

B. Arch (First Year) – First Semester

Total number of Contact Hours = 30, Total Credits =84

SN.	Code	Name of the Module	Contact Hours			No. of Credits	Marks			
			L	T	P/S		Theory		Studio/Practical	
							CA	EX	CA	EX
1	THD101	Introduction to Architecture	3	0	0	12	100			
2	ADE101	Basic Design-I	1	0	5	12			100	
3	MAT103	Mathematics	3	1	0	12	30	70		
4	AGR101	Architectural Drawing	2	0	3	12			50	50
5	AGR102	Art and Graphics I	1	0	3	12			100	
6	HTA101	History of Architecture-I	3	0	0	12	50	50		
7	CPL101	Introduction to Programming	2	1	2	12	25	50	25	
Total			15	2	13	84				

THD101 - Introduction to Architecture

Name of the Module : Introduction to Architecture

Module Code : THD 101

Semester : I

Credit Value : 12

Module Leader : Mr. Chimi

Module Tutor :

General Objectives of the module:

To introduce the student to the world of Architecture and establish the key elements involved in the creation of aesthetically appealing and practically appropriate Architecture. This module is designed to provide an insight into the principles and processes that underpin the discipline of Architecture. It is aimed to teach students, the key practical and theoretical influences that make students to understand and analyze Architecture.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Define Architecture and its relevance in present day context.
2. Comprehend and use architectural vocabulary through selected buildings and spaces.
3. Articulate the roles of an Architect and the services they provide to the society.
4. Relate Architecture with other associated disciplines of Engineering and Social Sciences.
5. Demonstrate user –Environment relationship with design principles developed through ages honouring physical & socio-psychological factors.
6. State the basic theories of design, principles for spatial organisation and circulation in designing any type of space.
7. Highlight Climatic, Social, Economic inputs in Architecture with Site Planning, Material, Construction considerations.

Learning and Teaching Approach Used: (3 - 0- 0)

Lectures : 3 hours / week

Tutorial : Nil

Studio : Nil

Assessment:

Theory:

Continuous Assessment -100 marks

1. Assignment - 80marks

By the end of the semester, students should submit atleast five assignments for this module.

2. Term Test- 15marks

3. Class Test - 5marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter:

- 1. Introduction to Architecture :** Definitions and origins of Architecture - Context for Architecture as satisfying human needs- Functional, aesthetic and psychological –Architecture as a discipline- Introducing the various functional aspects of Architecture: site, structure, skin, services, use, circulation etc. Introduction to the factors that lend meaning to Architecture- Architectural expression and symbolism- Character and style- Movements, philosophies, ideologies and theories- Meaning and interpretation of Architecture.
- 2. Scope of Architectural Design:** Architectural design analysis - Integration of aesthetic and function.
- 3. Architectural Space and Mass:** Point, line, plane, form, shape, pattern, light, colour, texture – Understanding the elements with respect to Architecture. Mass and space, visual and emotional effects of geometric forms and their derivatives – The sphere, cube, pyramid, cylinder and cone. Transformation of forms, Articulation of forms – mass-space/solid-void effects, articulation of edges, corners, surfaces.
- 4. Aesthetic Components of Design and Colour in Architecture:** Proportion, scale, balance, rhythm, axis, symmetry, hierarchy, datum, unity, harmony, dominance with respect to Architecture. Effect of colour in Architecture - Colour symbolism.
- 5. Organization of Forms and Spaces:** Spatial Relationships - Space within space, Interlocking spaces, Adjacent spaces, Space linked by a common space, Spatial Organization - Influencing factors and their types, Centralized, Linear, Radial, Clustered, Grid, Articulation of forms and spaces types - Edges and corners, Surface.
- 6. Principles of Composition:** Unity, harmony and specific qualities of design to include dominance, punctuating effect, dramatic effect, fluidity, climax, accentuation and contrast with building examples.
- 7. Character and Style in Buildings:** Factors influencing the character and style of buildings. Study of examples from Buddhist, Hindu and Islamic Architecture in India Greek, Roman, Gothic Renaissance, Modern and Post Modern Movement.
- 8. Circulation:** Circulation as organizing element: Building approach, building entrance, configuration of the path, path space relationship, form of circulation space
- 9. Works of Contemporary Architects:** Works of following modern and Post-Modern Architects and their ideologies and philosophies in brief, Example: Louis Sullivan, F.L.Wright, Louis Khan, Le Corbusier, Philip Johnson, Charles Correa, and Michael Graves, etc.

Reading List:

1. Farrelly, L. (2010). *The Fundamentals of Architecture*. (2nd Ed.). AVA Publishing.

2. Neil, P. (1968). *The language of Architecture*. Mouton & Co.
3. Parmar, V. S. (1973). *Design Fundamentals in Architecture*. (1st Ed.). Somaiya Publications Pvt Ltd.
4. Peter von Meiss (1992). *Elements of Architecture -From form to place*. Spon Press.
5. Rudolf, A. (2009). *The dynamics of Architectural form*. (30th Ed.). University of California Press.
6. Simon U. (2009). *Analysing Architecture*. (3rd Ed.). London: Routledge.
7. Smithies, K.W. (1983). *Principles of Design in Architecture*. (1st Ed.). Chapman & Hall.
8. Snyder, James, C. and Catanese, Anthony, J. (1980). *Introduction to Architecture*. (1st Ed.). Mc-Graw Hill.

References/Additional Reading list:

1. Ching, Francis D.K. (2007). *Architecture – Form, Space and Order*. (3rd Ed.). New Jersey: John Wiley & Sons.

Date : April, 2014.

ADE 101 - Basic Design-I

Name of the Module :	Basic Design - I
Module Code :	ADE 101
Semester :	I
Credit Value :	12
Module Leader :	Mr.Chimi
Module Tutor :	

General Objectives of the module:

The objective of the module is to introduce a beginner to the approaches, languages and rudimentary techniques of Architectural design.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. List the factors of Design regarding elementary forms.
2. Interpret the principles of design in the context, purpose and technology.
3. Demonstrate the roles of lines, color, and texture, volume of objects with the sense of contrast, harmony, balance and relative proportions that forms the part of any design.
4. Explain inherent visual properties of any physical object or enclosure.
5. Visualize various techniques of graphics to present & explain design ideas.
6. Make models with clay, paper and thermocols, etc.
7. Identify various elements of design and visual composition.

Learning and Teaching Approach Used: (1 - 0 - 5)

Lectures	:	1 hour / week
Tutorial	:	Nil
Studio	:	5 hours / week

Assessment:

The external jury should have minimum of two members including the module tutor. The evaluators can be either from college or outside having the knowledge on this particular module. The tutor is not allowed to evaluate the students' portfolio during the external jury.

Studio:**Continuous Assessment - 70marks**

1. Studio assignment and projects - 50marks

By the end of the semester, this module should cover atleast two design assignments.

2. Term Test - 20marks

Semester End external viva/Jury- 30marks

1. Portfolio presentation

Students must obtain 40% each in Continuous Assessment and Semester end jury/presentation. The overall pass mark for the module is 50%

Pre-requisite – None

Subject Matter:

1. **Understanding of basic design, elements and principles of design:** Using elements and principles of design in making two and three dimensional compositions completed with different tones, textures, colures and hues including their application in collages, wall hangings, etc.
2. **Space and Architecture:** Understanding design as to create for a particular purpose and Architectural design as to create space – Exercise in terms of simple drawing and surroundings. Form created through lines (columns) and planes (volumes), combination thereof. Problems related to the understanding of the elements of Architectural design, concepts of space, form and function and their perception.
3. **Understanding Form and Transformations:** Understand and compose pure (platonic) solids. Understand simple and complex addition and subtractive transformations in platonic solids retaining and destroying the original form. To assign inter-related functions in form so that together they have a “fit”. Arrive at relationship between 2D and 3D compositions.
4. **Anthropometric studies:** Parameters of design, Anthropometrics, human activity and the use of space, interrelationship of Architectural space to form, structure, and materials and to nature as a contextual setting, measure drawings of simple living units.
5. **Understanding design as a function and Scale in Architecture:** Simple measurement exercises. Studying, analyzing and improving the design of simple objects.-Synthesis of observations in the study of a given space through elementary measured drawings, sketching and photography. - Design of a basis shelter, an Architectural form with a specific function.
6. **Understanding Order in Architecture:** Analyzing and selecting examples of architectural compositions in terms of their inherent order. Developing a predetermined order and its transformation in architectural compositions.
7. **Design exercise:** Design of mono-cellular- units/structures on a level plane, designing of simple spaces involving primarily horizontal circulation. Design exercises such as gates, kiosks, petrol pumps, bus stand, police booths, advertisement booths, flower shops, Entrance gates, Exhibition stalls, Rain shelters, etc. others based on emerging contemporary ideas in the local Bhutanese and global contexts.**All the design exercises should be supported by the case studies.**

Reading List:

1. Exner V., Pressel D. (2009). *Basics Spatial Design*. Birkhanser.
2. Owen Capplemann & Michael Jack J. (1993). *Foundations in Architecture : An Annotated Anthology of Beginning Design Projects*. (1st Ed.). New York: Van Nostrand Reinhold.
3. Parmar, V. S. (1973). *Design Fundamentals in Architecture*. (1st Ed.). Somaiya Publications Pvt Ltd.
4. Peter von Meiss (1992). *Elements of Architecture -From form to place*. Spon Press.
5. Pierre Von Meiss (1990). *Elements of Architecture: From Form to Place*. (New Ed.). Routledge.
6. Rudolf, A. (2009). *The dynamics of Architectural form*. (30th Ed.). University of California Press.
7. Smithies, K.W. (1983). *Principles of Design in Architecture*. (1st Ed.). Chapman & Hall.
8. Zell, Mo (2008). *Architectural Drawing Course: Tools and Techniques for 2D and 3D Representation*. Barron's Educational Series.

References/Additional Reading list:

1. Ching, Francis D.K. (2007). *Architecture – Form, Space and Order*. (3rd Ed.). New Jersey: John Wiley & Sons.
2. Ernst, Neufert (2012). *Neufert Architects' Data*, (4th Ed.). UK: Blackwell publishing ltd.

Date : April, 2014

MAT103 - Mathematics

Name of the Module :	Mathematics
Module Code	: MAT 103
Semester	: I
Credit Value	: 12
Module Leader	: S. T. Venkatesan
Module Tutor	: (By Science and Humanities Department)

General Objectives of the Module:

The module is introduced to develop the mathematical techniques that support Engineering related modules and provides methods for analysis of practical engineering problems. To develop the student's ability to formulate engineering problems in terms of mathematical model and to interpret the solution

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Determine the rank and inverse of a matrix.
2. Apply the matrix method to solve linear equations.
3. Obtain the Eigen Value and Eigen Vector of a square matrix.
4. Differentiate a function successively and also able to apply Leibnitz's theorem to find the nth derivative of the function.
5. Determine the concavity and convexity of a curve.

6. Use Taylor's expansion function.
7. Apply the ordinary differential equation in mathematical problems.
8. Solve Differential Equations of first order, first degree and first order, second degree.
9. Apply the numerical analysis techniques to evaluate complex area and volume problems.
10. Apply the statistical tools to simple data handling
11. Evaluate the correlation and regression of two sets of data.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment - 30 marks

1. Assignment - 10marks
2. Term Test- 15marks
3. Class Test - 5marks

Semester End Examination - 70marks

1. Written examination (3 hrs. duration) – 70 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%

Pre-requisite - None

Subject Matter:

1. Algebra of Matrices: Adjoin Transpose and Inverse of Matrices, Orthogonal matrix, Rank of Matrix, Consistency and Inconsistency of a linear Equation. Eigen Value and Eigen Vector.

2. Statistics and Probability: Measure of Central Tendency and Measure of Dispersion. Kurtosis, Curve fitting, Method of Least Squares (Straight Line and Parabola), Correlation and Regression.

3. Calculus: Telor's and Mclaurin's expansion for two variable, Maxima, Minima for a function of two variable. Successive differentiation, Leibnitz's Theorem, Tangent and Normal, Curvature (Cartesian and parametric forms only)

4. Partial differentiation: Euler's Theorem, Total Differential Coefficient, Change of variables.

5. First order differential equations: Exact, linear and Bernoulli's form, second order differential equations with constant coefficients

6. Numerical Analysis: Finite differences, Newton's forward and backward interpolation formulae, central difference interpolation formulae. Trapezoidal and Simpson's 1/3rd rules for numerical integration.

Reading List:

1. Das, H.K.(2011).*Higher Engineering Mathematics. (14th Ed.)*. New Delhi: S. Chand.
2. Erwin Kreyszig.(2011).*Advanced Engineering Mathematics. (10th Ed)*. Wiley Student Edition.

3. Grewal, B.S. (2007). *Higher Engineering Mathematics*. (40th Ed.). Khanna Publishers.
4. Gupta S.C and Kapoor, V.K. (1996). *Fundamentals of Mathematical Statistics*, (9th Ed.). New Delhi: Sultan Chand & Sons.
5. Ramana, B.V. *Higher Engineering Mathematics*, (11th Ed.). New Delhi: McGraw Hill Co.Ltd.
6. Thomas G. B. (1998). *Calculus and Analytic Geometry*. London: Addison Wesley.
7. Veerarajan, Y.(2002). *Engineering Mathematics (for first year)*, (2nd Ed.). New Delhi: Tata Mc Graw – Hill pub., Co., Ltd.
8. Venkataraman, M.K. (2003). *Engineering Mathematics, Volume I*, (4th Ed.). Chennai: The National Pub, Co.
9. Wylie, C. R. & Barret, L.C.(1995). *Advanced Engineering Mathematics*, (6th Ed.). New York: Mc Graw Hill.

Date : April, 2014.

AGR101 - Architectural Drawing

Name of the Module :	Architectural Drawing
Module Code	: AGR101
Semester	: I
Credit Value	: 12
Module Leader	: Mr. Chimi
Module Tutor	:

General Objectives of the module:

It is the primary medium for development and communicating design concepts. Through this module the students are trained to develop imaginative and 3D spatial capabilities and acquire the skill of preparing plans, sections and elevations and understanding the drawing conventions and symbols used in them.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Compute scales, dimensions of geometrical constructions.
2. Explain projections lying in different quadrants and orientation.
3. Draw perspective, orthographic and isometric views and projection of objects.
4. Differentiate the solids such as pyramids, prisms, cylinders, cones, spheres etc.
5. Describe the concept of intersection of solids and draw various intersections of solids.
6. Determine the relation between elevation, plan, and section of an object, group of objects and 3D views of simple object, and demonstrate through drawings
7. Describe the concept of isometric projection and perspective projection
8. Demonstrate the concept of shade and shadow in sciagraphy.
9. Make modules of basic shapes and solids.

Learning and Teaching Approach Used: (2 - 0 - 3)

Drawing and model making skills will be taught to improve the abilities to understand space and form.

Lectures	:	2hour / week
Tutorial	:	Nil

Studio : 3 hours / week

Assessments

Studio:

Continuous Assessment - 50marks

1. Studio assignment - 30marks
2. Class Test - 5marks
3. Term test- 15marks

Semester End Exam- 50marks

1. Written examination (4 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%

Pre-requisite – None

Subject Matter

- 1. Drawing tools and Accessories:** Introduction to the module and drawing equipment, setting of drawing equipment, B.I.S./code of practice for architectural designs. Drafting and quality of lines with pencil.
- 2. Basic technical drawing:** Concept and types of line. Division of lines and angles. Drawing polygons. Inscribing and circumscribing circles in polygons. Drawing geometrical Conics and Curves- ellipse, parabola, hyperbola, cycloid, involutes.
- 3. Scales:** Types and uses of scales. Scales used by an architect. Reducing and enlarging scales. Types of scales: Plain scale and Diagonal scale, comparative scales, etc
- 4. Development of Surfaces and solids:** Surface development and model making of Planes, solids like cylinder, cone, prism and pyramids.
- 5. Orthographic Projections:** Definition, meaning a concept. Planes of Projections. First angle projections. Projection of points, lines, planes, solids (prisms, pyramids, cones, cylinders, spheres etc.) in different positions, Sections of solids (prisms, pyramids, cones, cylinders, spheres etc.) in varying conditions of sectional plane.
- 6. 3-D Metric Drawing:** Types, uses and advantages. Isometric, axonometric views of planes, simple and composite solids.
- 7. Perspective Drawing:** Purpose and use. Differences with metric projections. Anatomy of a perspective –Station point, picture plane, eye level, horizon line, ground line, vanishing point, etc. Types of perspective – One point, two points, three point perspectives. Perspective of simple and complex box blocks. Perspective of simple curved surface. Perspective of simple household furniture items.
- 8. Sciagraphy:** Values in Shades and shadows. Constructing plan shadows (point, line and plane) Short – Cut methods for Constructing shadows Presentation techniques in Sciagraphy. Sciagraphy of geometrical and architectural forms – Shades & shadows on building facades.

Reading List:

1. Agarwal, B. and Agarwal, C. M. (2013) *Engineering Drawing*.(2nd Ed.).Tata McGraw-Hill.
2. Albert. O. Halse (2011). *Architectural Rendering Techniques*.(n.d.).USA:Literary Licensing, LLC.
3. Ernest R.Norling (1999).*Perspective made easy*. NY: Dover Publication inc.
4. Francis D. K. Ching (2009). *Architectural Graphic*. (5th Ed.).John – Wiley and Sons.
5. Gill, Robert W. (1991).*Basic Perspective*. London: Thames and Hudson.

6. Gill, Robert W. (1991). *Basic Rendering: Effective Drawing for Designers*. Thames & Hudson
7. Malik, Shankar (1994). *Perspective and Sciagraphy*. Allied Publishers.
8. Morris I. H. (2004). *Geometrical Drawing for Art Students*. Madras: Orient Longman.

Date : April, 2014.

AGR 102 - Arts and Graphics- I

Name of the Module : Arts and Graphics-I

Module Code : AGR101

Semester : I

Credit Value : 12

Module Leader : Mr. Chimi

Module Tutor :

General Objectives of the module:

The module gives the learner an overall understanding of fundamentals of fine arts and the effective use of free hand sketches. It is used for visual communication in order to prepare them for the higher levels of design education. The learners will get hands-on experience to various media and art expressions, outdoor sketching and modeling. Further, they are enabled to give expressions to their design thoughts and concerns at every stage of the assigned projects. The Module is production-oriented and practical, where a learner is expected to display mastery of skill and creativity.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Draw technical drawing with drawing instrument and make free hand sketches clearly and rapidly.
2. Describe the fundamentals of visual arts and its use in designing.
3. Generate free hand sketching, rendering and colouring of various spaces/objects.
4. Prepare outdoor sketches of assigned buildings or outdoor settings.
5. Comprehend and visualize various geometric forms of solids and surfaces.
6. Create numerous mediums and techniques of art through which artistic expression can be achieved.

Learning and Teaching Approach Used: (1 - 0 - 3)

Lectures : 1 hour / week

Tutorial : Nil

Studio : 3 hours / week

Assessment:

The external jury should have minimum of two members including the module tutor. The evaluators can be either from college or outside having the knowledge on this particular module. The tutor is not allowed to evaluate the students' portfolio during the external jury.

Studio:

Continuous Assessment - 70marks

1. Studio assignment - 50marks

By the end of the semester, students should submit atleast one assignment under each topic for this module.

2. Project-20marks

Semester End external viva/Jury- 30marks

1. Portfolio presentation

Students must obtain 40% each in Continuous Assessment and Semester end jury/presentation. The overall pass mark for the module is 50%

Pre-requisite – None

Subject Matter

1. **Elements of Design:** Line, Direction, Shape size and form, colour, unity, texture, tone, direction, proportion, form, shape, solids and voids.
2. **Principles of Design:** Balance, repetition, rhythm, unity, harmony, value, contrast and proportions.
3. **Fundamentals of visual arts :** visual relationships, proportion; simple perspective of various geometric forms; study of objects in light and shade (still life), three dimensional compositions of spaces and their graphic expression.
4. **Basic Design and Communication Graphics:** Study in composition, scale and proportion, rhythm, harmony and character, diagrams, ideograms, business graphics, skills and presentation techniques
5. **Free-hand sketching skills and techniques:** Rendering in ink and colour, thermocol and clay modelling; Introduction of reductive logic in Graphic design, Interpretation and visual/iconic representation of various ideas, emotions and human activities; Introduction to visual cognition, psychological responses to art and art appreciation.
6. **Still life drawing:** From observation, drawing from nature-shrubs, trees, grass, plants, flowers, rocks, water. Colouring basic geometrical figures and their composition. Understanding textures and their effect on an object etc. Exercises in collage to understand methods of composition with different elements, textures and colours

Reading List:

1. Ambrose, G. and Harris, P. (2009). *The Fundamentals of Graphic Design*. SA: AVA Publishing.
2. Caldwell peter (1995). *Pen and Ink Sketching.(Revised Ed.)*.London: B.T. Bats ford Ltd.
3. Francis D. K. Ching (1990).*Drawing: A Creative Process.(1st Ed.)*.New York: Van Nostrand Reinhold.
4. Huntly, Moira. (1997).*The artist drawing book. (Revised Ed.)*. U.K.: David & Charles.
5. Landa, R. (2011). *Graphic Design Solutions*. Wadsworth.
6. Webb, Frank (1995).*The Artist guide to Composition.(1st Ed.)*.U.K: David & Charles.

Date : April, 2014.

HTA 101 - History of Architecture-I

Name of the Module : History of Architecture-I
Module Code : HTA 101
Semester : I

Credit Value : 12
Module Leader : Mr.Chimi
Module Tutor :

General Objectives of the Module:

This module will provide the basic information about the development of Architecture in Europe from pre-historic to Byzantine period. It deals with how Architecture was influenced by geographical, geological, cultural, social and religious forces. Students will be exposed to the development in various periods with selected examples of buildings and their uniqueness in terms of form, material and construction techniques.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Describe the progress in various civilizations leading to the development of shelter and how art and Architecture emerged in society.
2. Explain the development of Greek, Roman Architecture, Early Christian Architecture and Byzantine Architecture.
3. Relate Architecture with respect to politics, society, religion and climate.
4. Identify the cultural and religious significance of ancient Buddhist art and Architecture.
5. Explain the development of architectural form with reference to technology, style and character in the Indus valley Civilization, Vedic period and manifestation of Buddhist and Hindu Architecture.
6. Identify and describe rock cut and stone Architecture of Dravidian period and later developments in south India and their relation to Bhutanese art and Architecture.

Learning and Teaching Approach Used: (3 - 0 - 0)

Lectures : 3 hours / week
Tutorial : Nil
Studio : Nil

Assessment:

Theory:

Continuous Assessment - 50marks

1. Assignments -30 marks.

By the end of the semester, students should submit at least five assignments for this module.

2. Term test -15 marks.
3. Class test - 5 marks

Semester End Examination - 50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

1. **Prehistoric Age and Egypt:** Old Stone Age - The Agricultural revolution – The New Stone Age - Development of Shelter. Nature of Art and Architecture - Factors influencing Architecture - Outline of Architectural Character– Great Pyramid of Cheops, Giza, Great temple of Ammon, Karnak.
2. **West Asia:** Evolution of Sumerian, Babylonian and Persian cultures - Factors influencing Architecture -Outline of architectural character - Ziggurat, Urnammu, Palace of Sargon, - Palace at Persepolis.
3. **Classical Period: Greece:** Landscape and culture of Greece- Minoan and Mycenaean cultures- Hellenic and Hellenistic cultures – Greek character- Greek city planning- Architecture in the archaic and classic periods – Domestic Architecture; Public Buildings: Agora, stoas, theatres, bouleterion and stadias – Greek temple: evolution and classification- Parthenon and Erechthion- Orders in Architecture: Doric, Ionic, Corinthian - Optical illusions in Architecture
4. **Classical Period: Rome:** The Roman temples- Roman urban planning- art and Architecture as imperial propaganda: forums and basilicas- domestic Architecture – structural forms, materials and techniques of construction - Orders in Architecture: Tuscan and Composite Rome: Forum Romanum and other Imperial Forums, Enclosure and manipulation of space: Pantheon- Public buildings: Colloseum, Circus Maximus, Thermae of Caraculla.
5. **Early Christian and Byzantine: Evolution** of church forms - Factors influencing Architecture -Outline of architectural character - St. Clement, Rome St. Sophia, Constantinople; St. Marks, Venice; St.Vitale, Ravenna.
6. **Ancient India:** Indus Valley Civilization: culture and pattern of settlement.- Aryan civilization – theories and debates of origin- Vedic culture - Vedic village and rudimentary forms of bamboo and wooden construction - origins of Buddhism and Jainism.
7. **Buddhist Architecture:** Evolution of Buddhism, Buddhist thought, art and culture - Hinayana and Mahayana Buddhism - Evolution of building typologies- The stupa, vihara and the chaitya hall - Symbolism of the stupa - Architectural production during Ashoka's rule Ashokan Pillar, Sarnath - Rock cut caves at Barabar - Sanchi Stupa- Rock cut Architecture in Ajanta and Ellora - Karli - Viharas at Nasik.
8. **Evolution of Hindu Temple Architecture :** Evolution of temple form - Meaning, symbolism, ritual and social importance of temple - Categories of temple - Elements of temple Architecture

Reading List:

1. A. Volwahren (1969). *Living Architecture - India (Buddhist and Hindu)*. London: Oxford and IBM.
2. Fisher (1993). *Buddhist Art and Architecture (2002 revision)*. Thames & Hudson.
3. Gosta, E.Sandstrom (1975). *Man the Builder*. New York: McGraw-Hill Book Company.
4. Leidy, D.P. (2009). *The Art of Buddhism: An Introduction to Its History and Meaning. (1st Ed.)*. Shambhala.
5. Percy Brown (1996). *Indian Architecture (Buddhist and Hindu Pd.)*.Bombay: Tarapore Vala and Sons.
6. Pier Luigi Nervi (1972). *History of World Architecture – Series*. New York: Harry N.Abrams, Inc.Pub.
7. Satish Grover (2003). *The Architecture of India (Buddhist and Hindu Period)*. India:CBS Pub.

8. S.Lloyd and H.W.Muller (1986). *History of World Architecture – Series*. London: Faber and Faber Ltd.
9. Sir Banister Fletcher (1996). *A History of Architecture(20th Ed.)*.The Antholone Press.
10. Spiro Kostof (1995). *A History of Architecture - Setting and Rituals*. London: Oxford University Press.

Date : April, 2014.

CPL 101 - Introduction to Programming

Name of the Module : Introduction to Programming
Module Code : CPL 101
Semester : I
Credit Value : 12
Module Leader : Mr.Manoj Chhetri
Module Tutor : (*By IT Department*)

General Objectives of the module:

The objective of the module is to introduce students to programming and to cover the fundamentals of C-Programming.

Learning outcomes:

At the end of this module, students are expected to be able to:

1. Identify computer logical units.
2. Customize computer hardware.
3. Write programmes to solve science and engineering problems.
4. Code, run and debug programmes.
5. Use software tools available for programming.

Learning and teaching approach used (2-1-2)

Lectures : 2 hours/ week
 Tutorial : 1 hour/ week
 Practical : 2 hours/ week

Assessment:

Continuous Assessment - 25 marks

Practical assessment – 25 marks

Semester End Examination – 50 marks

Students must obtain 40% each in CA theory, CA in practical and Semester end report/presentation.

The overall pass mark for the module is 50%

Pre-requisite – None

Subject Matter:

1. Introduction: Define software, hardware, system software, application software, algorithm, programme, machine language, assembly and high level languages, assembler, compiler, interpreter, editor, operating system; batch processing, multiprogramming, timesharing, define

concepts of the finite storage, bits, bytes, kilo, mega, Giga bytes and concept of character representation. Compilation, linking, loading running of programme on Linux.

