through rendering, Perspective projection of simple components.

UNIT III MEASURED DRAWING OF HISTORICAL BUILDING 18

Understanding a historic building in totality or in part through measuring drawing.

UNIT IV MEASURED DRAWING OF CONTEMPORARY BUILDING 14

Understanding a contemporary building in totality or in part through measuring drawing.

TOTAL: 60 PERIODS

OUTCOME

- Ability to recognise and name components of a building.
- Ability to measure and draw components of a building.
- Ability to make isometric and perspective projections of components of a building.
- Understanding a building in total or in part through the process of measured drawing.

REQUIRED READING

- Francis D. K. Ching, 'Architectural Graphics' John Wiley and Sons, 2009.
- Rendow Yee, 'Architecture Drawing: A Visual Compendium of Types and Methods', John Wiley and Sons, 2012.
- Francis D. K. Ching, Steven P. Juroszek, 'Design Drawing', John Wiley and Sons, 2010.

REFERENCES

1. John M. Holmes, 'Applied Perspective', 2nd edition, Sir Isaac, Pitman and Sons Ltd., London 1967.
2. Robert W. Gill, 'Basic Perspective', Thames and Hudson, London, 2006.
3. Leslie Martin C., 'Architectural Graphics', 2nd edition, The Macmillan Company, New York, 1970.
4. Natascha Meuser, 'Drawing for Architects: Construction and Design Manual', Dom Pub, 2015.

OBJECTIVES

- To introduce diagrams and models as representation of reality and thought.
- To enable understanding of the important attributes of built environment through diagrams and models.
- To introduce how design thinking can be enhanced through diagrams and models.

UNIT I INTRODUCTION TO DIAGRAMS IN ARCHITECTURE 12

Introduction to idea of diagrams and models as basic representation of reality and thought. Historical evolution of diagrams and models in architecture with key examples from the past to the present, illustrating how attributes are identified and diagrammed for study and for design.

UNIT II UNDERSTANDING BUILT ENVIRONMENT THROUGH DIAGRAMS 18

Introduction to conventional functional diagramming such as activity, zoning, matrix, proximity chart, etc., Overview of diagrammable aspects of a building. Understanding key attributes of a real building through diagrammatic aspects. Exploring various methods to diagram the same building. Exploring different real buildings with the same methods to discern key differences in them.

UNIT III UNDERSTANDING BUILT ENVIRONMENT THROUGH MODELS 18

Model making as a tool to understand buildings through analogical thinking. Understanding different degrees of representations in models from the most realistic to the most abstract, based on purpose for which model is done. Techniques and materiality in model making.

UNIT IV DIAGRAMS AND MODELS AS AID TO DESIGN THINKING 12

Creating simple diagrams and models as proposition towards the future for an existing simple real life situation or for a future projection. The scale could range from macro to micro.

TOTAL: 60 PERIODS**OUTCOME**

- An understanding of diagrams and models as a mode of thought and analysis.
- An ability to discern the important attributes of a building through diagrams and models.
- Ability to project thoughts towards the future through diagrams and models.

REQUIRED READING

- Mark Garcia, 'The Diagrams of Architecture', Wiley 2010.
- Iain Fraser and Rod Henmi, 'Envisioning Architecture – An Analysis of Drawing, 1991', John Wiley and Sons, 1993.
- Alan F. Blackwell, 'Thinking with Diagrams', Springer, 2001.
- Nikolaus Gansterer, 'Drawing A Hypothesis: Figures of Thought', Springer, 2011.
- Neil Spiller, 'Visionary Architecture: Blueprints of the Modern Imagination', Thames and Hudson, 2008.
- Mo Zell, 'The Architectural Drawing Course', Thames and Hudson, 2017.
- Marc Treib, 'Drawing/Thinking Confronting an Electronic Age', Routledge, 2008.
- Mo Zell – The Architectural Design course, Understand the Principles and Master the Practices, Thames, and Hudson, 2008.

REFERENCES

1. Peter Cook, 'Drawing: The Motive Force of Architecture', Wiley, 2014.
2. Juhani Pallasmaa, 'The Thinking Hand', John Wiley, 2009.
3. Anthony Vidler, 'Diagrams of Diagrams: Architectural Abstraction and Modern Representation', Representations, No. 72. (Autumn, 2000), pp. 1-20.
4. Shin, Sun-Joo, Lemon, Oliver and Mumma, John, 'Diagrams', The Stanford Encyclopaedia of Philosophy, Winter 2018 Edition, Edward N. Zalta (ed.).
<https://plato.stanford.edu/archives/win2018/entries/diagrams/>
5. Matt Bua, 'Architectural Inventions: Visionary Drawing of Buildings', Laurence King Publishing, 2012.
6. Lorraine Farrelly, Representational Techniques, AVA, 2011.

OBJECTIVES

- To enable the understanding of the qualitative and quantitative aspects of basic space design for human use.
- To facilitate exploration of ways to address timeless aspects involved in the design of human built habitat in a micro scale.
- To enable a sensitivity towards the cultural, particular and temporal aspects of architecture.

CONTENT

Humans create and shape spaces/ forms for use. Use includes all aspects of human life- starting from containing the human as a unit (anthropometrics), the needs for carrying out of basic activities, spatial requirements for them, relationship between spaces, requirements of shelter, privacy, social and cultural factors, environmental response, psychological well being, light and air, meaning and symbolism, structure and economy, and so on. Architecture as a discipline brings all these needs together into a coherent totality through the act of conscious design. Conscious design involves the study/analysis of the existing and extrapolating towards the future through speculation.

In the Basic Space Design Studio, the focus would be on simple architectural design projects that would enable the learning of the fundamentals of space with respect to all the above. The projects would be based on small, everyday situations involving simple circulation, materials and use. It could a typology of private or public nature. Some suggestive projects are bedroom, bathroom, kitchen, shop, pavilion, creche, snack bar, residence, petrol bunk, fire station, bus stop. There would be a maximum of three projects.

The techniques used for study and presentation can align themselves towards the above, such as cognitive maps, sketches, manual drawings, physical models with simple materials.

TOTAL: 135 PERIODS

OUTCOME

- Ability to design simple spaces for human use addressing spatial, social, cultural and temporal human needs.
- Ability to consider the particular context in the process of designing.

REQUIRED READING

- Kent C. Bloomer, Charles W. Moore, 'Body, Memory and Architecture', Yale, 1977.
- Gaston Bachelard, 'Poetics of Space', Beacon Press, 1994.
- Juhani Pallasmaa, 'The Eyes of the Skin - Architecture and the Senses', John Wiley, 2012.
- Joseph De Chiara, Michael J Crosbie, 'Time Saver Standards for Building Types', McGraw Hill Professional 2001.
- Julius Panero, Martin Zelnik, 'Human Dimension and Interior Space,' Whitney Library of Design, 1975.
- Joseph De Chiara, Julius Panero, Martin Zelnik, Time Saver Standards for Interior Design and Space Planning, McGraw Hill 2017.

REFERENCES

1. Hideaki Hareguchi, A Comparative Analysis of 20th Century Houses, Academy Editions, 1988.
2. Sam F. Miller, Design Process: A Primer for Architectural and Interior Design, Van Nostrand Reinhold, 1995.
3. Ernst Neuferts Architects Data, Wiley, 2012.
4. Philip Plowright, 'Revealing Architectural Design: Methods, Frameworks and Tools', Routledge, 2014.