2. Solution Formulation: defining the problem; structuring the solution using the top down approach; concepts of sequence, selection and iteration; Algorithm: flowchart, pseudo-code, recursive formulation of solution.

3. Representation of Data and Basic Data Types: Integer, characters, Endian, IEEE 754 floating point representation, ASCII, Unicode port representation.

4. Basic constructs: the basic format of C programme; input and output; characters, numbers and strings; arithmetic and logical operators; selection statements; iteration statements.

5. Functions: concept of a function; programming a function; passing data to and from a function. -Globally, by value and by reference.

6. Arrays: concept of an array; writing and reading to one and two dimensional arrays; passing arrays to and from functions.

7. Structures: concept of a structure; simple applications of structures.

8. Pointers: concept of a pointer; simple applications of a pointer.

List of Practical's:

1. Demonstration of PC Hardware parts
2. Use of various IDE Compilers
3. Sequence implementation
4. Selection implementation
5. Iteration implementation
6. Function implementation
7. Array implementation
8. Structure implementation
9. Pointer implementation

Reading list

1. Ashok N. Kamthane.(2011). *Computer Programming.(Revised Ed.)*.Pearson Education.
2. Ben Ezil. (2005). *Introduction to Programming, (2nd Ed.)*. Wilson WindowWare, Inc.
3. Brian W. Kernighan, Dennis M. Ritchie. (1988) *The C- Programming Language.(2nd Ed.)*. Prentice Hall.
4. David J.Eck.(2009). *Introduction to Programming using Java,(6th Ed.)*.Create Space.
5. E.Balaguruswamy.(2011). *Programming in ANSI*. Tata Mc Graw-Hill.

Date : April, 2014.

B. Arch. (First Year) – Second Semester

Total number of Contact Hours = 33, Total Credits =72

SN	Code	Name of the Module	Contact Hours			No. of Credits	Marks			
			L	T	P/S		Theory		Studio/Practical	
							CA	EX	CA	EX
1	ADE102	Basic Design-II	2	0	10			150		
2	TSM101	Structural Mechanics –I	3	1	0	12	30	70		
3	BLC101	Building Materials	3	1	2	12	50	30	20	
4	AGR103	Art and Graphics II	1	0	3	12			100	
5	ASC101	Academic Skills	3	1	0	12	100			

6	HTA102	History of Architecture – II	3	0	0	12	50	50		
Total			15	3	15	72				

ADE102 - Basic Design-II

Name of the Module : Basic Design - II

Module Code : BDE 102

Semester : II

Credit Value : 12

Module Leader : Mr.Chimi

Module Tutor :

General Objectives of the Module:

This module comprise of Basic Design and Creative Workshop. Through this module, students are introduced to the process of architectural design: From inception to representation. It is also an introduction to visual grammar, and how it relates to practical aspects of form, space and structure. Formulation of design objectives, relating functions to space through behavioral inputs, translation of 2D space to 3D form, aesthetic criteria in three-dimensional design.

The later part workshop will give students an opportunity to understand physically, the different types of architectural and graphics principles. It will also introduce the various modelling that will help students to have creative idea on three Dimensional objects and spaces.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Comprehend the problem and identify issues in architectural Designs.
2. Identify and state design parameters.
3. Identify functions and their relationships.
4. Relate activities to spatial data (dimensions, space-defining/establishing elements).
5. Translate the layouts to form.
6. Evaluate the alternatives in terms of design criteria.
7. Solve problems and prepare presentation in the 2-D format.
8. Develop three dimensional object (models)with different materials
9. Create compositions with two and three dimensions geometrical shapes and solids.

Learning and Teaching Approach Used: (2 - 0 - 10)

The concepts of drawings will be introduced through lectures and the drawings will be drawn by students during studio period, which will be reviewed and assess every week. The students will be encouraged to draw free hand sketches of any building components. The available time for learning is as below:

Lectures : 2 hour / week

Tutorial : Nil

Studio : 10 hours / week

Students are taken for the study tour to any place for a week to study any particular building or monuments or space to have a visual experience of a place, the influence social, culture on the

particular building or space. This will assist the students to develop their creativity in terms of incorporating various factors in their designs.

Assessment:

The external jury should have minimum of two members including the module tutor. The evaluators can be either from college or outside having the knowledge on this particular module. The tutor is not allowed to evaluate the students' portfolio during the external jury.

Studio:

Continuous Assessment - 100marks

1. Studio assignment and projects - 75marks

By the end of the semester, this module should cover atleast two design assignments.

2. Class Test - 10marks
3. Term Test:-15 marks

Semester End external viva/Jury- 50marks

1. Portfolio presentation

Students must obtain 40% each in Continuous Assessment and Semester end Jury/presentation. The overall pass mark for the module is 50%

Pre-requisite – Basic Design – I (ADE101) and Architectural Drawing (AGR101)

Subject Matter:

PART A: BASIC DESIGN

1. **Theories and practical aspects of form, space and structure;** Transformation of forms in geometrical composition; Relationships between form, function, and meaning; Taxonomy of spaces through small functional groupings; Various structural systems with their specific advantages in different context; Behavioural inputs; Safety and security aspects; Aesthetic criteria in three-dimensional architectural design; Properties of materials and their application – composition, strength, workability, joinery, colour, texture, transparency, etc.; Preliminary construction principles; Skills to represent ideas and forms through study model and drawings rendered in ink/colour.
2. **Element of site-planning and landscaping:** Interpretation of site information as a decision-making aid. The design of the environment outside the building.
3. **Case Studies:** Before starting any Design assignment, student should atleast do, one case study which is relevant to that particular Design assignment.
4. **Design assignments** should gradually build up in complexity, starting from single spatial unit, through multiple attached units, to clustering of several units. Some suggested types of design assignments:, Prayer room , Rest pavilion, Picnic shelter, Bus-stop shelter, Small Florist's shop, Hostel room for students or monks , Public Toilet, Internet Booth, Kids' Toy shop, Coffee shop, Curio shop, Meditation centre, Lodge in forest /hill etc.
5. **Study Tour:** Document and do presentation of any particular building or monuments or space to have a visual experience of a place, the influence social, culture on the particular building or space. The site of the final design assignment will be allocated from the place where students are taken for the study tour.

PART B: CREATIVE WORKSHOP

1. **Model making exercise:** Study and development of 3D forms using plastic material such as clay and Plaster of Paris, putty, etc. Development of 2D & 3D forms using hard material such

as paper, paper board, thermocol, wire, cardboard, wax, POP, acrylic sheets, wood, plastics, glass fibre.

2. **Carpentry exercise:** Introduce to various carpentry tools, machines and timber joints. Prepare a joints like lap joint, dovetail joint with a given blocks of sawed timber.
3. **Fabrication** –Introduction to welding equipment, processes and its applications, etc.
4. **Painting and polishing-** Classification of paints, varnishes ingredients of paints, Painting methods-brush, spray, hot spray etc.

Reading List:

1. Andrew Alpern (1982). *Handbook of Speciality: Elements in Architecture.*(1st Ed.).McGraw Hill Book Co.
2. Ching, Francis, D. K. (2011) *A Visual Dictionary of Architecture.*(2nd Ed.).UK:John Wiley & Sons,Inc.
3. Ching, Francis, D. K., Barry, S. and Zuberbuhler, D.(2009). *Building Structures Illustrated – Patterns, Systems, and Design.*(3rd Ed.). UK: John Wiley & Sons, Inc.
4. Gail Greet Hanna. (2002). *Elements of Design: Rowena Reed Kostellow and the Structure of Visual Relationship* (1st Ed.). NY: Princeton Architectural Press.
5. Gill, R. W. (1992).*Manual of Rendering with Pen and Ink. (Revised Ed.).* W. W. Norton & Co Inc.
6. Smithies, K.W. (1983). *Principles of Design in Architecture.*(1st Ed.). Chapman & Hall.
7. Snyder, James, C. and Catanese, Anthony, J. (1980). *Introduction to Architecture.*(1st Ed.). Mc-Graw Hill.

References/Additional Reading list:

1. Ching, Francis D.K. (2007). *Architecture – Form, Space and Order. (3rd Ed.).* New Jersey: John Wiley & Sons.
2. Ernst,Neufert (2012). *Neufert Architects’ Data, (4th Ed.).*UK: Blackwell publishing ltd.

Date : April, 2014

TSM 101 - Structural Mechanics-I

Name of the Module :	Structural Mechanics-I
Module Code :	TSM 101
Semester :	II
Credit Value :	12
Module Leader :	Mrs. Monika Thapa
Module Tutor :	(By Civil Engineering Department)

General Objectives of the Module:

This module basically sensitizes students on how structural resolutions become important in the realization of architectural design concept. At this stage, students shall be exposed to forces, moments, and resolution that are to be resolved. Concepts of determinate and indeterminate structures are also explained. Thrust shall be on steel and concrete structures, and enable students to solve basic, simple problems.

Learning Outcomes:

1. Define various terms in Engineering Mechanics.
2. Establish the equilibrium equation for a rigid body under set of forces.
3. Explain the effect of action of forces on a body and the concept of equilibrium.
4. Analysis a simple truss for joint loads.
5. Determine the internal forces induced in truss members due to external loads.
6. Calculate the sectional properties (centroid, moment of inertia, section modulus and radius of gyration) for various sections.
7. Calculate the centre of gravity and moment of inertia of a thin plate of various shapes.
8. Explain the stress – strain behaviours of steel and concrete due to axial loads
9. Determine the bending and shear force diagram for a beam with given loading.
10. Determine the stresses and strains developed in solids due to external
11. Derive the relationship between elastic constants.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment - 30marks

1. Assignments -10 marks.
2. Term test -15 marks.
3. Class test - 5 marks

Semester End Examination - 70 marks

1. Written examination (3 hrs. duration) – 70 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

- 1. Forces and Structural Systems:** Types of force systems - Resultant of parallel forces - principle of moments - principle of equilibrium - simple problems.
- 2. Analysis of Plane Trusses:** Introduction to Determinate and Indeterminate plane trusses - Analysis of simply supported and cantilever trusses by Method of Joints and Method of Sections.
- 3. Properties of Section:** Centroid-Moment of Inertia - Section Modulus – Radius of Gyration - Theorem of Perpendicular Axis - Theorem of Parallel Axis.
- 4. Elastic Properties of Solids:** Stress strain diagram for mild steel, High tensile steel and concrete - Concept of axial and volumetric stresses and strains.

5. **Elastic Constants:** Elastic constants - Relation between elastic constants - Application to problems.

Reading list:

1. Beer, Johnston, and Eisenberg. (2012). *Vector Mechanics for Engineers. (10th Ed.)*. McGraw-Hill.
2. J. P. Den Hartog.(2012). *Advanced Strength of Materials.(Revised Ed.)*. New York: Dover Publication Inc.
3. P.C.Punmia.(1994). *Strength of Materials and Theory of Structures.(Vol.I)*. New Delhi: Laxmi publications.
4. R.K.Bansal (2008). *A textbook on Engineering Mechanics*. New Delhi: Lakshmi Publications.
5. R.K.Bansal (2005). *A textbook on Strength of Materials*. New Delhi: Lakshmi Publications.
6. R.K. Rajput (1996). *Strength of Materials*. New Delhi: S. Chand & Company Ltd.
7. S.Ramamrutham.(1990). *Strength of materials*. New Delhi: Dhanpatrai& Sons.
8. William Nash (1999). *Schaum's Outline of Strength of Materials, (6th Ed.)*. New Delhi:McGraw Hill.

Date : April, 2014.

BLC101 – Building Materials

Name of the Module :	Building Materials
Module Code :	BLC101
Semester :	II
Credit Value :	12
Module Leader :	Mr. Ugyen Dorji
Module Tutor :	(By Civil Engineering Department only)

General Objective of the Module:

The aim of this module is to study the nature and characteristics of various building materials used in the building construction industry and its various applications. It will also introduce students to the eco-friendly building materials and its effects.

Learning Outcomes:

Upon the successful completion of this module, the students will be able to:

1. Describe the types and properties of stones, bricks, timber, and their applications in the building industry.
2. Explain the characteristics of concrete ingredient materials and their influence on the properties of concrete, types, production, and proportioning of concrete materials and the important characteristics of concrete.
3. Describe the types and properties of various steel and glasses, their applications in the building industry.
4. Describe the various types of stone masonry and of brick masonry (brick bonds), their suitability, and the construction methods including quality control measures (guidelines for supervision).
5. List out the various types of walls including partition and cavity, damp proofing materials and techniques, types of floors, their construction details, and selection criteria.

6. Categorize and explain the various eco-friendly building materials.

Learning and Teaching Approach:

The properties, specifications and the uses of different construction materials are introduced through lectures with examples and their application to real time structures. These lectures will be supplemented by relevant visual aids and site visits. The students are encouraged to select and use the appropriate materials for the real time structures. The students will be familiarised with testing procedures to determine the various properties of the commonly used materials in construction during the laboratory classes. Students will be made to focus more on the eco-friendly materials for construction industries.

To get the physical feeling of the materials and structures, they are advised to visit as many as construction sites in the vicinity.

The time allocated for these activities is given below.

Lectures : 3 hours/week

Tutorial : 1 hour/week

Practical : 2 hour/week

Assessment:

Theory:

Continuous Assessment – 50 marks

1. Assignment – 30 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term Test – 15 marks.
3. Class Test/Quizzes – 5 marks.

Semester End Examination – 30 marks

1. Written Examination (2 hours) – 30 marks

Practical:

Continuous Assessment – 20 marks

1. Regular Assessment of Experiments –15 marks
2. Class Test/Practical Examination/Viva Voce – 10 marks

Students must obtain 40% each in CA theory, CA in practical and Semester end examination. The overall pass mark for the module is 50%

Pre-requisite- Nil

Subject Matter:

1. Building Stones and Bricks and Clay Products and Lime:

Stones: Classification of rocks based on geological, physical and chemical composition, characteristics and use of various stones available in Bhutan – Stone quarrying methods, precautions to be taken, various explosives to be used – Methods of dressing and polishing of stones – Artificial stones – Various tests on stones as per I.S. Code.

Bricks: Sources and qualities of brick earth – Classification of bricks – Manufacture of bricks – Special forms of bricks and their uses – General qualities of bricks and their tests as per I.S. Code.

Clay Products: Various types of tile manufacturing and their uses, earthen wares, terra-cotta, stoneware, porcelain, glazing of tiles etc.

Lime: Classification of limes – Properties of lime – Preparation of lime including slaking of lime.

2. Timber, Wood Based Products, Glass and Metals:

Timber: Classification of timber – Properties of timber including testing methods – Seasoning and preservation of timber – Defects and decay – Properties of commonly available timber in Bhutan.

Wood Based Products: Veneers, plywood and its types – Manufacturing of plywood – Plywood grades as per I.S. Code – Laminated wood – Merits of plywood and laminated wood, laminated board block board batten board, hard board, particle board and composite board – Synthetic resins.

Glass: Ingredients and properties of glass – Types and selection of glass for different applications in the building industry. -Advantages and disadvantages of environment friendly glasses.

Metals: Types of metals – Properties of iron, steel, aluminium, zinc, lead etc. – Non-ferrous alloys.

3. Paints and Varnishes, Plastics, Asbestos and Bituminous Materials:

Paints and Varnishes: Constituents and characteristics of paints – Types of paint and their uses – Constituents of varnishes – Uses of varnishes – Different kinds of varnish (Lacquer) and polishes etc. -Introduction to eco-friendly paints –different types of available eco-friendly paints- their merits and demerits.

Plastics: Chemical composition of plastics – Raw materials and manufacturing of plastics – Classification of various plastics and their applications.

Asbestos and Bituminous Materials: Availability and uses of asbestos – Properties of asbestos – Various types of asbestos – Difference between asphalt & bitumen – Types, uses, properties of asphalt and bitumen – Composition of coal tar, wood tar, mineral tar and Naphtha.

Plastering, Pointing and Painting:

Types of plastering and pointing and their selection criteria and construction – White (Lime) washing and colour washing – Painting and distempering

4. Cement, Mortar and Concrete:

Cement: Properties of Ordinary Portland Cement (OPC) – Manufacturing of OPC – Chemical composition of OPC – Types of cements and their applications – Laboratory and field tests on OPC as per IS standards – Storage of cement.

Concrete: Ingredients of concrete and their characteristics – Types of admixtures used in concrete, their functions and applications – Preparation of concrete: batching, mixing, transporting, placing, compaction and curing – Properties of concrete and the relevant tests as per IS Codes – Concrete grades and mix designs as per IS code – Quality control measures in concrete preparation – Introduction to destructive and non-destructive tests. –classify the various eco-friendly concretes and its uses.

Mortars: Types and characteristics of mortar as per IS Code.

5. Sound and Fire Proof Construction:

I.S.Code specifications – Selection criteria and construction of sound and fire proof constructions.

Practical:

It is as same as the Civil Engineering Student/s Building Materials and Construction Practical.

At least minimum of ten experiments has to be conducted from the following:

1. Preparation of brick and stone masonry of different types using sand as the mortar.
2. Determination of water absorption and dimensional tolerance of bricks.
3. Determination of compressive strength of bricks and timber with the help of UTM/ CTM.
4. Determination of fineness modulus and grading of fine and coarse aggregates.
5. Determination of moisture content and bulking of sand.
6. Determination of water content for standard consistency of cement and setting times of cement.

7. Determination of workability of concrete through slump and compaction factor tests.
8. Preparation of concrete specimens for characteristic strength tests and determination of their strengths.
9. Load-Deflection curve and measurement of strains by mechanical and electrical strain gauge for a steel beam/concrete beam.
10. Bond strength between steel bar and concrete (a) in a beam specimen and (b) by pull out test.
11. Demonstration of the use of non-destructive test equipment.
12. Concrete Mix Design as per I.S. Code Method.
13. Site visits to on-going construction works in the local area to show the scaffolding and formworks etc.

Reading List:

1. Arora, S.P. and Bindra, S.P, (1997). *A Text Book of Building Construction*, New Delhi: Dhanpat Rai Publications.
2. Jha, J. and Sinha, S.K. (2004). *Building Construction*. New Delhi: Khanna Publishers.
3. Kumar, S. (1994). *Engineering Materials*. New Delhi: Standard Publishers & Distributers.
4. Melrin, N. (2006). *Text-Book of Engineering Materials. (4th Ed.)*. NY: John Wiley & Sons Inc.
5. Osman, A. (2009). *Green Architecture -Advanced Technologies and Materials.*(1st Ed.)USA:McGraw-Hill.
6. Pacheco,T. Fernando(2011).*Eco-efficient construction and building materials*. NY:Springer-Verlag London Limited
7. Rangwala, S.C. (2006). *Building Materials (3rd Ed.)*. New Delhi: Charotar Publications.
8. Smith, R.C. *Materials of Construction*. New York: McGraw-Hill Company.

References/Additional Reading list:

1. Bhutan Schedule of Rates – 2012. DES. MoWHS.
2. Labour and Materials Coefficients (Civil Works) – 2012. DES. MoWHS.
3. Specifications for Building and Road Works-2012. . DES. MoWHS.
4. *Standard and Specification for cost effective innovation, Building Materials and Sequence*. New Delhi: BMPTC Publication.

Date : April, 2014.

AGR 103 - Arts and Graphics-II

Name of the Module :	Arts and Graphics-II
Module Code	: AGR 103
Semester	: II
Credit Value	: 12
Module Leader	: Mr. Chimi
Module Tutor	:

General Objectives of the Module:

This module gives students an overall understanding of the effective use of various media and mixed media rendering in order to prepare for the higher levels of presentation skills. They will also get hands-on experience to various media and art expressions leading to meaningful art and design productions. Since the module is production-oriented, students are expected to display mastery of skill and creativity.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Identify various types of arts and explain its histories and philosophies.
2. Analyze principles, theories and graphics with architectural composition.
3. Use various media and mixed media in art productions through hands-on projects.
4. Make free hand sketches of various spaces.
5. Describe the various fundamentals of visual arts and its use in designing.
6. Prepare both outdoor and indoor sketches of assigned buildings or landscape spaces.
7. Generate numerous mediums and techniques of art.

Learning and Teaching Approach Used: (1 - 0 - 3)

Lectures	:	1 hour / week
Tutorial	:	Nil
Studio	:	3 hours / week

Assessment:

The external jury should have minimum of two members including the module tutor. The evaluators can be either from college or outside having the knowledge on this particular module. The tutor is not allowed to evaluate the students' portfolio during the external jury.

Studio:

Continuous Assessment - 70marks

1. Studio assignment - 50marks

By the end of the semester, students should submit atleast one assignment under each topic for this module.

2. Project-20marks

Semester End external viva/Jury- 30marks

1. Portfolio presentation

Students must obtain 40% each in Continuous Assessment and Semester end jury/presentation. The overall pass mark for the module is 50%

Pre-requisites- Nil

Subject Matter:

1. **Philosophy of Art:** Relevance of art of life: Art and artist, Art and society, Art and religion, Art and mysticism. Appreciation of art: Painting, Sculpture and Architecture.
2. **Art in Architecture:** psychological and emotional aspect of aesthetics. Advanced aspects of visual cognition, psychological responses of humans; Art, design, Architecture and cinema appreciation.
3. **Bhutanese Art and crafts and Techniques:** Study on Bhutanese arts and crafts like paintings, sculptures,

4. **Architectural Presentation Techniques:** Three-dimensional views, cut-away views, architectural rendering and model making in different media, colour presentation, optics and kinetics, Life drawing, Art lettering.
5. **Advanced Business Presentation:** Multi-media presentation, Reprographic techniques, print-making, architectural photography, Audio-visual projection, animated graphics. Business graphics appropriate for illustration of reports and as accompaniments for seminars.
6. **Exercises:** 1. Pencil and charcoal sketching, mixed media rendering, water colour compositions and primary use of acrylic / oil colours; alternative media work such as glass painting, earthen pot painting, murals and wall paintings. 2. Rendering in different media. Works of masters of Modern Architecture. 4. Preparation of collage and Murals for exterior and interior of the buildings such as waiting areas in hotels, schools and hospitals.

Reading List:

1. Adithya Kuber et al. (2005). *Jasubhai Digital Media Fast Track to digital Photography*. Maulic Pub.
2. Ambrose, G. and Harris, P. (2009). *The Fundamentals of Graphic Design*. SA: AVA Publishing.
3. Caldwell peter (1995). *Pen and Ink Sketching*. London: B.T. Bats ford Ltd.
4. Chang Dorji (2004). *Clear exposition of Bhutanese Architecture*. Thimphu: MoWHS.
5. Ching Francis (1990). *Drawing a Creative Process*. New York: Van Nostrand Reinhold
6. Huntly, Moira. (1997). *The artist drawing book. (Revised Ed.)*. U.K.: David & Charles.
7. Julie, A.K. *Shoot like a pro! Digital photography techniques*. McGraw-Hill
8. Landa, R. (2011). *Graphic Design Solutions*. New York: Wadsworth.
9. Saamdu Chetri & Samirendra N. D. (2004). *Money and Microenterprises in Bhutan: The Land of Zorig Chug Sum Thirteen Arts and Crafts*. Kmt Press Bhutan Sterling Publishers Pvt. Ltd.
10. Webb, Frank (1995). *The Artist guide to Composition. (1st Ed.)*. U.K: David & Charles **Date** : November, 2013.

Date : April, 2014.

ACS 101 - Academic Skills

Name of the Module :	Academic Skills
Module Code :	ACS 101
Semester :	II
Credit Value :	12
Module Leader :	Ms.Pema Choezom
Module Tutor :	(By Science and Humanities Department)

General Objective:

This module aims to familiarize students with academic standards, and equip them with the academic skills necessary for efficient study at university level.

Learning Outcomes: *On completion of the module, students should be able to:*

1. locate and select sources by evaluating the credibility of an author, a publisher or a website

2. read texts at a variety of levels by applying skimming and scanning techniques, and reading for detailed understanding
3. distinguish between fact and opinion in a source
4. collect and synthesise information using note-taking, summarizing and paraphrasing.
5. follow the writing process: planning, organizing ideas, structuring, synthesising, editing and proofreading
6. acknowledge sources used and create a reference list, using APA style
7. organise information according to the purpose of writing and the text type to be used
8. take organized notes using appropriate formatting and main ideas
9. deliver an organized oral presentation
10. organize and monitor progress of their own learning through maintenance of a portfolio

Learning and Teaching Approaches

Tutors will employ an interactive, student-centered approach, integrating language and critical thinking skills using the following strategies over the 60 hours of contact time.

- Demonstrations/Modeling (3 hours)
- Practical exercises and activities/Task-based learning (18 hours)
- Individual, pair and group work (e.g. Discussions, problem-solving activities, collaborative and individual tasks, peer feedback, debates, role-plays, etc.) (18 hours)
- Process learning, with diagnosis, feedback and remediation (e.g., with portfolio tasks) (15 hours)
- Presentations (6 hours)

Assessment

Since this module is entirely assessed through coursework, a student must complete all 4 components of the assessment outlined below (portfolio; 2 class tests; presentation; essay) and get an aggregate mark of 50% or above in order to pass.

Continuous Assessment:

A portfolio of work done in class and as homework including:	25%
Two Class Tests	30%
An oral presentation	15%
<u>A researched assignment (essay)</u>	<u>30%</u>
TOTAL:	100%

Subject Matter

Unit 1: Academic Standards (5 hours)

- a. Purpose of academic activity
 - b. Features of academic writing
 - c. academic argument and academic integrity/ethics
- Unit 2: Note-taking (6 hours)
- a. Basics of note-taking
 - b. Types of notes, strategies and activities
 - c. Listening and note-taking
- Unit 3: Academic Reading (13 hours)
- a. Identify text features & organization
 - b. Reading Techniques (skimming/scanning, SQ3R)
 - c. Locating, evaluating and selecting information
 - d. Summarising / paraphrasing academic texts
 - e. Critical reading (author viewpoints/biases, reading for detail)
- Unit 4: Academic Essay Writing (14 hours)
- a. Introduction to the Writing Process
 - i. 1. pre-writing (gathering information; brainstorming; planning and outlining); 2. drafting (writing); 3. revising & editing/proofreading; 4. publishing
 - b. Understanding & analyzing assigned topics/directions (BUG); using the writing process
 - c. Essay Format / Structure
 - i. Introduction & Thesis statement
 - ii. Body paragraphs (topic sentences; supporting sentences with evidence / examples/ explanation/ etc; concluding sentences / transitions; cohesive devices)
 - iii. Conclusion
- Unit 5: Referencing Techniques and APA format (10 hours)
- a. Introduction to using source materials
 - i. what are sources?, relevant terms, introduction to paraphrasing source material
 - b. Academic integrity and referencing
 - c. Locating, Evaluating and Selecting Sources
 - d. Using source materials for in-text citation
 - e. Making end-text/reference lists
 - f. Avoiding plagiarism
- Unit 6: Oral Presentations (10 hours)
- a. Introduction to academic argument in oral settings and presentations
 - b. Strategies for delivering an effective presentation
 - i. structure, signposting
- Unit 7: Types of Writing (2 hours)
- a. Reflective writing or Report writing
 - b. (or any other writing genres relevant to colleges: e.g., proposals/business plans, lab reports, and other technical writing types)

Reading List KARMA TSHERING

Essential Reading :

Teacher Materials (April, 2013)

Student Materials (April, 2013)

Additional Reading:

American Psychological Association. (2010). *Publication Manual of the American Psychological Association* (6th ed.). Washington, D.C.: American Psychological Association.

Renn, D. (2005). *Strategies for college success: A study skills guide*. Ann Arbor: University of Michigan.

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Date Revised: April 19, 2013

HTA 202 - History of Architecture – II

Name of the Module :	History of Architecture - II
Module Code :	HTA 202
Semester :	II
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

This module will provide an over view about the development of Architecture in the Western World through the evolution of Christianity and the development of Architecture in Asia particularly India through the evolution of Islam as a religion and the cultural and contextual determinants. It also gives the background of the development of Architecture of Europe from the Romanesque period to the Renaissance period, (6th - 16th Century AD) and the impact of various geographical, cultural, social, religious and political forces, their material and construction techniques.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Describe development of architectural form with reference to technology, style and character in the Western World through the evolution of the church from early Christian times up to the Renaissance period.
2. Explain the evolution of Gothic forms - How it influenced later development of Modern Architecture, European renaissance and revival of classicism in Architecture.
3. Identify and analyze how social and culture influenced the Renaissance Architecture in Europe.
4. Explain the philosophies of renaissance Architects of France and England.
5. Describe Islamic Architecture as evolving within specific cultural contexts including aspects of society, religion, politics and climate.
6. Explain the development of architectural form with reference to technology, style and character in the Indian context through the evolution of the mosque and tomb in the various phases of Islamic rule in the country.
7. Relate the Mughal and Islamic architecture with the evolution of Traditional Bhutanese Architecture.

Learning and Teaching Approach Used: (3 - 0 - 0)

Lectures	:	3 hours / week
Tutorial	:	Nil
Studio	:	Nil

Assessment:**Theory:****Continuous Assessment - 50marks**

1. Assignments -30 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15 marks.
3. Class test - 5 marks

Semester End Examination - 50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

- 1. Romanesque:** The medieval ages learning in the monasteries, evolution of the guilds Factors influencing Architecture outline of architectural character if Italy, France and England Examples: Pisa group, Italy Abbay aux Hommes, Caen, Tower of London.
- 2. Gothic Architecture:**
 - a. French Gothic:** Religious and social influences evolution of vaulting and development of structural systems outline of Architectural character Examples: Notre Dame, Paris.
 - b. English and Italian Gothic:** Development of English gothic vaulting, outline of Architectural character in England and Italy Examples: Westminster Abbey, Hampton Court Palace, London, Doges Palace, Venice, Milan Cathedral.
- 3. Renaissance Architecture:**
 - a. Italian Renaissance:** The idea of rebirth and revival of art sociological influences in art and Architecture, Development of thought, emergence of merchant communities and their patronage. Outline of the Architecture during the early Renaissance, High Renaissance and Baroque Periods Features of a typical Renaissance palace, e.g. Palazzo Ricardi, Study of life history philosophy, contribution of the following architects; Brunelleschi, Michelangelo, Andrea Palladio.
 - b. French and English Renaissance:** Outline of the architectural character of French and English Renaissance, Domestic Architecture in England, Study of the life, philosophy and works of the following architects: Sir Christopher Wren, Inigo Jones.
- 4. Baroque Architecture:** Roman Baroque churches: The central plan modified – St. Peters, Rome; French Baroque: Versailles – English baroque –St. Paul’s London – Domestic Architecture in England.

5. **Islamic Architecture:** Evolution of building types in terms of forms and functions: mosque, tomb, minaret, madarasa, palace, caravanserai, market - character of Islamic Architecture: principles, structure, materials and methods of construction, elements of decoration, colour, geometry, light
6. **Mughal Architecture:** Evolution of Architecture and outline of Mughal cities and gardens under the Mughal rulers: Babur, Humayun, Akbar, Jahangir, Shahjahan, Aurangazeb- important examples- decline of the Mughal Empire. –Their relation with Bhutanese Architecture.

Reading List:

1. Catherine Asher (2001). *Architecture of Mughal India*. Cambridge University Press.
2. Ching, Francis D. K., Jarzombek, M.M. and Prakash, V. (2010). *A Global History of Architecture*. John Wiley & Sons.
3. Christopher Tadgell (2002). *The history of architecture in India : from the dawn of civilization to the end of the Raj*. London : Phaidon Press
4. George Mitchell (2006). *Architecture of the Islamic World - its history and social meaning*. London: Thames and Hudson.
5. Pier Luigi Nervi (1972). *History of World Architecture – Series*. New York: Harry N.Abrams, Inc.Pub.
6. Robert Hillenbrand (1994). *Islamic Architecture- Form, Function and Meaning*. Edinburgh University Press.
7. R.Nath(1985). *History of Mughal Architecture Vol. I to III*. New Delhi: Abhinav Publications.
8. Satish Grover (2002). *Islamic Architecture in India*. New Delhi, CBS Pub.
9. S.Lloyd and H.W.Muller (1986). *History of World Architecture – Series*. London: Faber and Faber Ltd.
10. Sir Banister Fletcher (1996). *A History of Architecture, (20th Ed.)*. Architectural Press.

Date : April, 2014.

B. Arch. (Second Year) – Third Semester

Total number of Contact Hours = 31, Total Credits =72

SN .	Code	Name of the Module	Contact Hours			No. of Credits	Marks			
			L	T	P/S		Theory		Studio	
							CA	EX	CA	EX
1	ADE203	Architectural Design-I	1	0	8	12			150	

2	TSM202	Structural Mechanics -II	3	1	0	12	30	70		
3	BLC202	Building Construction-I	2	1	2	12	25	25	25	25
4	BSS201	Climatology	3	2	0	12	50	50		
5	POS201	Principle of Surveying-I	2	1	3	12	25	50	25	
6	HTA203	History of Architecture-III	3	0	0	12	50	50		
Total			14	4	13	72				

ADE 203 - Architectural Design - I

Name of the Module : Architectural Design - I

Module Code : ADE 203

Semester : III

Credits Value : 12

Module Leader : Mr. Chimi

Module Tutor :

General Objectives of the Module:

This module creates a basic understanding of the aesthetic aspects that shapes the built environment. It is also to expose the students towards the design of simple residential buildings or school. Here the students will be able to understand the process of design of any building in small scale incorporating barrier free elements and details.

In this module, students are expected to observe individual critiques Students are required to formally present the progress of their work to the module tutor for informal/formal review every week.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Describe conceptualization of form, space and structure through creative thinking and initiate architectural design process from first principles.
2. Assess land and landforms and the elements of built space for the concept design.
3. Design some simple structural systems and building components.
4. Develop concept leading to the creation of a three-dimensional system that will ultimately be used to generate architectural form.
5. Work in group or alone.
6. Give critique on various designs and the existing buildings or spaces.
7. Generate a coherent architectural project, represented through technical drawings and models.

Learning and Teaching Approach Used: (1 - 0 - 8)

Lectures : 1 hour / week

Tutorial : Nil

Studio : 8 hours / week

Assessment:

The external jury should have minimum of two members including the module tutor. The evaluators can be either from college or outside having the knowledge on this particular module. The tutor is not allowed to evaluate the students' portfolio during the external jury.

Studio:

Continuous Assessment - 150marks

1. Studio assignment and Project - 90marks
2. Test-10marks
3. Semester End external viva/Jury- 50marks
 1. Portfolio presentation

Students must obtain 40% each in CA theory and Semester end jury/presentation. The overall pass mark for the module is 50%.

Pre-requisite – Basic Design – II (ADE 102)

Students will be asked to do the working drawing of their own residential building/flats, during the semester vacation after completion of First Year-Second Semester. This should be submitted to the tutor within the first month of third semester.

Subject Matter:

1. **Design Methodology:** Steps in design methodology through small studio problems. Relevant literature review, similar case studies, programming and formulation of concept in architectural studio assignments. Generation of Bubble Diagram and Activity Proximity Matrix to establish a functional relationship among various spaces. Application of climatic data, basic structural and social consideration in architectural design.
2. Study of the **Social and Physical Environment**& methods of construction in Architecture, emerging out of the traditional way of life of the people in any particular place including topography. This may be a village or part of a small town or suburban, etc.
3. **Design Exercises:** Residential buildings, Institutional buildings: Banks, nursery or primary schools, primary health center, neighbourhood market, etc.
4. **Areas of focus/ concern:**
 - Architectural form and space aesthetic and psychological experience of form and space in terms of scale, colour, light, texture, etc.,
 - Function and need: User requirements, anthropometrics, space standards, circulation,
 - Image and symbolism

Reading List:

1. Andrew Alpern (1982). *Handbook of Speciality: Elements in Architecture. (1st Ed.)*. McGraw Hill Book Co.
2. Edward D.Mills (2010). *Planning the Architects Handbook, (10th Ed.)* Newnes-Butterworths.
3. Hideaki Hareguchi (1988). *A Comparative analysis of 20th century houses. (9th Ed.)*. Academy Editions.
4. Julius Panero & Martin Zelnik (2014). *Human Dimension and Interior Space: A Source Book of Design Reference Standard. (Revised Ed.)*. Ten Speed Press.
5. Sam F. Miller (1995). *Design Process: A Primer for Architectural and Interior Design*. Van Nostrand Reinhold.

References/Additional Reading list:

1. Ching, Francis D.K. (2007). *Architecture – Form, Space and Order*. (3rd Ed.). New Jersey: John Wiley & Sons.
2. Ernst, Neufert (2012). *Neufert Architects' Data*, (4th Ed.). UK: Blackwell publishing ltd.
3. Joseph De Chiara, Michael J. Crosbie (2001). *Time Saver Standards for Building Types*. McGraw Hill Professional.
4. Joseph De Chiara, Julius Panero and Martin Zelnik (2001). *Time Saver Standards for Interior Design and Space Planning*. McGraw Hill.

Date : April, 2014

TSM 202 - Structural Mechanics-II

Name of the Module :	Structural Mechanics-II
Module Code :	TSM 202
Semester :	III
Credit Value :	12
Module Leader :	Mrs. Monika Thapa
Module Tutor :	(By Civil Engineering Department)

General Objectives of the Module:

This module makes students aware of how structural resolutions become important in realization of Architecture design concept. At this stage, students shall be exposed to forces, moments, and resolution that are to be resolved. The focus is to study the concept of shear force and bending moment in beam section, deflection of beams and theory of columns and to know the concept of indeterminate structure.

Learning Outcomes:

Upon the successful completion of this module, the students will be able to:

1. Understand the basic concepts of shear force and bending moment acting on beams subjected to various loading conditions.
2. Determine the stresses in beams and strength of sections.
3. Calculate deflection of beams using various methods.
4. Visualize various theories of columns by working.
5. Analysis and obtain the bending moment and shear force output of a statically indeterminate beam.
6. Work out shear force and bending moment on beams subjected to different loading conditions.
7. Determine shear stress and bending stress distribution in bending sections.
8. Calculate and find slope and deflection of beams.
9. List out various behaviour of continuous beams, fixed beams and portal frames.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment - 30marks

1. Assignments -10 mark.
2. Term test -15 marks.
3. Class test - 5 marks

Semester End Examination - 70 marks

1. Written examination (3 hrs. duration) – 70 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

1. **Shear Force and Bending Moment:** Basic concepts – shear force and bending moment diagrams for cantilever and simply supported beams subjected to various types of loadings (Point loads, uniformly distributed loads, uniformly varying loads and concentrated moments/couple) – Over hanging simply supported beams.
2. **Stresses in Beams:** Theory of simple bending - bending stresses in beams, shear stresses in beams examples on simple sections. Strength of sections - Beams of composite sections (Flitched beams) - Stress distribution diagrams.
3. **Deflection of Beams:** Slope and deflection at a section/point - Double Integration and Macaulay's method for calculation of deflection for simply supported and cantilever beams for concentrated loads and uniformly distributed loads.
4. **Columns:** Short and long columns – Concept of Elastic stability – Euler's theory – Assumptions and Load carrying capacity of Columns with different end conditions – Concept of Effective length – Slenderness ratio – Limitations of Euler's theory – Rankine's formula – Eccentric loading – Core of a column section - Application to simple problems.
5. **Introduction to Indeterminate Structures:** Introduction – Determination of degree of determinacy for beams and frames - Concept in Analysis of continuous beams, fixed beams, and partial frames (No analysis problems).

Reading List:

1. A.R.Jain and B.K.Jain (1987). *Theory and Analysis of Structures, Vol. Roorkee:* Nemchand and Bros.
2. B.C.Punmia (1994). *Strength of Materials and Theory of Structures, Vol. 1.* New Delhi: Laxmi publications.
3. M. M. Ratwani & V.N.Vazirani (2008). *Analysis of Structure, Vol.1.* New Delhi: Khanna Publishers.
4. R.K. Bansal (1994). *A Text Book on Strength of Materials.* New Delhi: Laxmi Publications.
5. R.K. Rajput.(2007). *Strength of Materials.* New Delhi: S.Chand & Company Ltd.
6. R.S.Khurmi. *Strength of Materials.* New Delhi: S.Chand & Company Ltd.
7. Timoshenko, S.P., and D.H. Young (1993). *Elements of Strength of Materials.*(5th Ed.).East West Press.

Date: April, 2014.

BLC 202 - Building Construction – I

Name of the Module : Building Construction - I

Module Code	:	BLC 202
Semester	:	III
Credit Value	:	12
Module Leader	:	Mr. Chimi
Module Tutor	:	One Architect and Civil Engineer each

General Objectives of the Module:

This module is introduced to Architecture programme to study the various methods of construction. Students shall be also acquainted with the traditional and present constructional practices. Thrust will be given Eco-friendly construction methods.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Differentiate among the various types of stone and brick masonry bonds based on visual inspection and construction methodology.
2. Illustrate and develop composite masonry scheme for a given real life problem.
3. Prepare construction details of brick and stone arches and lintels.
4. Identify different types of carpentry joineries for building components.
5. Identify different types of doors and windows.
6. Interpret the standard door-window details for different requirement and size.
7. Design and draw a staircase for a given dimension.
8. Identify different details for bamboo construction.
9. Explain the various methods of shuttering, scaffolding and centering.

Learning and Teaching Approach Used: (2 -1 - 2)

Lectures will be supplemented by relevant visual aids and site visits. Students will be encouraged to develop the constructional detail of real life examples.

Lectures	:	2 hour / week
Tutorial	:	1 hour / week
Studio	:	2 hours / week

Assessment:

Continuous Assessment - 50marks

1. Studio assignment - 25marks

By the end of the semester, students should submit atleast five assignments for this module.

2. Theory - 25marks
 - i. Assignments-10marks
 - ii. Class test – 5marks
 - iii. Term Test – 10marks.

Semester End Examination- 50marks

1. Studio Examination (2Hrs.)-25marks.
2. Theory Examination (2 Hrs.)-25marks.

Students must obtain 40% each in CA Theory, CA Studio assignments, Semester End Examination Theory and Semester End Examination(Studio). The overall pass mark for the module is 50%.

Pre-requisite – Building Materials (BLC 101)

Subject Matter:

1. **Introduction:** Functional requirements of building and its components, introduction to concept of load bearing and framed structures. Exercises – involving the same.
2. **Brick masonry:** Design and construction of various structural components using bricks – basics of brick bonding principles, types of bonding, foundations, load bearing walls, cavity walls, lintels, arches, corbels, piers, flooring, etc.
3. **Stone Masonry:** Stone foundation, Masonry (Ashlar, rubble, cavity composite walls) flooring, coping, sills, lintels, corbels, arches, cladding. Design Exercises – Using stone for building components.
4. **Composite masonry:** cement concrete (hollow and solid); hollow clay tile masonry; glass block masonry. Construction details of brick and stone arches including lintels.
5. **Soils :** Design and construction techniques Foundations – basic rules, design details, Base modules – basic rules, design details walls – basic principles – Design of openings, arches vaults, floors and roofs. Design of buildings – using rammed earth, Adobe blocks, Compressed blocks – Exercises of the above
6. **Bamboo:** Design and Construction Techniques Foundations – Basic rules, design details, Base modules – Basic rules, design details. Design of walls, openings, floors and roofing- Thatch, grass, bamboo, reed. Design Exercises of buildings using bamboo for building components, structural application of bamboo – Arched, Barrel vaults, weave structures.
7. **Timber and timber products:** Doors and windows: simple carpentry joineries, different types of doors and windows, fixing details of frame, style, rail, panel, glazing including fixtures and fastenings. -Staircase: Types of staircase, their locations, fixing details and basic calculations of the tread and riser, etc. - Roof Trusses: Timber trusses, types; fixing details showing purlin, rafter, tie, strut, cleat etc. Different types of roof coverings: tiles, asbestos and metal sheets etc. with fixing details.
8. **Wall sections:** Typical section through a load bearing wall showing details of foundation, plinth, window or door(openings) sill, lintel with chajja, roof slab, cornice and parapet, roof details etc. Expansion joints.
9. **Form Works:** Centering and shuttering: their selection and construction – Types of scaffolding, their selection criteria and construction

Reading List:

1. Arora, S.P. and Bindra, S.P.(2013).*A Text Book of Building Construction.(revised Ed.)*. Dhanpat Rai Publications.
2. Barry (2005). *Construction of Buildings, Volume 1&2*. Oxford: Blackwell Publishing Ltd.
3. Dr. B.C,Punmia(2010). *A Text book of Building Construction.(10th Ed.)*. New Delhi: Laxmi Publications Pvt. Ltd.
4. Francis, D. K. Ching (2008). *Building Construction Illustrated.(4th Ed.)*. John Wiley & Sons Inc.
5. Merritt, F. S. and Ricketts, J. T.(2001). *Building Design and Construction Handbook. (6th Ed.)*.McGraw Hill.
6. T.D. Ahuja and G.S. Birdie (1996). *Fundamentals of Building Construction*. New Delhi: Dhanpat Rai Publishing Company Pvt. Ltd.
7. W.B. McKay (1992).*Building Construction (vol. I –IV)*.Orient Blackswan.

References/Additional Reading list:

1. *Bhutan Schedule of Rates – 2012*. DES. MoWHS.
2. *Labour and Materials Coefficients (Civil Works) – 2012*. DES. MoWHS.
3. *Specifications for Building and Road Works-2012*. DES. MoWHS.
4. *Standard and Specification for cost effective innovation, Building Materials and Sequence*.
New Delhi: BMPTC Publication.

Date: April, 2014.

BSS 201 –Climatology

Name of the Module :	Climatology
Module Code :	BSS 201
Semester :	III
Credit Value :	12
Module Leader :	Mr.Chimi
Module Tutor :	

General Objectives of the Module:

This module creates awareness that, Architecture to a large extent is influenced by Climatic/weather conditions. It is done by exposing student to factors of climate, the various climatic zones, heat flow through materials and buildings and the resultant ambience. They will be prepared to use this knowledge in design consideration.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Categorize different climatic regimes and assess the magnitude of design challenges.
2. Assess bio-climatic comfort conditions.
3. Analyze thermal characteristics of building components, estimate heat exchanges occurring in a building and means of thermal control.
4. Use prediction techniques for estimating daylight in interior building spaces.
5. Explain various passive methods of climate control in buildings and use of non-conventional energy resources such as building integrated solar energy conversion systems.
6. Identify and describe climatological aspects associated with the Architectural Design.
7. Use shading devices to overcome the harmful effects.
8. Explain transfer of heat into buildings through materials, and building elements.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures will be used as the basic method of introducing concepts and this will be reinforced by Site Visits and Case Studies to gain analytical skills. The knowledge used here can be used in Design studio and simultaneously the design assignment can be discussed in this class.

Lectures	:	3 hours / week
Tutorial	:	1 hour / week

Studio : Nil

Assessment:

Theory:

Continuous Assessment - 50marks

1. Assignments -30 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15 marks.
3. Class test - 5 marks

Semester End Examination - 50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

- 1. Concept of Solar Design and devices:** Movement of sun – Locating the position of sun – Sun path diagram – Overhead period–Solar shading–Shadow angles – Design of appropriate shading devices, glare, colour, amount of light, sky as a source of light, day light factor, effect of size and shape of opening in different planes with and without obstructions, Intensity of light speed, penetration, design and setting of buildings for day light in different parts of the climatic zones.
- 2. Heat Flow through Building Envelope Concepts:** Factors that influence temperatures, sun latitude, season, land, water, wind, altitude, atmospheric impurities, green open areas, trees and urban area. The transfer of heat through solids – Definitions – Conductivity, Resistivity, Specific heat, Conductance, Resistance and Thermal capacity – Surface resistance and air cavities– Air to air transmittance (U value) – Time lag and decrement i.e. value AIR heat transmittance co-efficient, scale , temperature.
- 3. Air Movement due to Natural and Built Forms:** The wind – The effects of topography on wind patterns – Air currents around the building – Air movement through the buildings – size and position of openings with and without overlays and other architectural elements. Effect of wind on design and siting of buildings - The use of fans – Thermally induced air currents – Stack effect, Venturi effect – Use of court yard.
- 4. Climate and Design of Buildings:** Design strategies in various climatic zones - warm humid climates, hot humid climates, hot and dry climates and cold climates – Climate responsive design exercises.

Reading List:

1. B. Givoni (1998). *Man, Climate and Architecture, Architectural Sciences Series*. London: Applied Science Publishers Ltd.
2. Donald Watson and Kenneth Labs (1993).*Climatic design: energy-efficient building principles and practices*.New York: McGraw-Hill Book Company.
3. Galloe, Salam and Sayigh A.M.M. (1998). *Architecture, Comfort and Energy*. Oxford: Elsivier Science Ltd.
4. Joseph de chiara and Le Copplemann (2010). *Planning and Design Criteria. (Digitized Ed.)*. Van Nostrand Reinhold.

5. Lstiburek, J.W. (2000). *Builder's Guide: Hot-humid Climates*, Building Science Corporation. MA: Westford.
6. Lstiburek, J.W. (2000). *Builder's Guide to Cold Climates: Details for Design and Construction*. Newtown: Taunton Press.
7. Martin Evans (2007). *Housing Climate and Comfort. (Digitized Ed.)*. London: Architectural Press.
8. O.H. Koenigsberger (2007). *Manual of Tropical Housing and Building – Part I - Climate design*. London: Orient Longman.

References/Additional Reading list:

1. Bureau of Indian Standards IS 3792 (1987). *Hand book on Functional requirements of buildings other than industrial buildings, (Part I – IV)*. Manakbhavan, 9, Bahadur Shah Zafar Marg, New Delhi – 110002.

Date : April, 2014.

POS201 – Principles of Surveying-I

Name of the Module:	Principle of Surveying -I
Module Code	: POS201
Semester	: III
Credit Value	: 12
Module Leader	: Mr. Leki Dorji
Module Tutor	: (By Civil Engineering Department)

General objectives of the module:

-To introduce principles of surveying and applications of linear and angular measuring instruments.

Learning outcomes:

Upon successful completion of this module, the student will be able to:

1. Demonstrate the basic surveying skills
2. Identify various surveying instruments.
3. Perform different methods of surveying
4. Compute data required for surveying
5. Integrate the knowledge and produce topographical map.

Learning and Teaching Approach Used: (2 - 1 - 3)

Lectures will be used as the basic method of introducing concepts and this will be reinforced by tutorials to gain analytical skills. Practical classes are provided to give experience on the use of various instruments. These skills will be provided by the following means;

Lectures	:	2 hours / week
Tutorial	:	1 hour / week
Practical	:	3 hours / week

Assessment:

Continuous assessment – 50 marks

Theory – 25 marks

1. Term exam - 10 marks.
2. Assignment – 10 marks.
3. Case Study – 5 marks

Practical – 25 marks

1. Assignment - 20 marks
2. Test - 5 Marks

Semester End Examination – 50 marks

Written examination (3hrs) - 50 Marks

Students must obtain 40% each in CA theory, CA in practical and Semester end examination. The overall pass mark for the module is 50%.

Subject matter:

- 1. Introduction:** Importance of surveying - classification of surveys - stages of survey operations - Principle of surveying - conventional signs - surveying instruments - their care and adjustment.
- 2. Measurement of Distances:** Principle of different methods and their accuracies - measurement by tape - sources of errors and precautions - corrections to tape measurements.
- 3. Measurement of Angles and Directions:** Reference meridians - bearing and azimuths, magnetic declination and its variations, use and temporary adjustments of compass, theodolites - measurement of horizontal and vertical angles by theodolites.
- 4. Traversing:** Principles of traversing by compass and theodolite - field work and checks - computation of coordinates by using Gale's traverse table - sources of errors - precision of traversing - checking and adjusting of traverses - omitted measurements.
- 5. Measurement of Elevations:** Different methods of determining elevations, leveling, Trigonometric, Tachometry - definitions of terms, principle - temporary and permanent adjustments of levels - methods of booking and reduction of field notes - introduction to curvature and refraction corrections - reciprocal leveling - plotting of profiles - reciprocal observations - sources of errors and precision of leveling procedures.
- 6. Plane Table Surveys:** Principles, advantages and disadvantages - plane table equipment - methods of plane table surveying - Resection-two and three point problems - field work in plane table surveying.
- 7. Contouring:** Definition and characteristics of contours use of contour maps - direct and indirect methods of contouring.
- 8. Introduction to Modern Surveying Technologies:** Total Station- parts of total station, horizontal and vertical angle measurements, adjustments, observation of readings, data processing procedures, GPS-parts of GPS, observation of readings, data processing procedures.*(It is addition to the existing Civil Engineering module)*

Laboratory Practical:

1. Determination of horizontal distance along a sloping ground by linear measurements.
2. Observe and determine bearings of traverse by compass.
3. Plot traverse and correct traverse by plane table.
4. Determination of reduced levels of given points using levelling instruments by both height on instrument and rise and fall methods.
5. Establish a Benchmark by check levelling.
6. Draw the longitudinal and cross sections profiles along a given route.
7. Take horizontal and vertical angular measurements repetition and reiteration method.
8. Determination of the tachometric constants of a given theodolite and gradient between two points.
9. Perform traversing by tachometric method.
10. Determination of elevations of a given point by trigonometrically levelling.

11. Conduct contouring by direct and indirect method.
12. Conduct topographical survey using total station.

Reading List:

1. Agor. R. (2000). *Surveying vol. I and II*. (3rd Ed.). New Delhi: Khanna publications.
2. Arthur. B. and Stanley R. (2006). *Surveying, (2nd ed.)*. Delhi: Prentice-Hall.
3. Duggal, S. K. (2007). *Surveying –I and II*, (2nd ed.). Delhi: Tata Mcgraw Hill.
4. Chandra,A.M. (2005). *Surveying –I, (2nd Ed.)*. New Delhi: New Age International.
5. B.C.Pumia (2000). *Surveying –I and II (3rd Ed.)*. New Delhi: Laxmi Publications.
6. Rangwala, S. C. (2005). *Surveying and levelling, (2nd ed.)*, New Delhi: Charotar Publishing House.

Date: April, 2014.

HTA 203 - History of Architecture - III

Name of the Module :	History of Architecture - III
Module Code :	HTA 203
Semester :	III
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

This module explains about the impact of industrialization, invention of new materials, revolutionary thinking and philosophies of Architects, emerging schools of thought, and contributions made by Architects of international fame. This also gives the detail background of diverse Post-Modern directions in Architecture in the western world from the 1960s onwards as well as the architectural production of Asia region from the end of Colonial rule to the contemporary period.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Identify the conditions of modernity and bring out its impact in the realm of Architecture.
2. Describe the detailed background of Modern Architecture as evolving from specific aspects of modernity- Industrialisation, urbanisation, material development, modern art as well as society's reaction to them.
3. Differentiate various philosophies like futurism, expressionism, brutalism and constructivism.
4. Identify and explain the philosophy and works of leading Architects like H.Fathy, B.Baker. T.Ando, P.Soleri and J.Bawa through their selected projects.
5. Describe the Bahaus school of thought, the contributions made by Walter Gropius, international style, contributions by leading Architects like Le Corbusier, Mies Van -der -Rohe, Alvar Aalto through study of selected examples.
6. Explain an overall understanding of the architectural developments in Asia influenced by various social and culture.

7. Identify the design issues leading to birth of neoclassical and eclectic Architecture prior to industrial revolution.
8. Relate history of Built environment to the works of contemporary Architects.

Learning and Teaching Approach Used: (3 - 0 - 0)

Lectures	:	3 hours / week
Tutorial	:	Nil
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment - 50marks

1. Assignments -30 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15 marks.
3. Class test - 5 marks

Semester End Examination - 50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

1. **Introduction to Modern Architecture:** Brief on Neo-Classicism Enlightenment Architects: Boullée and Ledoux. Industrial Revolution; Invention of Materials and Technologies and their influence on Architecture.
2. **Architectural Movements:** Art Nouveau and the works of Gaudí, Horta, Macintosh – A brief study of the Early works of F.L.Wright, Adolf Loos ; Futurists Movement Manifestos and the works of Sant'Elia Expressionism and the works of Mendelsohn, Taut, Polzeig Cubism and Constructivism and its influence on Architecture *De Stijl*: Ideas and works.
3. **Institutions:** Werkbund and Bauhaus/Works of Behrens and Gropius, Canonizing Modernism, International Style. Works and Ideas, LeCorbusier, Mies, Later Works of Wright, Alvar Alto.
4. **Modernism and Post- Modernism:** Brief on critiquing modernism through writings of Venturi, Jane Jacobs, Aldo Rossi Christopher Alexander. Historic Revivalism Pop Architecture Critical Regionalism Deconstructive Theory and Practice - Their limitations. Later Ideas and selected Works of – Fathy, Baker, Ando, etc.
5. **Architecture in Asia Region:** Chandigarh experiments, Influence of Corbusier, Louis Khan, Koenigsberger The formation of Institutions, Debates on Tradition as a source and burden, works and ideas: Works and philosophies of architects from Asia region like Nari Gandhi, Doshi, Kanvinde, Correa, A. Raje, U.C.Jain, Stein Housing and others famous architects from Japan, Singapore, Sri Lanka. - The issues of Appropriate Technology Architecture in the Horizon.
6. **Built Environment:** Relation between man and built environment-History of Built environment as a social expression and cultural expression from more recent times to the present and contemporary Designs and Architects.

Reading List:

1. Aldo, Rossi (2007). *The Architecture of the City*. Massachusetts: MIT Press.
2. Bill, Risebero (1985). *Modern Architecture and Design: An alternative History.(Revised Ed.)*. MIT Press.
3. Charles, Jencks (1984). *The Language of Post Modern Architecture*. Rizzoli.
4. Ching, Francis, D. K., Jarzombek, M.M. and Prakash, V. (2010). *A Global History of Architecture*. John Wiley & Sons.
5. Derek, Avery (2003). *Modern Architecture*. London: Chaucer Press.
6. James, Steele (1998). *The Complete Architecture of Balakrishna Doshi*. Thames and Hudson.
7. Kenneth, Frampton(1994). *Modern Architecture: A Critical History*. London: Tahmes and Hudson.
8. Robert Venturi (2011). *Complexity and Contradiction in Architecture (2nd Ed.)*. Museum of Modern Art. New York.
9. Sigfried, Giedion (2005). *Space Time and Architecture: The Growth of a New Tradition.(5th Ed.)*. Havard University Press.
10. Sir Banister Fletcher (1996). *A History of Architecture (20th Ed.)*. Architectural Press.
11. *The Phaidon Atlas of Contemporary World Architecture.(2008)* Phaidon Press

Date : April, 2014.

B. Arch. (Second Year) – Fourth Semester

Total number of Contact Hours = 28, Total Credits =72

SN.	Code	Name of the Module	Contact Hours			No. of Credits	Marks				
			L	T	P/S		Theory		Studio		
							CA	EX	CA	EX	

1	ADE 204	Architectural Design-II	1	0	8	12			150	
2	TSM203	Design of Structure – I	3	1	0	12	30	70		
3	BLC 203	Building Construction-II	2	1	2	12	25	25	25	25
4	THD 202	Bhutanese Architecture	3	0	0	12	50	50		
5	BSS 202	Water Supply & Sanitation	3	1	0	12	50	50		
6	THS 201	Sociology of Architecture	3	0	0	12	50	50		
Total			15	3	10	72				

ADE 204- Architectural Design - II

Name of the Module : Architectural Design - II

Module Code : ADE 204

Semester : IV

Credit Value : 12

Module Leader : Mr.Chimi

Module Tutor :

General Objectives of the Module:

To create a holistic understanding of the socio-cultural, geographic and economic aspects that shapes the built environment. It is also to expose the students towards the design of simple community oriented buildings. Thrust will be on rural materials, construction techniques and design details

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Prepare a comprehensive study of a rural settlement that is an exemplar of collective design evolved organically over a period of time.
2. Explain the importance of designing built form and open spaces that meet the aspirations of the community.
3. Demonstrate the concepts through 2D and 3D presentation including sketches and model.
4. Implement and relate the knowledge available at international level through books, literatures and websites.
5. Demonstrate an intermediate level of competence in architectural design followed from the previous semesters.
6. Assess the knowledge gathered from theoretical modules such as climatology, materials, structures etc. in design process.
7. Prepare technically correct Architectural Drawing and implement the knowledge acquired in building construction classes to practical design problem.
8. Generate a coherent Architectural project, represented through technical drawings and models.

Learning and Teaching Approach Used: (1 - 0 - 8)

The concepts of drawings will be introduced through lectures and the drawings will be drawn by students during studio period, which will be reviewed/ assess every week. The students will be encouraged to draw free hand sketches of any building components and the available time for learning is as below:

Lectures : 1 hour / week

Tutorial : Nil
Studio : 8 hours / week

Students are taken for the study tour to any place for a week to study any particular community to have a visual experience of a place, the influence social, culture on the particular community. This will also help student to have a better idea on the Sociology of architecture module simultaneously.

Assessment:

The external jury should have minimum of two members including the module tutor. The evaluators can be either from college or outside having the knowledge on this particular module. The tutor is not allowed to evaluate the students' portfolio during the external jury.

Studio:

Continuous Assessment - 100marks

1. Studio assignment and projects - 75marks
By the end of the semester, this module should cover atleast two design assignments.
2. Class Test - 10marks
3. Term Test:-15 marks

Semester End external viva/Jury- 50marks

1. Portfolio presentation

Students must obtain 40% each in Continuous Assessment and Semester end jury/presentation. The overall pass mark for the module is 50%

Pre-requisite – Architectural Design – I (ADE203)

Subject Matter:

1. **Scale and Complexity:** Introduction to concepts of shared open space, clustering, community, aggregation and economy. Projects involving public and community oriented buildings -multi room, single use, small span, multiple storied, horizontal and vertical movement; active and passive energy; comprehensive analysis of rural settlement in a hierarchical manner.
Exercises: Departmental store, Library, higher secondary school, campus student's center, etc. The projects will consciously provide for movement and use by the physically handicapped and elderly.
2. **Problems related to Rural Housing** - Field study tour to selected village/suburban- surveys on socio economic, physical, housing and surveys, etc. to study existing conditions analysis of survey data preparation of report, documentation and presentation in a seminar.
Exercises: Preparation of design brief solutions for housing and community facilities.
3. **Study Tour:** Document and do presentation of any particular community or town of larger scale compare to the Second Semester to have visual experience of a place, the influence social, culture on the particular building or space. The site of the final design assignment will be allocated from the place where students are taken for the study tour.
4. Area of concern/ focus :
 - Rural settlements and Architecture
 - Community oriented design
 - Simple public buildings
 - Emphasis will also be laid on site planning.
 - Emphasis shall be laid on clarity of details and architectural expression in functional and constructional elements.

Reading List:

1. Andrew Alpern (1982). *Handbook of Speciality: Elements in Architecture. (1st Ed.)*. McGraw Hill Book Co.
2. Edward D.Mills (1985). *Planning the Architects Handbook, (10th Ed.)* British Library C Taloguing in Publication Data.
3. Hideaki Hareguchi (1988). *A Comparative analysis of 20th century houses. (9th Ed.)*. Academy Editions.
4. Julius Panero & Martin Zelnik (2005). *Human Dimension and Interior Space: A Source Book of Design Reference Standard. (Revised Ed.)*. Whitney Library of Design Publication.
5. Sam F. Miller (1995). *Design Process: A Primer for Architectural and Interior Design*. Van Nostrand Reinhold.

References/Additional Reading list:

1. *An Introduction to Traditional Architecture of Bhutan*. Department of Works, Housing, and Roads, Royal Government of Bhutan, 1993.
2. *Bhutan Building Guidelines 2002*. Department of Urban Development & Housing .Ministry of Communications.
3. *Bureau of Indian Standards, The National Building Code of India (NBC)*. New Delhi, 2005.
4. Ching, Francis D.K. (2007). *Architecture – Form, Space and Order. (3rd Ed.)*. New Jersey: John Wiley & Sons.
5. Ernst, Neufert (2012). *Neufert Architects' Data, (4th Ed.)*.UK: Blackwell publishing ltd.
6. Guidelines for Planning and Development of Human Settlements in Urban and Rural Areas of Bhutan to minimise environmental impacts.(2013).DHS,MoWHS.
7. Joseph De Chiara, Michael J. Crosbie (2001). *Time Saver Standards for Building Types*. McGraw Hill Professional.
8. Joseph De Chiara, Julius Panero and Martin Zelnik (2001). *Time Saver Standards for Interior Design and Space Planning*. McGraw Hill.
9. *Rural Construction Rules 2013*. Department of Human Settlement. MoWHS.

Date : April, 2014

TSM 203 - Design of Structures -I

Name of the Module :	Design of Structures -I
Module Code :	STM 203
Semester :	IV
Credit Value :	12
Module Leader :	Dr. Cheki Dorji
Module Tutor :	(By Civil Engineering Department)

General Objectives of the Module:

The module is introduced to the students of Architecture to know and appreciate design of timber and concrete structure. The design of beam and slabs are incorporated with the criteria of limit state design methodology as per the BIS code. The next important focus is given to the design of column, foundation and staircase, based on IS codes IS 456.

Learning Outcomes:

1. Differentiate between the fundamentals of Working Stress and Limit State Method of design.
2. Apply methods of design through Working Stress and Limit State Methods.
3. Use the Limit State Method for design of a concrete beams, slabs, staircase and columns.
4. Establish the flexure design fundamentals in beam and slab design.
5. Establish the shear and torsion design fundamentals in beam and slab design.
6. Apply the theory of Limit State Design in designing singly and doubly reinforced beam.
7. Calculate the reinforcement requirement in slab with various end conditions.
8. Design a column with typical axial loading and moments from design charts.
9. Design a footing of a column with given load and soil character.
10. Use relevant IS code for the design of reinforced concrete structures and different grades of concrete and steel.
11. Design of singly reinforced rectangular beams by Elastic Theory.
12. Design one-way and two-way slabs using IS code coefficients.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment - 30marks

1. Assignments -10 marks.
2. Term test -15 marks.
3. Class test - 5 marks

Semester End Examination - 70 marks

1. Written examination (3 hrs. duration) – 70 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite –None

Subject Matter:

1. **Timber Structures** : Grading of Timber – Permissible Stresses – Design of timber beams – Madras terrace roof – Design of timber columns
2. **Tension Members**: Introduction - Net sectional area - permissible stresses - Design of Axially loaded Tension member – Lug angle – code provision - tension splice.
3. **Compression Members**: Introduction – various sections – built up section – Design of columns (excluding Lacing, Battening and other connections.)
4. **Properties of Steel and Concrete**: Structural properties of concrete - Grades and Strength of Concrete - durability – codal provisions and design requirements of steel and concrete.
5. **Working Stress Design Method**: Introduction to Elastic Theory basic concepts - stress strain relationships - design of singly reinforced beams merits and demerits of the method – codal requirements.
6. **Limit State Design Introduction**: Ultimate Load Method and Limit State Method – Advantages of Limit State Method over other methods - Limit state characteristic load and

characteristic strength of materials - partial safety factor stress strain relationship of steel and concrete safety and serviceability requirements.

7. **Limit State Design of Beams:** Analysis and design of singly and doubly reinforced rectangular and flanged beams for Bending - Design of beams for shear – Design of Continuous beams using IS code co-efficient.
8. **Limit State Design of Slabs:** Behaviour of one way and two way slabs – Design of one way and two way slabs for various edge conditions - Corner effects - Design of Simply supported and fixed circular slabs subjected to uniformly distributed loads.
9. **Limit State Design of RCC Columns:** Behaviour of Columns - Code provisions Design of axially loaded short columns of rectangular and circular sections, ties and spiral reinforcements - Concept of Long columns (No Design calculations).
10. **Limit State Design Of Staircase:** Types of Staircases – Design of Dog Legged Staircase.
11. **Working Stress Design of Foundation:** Types of foundations, isolated pad footings for simple design problems –Structural Concept of combined footings (No Design calculations) - Concept of raft and pile foundation (No Design calculations).

Reading List:

1. A.S.Arya (1978). *Structural Design in Steel, Masonry and Timber*. Roorkee: Nemchand and Bros.
2. Ashok K. Jain (1993). *Reinforced Concrete: Limit State Design. (4th Ed.)*. Roorkee: Nemchand and Bros.
3. C. Sinha and S.K. Roy (1983). *Fundamentals of Reinforced Concrete*. New Delhi: S.Chand & Co.
4. Dr. B.C. Punmia (2006). *Reinforced Concrete Structures, Vol, 1 & 2.(10th Ed.)*. New Delhi: Laxmi publication.
5. *Shah. (1998). Reinforced Concrete, Vol. 1 and 2*. Anand: Charotar Publishing House.
6. S.N. Sinha (1998). *Reinforced Concrete Design*. New Delhi: Tata McGraw Hill Publishing Co. Ltd.
7. S. Unnikrishnan Pillai and Devados Menon (1999). *Reinforced Concrete Design*. New Delhi: Tata McGraw Hill Publishing Co. Ltd.
8. Vazirani and Ratwani(1995). *Concrete Structures: Analysis, Design and Details of Structures in S.I. Units.(16th Ed.)*. New Delhi: Khanna Publishers.

References/Additional Reading list:

1. *IS 456:2000, Indian Standard, Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards*.
2. *IS 883 – Code of Practice for Design of Structural Timber in Buildings*.
3. *National Building Code of India – 2005, Part VI, Structural Design.P.Dayaratnam,(1984) Design of Reinforced Concrete Structures*. Oxford and IBH Publishing Co.

Date: April, 2014.

BLC 203 - Building Construction – II

Name of the Module : Building Construction - II
Module Code : BLC 203
Semester : IV

Credit Value : 12
Module Leader : Mr. Chimi
Module Tutor : One Architect and Civil Engineer each.

General Objectives of the Module:

This module introduces students to construction practices and details using concrete, steel and aluminum in the structural and non-structural components of a building.

It also exposes students to the current research in concrete, steel and aluminium construction and their detailing. Moreover this module will make the students matured enough to draw different techniques of architectural detailing including knowledge of material and product details.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Choose the appropriate building components in construction of Reinforced Cement Concrete structures.
2. Explain water proofing, insulation & protection systems and their methods of construction.
3. Demonstrate the methods of construction using steel for structural purposes such as roof trusses and roof covering.
4. Describe the methods of construction of building components using steel such as staircases, rolling shutters, doors and windows.
5. Demonstrate the detailing and the methods of construction of building components using Aluminium such as doors and windows, partitions and curtain walling.
6. Analyze, design and draw architectural detailing for their project/s and explain it properly to their clients/examiners.

Learning and Teaching Approach Used: (2 - 1- 2)

Lectures will be used as the basic method of introducing concepts and this will be reinforced by site visits and case studies.

Lectures : 2 hours / week
Tutorial : 1 hour / week
Studio : 2 hours / week

Assessment:

Continuous Assessment - 50marks

3. Studio assignment - 25marks

By the end of the semester, students should submit atleast five assignments for this module.

4. Theory - 25marks
 - i. Assignments-10marks
 - ii. Class test – 5marks
 - iii. Term Test – 10marks.

Semester End Examination- 50marks

3. Studio Examination (2Hrs.)-25marks.
4. Theory Examination (2 Hrs.)-25marks.

Students must obtain 40% each in CA Theory, CA Studio assignments, Semester End Examination Theory and Semester End Examination(Studio). The overall pass mark for the module is 50%.

Pre-requisite – Building Construction – I (BLC202)

Subject Matter:

1. Concrete Construction

- a. **Foundations** -Strip foundation, raft, isolated, combined, and continuous and their construction details.
- b. **Construction details of RCC frames**- Beams, columns, slabs, precast frames.
- c. **Construction details of apertures**- Concrete lintels, sunshades, arches, shading devices, screen walls, pergolas.
- d. **Construction details for RCC slabs**- One way slabs, 2-way slab, continuous, flat slab, waffle slab, coffer slab etc.
- e. **Concrete Staircases:** Basic principles, types of staircase- straight flight, dog-legged, quarter-turn, spiral, helical and other types. Support conditions for stairs and details of handrail, baluster etc. and finishes for stairs.

2. Steel Construction:

- a. **Structural steel sections**- Construction methods, methods of connections, steel in foundations, column-beam connections.
- b. **Steel Doors, Windows and Rolling Shutters:** Types of doors, windows– Operable, sliding etc., methods of construction using steel. Design and detailing of steel rolling shutter, collapsible gate, strong room, safe vault doors.
- c. **Steel roof trusses:** Design and detailing. Types of trusses- north-light, butterfly truss, bow-string truss, space frames, portal frames, spacer decks- construction details of the above and the context in which they are used.
- d. **Steel roof covering.** Types of roof covering using steel, aluminium, asbestos, and other sheets.
- e. **Steel staircases:** Basic principles, types of staircase- Straight flight, dog-legged, spiral and other types. Support conditions for stairs and details of handrail, baluster etc. and finishes for stairs.

3. Aluminium Construction:

- a. **Aluminium Doors and Windows:** Brief study of aluminium products- Market forms of aluminium, aluminium extrusions- sketches of the above. Aluminium doors and windows- design details. Doors- operable, sliding, pivoted, fixed. Windows- operable, sliding, fixed, louvered. Ventilators- top hung, bottom hung, pivoted, louvered
- b. **Aluminium Partitions, Stairs, Curtain Walling, Roofing:** Partitions- fixed partitions, false ceiling, shop front, using aluminium – Construction methods and details. - Aluminium staircase- Design and construction details- Including detailing of handrail and baluster. -Aluminium roofing- North lighting, glazing bar, roofing sheets - Construction details including gutter details -Aluminium Curtain walling- design and construction details.

4. Plastics :

- a) **Primary plastic building products** for walls, partitions and roofs - design and construction details.
- b) **Secondary building products** for windows, doors, roof lights, domes, and handrails- design and construction details.

5. Glass: Construction methods using glass for single storey all glass structures like pavilions, green houses, staircases. Construction methods using glass for single/multi-storey buildings including curtain walling details.

-Exercises of the above through case studies and drawings.

Reading List:

1. Alan Blanc (1993). *Architecture and Construction in Steel*. London: E&FN Spon.
2. Alan Blanc (1999). *Stairs, Steps and Ramps*. Butterworth: Heinemann Ltd.
3. Barry, R. (2005). *The Construction of Buildings (Vols. 1 to 5)*. Oxford: Blackwell Publishing Ltd.
4. Dr. B.C.Punmia (2001). *A Text book of Building Construction*. New Delhi: Laxmi Publications Pvt. Ltd.
5. Mark Lawson, Peter Trebilcock.(2003).*Architectural Design in Steel.(Revised Ed.)*. Taylor & Francis.
6. M.S. Shetty (2005). *Concrete Technology(M.E.).(Revised Ed.)*. New Delhi: S.Chand & Co.ltd.
7. T.D. Ahuja and G.S. Birdie (1996). *Fundamentals of Building Construction*. New Delhi Dhanpat Rai Publishing Company Pvt. Ltd.
8. W.B. Mckay (1992).*Building Construction (vol. I –IV)*.Orient Blackswan.

References/Additional Reading list:

1. *Bhutan Schedule of Rates – 2012*. DES. MoWHS.
2. *Labour and Materials Coefficients (Civil Works) – 2012*. DES. MoWHS.
3. *Specifications for Building and Road Works-2012*. DES. MoWHS.
4. *Standard and Specification for cost effective innovation, Building Materials and Sequence*. New Delhi: BMPTC Publication.

Date : April, 2014.

THD202 - Bhutanese Architecture

Name of the Module :	Traditional Architecture
Module Code :	THD102
Semester :	IV
Credit Value :	12
Module Leader :	Mr.Chimi
Module Tutor :	

General Objectives of the module:

The module is offered to provide knowledge regarding traditional and vernacular Architecture. Students are given exposure to the traditional Nomenclatures/Thobthangs, building form, construction technology and its relation to settlement system. The local, regional and socio-economic, environmental and technological impacts of housing design are given emphasis in the module. The knowledge gathered through field study and documentation of Traditional Bhutanese Architecture is an essential part of this module.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Identify and explain various building and monument typologies, construction tools, etc.
2. Categorize the requirement and application of traditional construction techniques.
3. Explain Thopthangs/nomenclature in Bhutanese Architecture and its derivational uses,
4. Identify and use local material available in various parts of Bhutan.

5. Relate building forms with culture and tradition.
6. Outline the vernacular styles construction, of different regions in Bhutan.
7. Relate anthropometrics and activity pattern with built form.
8. Categorize modern building materials and its relevance to the traditional architecture components in Bhutan.

Learning and Teaching Approach Used: (3 - 0 - 0)

Lectures will be used major part of teaching -learning process. Guest lecturers from the professional field will be invited for the lectures. This will be supported by site visit to the nearby area and research works.

Lectures : 3 hours / week

Tutorial : Nil

Studio : Nil

Assessment:

Theory:

Continuous Assessment -50 marks

1. Assignment - 30marks

By the end of the semester, students should submit atleast five assignments for this module.

2. Term Test- 15marks

3. Class Test - 5marks

Semester End Exam - 50marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%

Pre-requisite – None

Subject Matter:

1. **History of Bhutanese Architecture.** Introduction to the History ancient Bhutanese Dzongs, monasteries, stupas, Houses and their importance to the Bhutanese Architecture and society. Its origin to contemporary scenarios-Different types of built form in various region and climatic conditions.
2. **Ecology & Environmental** aspects of traditionally built forms and settlement patterns. Environment-built form relationship,- Traditional built form and settlement patterns and their connectivity with respect to the environment.
3. **Nomenclature** of traditional Bhutanese buildings, monuments and bridges: Dzongs, monasteries, temples, stupas/chortens, farm houses and bridges, their typologies, importance, locations- use of topography and terrain and cluster formation.
4. **Local materials, methods of construction,** detailing and craftsmanship - Timber, stone, clay, adobe bricks.
5. **Bhutanese Iconography:** Study on Bhutanese arts and crafts like paintings, sculptures, etc. and its narratives according to Bhutanese history.
6. **Tools:** Introduction of tools for carpenters and Architects: its types, uses and importance of the tools.

7. **Types and entitlements** of various building components - Roof types - Gable , hip, lean to (Chenkhep) ; Roof features - Jabzhi , Jamthog, Lung-go; decorative elements - Sertog, Gyaltshen, Gungdhar, Rabsel of different types, different types of window (Payab, Geykar,) , door (Mago), timber coloums(kachhen), Zhu(timber bracket) , cornices, decorative elements with its narratives.
8. **Contemporary Architecture:** Social, cultural and political influences on architecture and built form, -Its effects on the society, -Issues related to the traditional and contemporary built form. Case studies and research on various building typologies within Bhutan.

Reading List:

1. Amundsen, Ingun, B. (1994). *Bhutan: Living Culture and Cultural Preservation*.
2. Amundsen and H.Dunin-Woyseth. *In Traditional Dwellings and Settlements Working Paper Series Vol.67/IASTE, CEDR*. Berkeley: University of California.
3. *An Introduction to Traditional Architecture of Bhutan*. Department of Works, Housing, and
4. Ashi Dorji Wangmo Wangchuck (2006). *The Treasures of the Thunder Dragon: A portrait of Bhutan*.
5. Roads, Royal Government of Bhutan, 1993.
6. Chang Dorji (2004). *Clear exposition of Bhutanese Architecture*. Thimphu: MoWHS.
7. John Berthold.(2005). *Bhutan, Land of the Thunder Dragon* .
8. Paul, O. (1997). *Encyclopedia of Vernacular Architecture of the World*. Cambridge University Press.
9. Richardson, V. (2001). *New Vernacular Architecture*. Laurance King Publishing.
10. Schicklgruber,C. and Pommaret .F.(1997). *Bhutan: Mountain Fortress of the Gods*.

Date : April, 2014.

BSS 202 –Water Supply and Sanitation

Name of the Module :	Water Supply and Sanitation
Module Code	: BSS 202
Semester	: IV
Credit Value	: 12
Module Leader	: Mr. Chimi
Module Tutor	: One Architect and Civil Engineer each.

General Objectives of the Module:

This module is designed to familiarize students with building services that support the functioning of a building in the area of water supply and sewerage .It covers the detail study of the fundamentals of water supply and sanitation infrastructure required in urban areas and individual buildings. Basics of hot and cold water distribution systems, waste water disposal systems, fixtures and fittings required within buildings are also covered. Students are encouraged to explore the latest eco-friendly materials and technologies for recycling and reuse of water. Students can further enhance their understanding through solving problems introduced during the module.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Explain the basic principles of ground water hydrology, water and sanitation infrastructure, water and waste water treatment technologies and about sources of water.
2. Prepare water quality control and treatment systems and its distribution within a building.
3. Explain the water management concepts.
4. Describe the fundamentals of waste disposal from a building and design simple sewerage systems.
5. Analyze and implement various waste management concepts.
6. Explain the management of usable water and waste water.
7. Analyze and design storage, pumping, and plumbing, waste water drainage and treatment systems within buildings and its premises.

Learning and Teaching Approach Used: (3 – 1 – 0)

Lectures will be used as the basic method of introducing concepts and this will be reinforced by site visits and case studies to gain analytical skills. The knowledge used here can be used in Design studio and simultaneously the design assignment can be discussed in this class.

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment – 50marks

1. Assignments -30 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15 marks.
3. Class test - 5 marks

Semester End Examination - 50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

I. WATER SUPPLY AND WATER DISTRIBUTION SYSTEM

1. **Water Quality Control and Distribution System:** Water quality, purification and treatment – Surface and ground water sources, water/quality-nature of impurities, treatments - Sedimentation, Rapid sand filters, pressure filters –Sterilization and disinfection. -Water distribution systems. Distribution systems in small towns, layouts – Cold water lines, hot water lines, Design criteria for daily water requirements based on occupancy, various kinds of meters, Tank capacity - Pumping plant capacity, Testing of water hardness - Calculation of water consumption for Residential/Multistoried buildings Piping systems/piping materials/plumbing fixtures/selection –Domestic hot water systems, Solar water heating systems, application and installation
2. **Water Management Concepts:** Different methods of Harvesting rain water from roofs and paved areas, Waste water treatment – Conventional, modern systems .Mandatory provision

with respect to plumbing arrangements in apartment buildings. -Eco-friendly construction technologies and materials and their advantages.

II. SANITARY WASTE AND SEWERAGE SYSTEM

3. **Fundamentals, Sanitary Waste and Sewerage System:** Basic Principles of sanitation and disposal of waste matter from buildings, various systems of sewerage disposal and their principles -Model bye-Laws in regard to sanitation of buildings specifications of various sanitary fittings for buildings. Planning of bathrooms, -Toilets in domestic and multi-storied buildings. Standard type of sanitary fittings, Caulking compounds, traps, joints. -Flushing cisterns, manholes, septic tanks in relation to buildings. Intercepting Chambers, inspection Chambers and their location and ventilation of sewers. -Layout of simple drainage system for small buildings, apartments, commercial buildings – Gradient used in lying of drains and sewers, size of drain pipes and materials used. -Energy efficient designs and its methodologies.
4. **Waste Management Concept:** Sewerage disposal: Primary, secondary treatment, activated sludge, intermittent and trickling sand filters, sewage treatment plant – Layout for residential/commercial buildings.
5. **Solid waste disposal:** Refuse disposal, collection, and conveyance disposal of town refuse. - Sanitary landfills, incineration, vermiculture, aerobic digestion for compost, anaerobic digestion for energy and organic filler (Bio gas) and rural energy systems.
6. **Equipment's used for Management of Usable Water and Waste Water:** Space requirements, Configuration and Sizing of motors and deep well, centrifugal, submersible, reciprocating pumps and their location in building types.

Reading List:

1. AFE Wise (2002). *Water, Sanitary & Waste Services in buildings, (5th Ed.)*. Mitchell Publishing Co. Ltd.
2. Birdie, G.S. and Birdie, J.S.(1992) *Water Supply and Sanitary Engineering,(5th Ed.)*. Dhanpat Rai Publishing Company
3. Dr. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jai.(1995). *Water Supply Engineering, (Revised Ed.)*. Firewall Media.
4. G.M. Fair, J.C. Geyer and D.Okin (2007). *Water and Waste water engineering Volume II. (Digitized Ed.)*.New York: John Wiley & Sons, Inc.
5. S.C.Rangwala (1998).*Fundamentals ofWater supply and sanitary engineering. (11th Ed.)*. Anand: Chartar publishing house.

References/Additional Reading list:

1. *Handbook on Water Supply and Drainage with Special Emphasis on Plumbing*. Bureau of Indian Standards, New Delhi.1997.

2. *Manual of water supply and treatment, Second edition, CPHEEO, Ministry of works and housing, New Delhi 1995.*
3. *Renewable energy, basics and technology, supplement volume on integrated energy systems(Solar Agni systems). Pondicherry 605002. India.1998.*

Date : April, 2014.

THS 201 - Sociology of Architecture

Name of the Module : Sociology of Architecture

Module Code : THS 201

Semester : IV

Credit Value : 12

Module Leader : Mr. Chimi

Module Tutor :

General Objectives of the Module:

The aim of this module is to understand how architectural forms influence and react to socio-cultural phenomena. Students are exposed to major institutions and their need for functional spaces. It is expected that an understanding of the interrelationship between Architecture and society would help them to design spaces which support social interaction and 'express' the structure and culture of a given society. Finally enable the student to understand the factors that led to the growth of settlements and the changing scenario in the contemporary world.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Identify and explain the relationship between man and the built environment.
2. Outline the origins of human settlements, its determinants and their evolution.
3. List out the various characteristics of Human settlements and the manifestation of settlements as expression of political aspirations.
4. Explain the role played by the Architects and Architecture to the changing scenario of social life.
5. Analyze the impact of design decisions on different population sub-groups, particularly marginal groups.
6. Incorporate gender sensitivity in design and appreciate built space as a dynamic evolving system.

Learning and Teaching Approach Used: (3 - 0 - 0)

Lectures : 3 hours / week

Tutorial : Nil

Studio : Nil

Assessment:

Theory:

Continuous Assessment - 50marks

1. Assignments -20 marks.

2. Debate-20marks
3. Term test -10 marks.

Semester End Examination - 50marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter

1. **History of Evolution of Human Settlements:** Origin of civilization, -Effects of civilization on Human settlements, determinants of Human settlements, early towns in Bhutan. Introduction to settlement planning followed during various river valley civilizations. Historical survey of the city/town as an Architectural form, and as an expression of the vitality of a civilization. Comparative study of the origin and growth of settlements.
2. **Historical Periods and Growth of Human Settlements:** Ancient, Medieval, Renaissance, Industrial and Post-Industrial age. Principles of settlement planning in ancient Greece, Rome and India. Medieval towns in Europe and India. Renaissance city planning.
3. **Human Settlements and their Characteristics:** Importance of shelter and its form and scale in city, concepts of land marks, axis and orientation, city as living commercial, cultural and functional entities. Colonial urbanization. Industrial revolution and planning theories of the nineteenth century.
4. **Sociological Perspective and Organizing Social Life:** Functionalist perspective, Conflict perspective, Internationalist perspective; Culture of space and cultural ecology; Social structure and social control; Stratification and social inequality; Social mobility and Social defiance.
5. **Social Institutions:** Family, kinship pattern and authority; Religion as social work and significance in planning; Voluntary associations (identifying NGOs and involving them as partners of development, operational issues); Groups (primary, secondary and reference groups).
6. **Community Development:** Development induced displacement (anthrop-social considerations); Resettlement and rehabilitation; Neighbourhood pattern and development strategy; Rural and urban issues; Community based and workshop based methods; Qualitative data Analysis and report writing.
7. **Gender and Development:** Gender and sex; Gender sensitive; Gender and development planning; Gender and implications for spatial planning.
8. Bhutan and global communities their social structures and problems, cultural heritage, rituals and community gathering etc. Urbanisation – Trend and characteristics, dynamics of urban growth and social change, urban attitude, value and behaviour.

Reading List:

1. Combaire, J and Cahnman, W.J. (1971). *How cities grew: the sociology of cities. (4th Ed.)*. N.J: The Florham Press, Madison.
2. Ashi Dorji Wangmo Wangchuck (2006). *The Treasures of the Thunder Dragon: A portrait of Bhutan*.
3. Dickinson, R.E. (1963). *The West European City.(2nd Ed.)*. London: Routledge and Kegan Paul Ltd.
4. Dutt, B.B. (2009). *Town Planning in Ancient India*. Delhi: Isha Books.

5. Kosambi, D.D. (1994). *The Culture and Civilisation of ancient Indian historical outline.(Revised Ed.)*. New Delhi: Vikas publishing Home Pvt. Ltd.
6. Leach, N. (2009). *Rethinking Architecture: A Reader in Cultural Theory(3rd Ed.)*. London: Routledge.
7. Paul, J. (2010).*The Sociology of Architecture: Constructing Identities*. Liverpool: University Press.
8. Paul, O. (1997). *Vernacular Architecture. A Reader in Cultural Theory*. Cambridge Univ. Press.
9. Schicklgruber,C. and Pommaret .F.(1997). *Bhutan: Mountain Fortress of the Gods*.

Date : April, 2014.

B. Arch. (Third Year) – Fifth Semester

Total number of Contact Hours = 28, Total Credits =72

SN.	Code	Name of the Module	Contact Hours			No. of Credits	Marks			
			L	T	P/S		Theory		Studio/Practical	
							C A	EX	CA	EX
1	ADE305	Architectural Design-III	1	0	8	12			120	30
2	TSM304	Design of Structures –II	3	1	0	12	30	70		
3	BLC 304	Building Construction –III	2	1	2	12	25	25	25	25
4	BSS303	Illumination & Electrical Services	3	1	0	12	50	50		
5	CAA301	Computer Application in Architecture	1	0	2	12			50	50
6	MGT301	Entrepreneurship Development	3	0	0	12	30	70		
Total			13	3	12	72				

ADE 305 - Architectural Design – III

Name of the Module : Architectural Design - III

Module Code : ADE 305

Semester : V

Credit Value : 12

Module Leader : Mr.Chimi

Module Tutor :

General Objectives of the Module:

This module gives the better understanding to handle complex architectural project in Spatial Design encompassing multiple issues like climate, user needs, and structure, circulation and building services. It is aimed to explore the built forms and built environment typologies on urban lands with a thrust on issues like urban land economics, technology and ecology. Development of design skill and creative abilities through a systematic design programming including analysis, synthesis and concept formulation is the prime focus of this design module.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Use Green Architecture Design principles with Energy conscious design approaches.
2. Design of green buildings and building components.
3. Inculcate the importance of services integration and construction in spatial planning in the context of design of High-rise buildings and service intensive buildings.
4. Explain the importance of Architecture as an element of identity in urban areas and urban design principles that govern their design.
5. Design structure and services along with the development of architectural spaces.
6. Explain the complexity and salient features of the design project through case studies and field visits to document and present findings.
7. Generate a coherent architectural project, represented through technical drawings and models.

Learning and Teaching Approach Used: (1 - 0 - 8)

Concept and Drawing will be prepared by students during studio period, which will be reviewed and assessed every week. The students will be encouraged to draw free hand sketches of any building components. Using of drawing tools and graphics software will be also allowed.

Lectures	:	1 hour / week
Tutorial	:	Nil
Studio	:	8 hours / week

Assessment:

The external jury should have minimum of two members including the module tutor. The evaluators can be either from college or outside having the knowledge on this particular module. The tutor is not allowed to evaluate the students' portfolio during the external jury.

Studio:

Continuous Assessment - 100marks

1. Studio assignment and projects – 90marks
By the end of the semester, this module should cover at least two design assignments.
2. Term Test-10 marks

Semester End external viva/Jury- 20marks

1. Portfolio presentation

Semester End Examination- 30marks

1. Written examination (12 hrs. duration) – 30 marks

Students must obtain 40% each in Continuous Assessment, Semester end jury/presentation and Semester end Examination. The overall pass mark for the module is 50%

Pre-requisite - Architectural Design – II (ADE204)

Subject Matter:

1. **Design of multi-functional public building**, large structure, multi-level in the urban setting. Introduction to urban development, controls, codes and bye-laws. Design and detailing for movement and use by physically handicapped people within and around building

2. Exercises in articulation and manipulation of programmed needs, **Design methodology**, criticism and evaluation of alternative concepts.
3. **Study of an urban environment in use.** Urban activities, services and construction methods, and integration of social facilities and, growth and change shall be the focus of the study.
4. **Methods of space programming;** Behavioural survey, Formulation of design criteria- Application of climatic data, socio-cultural factors, behavioural aspects and structural considerations;
5. **Site analysis and Green Design concepts,** Application of building services, Design evaluation techniques and Design Analysis of Landmark Architecture, Field study tour for historical and modern buildings.
6. **Exercises:**By the end of the semester, this module should cover atleast two design assignments of given topics or other than this, which should be supported by case studies. Design of Art Galleries, Libraries, Banks, Office building complex, Commercial complex, Hotels, Resorts, Transport terminals, etc.

Reading List:

1. Andrew Alpern (1982). *Handbook of Speciality: Elements in Architecture. (1st Ed.)*. McGraw Hill Book Co.
2. Baker, Nick and Krishnan,Arvind (1999). *Climate Responsive Architecture: A Design Handbook for energy Efficient Buildings*. Tata –McGraw Hill.
3. Edward D.Mills (1985). *Planning the Architects Handbook, (10th Ed.)* British Library C Taloguing in Publication Data.
4. Hideaki Hareguchi (1988). *A Comparative analysis of 20th century houses. (9th Ed.)*. Academy Editions.
5. Julius Panero & Martin Zelnik (1983). *Human Dimension and Interior Space: A Source Book of Design Reference Standard. (Revised Ed.)*. Whitney Library of Design Publication.
6. Quentin Pickard RIBA. (2002).*The Architects' Hand Book*. Bladewell Science Ltd.
7. Sam F. Miller (1995). *Design Process: A Primer for Architectural and Interior Design*. Van Nostrand Reinhold.

References/Additional Reading list:

1. *An Introduction to Traditional Architecture of Bhutan*. Department of Works, Housing, and Roads, Royal Government of Bhutan, 1993.
2. *Bhutan Building Guidelines 2002*. Department of Urban Development & Housing .Ministry of Communications.
3. *Bureau of Indian Standards, The National Building Code of India (NBC)*. New Delhi, 2005.
4. Ching, Francis D.K. (2007). *Architecture – Form, Space and Order. (3rd Ed.)*. New Jersey: John Wiley & Sons.
5. Ernst, Neufert (2012). *Neufert Architects' Data, (4th Ed.)*.UK: Blackwell publishing ltd.
6. Guidelines for Planning and Development of Human Settlements in Urban and Rural Areas of Bhutan to minimise environmental impacts.(2013).DHS,MoWHS.
7. Joseph De Chiara, Michael J. Crosbie (2001). *Time Saver Standards for Building Types*. McGraw Hill Professional.
8. Joseph De Chiara, Julius Panero and Martin Zelnik (2001). *Time Saver Standards for Interior Design and Space Planning*. McGraw Hill.
9. *Rural Construction Rules 2013*. Department of Human Settlement. MoWHS.

10. Watson, D. & Crosbie, M. J. (2004). *Time Saver Standards for Architectural Design: Technical Data for Professional Practice. (8th Ed.)*. New York: McGraw-Hill Professional.

Date : April, 2014

TSM 304 - Design of Structures -II

Name of the Module :	Design of Structures -II
Module Code :	STM 304
Semester :	V
Credit Value :	12
Module Leader :	Dr. Cheki Dorji
Module Tutor :	(By Civil Engineering Department)

General Objectives of the Module:

This module introduces the concepts of design of masonry walls, Principles of prestressed concrete and about shell structure and folded plates and about earthquake resistant structure detailing. At this stage, the student has an idea about different roofing systems while doing architectural design projects.

Learning Outcomes:

1. Analyse and design the steel structural members in a building.
2. List the types, efficiency and strength, advantages and disadvantages of rivet and welded joints in steel.
3. Design of Tension (beams) and compression (columns) steel members in a building under various conditions.
4. Analyse and design of riveted joints.
5. Design of fillet-welded joints.
6. Analyse and design brick masonry walls.
7. Determine classification and principles of structural action of shell structure and folded plates.
8. Design of structural elements like footings, retaining walls and masonry walls.
9. Understand the principle, methods, advantages and disadvantages of pre stressed concrete.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Continuous Assessment - 30marks

1. Assignments -10 marks.
2. Term tests -15 marks.
3. Class test - 5 marks

Semester End Examination - 70 marks

1. Written examination (3 hrs. duration) – 70 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

1. STEEL STRUCTURES

- a. **Riveted and Welded Joints:** Assumptions – failure of Riveted joints – Strength and Efficiency of Riveted Joints – Types – Design of Riveted Joints for Axially Loaded Members (Excluding eccentric connections) - Types of welded joints – Permissible stresses – Advantages and disadvantages – Design of Fillet welds (Excluding eccentric connections).
 - b. **Steel Sections and Bolted Joints:** Properties of rolled steel sections - Bolted joints - Analysis and Design.
 - c. **Steel Beams:** Introduction - Allowable stresses - General specifications - Design of laterally supported beams.
 - d. **Steel Columns:** Introduction - Allowable stresses - Various shapes - Built up sections, Design of columns –Simple cross sections only.
2. **Masonry:** Analysis and Design of brick masonry walls - Load bearing walls - Use of Nomograms - Code requirements.
3. **Retaining Walls:** Types of Retaining walls – Design of RCC cantilever Retaining walls.
4. **Pre-stressed Concrete:** Introduction to pre-stressed concrete principle of pre-stressing - Methods of pre stressing - Advantages and disadvantages.
5. **Shells And Folded Plates:** Introduction to shells and folded plates - Structural action - Classification of shells.
6. **Seismic Resistant Structures:** Introduction to detailing of seismic resistant structures – R.C.C. Structures and Masonry Structures.

Reading List:

1. A.S.Arya (1978). *Structural Design in Steel, Masonry and Timber.*(3rd Ed.). Roorkee: Nemchand and Bros.
2. Dayaratnam.P.(1983). *Design of Steel Structures.*(2nd Ed.).M. Primlani.
3. Dr. B.C. Punmia (1994). *Reinforced Concrete Structures, Vol, 1 & 2.* New Delhi: Laxmi publication.
4. G.S.Ramaswamy (1986). *Concrete shell roofs.* CBS Publishers and Distributors.
5. Gurucharan Singh (1982). *Design of Steel Structures.* New Delhi: Standard Publishers.
6. N.Krishnaraju (1998). *Prestressed Concrete.*Tata McGraw-Hill Publishing Co.
7. Ramachandra S. (2006). *Design of Steel Structures.* New Delhi: Stard Book House.
8. S.N. Sinha (1998). *Reinforced Concrete Design.* New Delhi: Tata McGraw Hill Publishing Co. Ltd.

References/Additional Reading list:

1. *IS 456:2000, Indian Standard, Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards.*
2. *IS 800 – Code of Practice for use of Structural Steel in General Building Construction*
3. *IS 1905, Code of Practice for Structural Safety of Buildings*
4. *IS 13828 (1993) – Indian Standard Guidelines for improving Earthquake*
 - a. *Resistant low strength masonry building.*
 - b. *RCC Structures subjected to seismic forces.*
5. *IS 13920 (1993) - Indian Standard Code of practice for ductile detailing.*
6. *National Building Code of India – 2005, Part VI, Structural Design*

Date: April, 2014.

BLC 304 - Building Construction-III

Name of the Module : Building Construction-III
Module Code : BLC 304
Semester : V
Credit Value : 12
Module Leader : Mr. Chimi
Module Tutor : One Architect and Civil Engineer each.

General Objectives of the Module:

This module aims to educate students on protective, preventive and corrective actions, to be taken in a building with regards to various materials including energy efficient and eco-friendly materials, details, and stages in construction. The students will also gain knowledge on vertical movement systems in multi-storied and high-rise buildings, the various mechanisms and devices, their installations, working so as to integrate them in the process of design.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Describe heat transfer into buildings by various materials, their properties, uses and methods of application in floors, walls and roofs.
2. Describe various types of DPC and acoustical treatment in various parts of building and their properties and applications.
3. Implement innovative construction techniques adopted for floor, wall and roofing.
4. Use energy efficient and eco-friendly construction materials, its detailing and construction techniques.
5. Categorize various types of mass vertical movement in high-rise buildings, in terms of their varieties, installations in planning, contextual application.
6. Explain the vertical movements systems like escalators, conveyors and moving walkways.
7. Design innovative structures for large spans and to provide aesthetic appeal and functional efficiency.
8. Analyze, design and draw architectural detailing for their project/s and explain it properly to their clients/examiners.

Learning and Teaching Approach Used: (2 - 1- 2)

Based on the lectures delivered, the students will draw the construction drawing and details, which will be by relevant visual aids and site visits.

Lectures : 2 hours / week
Tutorial : 1 hour / week
Studio : 2 hours / week

Assessment:

Studio:

Continuous Assessment - 50 marks

1. Assignment - 30marks
2. Term Test- 20marks

Semester End Examination - 50marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in Continuous Assessment and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – Building Construction – II (BLC 203)

Subject Matter:

1. **Low Cost Building Technology:** Drawings of foundations - walls - Roofs - partitions - ceiling panel - doors and windows. Miscellaneous - Drawing of Brick jalis, Screen walls - pavement blocks, etc. Uses of Eco-friendly materials and its technologies.
2. **Water and Damp-Proofing:** Damp proofing, hot applied and cold applied, Emulsified asphalt, Bentonite clays, butyl rubber, silicon, vinyl's, Epoxy resins and metallic water proofing materials - properties, uses.. Application of the above under various situations basement floors, swimming pool, terraces, etc. Construction methods for water-proofing, damp-proofing for concrete walls, basements, retaining walls, swimming pools etc.
3. **Thermal Insulation:** Heat transfer and heat gain by materials vapor barriers and rigid insulation. Blanket, poured and reflective insulation - Properties and uses of spun glass, foamed glass, cork, vegetable fibers, mineral fibers, foamed plastics, and vermiculite and glass fibers. Gypsum manufacture, properties and uses, plaster of Paris and hydride gypsum. Construction details of the material application of floor, walls and roofs. Energy efficient materials.
4. **Acoustic Insulation:** Porous, Baffle and perforated materials such as acoustic plastic, acoustic tiles, wood, partial board, fiber board, cork, quilts and mats Brief study on properties and uses of the above current developments.
5. **Vertical Movement Equipment in Buildings:** Elevators Historical development of elevators lifts. Elevators, size, capacity, speed, mechanical safety method, positioning of core under planning grid. Types of elevators - Electric, hydraulic, passenger, hospital, capsule, freight, etc. Dumb waiters, details of lift shaft and other mechanism. Detailing and fitting for physically handicapped.
6. **Escalators and Conveyors:** Parallel and crisscross escalators, horizontal belt conveyors, horizontal moving walkways, concern for physically handicapped mechanical safety systems and automatic control.
7. **Miscellaneous Structures:** Shell structures, domes, space frame, shell barred vault, folded plate structures, tensile structures, pneumatic structures, etc. Introduction to eco-friendly structures, its construction materials and methodologies.

Reading List:

1. Alan Blanc, M. McEvoy and Roger Plank (2013). *Architecture and Construction in Steel*. London: E&FN Spon.
2. Arthur R. Llon (1997). *Materials for Architects and builders: - An introduction*. GB: Holder Headline group.

3. Barry, R. (2005). *The Construction of Buildings (Vols. 1 to 5)*. Oxford: Blackwell Publishing Ltd.
4. Dr. B.C. Punmia (2001). *A Text book of Building Construction*. New Delhi: Laxmi Publications Pvt. Ltd.
5. James Ambrose (1992). *Building Construction, Service Systems*. New York: Van Nostrand Reinhold.
6. M.S. Shetty (2005). *Concrete Technology*. New Delhi: S.Chand & Co.ltd.
7. S.C. Rangwala (2008). *Building Construction*. India: Charotar Publishing House.
8. T.D. Ahuja and G.S. Birdie (1996). *Fundamentals of Building Construction*. New Delhi Dhanpat Rai Publishing Company Pvt. Ltd
9. W.B. Mckay (1992). *Building Construction (vol. I –IV)*. Orient Blackswan.

References/Additional Reading list:

1. *Bhutan Schedule of Rates – 2012*. DES. MoWHS.
2. *Labour and Materials Coefficients (Civil Works) – 2012*. DES. MoWHS.
3. *Specifications for Building and Road Works-2012*. DES. MoWHS.
4. *Standard and Specification for cost effective innovation, Building Materials and Sequence*. New Delhi: BMPTC Publication.

Date : April, 2014.

BSS 303 –Illumination and Electrical Services

Name of the Module :	Illumination and Electrical Services
Module Code :	BSS 303
Semester :	V
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	One Architect and Electrical Engineer each.

General Objectives of the Module:

This module gives a generalized idea about the electrical services and illumination engineering in any built environment. The module gives an idea about the Natural daylighting and illumination, lighting design guideline for indoor and outdoor spaces, component of electrical services, the power distribution networks, their fundamentals and classification.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Explain the fundamentals of electrical lay outing in building.
2. Compare among various electrical wiring system.
3. Design the electrical wiring system for a building.
4. Explain the principles of illumination engineering.
5. Identify the various luminaries for specific purpose.
6. Design the indoor and outdoor illumination for a street, landscaped garden etc.
7. Implement the energy efficiency guideline in illumination design.

8. Implement the laws and basics of electricity and wiring systems within domestic and commercial buildings.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment - 50marks

1. Assignments -30 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15 marks.

3. Class test - 5 marks

Semester End Examination - 50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

1. **Fundamentals of Lighting:** Principles of light – Electromagnetic radiation, waves, nature of vision, measurement of lighting. Principles of illumination: definitions, Visual tasks, Factors affecting visual tasks Units of light, definitions of flux, solid angle, luminous intensity – utilization factor – depreciation factor- MSCP – MHCP, brightness, glare.
2. **Natural Daylighting:** Movement of sun – Locating the position of sun – Sun path diagram – Overhead period–Design of appropriate shading devices, Glare, colour, amount of light, sky as a source of light, day light factor, effect of size and shape of opening in different planes with and without obstructions, Intensity of light speed, penetration, design and setting of buildings for day light in different parts of the climatic zones.
3. **Illumination and Lighting:** Radiation, colour, eye & vision; different entities of illuminating systems; Light sources: daylight, incandescent, electric discharge, fluorescent, arc lamps and lasers. Architectural lighting and special effects; Luminaries, wiring, switching & control circuits; Laws of illumination; illumination from point, line and surface sources.
4. **Electrical Systems and Installations:** Basics of electricity - Single/Three phase supply - Protective devices in electrical installations Earthing for safety - Types of earthing - ISI specifications. Types of wires, wiring systems and their choice. Planning electrical wiring for building - Main and distribution boards - transformers and switch gears Layout of substations.
5. **Introduction to Building Automation Systems:** Telecom systems, Computer systems and networking, Security and surveillance system, Cable management. Utility services for large building/office complex & layout of different meters and protection units. Different type of loads and their individual protections. Selection of cable/wire sizes; potential sources of fire hazards and precautions. Emergency supply – standby & UPS. A specific design problem on this aspect.
6. **Lighting Design: Installation and Application in Buildings:** Artificial light sources, spectral energy distribution, Luminous efficiency- colour temperature – colour rendering, Additive, subtractive colour and their application areas and outdoor lighting for Office, Schools,

Libraries, Residential, Hospital, Parking, Outdoor. Elementary ideas of special features required and minimum level of illumination for the physically handicapped and elderly in building types - solar energy systems for lighting – Photovoltaic systems for Residential/Commercial buildings. -Reducing electric loads, installation and maintenance.

Reading List:

1. Ander, D.G. (2003). *Daylighting Performance and Design*. (2nd Ed.). John Wiley & Sons.
2. E.P. Ambrose (1968). *Electric Heating*. New York: John Wiley & Sons Inc.
3. Gordon, G. (2003). *Interior Lighting for Designers*. (Revised Ed.). John Wiley & Sons.
4. Hopkinson, R.G. and Kay, J.D. (1972). *The lighting of buildings* (Revised Ed.). London: Faber and Faber.
5. North American Philips Lighting Corp. (2010). *Lighting handbook*. North American Philips Lighting Corp., 1984.
6. Peter Tregenza, Michael Wilson. (2013). *Daylighting: Architecture and Lighting Design*. Routledge.
7. Philips, D. *Lighting Modern Buildings*. (Revised Ed.). Routledge.
8. Steffy, G. (2002). *Architectural Lighting Design*. (Revised Ed.). John Wiley & Sons.
9. William M. C. Lam, Christopher Hugh Ripman. (2008). *Perception and lighting as formgivers for Architecture*. (Digitized Ed.). Van Nostrand Reinhold.

References/Additional Reading list:

1. *Handbook for Building Engineers in Metric systems*, NBC. New Delhi, 1968.
2. Joseph De Chiara, Julius Panero and Martin Zelnik (2001). *Time Saver Standards for Interior Design and Space Planning*. McGraw Hill.

Date: April, 2014.

CAA 301 - Computer Application in Architecture

Name of the Module :	Computer Application in Architecture
Module Code :	CAA 301
Semester :	V
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

In this module, students are exposed to various application softwares which would enable them to prepare computer graphic presentations, and visual simulation during design development. Some component of the module would also enhance the capability of the students to develop CAD related software modules applicable for advanced level of designs and presentation skills.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Use AutoCAD in generating 2D and 3D graphics.
2. Use the basic tools of CAD i.e. formatting, drawing tools and modification tools.

3. Use advanced tools such as layers, line type, 2D drafting of building drawings.
4. Demonstrate the basic interface and editing necessary for creating 3D objects.
5. Create 3D objects and modify tools for the same.
6. Prepare any presentation drawing, using related softwares such as CAD, REVIT and other rendering softwares.
7. Generate 3D graphics, animations and visual simulations.
8. Describe and utilize with the basics of AUTOLISP.

Learning and Teaching Approach Used: (1 - 0 - 2)

Lectures	:	1 hour / week
Tutorial	:	Nil
Studio	:	2 hours /week

Assessment

Practical:

Continuous Assessment - 50 marks

1. Term test-20marks
2. Project – 30 marks

Semester End Examination –

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in Continuous Assessment and Semester end examination. The overall pass mark for the module is 50%

Pre-requisite – None

Subject Matters:-

1. **Introduction to Computer Aided 2D Drafting:** Need for automated design and drafting; Understanding the use of drawing Tools for automated designs and drafting; Elements of spatial data in CAD tools like Arcs, lines, rectangles, polylines, points, circles, donuts, layers, grids, snaps and object snaps, etc. Drawing units, scales, limits that size and dimensioning, texting. Setting up of drawings of various simple architectural objects with complete text and Dimensioning.
2. **Editing and Controlling Display in CAD:** Move, scale, copy, offset, change, trim, extend, mirror, divide, measure, array, break, hatch, block, zoom, regen, view, pan, fonts, etc.
3. **Data Conversions:** Paper maps, digital layout maps, on screen digitization; Base map evaluation, scanning the maps, digitization, scale conversion, symbolization, layer control, plotting and related commands. Exercises with case studies of small layouts and large scale regional level plans may be taken up.
4. **Advance Computer Aided 2D Drafting:** Advanced features- x-ref, dynamic blocks, 2D and 3D conversion, perspective view, rendering, use of material finishes and lighting. Advance command programming - transparent overlays hatching utilities, assigned colour and line type, use of multiline, style, block, symbol Library manipulation for Accurate drawing. Advance exercise in 2D drafting of various complex building drawings, incorporating the above said utilities.
5. **Introduction to 3D modelling:**
Tools: Slide facilities script attributes, V-port, editing session. Introduction to 3D-modelling technique and construction planes, drawing objects, 3D surfaces setting up elevation thickness and use of dynamic projections in ACAD/ Revit Architecture/3DMAX.
Project: Create 3D sculpture using 3D primitives (cubes, spheres etc.)
6. **Auto LISP:** programming in Auto LISP and creation of architectural library elements.
7. **Exercises:** Basic and advanced architectural drafting and presentation.

Reading List:

1. A.Watt (1989). *Fundamentals of Three-Dimensional Computer Graphics*. Massachusetts: Addis Wesley.
2. Donnie Gladfelter.(2013) *Autocad 2014 and Autocad LT 2014*. Autodesk, Inc.
3. Eddy, K., Read, P. and Vandezande, J.(2010). *Autodesk Official Training Guide Autodesk Certification Preparation*. India: WILEY India Pvt. Ltd.
4. James Vandezande, Eddy Krygiel, Phil Read.(2014). *Mastering Autodesk Revit Architecture 2014*. Autodesk, Inc.
5. Omura, G. (1990). *The ABC'S of AutoLISP*. U.S.A: Sybex Inc.
6. Robert, M. T. (1988). *Advanced Techniques in AutoCAD*. BPB Publications.
7. Sham Tickoo,(2008). *Autocad 2009; A Problem Solving Approach.(1st Ed.)*. Autodesk Press.

Date : April, 2014.

MGT 301- Entrepreneurship Development

Name of the Module:	Entrepreneurship Development
Module Code:	MGT301
Semester:	V
Credit Value:	12
Module Leader:	Mr. Ugyen Dorji
Module Tutor:	<i>(By Civil Engineering Department)</i>

General objective:

To provide basic understanding of entrepreneurship and entrepreneurial skills, opportunities in the country, RGoB's initiatives and supports, and other management practices like financial, materials and project management.

Learning outcomes:

Upon successful completion of this module the student will be able to

1. Explain characteristics of a good entrepreneur.
2. Justify the relation between an entrepreneur and society and the scope.
3. Explain basic idea of finance, materials, personnel and project management related to business management.
4. Understand the produces and formalities for establishing a business.
5. Carry out economic analysis of a project.
6. Calculate depreciation of properties by various methods.
7. Know basic methods of survey and analysis of markets.
8. Explain tax rules and regulations.
9. Prepare business project proposal.

Learning and teaching approach used:

Lectures introduce concepts and provide a broad background; demonstrations are used to clarify particular points of detail or to illustrate concepts. Case studies will be used where appropriate.

Lectures	:	3 hours / week
Tutorial	:	Nil
Studio	:	Nil

Assessment:**Continuous Assessment – 30 marks**

1. Term test- 10 marks.
2. Assignments – 10 marks.
3. Case study – 10 marks

Semester end examination - 70 marks

1. Written examination (3 hrs. duration) – 70 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite: None

Subject matter:**1. Introduction to Entrepreneurship**

2. Introduction to Engineering Economy: Engineering and Engineering economy - Risk and uncertainty - Equity and debt capital accounting fundamentals - Elements of cost - flow of capital within a firm.

3. Economic Environment and cost concept: Concept of value and utility - consumer and producer goods and services - measures of economic worth - law of supply and demand - law of diminishing return - break even analysis - opportunity cost - classification of cost.

4. Money – Time relationship: Simple interest - compound interest - annuity series - cash flows over time

5. Methods of making economic studies: Payback period - Accounting rate of return - Internal rate of return - Benefit cost ratio or profitability index - Sensitivity analysis - Statistical methods.

6. Depreciation: Purpose - methods of depreciating - accounting for the depreciation of capital assets - valuation.

7. Elementary Notions of Management: Time management - Resource management, Materials management - Production planning - PERT-CPM - Financial Management - Personal management - Management information systems - Implications of computers for management control.

8. Setting up an Industry: Formation of a company - Licensing procedures and formalities - Sources of information. Incentives - Subsidies and concessions for industry – industrial development agencies and their functions.

9. Project Planning: Identification of opportunities - market survey - break-even analysis - Techno economic feasibility studies - financial viability.

10. Marketing: Market survey and analysis - marketing arrangements and strategies, projections, predictions and forecasts market feedback.

11. Business and Industrial Laws: Labour laws - income tax - excise duty - sales tax

12. Project Report: Preparation of a detailed project report.

Reading List:

1. Entrepreneurship Development Institute of India .(2005).*Manual For Entrepreneurs*. Tata McGraw-Hill Education.
2. Balaraju,T.(2009). *Entrepreneurship development: an analytical study*. Akansha Pub. House.
3. Kasner, F. (n.d).*Human relation in Management*. Delhi: Tata McGraw Hill.
4. Prasad,I.B. (n.d).*Entrepreneurship Development*. Delhi: Khanna Publishers.
5. *Small Business Entrepreneurs in Asia and Europe / Towards a Comparative Prespective*. (1997). Delhi: Sage Publications.

6. Thuesen, H. G . (1977). *Engineering Economy*. Englewood Cliffs. New Jersey: Prentice Hall.

Date: April, 2014.

B.Arch. (Third Year) – Sixth Semester

Total number of Contact Hours = 26, Total Credits =72

SN.	Code	Name of the Module	Contact Hours			No. of Credits	Marks			
			L	T	P/S		Theory		Studio/Practical	
							C A	EX	CA	EX
1	ADE306	Architectural Design –IV	1	0	8	12			120	30
2	BLC305	Working Drawing	1	0	3	12			100	50
3	BSS304	Building Acoustics	3	0	0	12	50	50		
4	THS302	Housing and Community Planning	3	0	0	12	50	50		
5	ADE307	Landscape Design & Site Planning	3	0	0	12	25	50	25	
6	DZO301	Dzongkha	2	1	0	12	30	70		
Total			13	2	11	72				

ADE 306 - Architectural Design - IV

Name of the Module : Architectural Design – IV

Module Code : ADE 306

Semester : VI

Credit Value : 12

Module Leader : Mr. Chimi

Module Tutor :

General Objectives of the Module:

Architectural design is an expression of culture, values and technological progress of a society. Through this module, students learn to think critically and address multitude of issues as behavioural, cultural, environmental etc. which are articulated as coherent built forms. They also inculcate and acquire artistic & technical knowledge and presentation skills for effective communication of their ideas graphically.

It is also aimed to explore the design and form of building typologies that are the result of pressure on urban lands with a thrust on issues like urban land economics, technology and ecology.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Solve the cultural, behavioral and technical problems faced in the practice of Architecture.
2. Relate buildings to their urban contexts & natural environments, and aesthetic, economic, political, and social issues.

3. Design large complex buildings and campuses, which involves structural synthesis, circulations, within and around buildings.
4. Describe the typological precedents, programmatic organization, formal composition, construction methodology and develop design logic, critical thinking, and spatial form-making.
5. Explain the complexity, functioning and salient features of the design project document it and present the findings.
6. Develop comprehensive approach to architectural design based upon creative design and visualization, technology and practice, history and theory, urbanism and landscape.
7. Generate a coherent architectural project, represented through technical drawings and models.

Learning and Teaching Approach Used: (1 - 0 - 8)

The concepts of drawings will be introduced through lectures and the drawings will be drawn by students during studio period, which will be reviewed/ assess every week.

Lectures	:	1 hour / week
Tutorial	:	Nil
Studio	:	8 hours / week

Students are taken for the study tour to any place for a week to study any particular community to have a visual experience of a place, the influence social, culture on the particular community. This will also help student to have a better idea on community design and importance of social and cultural influence in designing community space.

Assessment:

The External jury should have minimum of two members including the module tutor. The evaluators can be either from college or outside having the knowledge on this particular module. The tutor is not allowed to evaluate the students' portfolio during the external jury.

Studio:

Continuous Assessment - 100marks

1. Studio assignment and projects – 90marks
By the end of the semester, this module should cover atleast two design assignments.
2. Term Test-10 marks

Semester End external viva/Jury- 20marks

1. Portfolio presentation

Semester End Examination- 30marks

1. Written examination (12 hrs. duration) – 30 marks

Students must obtain 40% each in Continuous Assessment, Semester end jury/presentation and Semester end Examination. The overall pass mark for the module is 50%

Pre-requisite – Architectural Design – III (ADE305)

Subject Matter:

1. **Scale and Complexity:** Advanced and complex problems involving large scale Multi-storeyed buildings and complexes for Residential/ Commercial/ Institutional/ Mixed-Use in an urban context with focus on visual characteristics, service integration and sustainable practices.
2. **Synthesis of Building Sciences and Architectural Space Programme** into a design matrix. Integration of site planning techniques drawing knowledge from climatology, solar

Architecture, landscaping, environmental behaviour. Introduction of basic social engineering themes on community planning, historical attributes and lessons, preliminary concepts of urban economics with real life examples with innovative coordination of building services and building technology.

3. **Design problems on the design of closed environment**, with emphasis on the articulation of interior spaces, detailing and finishing materials, textures, colour and light, acoustics and air-conditioning. Exterior spaces formed by buildings.
4. **Study tour** to the sub urban or urban community and study the social and cultural life and its impact on Architecture and Planning, before moving to the semester end project exercises.
5. **Exercises:** By the end of the semester, this module should cover atleast two design assignments of given topics, which should be supported by case studies. Design of College office buildings, corporate complex, Intelligent Office buildings (Institutional), multi-use centre, Arts and Craft center, convention center, Large Commercial Complex (Commercial), Sports stadium, Resorts, Museums, Hotels(Recreational), Apartment buildings, Mixed Residential Developments (Residential), etc.
6. **Study Tour:** Document and do presentation of any particular community or town of larger scale compare to the Second Year-Second Semester to have visual experience of a place, the influence social, culture on the particular building or space. The site of the final design assignment will be allocated from the place where students are taken for the study tour.
7. Areas of focus/ issues:
 - Sustainable building practices, green issues, alternative energy
 - Intelligent building techniques and service integration
 - Architectural Detailing
 - Advanced building practices

Ultimately, the students will apply both manual and electronic rendering skills and 3-dimensional presentation techniques to clarify the final design in totality.

Reading List:

1. Andrew Alpern (1982). *Handbook of Speciality: Elements in Architecture. (1st Ed.)*. McGraw Hill Book Co.
2. Baker, Nick and Krishnan, Arvind (1999). *Climate Responsive Architecture: A Design Handbook for energy Efficient Buildings*. Tata –McGraw Hill.
3. Edward D.Mills (1976). *Planning, 4 volumes*. London: Newnes, Butterworths.
4. Edward D.Mills (1985). *Planning the Architects Handbook, (10th Ed.)* British Library Cataloguing in Publication Data.
5. E and O.E. (1973). *Planning*. London: Liffie Books Ltd.
6. Hideaki Hareguchi (1988). *A Comparative analysis of 20th century houses. (9th Ed.)*. Academy Editions.
7. Quentin Pickard RIBA. (2002). *The Architects' Hand Book*. Bladewell Science Ltd.
8. Sam F. Miller (1995). *Design Process: A Primer for Architectural and Interior Design*. Van Nostrand Reinhold.

References/Additional Reading list:

1. *An Introduction to Traditional Architecture of Bhutan*. Department of Works, Housing, and Roads, Royal Government of Bhutan, 1993.

2. *Bhutan Building Guidelines 2002*. Department of Urban Development & Housing .Ministry of Communications.
3. *Bureau of Indian Standards, The National Building Code of India (NBC)*. New Delhi, 2005.
4. Ching, Francis D.K. (2007). *Architecture – Form, Space and Order. (3rd Ed.)*. New Jersey: John Wiley & Sons.
5. Ernst, Neufert (2012). *Neufert Architects’ Data, (4th Ed.)*.UK: Blackwell publishing ltd.
6. Guidelines for Planning and Development of Human Settlements in Urban and Rural Areas of Bhutan to minimise environmental impacts.(2013).DHS,MoWHS.
7. Joseph De Chiara, Michael J. Crosbie (2001). *Time Saver Standards for Building Types*. McGraw Hill Professional.
8. Joseph De Chiara, Julius Panero and Martin Zelnik (2001). *Time Saver Standards for Interior Design and Space Planning*. McGraw Hill.
9. Julius Panero & Martin Zelnik (1983). *Human Dimension and Interior Space: A Source Book of Design Reference Standard. (Revised Ed.)*. Whitney Library of Design Publication
10. *Rural Construction Rules 2013*. Department of Human Settlement. MoWHS.
11. Watson, D. & Crosbie, M. J. (2004). *Time Saver Standards for Architectural Design: Technical Data for Professional Practice. (8th Ed.)*. New York: McGraw-Hill Professional.

Date : April, 2014

BLC 305 – Working Drawing

Name of the Module :	Working Drawing
Module Code :	BLC 305
Semester :	VI
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

Learning of building construction will not realize its full objectives unless it is supplemented by a thorough understanding of the methods for achieving sound detailing. It is necessary for the students to understand the principles of detailing as applicable to various structural and non-structural situations in any part of the world.

This module will enable the students to make a set of working drawings or complete detailing with full information required to construct a building. The students will also learn how to give dimensions properly and intelligently, how to write brief specification, notes and references.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Solve the challenges in detailing for both the newly designed buildings as well as while carrying out additions and alterations to existing buildings.
2. Identify and describe the various Fittings, Furniture & Equipment of the buildings and their installation methods.

3. Design complex buildings incorporating various allied requirements.
4. Prepare the working drawings in such a way that, it should satisfy the tender documents.
5. Analyze, design and draw architectural detailing for their project/s and explain it properly to their clients/examiners.
6. Administer the total project confidently in the professional works.

Learning and Teaching Approach Used: (1 - 0 - 3)

Lectures	:	1 hour / week
Tutorial	:	Nil
Studio	:	3 hours / week

Assessment:

Studio:

Continuous Assessment - 100marks

1. Studio assignment and projects - 80marks

By the end of the semester, students should submit atleast five assignments for this module.

2. Term Test- 20marks

Semester End Examination- 50marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in Continuous Assessment and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – Building Construction III (BLC304)

Subject Matter:

1. **Introduction to current developments in Building Industry:** Smart Materials: Characteristics, classification, properties, energy behaviour, intelligent environments. Recycled and ecological materials and energy saving materials.-Exercises of the above through case studies and drawings.
2. **Detailing for Institutional Buildings.** a) Detailing of a residence - selected spaces. b) Detailing of classrooms, library (in school, college). c) Detailing of lecture hall, auditorium, and exhibition spaces.-Exercises of the above through case studies and drawings.
3. **Detailing for Commercial Buildings.:** a) Detailing of shop-fronts, office spaces for commercial buildings including detailing of crucial elements such as entrance porches, main doors, staircases, show-windows, enclosed and air-conditioned atrium spaces. b) Detailing of façade and selected spaces for apartment buildings, hotels and hostels. -Exercises of the above through case studies and drawings.
4. **Detailing of Built-In Furniture And Fittings:** Detailing of built-in elements like kitchen counters, cupboards, cabinets, toilets, toilet fitting. -Exercises of the above through case studies and drawings.
5. **Detailing of Exterior and Interior Architectural Elements:** Detailing of architectural elements like indoor fountains, water walls, transparent floors, street furniture, hard and soft landscape, swimming pools, water bodies and courtyard spaces. Detailing of interior

architectural elements in existing buildings (e.g. Staircase in bookshops, restaurants, playpen in restaurants, reception areas in hotel lobbies etc.) -Exercises of the above through case studies and drawings.

6. **Working Drawing:** It is prepared as a part of the contract documents with proper labelling and dimensioning techniques. The drawings shall be based on building design prepared as design studio assignment. Drawings shall include: Plans: Foundation plan; Ground Floor Plan; Upper Floor Plans; Terrace or Roof plan including roof drainage.
 - a. Site Plan / layout plan showing different buildings, internal roads, water supply, and sewerage including area drainage.
 - b. Elevations: Elevations of all sides (front, back and both the sides).
 - c. Sections: Transverse and longitudinal sections. Sections through staircase, lift, sanitary units and other full/part details as required.
 - d. Schedule and details: Door/window schedule and details including finish and fixture schedule.
 - e. Detail layout of toilet and kitchen with sections showing floor drainage including all pipes lines.
 - f. Electrical and plumbing lay out details.

Reading List:

1. Alan Blanc; Michael McEvoy; Roger Plank (2013). *Architecture and Construction in Steel*. London: E&FN Spon.
2. Alan Blanc (1999). *Stairs, Steps and Ramps*. Butterworth: Heinemann Ltd.
3. Barry, R. (2005). *The Construction of Buildings (Vols. 1 to 5)*. Oxford: Blackwell Publishing Ltd.
4. Chudley, R. and Greeno, R. *Building Construction Handbook*.
5. Dr. B.C.Punmia (2001). *A Text book of Building Construction*. New Delhi: Laxmi Publications Pvt. Ltd.
6. Richardson Dietruck (2002). *Big Idea and Small Building*. Thames and Hudson.
7. Thomas R. Ryan, Edward Allen, Patrick J. Rand. (2011). *Detailing for Landscape Architects: Aesthetics, Function and Constructability*. John Wiley & Sons.
8. T.D. Ahuja and G.S. Birdie (1996). *Fundamentals of Building Construction*. New Delhi Dhanpat Rai Publishing Company Pvt. Ltd.
9. Wakita, O.A. and Linde, R.M.(2003). *The Professional Practice of Architectural Working Drawings*.(3rd Ed.). John Wiley & Sons.
10. Wakita, O.A. and Linde, R.M.(2007). *The professional practice of architectural detailing*.(2nd Ed.). John Wiley & Sons.
11. W.B. Mckay (1992).*Building Construction (vol. I –IV)*. Orient Blackswan.

References/Additional Reading list:

1. *Bhutan Schedule of Rates – 2012*. DES. MoWHS.
2. *Labour and Materials Coefficients (Civil Works) – 2012*. DES. MoWHS.
3. *Specifications for Building and Road Works-2012*. DES. MoWHS.
4. *Standard and Specification for cost effective innovation, Building Materials and Sequence*. New Delhi: BMPTC Publication.

Date: April, 2014.

BSS 304–Building Acoustics

Name of the Module :	Building Acoustics
Module Code :	BSS 304
Semester :	VI
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

This module is introduced to impart a clear idea about Architectural Acoustical Services to any built form. It is broadly divided into two parts. In the beginning, along with physics of sound, the principles of room acoustics are covered. The major emphasis is given to the acoustical design of auditorium, lecture theatre and studios. In the second part Environmental acoustics and noise control is delivered. The sound transmissions in outdoor and noise reduction strategies are framed in the course.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Explain the physics of sound propagation through materials.
2. Outline the measures or guideline for room acoustics.
3. Implement the acoustical guidelines for Auditorium design.
4. Design a studio with complete acoustical efficiency.
5. Calculate the reverberation time for an enclosed space.
6. Estimate the sound transmission class of a composite wall system.
7. Design a sound proof partition wall for specific use.
8. Develop the environmental noise control design components to reduce urban traffic noise.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment - 50marks

1. Assignments -30 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15 marks.
3. Class test - 5 marks

Semester End Examination - 50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

1. **Fundamentals of Sound:** Sound waves, frequency, intensity, wavelength, measure of sound, decibel scale, speech and music frequencies, human ear characteristics.
2. **Sound Transmission and Absorption:** Outdoor noise levels, acceptable indoor noise levels, sonometer, determinate of density of a given building material, absorption co efficient and measurements, choice of absorption material, resonance, reverberation, echo, exercises involving reverberation time and absorption co-efficient.
3. **Noise Control and Sound Absorption:** Types of noises, transmission of noise, transmission loss, noise control and sound insulation, remedial measures and legislation. Sound absorbing materials – Descriptions & characteristics. Choice of absorbers – Measurement of absorption - Frequency dependence. Acoustical requirements in auditorium design. Acoustical design of rooms for speech, music, studios. Acoustical correction of existing auditoriums.
4. **Sound amplification systems.** Environmental noise control - Noise sources - Airborne & structure-borne noise, transmission of noise in buildings' methods of environmental noise control – Control of mechanical noise and vibrations.
5. **Acoustics and Building Design:** Sound isolation –Transmission loss- noise reduction – Speech privacy- Construction criteria, Site selection, shape, volume, treatment for interior surfaces, basic principles in designing open air theatres, cinemas, broadcasting studios, concert halls, class rooms, lecture halls, schools, residences. Call Centers, Office building and sound reinforcement systems for building types. Basic acoustical concepts and problems in contemporary architectural design. Properties of sound – origin, propagation, reflection, absorption, diffusion, room resonance, echo. Human ear and hearing – Weber Fechner's Law, Intensity, intensity level, sound pressure level, PHON. Reverberation, Sabine's reverberation formula, reverberation time (RT) measurement of RT.

Reading List:

1. B.J.Smith, R.J.Peters, Stephanie Owen(1996). *Acoustics and Noise Control*. Longman Group Ltd.
2. Leslie.L.Doelle.(2008).*Environment al Acoustics-Architectural Record Series*. McGraw-Hill.
3. M. David Egan (2007). *Architectural Acoustics*. J. Ross Publishing.
4. Moore, J.E.(2010) *Design for Good Acoustics and Noise Control.(Reprint)*. Macmillan.
5. Thomas D.Northwood (2008). *Architectural Acoustics.(Revised Ed.)*. Dowden: Hutchinson and Ross Inc.
6. Wood, A.B. (1964). *A Text book of sound.(3rd Ed.)*London: Bell and Sons.

References/Additional Reading list:

1. *National Building Code of India 2005- Part 8*. Bureau of Indian Standards.

Date: April, 2014.

THS 302 - Housing and Community Planning

Name of the Module : Housing and Community Planning

Module Code : THS 301

Semester : VI
Credit Value : 12
Module Leader : Mr. Chimi
Module Tutor :

General Objectives of the Module:

This module broadens the students understanding on the issues of housing and community planning. The module embraces the concept of ‘whole to the part’; dealing with the neighbourhood level, cluster level to the dwelling unit level. Different housing typology is explained with examples. Students shall be given ‘housing typology study’ exercise for better understanding. Norms and Standards and Building Bye Laws are exposed. Climate sensitive, energy efficient and sustainable design issues are also explained. Housing finance and affordability issues, community participation in decision making, users’ satisfaction in housing shall be taught.

Learning Outcomes:

On completion of the module, the students are expected to be able to:

1. Comprehend the intricate issues and the multidisciplinary nature of housing and community planning.
2. Explain the physical, social and economic dimensions of housing.
3. Explain the factors that influence housing affordability.
4. Explain the standards and guidelines for housing
5. Describe the evolution of community and neighbourhood planning.
6. Classify different housing typology with examples.
7. Explain concepts of climate balancing, energy rating, sustainability and flexible designing.
8. Explain the importance and ways of community participation in decision making in design and layout.
9. Explain the tools to measure affordability, climate sensitivity and residents’ satisfaction in housing.

Learning and Teaching Approach Used: (3 - 0 - 0)

Lectures : 3 hours / week
Tutorial : Nil
Studio : Nil

Assessment:

Theory:

Continuous Assessment - 50marks

1. Assignments -30marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -20 marks.

Semester End Examination -50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

- 1. Introduction:** Significance of housing in National Development Goals; Equity and efficiency parameters of housing; Current issues in housing.
- 2. Assessing Housing** Existing Housing Statistics; Definitions; Urban and rural housing statistics; Introduction to concepts of Housing Shortage, Housing Need, quantitative and qualitative aspects of housing; Housing Demand - Understanding current methods of demand assessment; Knowledge of data sources and their use and interpretation; Limitations of existing methods of assessments.
- 3. Housing Development Process:** Understanding of factors affecting residential location, theoretical knowledge of ecological, neo-classical, institutional approach to housing; Housing subsystems and their characteristics: Formal and non-formal housing; Process of Public and private sector housing development process; policy context, actors and their interrelationships; Inner city housing, Slums, Squatter housing, Unauthorized Housing; Role of different institutions in housing; International agencies, NGOs, Financing Organizations, Private developers, cooperatives-NHDCL.
- 4. Housing Standards and Design:** Factors determining residential densities; Densities, costs and development control regulations; Housing designs parameters and their relationship to costs; Housing design and climate; Housing for disaster prone areas. Communities: its characteristics and housing; Socio-economic implication of slums, clearance/ improvement of slum; Sites and services schemes, squatter upgrading, incremental approach.
- 5. Housing Policy Analyses:** Understanding and evaluation of Housing Policy and programmes in India; five year plans, Policy framework for urban and rural housing; Comparative policy analysis; Housing for the low income groups; Cooperative housing, objectives and principles; management and financing of housing projects; Investment in housing in public and private sectors.
- 6. Socio-Economic Aspects:** Social economic factors influencing housing affordability – equity in housing development sites and services-Slum up gradation community participation –Crime prevention, Health principles in Housing. Social-economic aspects of urban housing and problems of slums. Housing policy, finance and development
- 7. Site Planning and Housing Design:** Modern city planning process, survey methods and programme analysis techniques. Master Plans. Site planning and the rationale of urban regulatory controls, densities and related concepts. Urban redevelopment and renewal urban traffic and transportation planning. Site Planning: Selection of site for housing, consideration of physical characteristics of site, locational factors, orientation, climate, topography – Landscaping.
- 8. Housing Process:** Various stages and tasks in project development –Community participation and housing management – Environmental aspects and national calamities and disaster mitigation.

Reading List:

1. Andro, D.Thomas (1986). *Housing and Urban Renewal*. Sidney: George Allen and Unwin.
2. Arian Mostaedi(2003).*Sustainable Architecture: HighTech Housing*. Gingko Press.
3. Chattopadhyay, S.(2009). *New Essays on Inclusive Housing*. Macmillan.
4. Christopher Alexander (2002).*A Pattern Language*.New York: Oxford University press.

5. French, H. (2006). *New urban housing*. London: Laurence King Publishing
6. Gallion Arthur, B. & Eisna Simon (2005). *The Urban Pattern: City Planning and Housing*. Cbs.
7. *Housing for low income, sector model*. HUDCO publications.
8. Joseph de Chiara (1995). *Time saver standards for Housing and Residential development*. New York: Mcgraw Hill Co.
9. Johansson, B. and Astrand, J.(1990). *11 Successful Housing Projects*. Sadel LCHS.
10. Richard Kintermann and Robert (1977). *Small site planning for cluster Housing*. New York: Vannastrand Reinhold Company

Date: April, 2014.

ADE 307 - Landscape Design and Site Planning

Name of the Module :	Landscape Design and Site Planning
Module Code :	ADE 307
Semester :	VI
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

This module comprises two components, one relates to landscape design and the other relates to site planning principles. Initially the basics of landscape design, principles of behavioral issues, and techniques of landform design, drainage design, and plant sciences are elaborated. Exposure is given on the historical evolution of various popular landscape styles. Finally various applications of landscaping in varied climatic conditions are presented, such as, terrace landscaping, avenue landscaping, and indoor landscaping, residential area landscaping.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Explain the significance of landscape as complimentary functions to the architectural buildings and its premises.
2. Evaluate and create external environments as well as recreating suitable environment in the degenerated project sites through the exposure to this field of study.
3. Identify various elements of landscape Architecture and the principle of landscape design.
4. Define the ecological balance and impacts of human activities and stress the need for environmental protection and landscape conservation.
5. Analyze the artistic and technical aspects of designing open spaces at different scales.
6. Design Eco-friendly landscape features using locally available and energy efficient materials.
7. Design the landscape for the Design Assignment given in the same semester.
8. Prepare with latest design inputs to the architectural projects and Thesis.

Learning and Teaching Approach Used: (3 - 0 - 1)

Lectures will be used as the basic method of introducing concepts and this will be reinforced by site visits and case studies.

Lectures	:	3 hours / week
Tutorial	:	Nil
Studio	:	1 hour/week

Assessment:

Continuous Assessment - 50marks

1. Assignments -15 marks.
2. Term test -10 marks.
3. Project – 25marks

Semester End Examination - 50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory/assignments and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

1. **Introduction:** Introduction to landscape Architecture. History of landscape design, ecology, ecological balance, landscape conservation, reclamation and landscaping of derelict lands, environmental impact assessment. Aesthetic theories and principles of space establishment, site survey, analysis and appraisal.
2. **Elements in Landscape Design:** Hard and soft landscape elements; Plant materials - classification, characteristics, use and application in landscape design; Water and Landform.
3. **Urban Landscape:** Characteristics and components of open space patterns in towns and cities (traditional and contemporary) basic types: streets, squares, plazas, gardens, public parks at district, local and neighbourhood levels; Park systems; Landscape design related to land-use, circulation networks and activity; Street furniture as a component of urban landscape.
4. **Site Planning:** Organisation of spaces - circulation, built form and open spaces, site planning and micro climate, site planning for neighbourhood parks, children's play area and campus development. –Eco-friendly strategies in site planning.
5. **Landscape Aspects of Site Planning:** Principles of understanding and evaluating and existing landscape; Development as a response to constraints and offered by the site; the landscape concept and open space structure as a basic component of the site plan. The role of vegetation: environmental benefits, functional requirements, aesthetic considerations; Typical situations and criteria for design with plants and selection of species; grading in relation to existing contours, plinth levels, road alignment and storm water drainage; principles of cut and fill.
6. **Landscaping of Functional Areas:** Urban open spaces and principle of urban landscape; Street landscaping, landscape design for waterfront areas and functional areas in urban centers; green roofs.
7. **Exercise:** To designed the landscape for the Architecture Design-IV.

Reading List:

1. Acquaah, G. (2009). *Horticulture– Principles and Practices*,(4th Ed.). PHI Learning Pvt. Ltd.

2. Anne Beerand Cathy Higgins.(2000).*Environmental Planning for Site Development: A Manual for Sustainable Local Planning and Design.*(2nd Ed.). Routledge.
3. Brian Hacket (1979). *Planting Design*. Mc Graw Hill, Inc.,
4. Cliff Tandy (1973).*Handbook of urban landscape*. Architectural press.
5. Grant W Reid (1993). *From Concept to Form in Landscape Design*. Van Nostrand Reinhold Company.
6. Geoffrey and Susan Jellicoe (1987). *The Landscape of Man*. Thames and Hudson.
7. Michael Laurie (1986). *An Introduction to Landscape Architecture*. Elsevier.
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References/Additional Reading list:

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Date : April, 2014.

DZO 301–Dzongkha

The following module descriptor will supplement the existing Dzongkha Module DZO301 of Engineering programmes for Architecture programme.

ཉམས་ཚན་གྱི་མང་།	བཟོ་རིག་ལུ་མཁོ་བའི་འབྲུག་གི་བྱིས་བཟོ་(རྫོང་ཁ།)།
ཉམས་ཚན་མང་རྟགས།	DZO301
ཉམས་འབྲུག།	༡༩
ལོ་རིམ།	གཞུག་ལག་གཞི་རིམ་ལོ་ངོ་གསུམ་པ།
ཤོད་བྱས།	བྱུག་པ།
འབྲུག་ཚན་སློབ་མི།	དགོན་པོ་ཚོ་རྗེ།

༡ རྒྱུ་རྒྱུ་བྱུག་དམགས་ལུལ།

འཇམ་སྤྱི་ཅི་དང་ ལྷག་པར་ ཉི་མཱ་ལ་ཡའི་ཆ་ཤས་ཚུ་གཏོགས་པའི་ དཔལ་ལྷན་འབྲུག་པའི་ཐ་སྲད་ཚོས་སྲིད་ལུགས་གཞིས་གྱི་ལྷག་པའི་ལམ་སྲོལ་བྱིས་བཟོ་བཀོད་པ་ཚུ་ མི་ཉམས་གོང་འཕེལ་དང་རྒྱ་རྒྱུང་བཞག་ནི་ལུ་ཁེ་ཕན་ཡོད་དེ་ཁར་མ་འོང་འབྲུག་གི་ན་གཞོན་ཚུ་གིས་རྒྱུད་ལུ་ ཚན་རིག་དང་འབྲེལ་བའི་བཟོ་བཀོད་གྱི་རིག་པ་ཚུ་ ཕན་ཚུན་བརྗེས་སོར་དང་ཉམས་སྲུང་ཐོབ་ལས་ འབྲུག་པའི་བྱུང་ཚོས་ མ་འདྲ་བའི་རང་བཟོ་རྣམ་གཞག་ཚུ་ འབྲི་སྐབ་ཤེས་ཡོན་གྱིས་མཁས་རིག་ཅན་ལུ་འགྱུར་ཉེ་ རང་གི་ངོ་རྟགས་བརྟན་ཚུགས་བཟོ་ནི།

ཤོད་བྱུང་གྲུབ་འབྲེལ།

སློབ་ཚན་འདི་མཇུག་བསྐྱེད་དུ་སློབ་སྦྱོང་གི་སྐོར་

- རང་ལུགས་ལུ་འཇོམ་སྤྱོད་ནང་བཅོལ་བའི་ལུགས་ལྟུང་ཚུལ་གྱི་སློབ་བཤེད་པ་རྒྱབ་ཚུགས།
- འབྲུག་རྒྱལ་ཁབ་ནང་བཅོལ་བའི་ལུགས་ལྟུང་ཚུལ་གྱི་སློབ་འབྲི་སླབ་འབད་ཚུགས།
- རང་ལུགས་ཀྱི་ས་སྤངས་དང་ས་དགའ་སློབ་བཟླ་དབྱེད་འབད་ཚུགས།
- བྱིས་གསར་རྙིང་གི་འབྲུག་བཅུགས་ཐངས་ཀྱི་སློབ་ལས་དབྱེ་བ་དབྱེད་ཚུགས།
- ལག་ཚུལ་འཛུགས་འཛུགས་འབད་ཚུགས།
- གཟུང་དཀར་འཕྲོད་སྦྱོར་བཟླ་དགོ་པའི་ཁྱེད་ཚོ་དོན་བཤེད་ཚུགས།
- བྱིས་རབ་འབྲིང་ཐ་གསུམ་གྱི་སྤྱི་ནང་གི་བཅོལ་བའི་ལུགས་ལྟུང་ཚུལ་གྱི་བཤེད་པ་བརྒྱབ་ཚུགས།
- རང་ལུགས་བྱིས་ཀྱི་བཅོལ་བའི་དང་འབྲེལ་བའི་ཐོབ་ཡིན་གྱི་ཁྱེད་ཚོ་དང་དགོས་པ་ཚུ་བཤེད་པ་གི་སློབ་འབད་ཚུགས།
- རྒྱུ་ལཱ་འདི་དང་ལྷ་ཁང་བཅོལ་བའི་དང་འབྲེལ་བའི་སློབ་ལས་ཁྱེད་ཚོ་གི་ལུགས་ལྟུང་ཚུགས།
- ཐོབ་ཚུལ་རབ་འབྲིང་ཐ་གསུམ་གྱི་སློབ་ལས་བཤེད་པ་བརྒྱབ་ཚུགས།

སློབ་སློབ་དང་སློབ་སྦྱོང་།

སློབ་དུས་རེ་རེ་ནང་ བདུན་ཕྱག་བཅོལ་དང་དུས་ལུན་ཚུ་ཚོད་ ༤༥ ཡོད་ས་ལས་ལེགས་བཤེད་པ་གིས་ཚུ་ཚོད་ ༡༥ ལྟོ་ལོ་དང་། ལྷག་ལུས་ཚུ་ཚོད་ ༣༠ ལོ་བཅུད་སྦྱོང་མཐའ་དབྱེད་སློབ་བྱེད་དང་གསལ་བཤེད་འབད་ནི་ཨིན། སློབ་སློབ་འཕྲོ་མཐུད་འབད་དེ་ དབྱེ་དབྱེད་དང་ལག་ལེན་འབྲི་རྒྱུགས་གཉིས་ སློབ་ཚན་དང་སློབ་དུས་ལུ་ཁ་བྱེས་ཏེ་འབྲི་རྒྱུགས་ལེན་ནི་ཨིན།

༡༠དབྱེ་ཞིབ་ལམ་ལུགས།

༡༠ སློབ་སྦྱོང་ལམ་	༥༠%
༡ སློབ་ཁང་གསལ་བཤེད།	༡༠%
༢ དབྱེ་དབྱེད་འབྲི་རྒྱུགས།	༡༠%
༣ ལག་ལེན་སྦྱོང་བ།	༡༠%
༤ ལས་འགྲུལ་དང་ཞིབ་འཚོལ།	༢༠%
༥ སློབ་དུས་ཚོས་རྒྱུགས།	༥༠%
རྒྱུགས་བཅོལ་སྤྱོད་	༡༠༠%

༡༡སློབ་ཚན་བཤེད་ལམ།

- ༡༠ སློབ་ཀྱི་ལས་དོན་དབྱེ་བ་ལ་གསལ།
- ༡ འཇོམ་སྤྱོད་ནང་བཅོལ་བའི་ལུགས་ལྟུང་ཚུལ་གྱི་ཚུལ་གཞུག།
- ༢ འབྲུག་རྒྱལ་ཁབ་ནང་བཅོལ་བའི་ལུགས་ལྟུང་ཚུལ་གྱི་ཚུལ་གཞུག།
- ༣ བྱིས་ཀྱི་ས་སྤངས་ས་དགའ་ལོ་དོན་དང་ལག་ལེན་འཐབ་ཐངས།
- ༤ གཟུང་དཀར་འཕྲོད་སྦྱོར་བཟླ་དགོ་པའི་ཁྱེད་ཚོ་དོན་དང་ཕན་ལོན།
- ༥ ཚན་ལུགས་དང་འབྲེལ་བའི་བྱིས་ཀྱི་ས་སྤངས་ལོ་དོན་དང་ཚུལ་གྱིས་བཅུགས་ཐངས།
- ༦ རྒྱུ་ལཱ་འཛུགས་ལུ་ལག་ཚུལ་འཛུགས་འཛུགས་དང་དབྱེ་བ།

ལོ་ནང་གསལ་དབྱེ་རིམ་ལ་གསལ།

- ༡ གྲིམ་བྱི་ནང་གི་བཀོད་པ་དང་ཚོན་དང་པཏའི་ཐོབ་ལམ།
- ༢ རྟེན་འོག་ཐོག་ཚད་དང་རྒྱ་ཚད་དབྱ་བའི་ཐོབ་ཐངས།
- ༣ གཞུང་དང་བོ་གཞུང་གི་ལྷན་ཚོགས་ཐོབ་ལམ།
- ༤ གྲིམ་རྒྱ་བཏོན་འི་ཕྱོགས་བཟང་དན་དང་སྤང་སྤང་འབད་ཐངས་ལག་ལེན།
- ༥ སུག་སྐྱ་ལུ་གྲུ་སྐྱ་སྤྱི་དག་གི་གསུམ་གྱི་ཐོབ་ལམ་དང་དབྱེ་བ།
- ༦ སྤང་མཚུག་དང་ཡ་ཐེམ་མ་ཐེམ་ག་སྤང་གཟིང་གི་བཟོ་རྒྱུ་དང་ཐོབ་ལམ།
- ༧ རྩ་གཏུང་པར་ཚོས་བཞེགས་དང་མོར་བུའི་ཉེ་སྤང་བཟོ་བཀོད་ཐོབ་ལམ།
- ༨ སྤོག་དང་དང་པ་ཉི་ལེབས་སྤྱི་ལོ་ཚུ་གི་རྒྱུ་བཤད་དང་ཐོབ་ཐངས།
- ༩ ལྷ་ཁང་དང་མཚོད་རྟེན་གསེར་ཐོག་ཚུ་གི་དགོས་པན་དང་ཐོབ་ལམ།

༡༢ རྒྱབ་ཁུངས།

- ལྷང་རྩོམ་འབྲུག་གི་གྲིམ་བཟོ་རྒྱུ་བཤད་ཀྱི་ཞེམ་གྱི་སྤེལ་ཁང་། ༢༠༠༤།
- ལྷང་ཚོན་སངས་རྒྱལ་རྩོམ་འབྲུག་གི་མཚོད་རྟེན་རྒྱུ་བཤད།
- མཁན་པོ་ལུན་ཚོགས་བཀའ་སྤྱོད་འབྲུག་གི་བཟོ་རིག་རྒྱུ་བཤད་ལུ་བཟང་གཞན་པན། ༢༠༠༣།
- གཏུང་སྐྱེས་འཕྲིན་མོར་བུ་དགོངས་རྒྱུ་ལུ་མཚོད་རྟེན་ཚོན་མོའི་དཀར་ཆག།

༡༢ རྒྱབ་ཁུངས་ལྷན་ཚོགས་ ༢༥/༠༤/༢༠༡༤

B. Arch. (Fourth Year) – Seventh Semester

Total number of Contact Hours = 29, Total Credits = 72

SN.	Code	Name of the Module	Contact Hours			No. of Credits	Marks			
			L	T	P/S		Theory		Studio/Practical	
							C A	EX	CA	EX
1	ADE408	Architectural Design-V	1	0	10			200	150	
2	ADE 409	Interior Design	3	0	0	12	50	50		
3	BSS405	HVAC & Mechanical Services	3	1	0		50	50		
4	BPD401	Estimation, Costing & Tendering	3	1	0	12	30	70		
5	THD403	Sustainable Architecture & Development	3	0	0	12	10 0			
6		Departmental Elective-I	3	1	0	12	10 0			
Total			16	3	10	72				

**ADE 408 - Architectural Design – V
(Housing)**

Name of the Module : Architectural Design – V
Module Code : ADE 408
Semester : VII

Credit Value	:	12
Module Leader	:	Mr. Chimi
Module Tutor	:	More than one tutor

General Objectives of the Module:

In this module, students are introduced to the process of designing complex mixed use buildings and real estate projects by taking them through the stages of space programming, analysis, evaluation of design criteria and fundamentals of composite site planning. Students are also encouraged to explore the economic feasibility and profitability of the project/building. This module also familiarizes students with complex building services, utilities, building automation and facility planning.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Comprehend the complexities and issues related to designing complex mixed use buildings.
2. Evaluate the design criteria from the space programming and economic point of view.
3. Describe the different aspects of facility planning in housing.
4. Identify and design different building services, utilities and building automation tools.
5. Comprehend the fundamentals of site planning.
6. Identify and plan the physical infrastructure required in large sites.
7. Explain the techniques of post occupancy evaluation and measurement of user satisfaction.
8. Identify the social and economic factors influencing housing design and the various schemes in housing promotion.
9. Differentiate different types of housing in housing design, pattern and the components in housing design.
10. Generate a coherent architectural project, represented through technical drawings and models.
11. Organize the various stages involved in development of housing and its management.

Learning and Teaching Approach Used: (1 – 0 -10)

Design projects will be either done in pair, group or individually, depending upon the strength of the students in the studio.

Lectures	:	1 hour / week
Tutorial	:	Nil
Studio	:	10 hours / week

Assessment:

The external jury should have minimum of two members excluding the module tutor. The one of the evaluators can be either from college or outside and the second one should be compulsory from outside expertise having the knowledge on this particular module. The tutor is not allowed to evaluate the students' portfolio during the external jury.

Studio:

Continuous Assessment – 350marks

1. Studio assignment and projects – 200marks

The marks will be distributed by Module leader from initial studies like case studies and concept design till the final internal marking, which will be held a day or two before external jury.

Semester End external viva/Jury- 150marks

1. Design presentation

Students must obtain 40% each in Continuous Assessment and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – Architectural Design – IV (ADE306)

Subject Matter

1. Design problem involving a high density, large scale housing, Socio-economic determinants, Legislative and economic constraints and technological alternatives shall be studied in detail.
2. Exercises in simulation and conceptual modelling shall be conducted. Application of concepts of community participation, phasing, financing and construction.
3. Design and standards for different physical infrastructure in sites such as roads/streets, pedestrian pathways, parking lot, electrical substation, cable trenches, drains and other site drainage infrastructure, solid waste management facilities, water supply and ground water treatment units, cooking gas supply stations, waste water treatment and other sanitary facilities.
4. Design and standards for different building services, utilities and building automation facilities such as multi-level car park, different types of ramp, basement, mechanical ventilation in basements, firefighting facilities and equipment, AC plant room, Air Handling units & ducts, generator rooms, water treatment and storage, boom barriers etc.
5. Project documentation including basic working drawings, preliminary estimates, outline specifications and scheduling aimed at comprehensive understanding of the implementation process. Some suggested types of design assignments are: Housing projects, Real estate etc.

Reading List:

1. Baker, Nick and Krishnan, Arvind (1999). *Climate Responsive Architecture: A Design Handbook for energy Efficient Buildings*. Tata –McGraw Hill.
2. Christopher Alexander (2002). *A Pattern Language*. New York: Oxford University press
3. Crosbie, M.J. (2003). *Multi-Family Housing: The Art of Sharing*. Images Publishing.
4. Edward D. Mills (1976). *Planning, 4 volumes*. London: Newnes, Butterworths.
5. Edward D. Mills (1985). *Planning the Architects Handbook, (10th Ed.)* British Library
6. Forbes Davidson and Geoff Payne (2002). *Urban Projects Manual. (2nd Ed.)*. Liverpool: Liverpool University Press.
7. Hideaki Hareguchi (1988). *A Comparative analysis of 20th century houses. (9th Ed.)*. Academy Editions.
8. Quentin Pickard RIBA. (2002). *The Architects' Hand Book*. Bladewell Science Ltd.
9. Richard Untermanu & Robert Small (1977). *Site Planning for Cluster Housing*. London: Van Nostrand Reinhold Company.
10. Russ, T.H. (2009). *Site Planning and Design Handbook. (2nd Ed.)*. McGraw Hill.
11. Sam F. Miller (1995). *Design Process: A Primer for Architectural and Interior Design*. Van Nostrand Reinhold.

References/Additional Reading list:

1. *An Introduction to Traditional Architecture of Bhutan*. Department of Works, Housing, and Roads, Royal Government of Bhutan, 1993.

2. *Bhutan Building Guidelines 2002*. Department of Urban Development & Housing .Ministry of Communications.
3. *Bureau of Indian Standards, The National Building Code of India (NBC)*. New Delhi, 2005.
4. Ching, Francis D.K. (2007). *Architecture – Form, Space and Order*. (3rd Ed.). New Jersey: John Wiley & Sons.
5. Ernst, Neufert (2012). *Neufert Architects' Data*, (4th Ed.).UK: Blackwell publishing ltd.
6. Guidelines for Planning and Development of Human Settlements in Urban and Rural Areas of Bhutan to minimise environmental impacts.(2013).DHS,MoWHS.
7. Joseph De Chiara, Michael J. Crosbie (2001). *Time Saver Standards for Building Types*. McGraw Hill Professional.
8. Joseph de chiara & others (1995). *Time Saver Standards for Housing and Residential development*. New York: McGraw-Hill Co.
9. Joseph De Chiara, Julius Panero and Martin Zelnik (2001). *Time Saver Standards for Interior Design and Space Planning*. McGraw Hill.
10. Julius Panero & Martin Zelnik (1983). *Human Dimension and Interior Space: A Source Book of Design Reference Standard*. (Revised Ed.). Whitney Library of Design Publication.
11. *Rural Construction Rules 2013*. Department of Human Settlement. MoWHS.
12. Watson, D. & Crosbie, M. J. (2004). *Time Saver Standards for Architectural Design: Technical Data for Professional Practice*. (8th Ed.). New York: McGraw-Hill Professional.

Date : April, 2014

ADE 409 - Interior Design

Name of the Module :	Interior Design
Module Code :	ADE 409
Semester :	VII
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

This module is offered after student already have some knowledge about User Anthropometrics, Building materials & finishes and Details of Construction. It is offered to provide theoretical input to students on organization and articulation of interior space through materials, form, colours, texture, techniques, symbolism and semantics. Thrust is also on creating a natural environment through use of landscape and planting design and to create awareness that this is a specialization in Architecture.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Describe the role Interior Design profession.
2. Explain the elements of Interior Design with practical examples and applied forms. Colour, Texture, Light, Sound, Thermal environment, Plants, furniture – their roles in Spatial Design.
3. Identify and implement various styles of Interiors—Oriental to Western with their appropriateness in modern interiors.
4. Categorize and use the emerging trends of various new materials, finishes, luminaires, design accessories, etc.

5. Prepare realistic estimate for the studio design projects in BOQ.
6. Explain the evolution in the historical context and as to how arts and crafts influence decoration and detail.
7. Explain the importance of floors, ceilings, walls and other elements of buildings to contribute to aesthetic and physiological effect.
8. Classify the components like lighting fixtures, objects of art, hard and soft landscape elements for good articulation of space.

Learning and Teaching Approach Used: (2 - 0 - 2)

Lectures	:	2 hours / week
Tutorial	:	Nil
Studio	:	2 hours / week

Assessment:

Studio:

Continuous Assessment - 70marks

1. Studio assignment and projects - 50marks
2. Term test-20marks.

Semester End Examination - 30marks

1. Written examination (3 hrs. duration) – 30 marks

Students must obtain 40% each in Continuous Assessment and Semester end Examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

1. **Introduction to Interior Design:** Definition of interior design, interior design process, vocabulary of design in terms of principles and elements, Introduction to the design of interior spaces as related to typologies and functions, themes and concepts, study and design.
2. **History of Interior Design:** Brief study of the history of interior design through the ages relating to historical context, design movements and ideas etc. Brief study of folk arts and crafts, vernacular design in India with reference to interior design and decoration.
3. **Elements of Interior Design enclosing Elements:** Introduction to various elements in interiors like floors, ceilings, walls, staircases, openings, interior service elements, incidental elements etc. and various methods of their treatment involving use of materials and methods of construction in order to obtain certain specific functional, aesthetic and psychological effects design projects
4. **Elements of Interior Design Lighting, Accessories, Interior Landscaping:** Study of interior lighting different types of lighting, their effects, types of lighting fixtures. Other elements of interiors like accessories used for enhancement of interiors paintings, objects de art, etc. Interior landscaping elements like rocks, plants, water, flowers, fountains, paving, artefacts, etc. their physical properties, effects on spaces and design values.
5. **Elements of Interior Design Furniture Design:** Study of relationship of furniture to spaces and human movements furniture design as related to human comfort, function, materials and methods of construction, changing trends and lifestyles, innovations and design ideas study on

furniture for specific types of interiors like office furniture, children's furniture, residential furniture, display systems, etc. projects on furniture design.

Reading List:

1. Ching, Francis, D, K, and Binggeli, C. (2005). *Interior Design Illustrated*. John Wiley & Sons Inc.
2. Kasu, Ahmed (1995). *Interior Design*. Iquara Publications Pvt. Ltd.
3. Pile, John (1997). *Colour in Interior Design*. Mc-Graw Hill Professional Publishing.
4. Pile, John (2004). *History of Interior Design*. Laurence King Publishing.
5. Riggs, Rosemary, J. (1992). *Materials and Components of Interior Design*. Prentice Hall.
6. Steport De Van Kness, Logan and Szebely (1980). *Introduction to Interior Design*. New York: Macmillan Publishing Co.
7. Sully, Anthony (2012). *Interior Design: Theory and Process*. A&C Black.
8. Taylor, Lesley (2003). *Design and Decorate Interiors: Inspirational Ideas for Stylish Living*. New Holland.
9. Whiton, Sherrill (2010). *Elements of Interior Design and Decoration*. Muschamp Press.

References/Additional Reading list:

1. Ernst, Neufert (2012). *Neufert Architects' Data, (4th Ed.)*.UK: Blackwell publishing ltd.
2. Joseph De Chiara, Julius Panero and Martin Zelnik (2001). *Time Saver Standards for Interior Design and Space Planning*. McGraw Hill.

Date : April, 2014

BSS 405–HVAC and Mechanical Services

Name of the Module :	HVAC and Mechanical Services
Module Code :	BSS 405
Semester :	V
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

The module is introduced to give a clear understanding about heating ventilation and air conditioning in a building and the communication and security systems. In this students will cover all aspects of HVAC and communication system for human comfort and safety.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Prepare the flow diagram of HVAC, lift and other mechanical services
2. Differentiate between different types of HVAC and mechanical services.
3. Relate the thermal need of an enclosed space reference to solar parameter.
4. Calculate and estimate the heating or cooling load of a building.
5. Design the air-conditioning system in an effective manner

6. Design the duct layout of a building for air-conditioning purpose and the location and sizes of various mechanical services required in the building
7. Explain various ways by which fire safety design can be achieved in buildings through passive design.
8. Identify and explain the causes of fire, need for protection, standards and norms involved, and various considerations in planning and making it barrier free.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment - 50marks

1. Assignments -30 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15 marks.
3. Class test - 5 marks

Semester End Examination - 50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

1. **Basic Refrigeration Principles:** Thermodynamics – Heat – Temperature – Latent heat of fusion – evaporation, saturation temperature, pressure temperature relationship for liquid refrigerants, refrigeration cycle components – vapour compression cycle – compressors – evaporators – Refrigerant control devices – electric motors – Air handling Units – cooling towers.
2. **Air Conditioning: Systems and Applications:** Air conditioning system for small buildings – window types, evaporative cooler, packaged terminal units and through the wall units split system Systems for large building – Chilled water plant – All Air system, variable air volume, All water system Configuring/ sizing of mechanical equipment, equipment spaces and sizes for chiller plant, cooling tower, Fan room, Circulation Pumps, Pipes, ducts.
3. **Air Conditioning:** Design issues and Horizontal Distribution System: Design criteria for selecting the Air conditioning system for large building and energy conservation measures - Typical choices for cooling systems for small and large buildings - Horizontal distribution of services for large buildings - Grouped horizontal distribution over central corridors, Above ceiling, In floor, Raised access floor, Horizontal distribution of mechanical services.
4. **Fire Safety General Provisions:** Causes of fire in buildings, Fire protection, standards - safety regulations, NBC, Planning considerations in buildings like Non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types.
5. **Fire Detection and Fighting Installations:** Types of detectors and usage -Heat detectors, smoke detectors, photoelectric detectors etc., Alarm Systems, Fire fighting Pumps, Fire tank

(static capacity) Dry and wet risers, Automatic sprinklers/ fire drill, refuge areas, - Communications and Security Systems.

Reading List:

1. A.F.C. Sherratt (1980). *Air-conditioning and Energy Conservation*. London: The Architectural Press.
2. Gupta, J.K. and Khurmi, R.S. (2005). *Text book of Refrigeration & Air Conditioning*. S. Chand.
3. Jones, W.P. (2005). *Air Conditioning Application and Design*. Prentice Hall.
4. Lang, V.P., *Principles of Air Conditioning*.
5. Pita, E.D. (2002). *Air Conditioning Principles and Systems*. Prentice Hall.
6. William H. Severns and Julian R. Fellows (1988). *Air-conditioning and Refrigeration*. London: John Wiley and Sons.

References/Additional Reading list:

1. *Fire Safety: National Building Code of India 1983*. Bureau of Indian Standard.

Date: April, 2014

BPD401 – Estimation, Costing and Tendering

Name of the Module :	Estimation, Costing and Tendering
Module Code :	BPD401
Semester :	VII
Credit Value :	12
Module Leader :	Mr. Ugyen Dorji
Module Tutor :	(By Civil Engineering Department)

General Objective of the Module:

The aim of this module is to introduce the principles and concepts of estimating (labour and material) and analysing the rate of various building materials conforming to their specifications as per the given structural drawings.

Learning Outcomes:

Upon successful completion of this module, the students will be able to:

1. Perform different methods of building estimate.
2. Compute the quantities of various materials required for the engineering structures.
3. Analyze the rates of the material and manpower as per latest SQCA Specifications for Building & Road Works.
4. Write the specifications of the materials and construction methods.
5. Determine the value of the existing structures.
6. Prepare the tender documents as per latest CDB Manual and Financial Manual.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Practical	:	Nil

Assessment:**Continuous Assessment – 30 marks**

1. Term Test -10 marks.
2. Assignment: 10 Marks.
3. Class Test/Project: 10 Marks

Semester End Examination – 70 marks

1. Written Examination (3hrs duration) – 70 marks

Students must obtain 40% each in Continuous Assessment and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite– None

Subject Matter:

1. **Quantity Estimation:** Principles of estimation – Methods and units – Estimation of materials in building, roads, and any other prominent structures.
2. **Rate Analysis:** Analysis of rates for building, roads, and other prominent structures as per current practice of Bhutan Schedule of Rates.
3. **Principles of Specification:** Principle of general specifications of buildings and other prominent structures – Detailed specification of various building works, maintenance works and other prominent structures (Emphasis should be given on as per SQCA).
4. **Tendering and Documentation:** Tenders and type of tenders – Contracts and type of contracts – Award of contract – Legal problem in contract – Arbitrator and role of arbitrator in civil related works (Emphasis should be given on as per SQCA and Financial Manual and Procedures).
5. **Valuation:** Valuation of real properties (buildings etc.) – Rent fixation of buildings.
6. **Accounting:** Various books of accounts.
7. **Administration:** Departmental and contract works.

Reading Lists:

1. Arya, A.S. (2000). *Masonry and Timber Structures including Earthquake Resistant Design*. Roorkee: Nem Chand & Bros.
2. Bellis, H.F. and Schmidt, W.A. (2001). *Architectural Drafting*. London: McGraw-Hill.
3. Dutta, B.N. (2004). *Estimating and Costing in Civil Engineering – Theory and Practice Including Specifications and Valuation*. Delhi: UBS Publishers.
4. Rangwala, S.C. (2001). *Estimating, Costing and Tendering [Professional Practice]*, Delhi: Charotar Publishing House.
5. Khanna, P.N. (2001). *Indian Practical Civil Engineers' Handbook – the standard ever-day reference book for all engineers & architect*. Delhi: Engineers' Publishers.
6. Patil, B.S. (2006). *Civil Engineering Contracts and Estimate. (3rd ed.)*. Universities Press.
7. Goyal, S.C. and Jain, O.P. (2001). *Manual Estimating*. Roorkee: Nem Chand & Bros.
8. Hoelscher, R.P. and Springer, C.H. (2002). *Engineering Drawing & Geometry*. London: John Wiley & Sons Inc.
9. Ministry of Finance, (2001). *Financial Manual*.
10. Ministry of Finance, (2009). *Procurement Rules and Regulations*
11. SQCA, (2009). *Specifications for Building & Road Works, Bhutan Schedule of Rates, Labour & Material Coefficient (Civil)*.
12. CDB, (2009). *Registration Manual*.

Date: April, 2014

THD 403 - Sustainable Architecture and Development

Name of the Module : Sustainable Architecture and Development
Module Code : THD 403
Semester : VII
Credit Value : 12
Module Leader : Mr. Chimi
Module Tutor :

General Objectives of the Module:

The module is offered to sensitize students about the importance and the need for Sustainable Planning concept and appropriate Architectural Design concepts as an emerging thrust area.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Describe the energy rating of building material.
2. Implement the green building principles.
3. Derive the sustainable principles from the basic climatology and energy efficient design principles.
4. Apply the sustainable design principles in local, neighbourhood and regional planning scale.
5. Explain the various concepts of environment, ecology, roles of Institutions and citizens.
6. Identify various Sustainable Technologies involved –their response to climate – other technical options.
7. Advocate and practice Green architecture.

Learning and Teaching Approach Used: (3 - 0 - 0)

Lectures : 3 hours / week
Tutorial : Nil
Studio : Nil

Assessment:

Theory:

Continuous Assessment – 100 marks

1. Assignments -50 marks
2. Term test -15marks.
3. Test-5marks
4. Semester End Report/presentation - 30 marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter:

1. **Introduction:** Concept and Definition – 1970; Stockholm Declaration – 1972 ; Brunt land commission – 1987 ; Earth summit – 1992 (UCED). Environmental impact on human development related activities due to population growth, pace of urbanization, increase in consumption of energy, natural resources, waste generation, deforestation and pollution.
2. **Impact of Construction Industry on Environment:** Depletion of Earth’s resources, minerals and energy, towards anthropogenic Climatic changes towards hotter and drier, Desertification, Coastal flooding and erosion, Water shortage – decline in water quality, Food security-threatened, Imbalance in Eco system.
3. **Global Initiative and Major Achievements Rio Declaration:** Agenda – 21 - Forest principles - Legally binding conventions, the need: Governments commitments -priority areas.
4. **Action Planning Towards Sustainable Architecture:** Appropriate Policy framework for sustainable planning and development, Selection of land for human settlement and quarrying, Reduction of construction activities in eco sensitive zone. Selection and use of timber from sustainability managed forest. Integrated waste management policy and system- segregation, collection, recycling, treatment and disposal at sustainable managed site. Integrated Energy, water, Construction materials and technology, management policy, framework for built environment, waste management policy framework. Sustainable building material Technology options. Application of concept of Green Architecture, Agile Architecture, LEEDS rating. TERI rating system, Building automation etc.
5. **Sustainable Planning and Policies:** Government policies, programmes and actions - Action by Architects and designers – Action by builders/ promoters - Awareness programme - Case studies /workshops Sustainable City Planning initiatives.

Reading List:

1. *An exploration of sustainability in the provision of basic urban services in Indian Cities.* TERI-Press, 2009.
2. Anne Beerand Cathy Higgins.(2000).*Environmental Planning for Site Development: A Manual for Sustainable Local Planning and Design.*(2nd Ed.). Routledge.
3. Arian Mostaedi.(2003). *Sustainable Architecture: HighTech Housing.* Gingko Press.
4. *Bioclimatic Architecture.* ENEA and IN/ARCH Publication, 1990.
5. M anik & Girish, Komisva, IIPA. (1997). *Keeping Cities Clean and Green.* Uppal Publishing House.
6. *Sustainable Building Design Manual – Vol. 1 & Vol. 2.* Published by Energy & Resources.2004.
7. *Wealth from waste.* TERI-Press, 2005.

Date: April, 2014

B. Arch. (Fourth Year) – Eighth Semester

Total number of Contact Hours = 0, Total Credits =24

SN.	Code	Name of the Module	Contact	No. of	Marks
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			Hours			Credits				
			L	T	P/S		Theory		Practical	
							CA	EX	CA	EX
1	PRT401	Internship Programme	0	0	0	24			30	70
Total			0	0	0	24				

PRT 401 - Internship Programme

Name of the Module : Internship Programme

Module Code : PRT 401

Semester : VIII

Credit Value : 24

Module Leader : Mr. Dhrubaraj Sharma

Module Tutor :

General Objectives of the Module:

This is an important element of the programme where learners can be introduced in the actual work of architecture. The experience can connect their classroom learning to real world of work under the supervision of a registered architect. The module which shall comprise of a minimum of 90 working days will provide adequate experience to connect the classroom learning to real world of work & office management.

Along with the Internship Programme, students shall also carry out an assignment/documentation on a space study and give critical review/ write-ups and improvement proposals to the existing public space and their designs.

Learning Outcomes:

Upon successful completion of this module the student will be able to.

1. Execute the different stages of a live project and the involvements of other professionals in the project
2. Prepare architectural drawings including detailed working drawings.
3. Implement the practical aspects of working in an architect's office.
4. Work in close coordination with other professionals like structural engineering, electrical engineering and building services.
5. Prepare presentation slides and drawings and make design presentation to the client.
6. Prepare a project report.
7. Prepare a critical analysis of the project after a site visit.
8. Conduct meetings, material survey and office administration in order to gain insight into the day-to-day functioning of an architect's office.

Learning and Teaching Approach Used:

The internship programme would be carried out in offices approved by the Institution and in firms registered under the Bhutan Institute of Architect/Construction Development Board for a semester. The choice of the place of training shall be Architectural Firms, Organizations, Development

Authorities, etc. which are headed by Architects. The Head of Architecture Department and Dean of Academic Affairs shall approve the choice of the office. Each student will be assigned with a module tutor at the Department to whom the students shall report the work progress in the prescribed format.

Students should submit his/her report/set of drawings to the module Leader and do a presentation of the works they have done in the end of 8th semester.

Assessment:

Internship Presentation Report & Evaluation

The internship programme will be assessed as per the table given in **APPENDIX -1**.

I. Marks from the training supervisor. 30 marks

The progress of practical training shall be assessed through submission of internship manual supported by visual documents maintained by students every week along with the monthly progress report from the trainees by an Architect, who supervises him/her.

1. The students would be evaluated based on the following criteria:
2. Adherence to time schedule, Discipline.
3. Ability to carry out the instructions on preparation of schematic drawings, presentation drawings, working drawings.
4. Ability to work as part of a team in an office.
5. Ability to participate in client meetings and discussions.
6. Involvement in supervision at project site.

II. Semester End presentation - 70 marks

1. Training Presentation: 30marks.
2. Training Report: 20 marks
3. Public space study report and presentation : 20 marks

At the end of the Internship programme, a portfolio of work done during the period of internship along with the space study report should be submitted to the module tutor. The portfolio should contain drawings, detailing, materials, construction method and service integration and the knowledge gained during the internship and site visits.

The final evaluation of the practical training will be based on the internship report submitted and presented by the student which may include but not limited to the following.

1. Architectural office training:
2. Field Observation and Site Supervision:
3. Critical Appraisal:
4. Field Documentation of Architectural details and working drawings:
5. Space study presentation and report.

Subject Matter:

The Internship programme will include but not limited to the following.

Part A: Architectural office training

Students are required to be involved in all aspects of office work for a minimum of 90 working days in an architectural office. They are expected to work on any architectural project/ stage the office or the supervising architect may assign as per the convenience/projects that the office is dealing.

Part B: Field Observation and Site Supervision

To gain adequate field exposure Students are required to be involved in all the site visits and site supervision that the training supervisor and his office undertakes. Students are expected to see how the drawing prepared in an office is implemented and executed at the site. They are also expected to know aspects of site management like material and labour procurement, material storage,labour housings and any other site issues by visual survey/documentation.

Part C: Critical Appraisal

A student may select any small public space and trace down its evolution from historical perspectives to present day condition. Changes during the execution and changes done after occupation-reason thereof shall be documented wherever possible. User's reaction on different aspects of the space and student's personal remarks based on the faculties will form a balanced critical appraisal along with a proposal for its intervention. The study is to be presented in the form of series of sketches, photographs, supported by an analysis and observations report

Part D: Field Documentation of Architectural details and working drawings.

-Documentation of details from personal observations, office records or field studies. This may include historical as well as contemporary details. However copy and paste of details from soft copies of the details shall not be encouraged.

Date : April, 2014

B. Arch. (Fifth Year) – Ninth Semester

Total number of Contact Hours = 27, Total Credits =72

SN.	Code	Name of the Module	Contact Hours			No. of Credits	Marks			
			L	T	P/S		Theory		Studio/Practical	
							CA	EX	CA	EX
1	ADE510	Architectural Design - VI	1	0	10	24			250	100
2	THS503	Urban Planning and Design	3	0	0	12	50	50		
3	THD504	Energy Efficient Design	3	1	0	12	100			
4	PPB501	Professional Practices and Ethics	3	1	0	12	50	50		
5		Departmental Elective-II	3	1	0	12	50			50
	ATH501	Architectural Thesis	1							
Total			14	3	10	72				

ADE 510 -Architectural Design - VI *(Urban Design)*

Name of the Module : Architectural Design - VI
Module Code : ADE 510
Semester : IX
Credit Value : 12
Module Leader : Mr. Chimi
Module Tutor : *At least two tutors are required.*

General Objectives of the Module:

This module helps to develop confidence in students to handle projects at city scale and as civic projects. To create awareness that Architecture is an integral part of the city environment and to sensitize that design programmes have their own environmental impacts. This module is also to explore the continuity and dynamics of urban form with a thrust on the interrelationships between the disciplines of Architecture, Urban Design and Town Planning.

Learning Outcome:

After successful completion of this module, the student will be able to:

1. Design the complex architectural projects at city scale to solve the issues relating to various sectors of urban development.
2. Decide and prepare the concepts, material choice, technology, feasibility in terms of process and end products of urban design.
3. Use various components and aspects of the urban environment as well as their interrelationships.
4. Use the techniques of mapping and diagramming to understand the dynamic urban environment.
5. Solve the issues on public spaces, physical infrastructure, socio-cultural aspects- heritage, gender, class, and dynamics of urban growth.

6. Take design decisions in a comprehensive manner understanding their implications in the larger context.
7. Research and design buildings and spaces in city level and the issues related to the urban area.
8. Generate a coherent architectural project, represented through technical drawings and models.
9. Administer the projects of bigger scale collectively.

Learning and Teaching Approach Used: (1 - 0 - 10)

Design projects will be either done in pair, group or individually, depending upon the strength of the students in the studio.

Lectures	:	1 hour/week
Tutorial	:	Nil
Studio	:	8 hours / week

Assessment:

The external jury should have minimum of two members excluding the module tutor. The one of the evaluators can be either from college or outside and the second one should be compulsory from outside expertise having the knowledge on this particular module. The tutor is not allowed to evaluate the students' portfolio during the external jury.

Studio:

Continuous Assessment - 350marks

1. Studio assignment and projects - 200marks

The marks will be distributed by Module leader from initial studies like case studies and concept design till the final internal marking, which will be held a day or two before external jury.

Semester End external viva/Jury- 150marks

1. Design presentation.

Students must obtain 40% each Continuous Assessment in Studio Assignments and Semester end External Jury. The overall pass mark for the module is 50%.

Pre-requisite – Architectural Design – V (ADE408)

Subject Matter:

1. **Scale and Complexity:** Projects involving the urban context and Architecture in the urban context with a thrust on understanding interdependencies and formulating appropriate design directions.
2. **Design projects pertaining to Urban Design** problems including Urban Renewal and Redevelopment Involving intensive study of visual and other sensory relationship between and their environment, problems concerning both preservation and development based on correlation of socio economic and physical state and problems pertaining to traffic – Design and detailing for physically handicapped at the city/street/building scale.
3. **Typology/ project:** Those involving large scale urban interventions as well as large scale projects which have impact on the urban context- revitalization and renewal of urban fragments, evolving guidelines for heritage areas, adaptive reuse, urban waterfront development, transportation nodes, new communities, multi-use urban complexes, urban nodes/streets/district, Conservation and Re-development, revitalization of historic core, etc.
4. Areas of focus/ issues:

- Exploration of relationship between buildings and urban forms.
- Contemporary processes in design
- Land use Planning.
- Addressing issues in urban areas – transportation, sustainability, heritage, sprawl, place making, identity, collective memory

Reading List:

1. Baker, Nick and Krishnan, Arvind (1999). *Climate Responsive Architecture: A Design Handbook for energy Efficient Buildings*. Tata –McGraw Hill.
2. Catanese, A.J. and Snyder, J.C. (2007). *Introduction to Urban Planning.(Reprint)*. McGraw-Hill.
3. Catanese, A.J. and Snyder, J.C. (2007). *Urban Planning.(Reprint 2nd Ed)*. McGraw-Hill.
4. D. Gosling and Maitland, (1984). *Concept of Urban Design*. St. Martin's Press.
5. Edmund Bacon. (1995). *Design of Cities.(Revised Ed.)*. Thames and Hudson.
6. Forbes Davidson and Geoff Payne (2000). *Urban Projects Manual. (2nd Ed.)*. Liverpool: Liverpool University Press.
7. Jawgeih, I. (1987). *Life between Buildings, - Using Public Space*. Arkitektens Forleg.
8. Jan Gekhl, (2011). *Life Between Buildings: Using Public Space.(6th Ed.)*. Island Press.
9. Kevin Lynch and Gary Hack (2002). *Site Planning.(3rd Ed.)*. Cambridge: MIT Press.
10. Lawrence Halprin, (2008). *Cities. (Reprint)* New York: Reinhold Publishing Corporation.
11. Quentin Pickard RIBA. (2002). *The Architects' Hand Book*. Bladewell Science Ltd.
12. Russ, T.H.(2002). *Site Planning and Design Handbook*. McGraw Hill.

References/Additional Reading list:

1. *An Introduction to Traditional Architecture of Bhutan*. Department of Works, Housing, and Roads, Royal Government of Bhutan, 1993.
2. *Bhutan Building Guidelines 2002*. Department of Urban Development & Housing .Ministry of Communications.
3. *Bureau of Indian Standards, The National Building Code of India (NBC)*. New Delhi, 2005.
4. Ching, Francis D.K. (2007). *Architecture – Form, Space and Order. (3rd Ed.)*. New Jersey: John Wiley & Sons.
5. Ernst, Neufert (2012). *Neufert Architects' Data, (4th Ed.)*.UK: Blackwell publishing ltd.
6. *Guidelines for Planning and Development of Human Settlements in Urban and Rural Areas of Bhutan to minimise environmental impacts.(2013)*.DHS,MoWHS.
7. Joseph De Chiara, Michael J. Crosbie (2001). *Time Saver Standards for Building Types*. McGraw Hill Professional.
8. Joseph de chiara & others (1995). *Time Saver Standards for Housing and Residential development*. New York: McGraw-Hill Co.
9. Joseph De Chiara, Julius Panero and Martin Zelnik (2001). *Time Saver Standards for Interior Design and Space Planning*. McGraw Hill.
10. *Rural Construction Rules 2013*. Department of Human Settlement. MoWHS.
11. Watson, D. & Crosbie, M. J. (2004). *Time Saver Standards for Architectural Design: Technical Data for Professional Practice. (8th Ed.)*. New York: McGraw-Hill Professional.
12. Watson.D., Plathus,A. and Shibley,R.(2010). *Time saver for Urban design(2nd Ed.)*. McGraw-Hill professional printing.

Date : April, 2014

THS 503 - Urban Planning and Design

Name of the Module : Urban Planning and Design

Module Code : THS 503

Semester : IX

Credit Value : 12

Module Leader : Mr. Chimi

Module Tutor :

General Objectives of the Module:

This module aims to give the students of Architecture a holistic understanding of the concept of town planning and urban design. It develops the knowledge and understanding to think creatively and holistically in designing sustainable urban neighbourhood. It also makes aware of the discipline of urban design.

Apart from providing the students, an insight on philosophy of planning, they are also exposed to the practical steps of town planning and urban design by citing various examples.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. Describe the evolution of historic urban form.
2. Recognize and explain modern planning concepts like Garden city, Radial city, La cite Industrial revolution, city beautiful, grid iron and examples of urban planning from around the world.
3. Identify and implement the various methods of Survey, data collection and techniques of Analysis.
4. Explain the different schools of thought on Urban Planning.
5. Describe the concepts of Integrated Urban Conservation.
6. Examine the basic theories of Settlement System planning like Chrystaller's Central Place theory.
7. Determine the components of a city and their interdependent roles.
8. Evaluate the principles and processes of design for creating high quality places and enhancing the public realm for the benefit of all in society
9. Explain the roles of various actors in shaping sustainable places and to be sensitive to community needs
10. Classify the various contemporary urban issues and find the possible ways to address them.

Learning and Teaching Approach Used: (3 - 0 - 0)

Teaching will involve a mixture of interactive lectures, seminars and workshop. The module will encourage the use of case study approach, allowing students to learn through analysis and discussion of cases, as well as participation in role-playing exercises.

Lectures	:	3 hours / week
Tutorial	:	Nil
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment - 50marks

1. Assignments -30 mark.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -25 marks.
3. Class test – 5marks.

Semester End Examination -50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in Continuous Assessment in theory and Semester end examination.

The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

- 1. Introduction to Urban Design:** Components of urban space and their interdependencies- Outline of issues/ aspects of urban space and articulation of need for urban design- Scope and objectives of urban design as a discipline
- 2. Elements of Urban Design:** Urban form as determined by inter - Play of masses, voids, building typology; Scale, harmony, symmetry, colour, texture, light and shade; Dominance, height, urban signage and graphics; Organization of spaces and their articulation in the form of squares, streets, vistas and focal points; Image of the city and its components such as edges, paths, landmarks, street features, sky - line, etc.; Urban transportation
- 3. Historic Urban Form:** Western: Morphology of early cities- Greek agora- Roman forum- Medieval towns- Renaissance place making- ideal cities – Industrialization and city growth- the eighteenth century city builders Garnier’s industrial city- The American grid planning- anti urbanism and the picturesque- Cite industrielle- Cite nuovo-radiant city . Indian: evolution of urbanism in India-Mughal city form- medieval cities - colonial urbanism- urban spaces in modernist cities: Chandigarh,etc. Some basic examples of Bhutanese towns.
- 4. Urban Space:** Ideas of Imageability and townscape: Cullen, Lynch- place and genius loci- collective memory- historic reading of the city and its artefacts: Rossi- social aspects of urban space: life on streets and between buildings, gender and class, Jane Jacobs, Wiiliam Whyte, etc.
- 5. Issues of Urban Space:** Understanding and interpreting of urban problems/ issues- place-making and identity, morphology: sprawl, generic form, incoherence, privatized public realm-effects/ role of real estate, transportation, zoning, and globalisation - ideas of sustainability, heritage, conservation and renewal- contemporary approaches: idea of urban catalyst, transit metropolis, community participation.
- 6. Control of Urban Design:** Urban design and its control; Control of visual pollution; Agencies responsible for ensuring better urban design, their roles, powers and limitations.
- 7. Sustainable and contemporary Urban Design:**Sustainable Urban Design Framework- Vertical Urbanism-Contemporary case studies from developing and developed economies that offer design guidelines and solutions to address various issues/ aspects of urban space.

Reading List:

1. A.E.J. Morris,(1996). *History of Urban Form before the Industrial Revolution*, Prentice Hall.
2. Carmona, Matthew, Tim Heath, Taner Oc, and Steven Tiesdell. *Public Places - Urban Spaces: The Dimensions of Urban Design*. Oxford: Architectural Press, 2003.
3. Catanese, A.J. and Snyder, J.C. (2007). *Introduction to Urban Planning.(Reprint)*. McGraw-Hill.
4. Catanese, A.J. and Snyder, J.C. (2007). *Urban Planning.(Reprint 2nd Ed)*. McGraw-Hill.
5. Edmund Bacon. (1995). *Design of Cities.(Revised Ed.)*. Thames and Hudson.
6. Farr, Douglas (2008). *Sustainable Urbanism: Urban Design with Nature* London: John Wiley.
7. Gordon Cullen (1978).*The Concise Townscape*. The Architectural Press.
8. Jawgeih, I. (1987).*Life between Buildings,- Using Public Space*. Arkitektens Forleg.
9. Jan Gekhl,(2011).*Life Between Buildings: Using Public Space.(6th Ed.)*. Island Press.
10. Lawrence Halprin, (2008). *Cities. (Reprint)* New York: Reinhold Publishing Corporation
11. Paul D. Speriregon.(2).*Architecture of town and cities.(1st Ed.)*. The MIT press
12. Raymond J Curran.(2007). *Architecture and the urban experience.(Reprint)*.Van Nostrand Reinhold Company.
13. Von Hausen, Michael. (2013). *Dynamic Urban Design: A Handbook for Creating Sustainable Communities Worldwide*. iUniverse, Bloomington.
14. Von Hausen, Michael (2004): *Urban Design and Planning Graphics Resource Book: Effective Visual Communication Techniques for Informed Decision-Making*. SFU, Vancouver.

Date: April, 2014

THD504- Energy Efficient Design

Name of the Module :	Energy Efficient Design
Module Code :	TOD504
Semester :	IX
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

In the face of a crisis of depleting resources, this module aims to familiarize the student with passive design consideration and the use of non-renewable sources of energy in buildings.

The module is broadly classified into three sections. Initially the classification of energy source and its global utilization, the impact of energy in countries economy is the main feature. The second part talks about the principles of energy conservation in the buildings. The basic physics behind the energy system in buildings are discussed. Thermal and the visual comfort with energy efficient design concepts are deal in the module.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Differentiate the renewable and non-renewable energy potential from perspective of future demand.
2. Identify the need of energy efficient system in global and regional scale.
3. Illustrate the link between energy utilization and economy.
4. Apply the heat exchange principle to calculate the thermal demand through building envelope with different material.
5. Estimate and compare the heating/cooling load for a given building for various energy efficient design criteria.
6. Apply the solar passive cooling fundamentals in building design.
7. Design an energy efficient building as per ECBC guideline.
8. Use energy efficient design component in different types of buildings.

Learning and Teaching Approach Used: (3 – 0 - 0)

Teaching will involve a mixture of interactive lectures, seminars and workshop. The module will encourage the use of case study approach, allowing students to learn through analysis and discussion of cases studies and research works.

Lectures	:	3 hours / week
Tutorial	:	Nil
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment – 100 marks

1. Assignments -50 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15marks.
3. Test-5marks
4. Semester End Report/presentation - 30 marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter:

1. **Architecture and Energy:** Renewable Sources of Energy - Global Climates and Architecture in Historic Perspective - Contemporary Trends - Sustainability and Architecture
2. **Solar Passive Architecture:** Design Considerations involving Site Conditions, Building Orientation, Plan form and Building Envelope - Heat transfer and Thermal Performance of Walls and Roofs
3. **Passive Heating:** Direct Gain Thermal Storage of Wall and Roof - Roof Radiation Trap - Solarium - Isolated Gain
4. **Passive Cooling:** Evaporative Cooling - Nocturnal Radiation cooling - Passive Desiccant Cooling - Induced Ventilation - Earth Sheltering - Wind Tower - Earth Air Tunnels
5. **Day Lighting and Natural Ventilation:** Daylight Factor - Daylight Analysis - Daylight and Shading Devices - Types of Ventilation - Ventilation and Building Design.
6. **Green building:** Introduction and concepts. Energy utilization and efficiency in building design, Options for energy saving in settlement planning and building design.Example of green buildings and Green urbanism.
-Thrust will be given on research and presentations.

Reading List:

1. Arvind Krishnan & Other (2001). *Climate Responsive Architecture, A Design Handbook for Energy Efficient Buildings*. New Delhi: TATA McGraw Hill Publishing Company Limited.
2. Baker, N. and Steemers, K.(2004). *Energy and Environment in Architecture – A Technical Guide*. Taylor & Francis.
3. *Energy Conservation Building Code (ECBC)*. USAID-INDIA,2007.
4. Fuller Moore (1993). *Environmental Control Systems*. New Delhi: McGraw Hill INC.
5. Givoni .B.V. (1994). *Passive and Low Energy Cooling of Buildings*. New York: Van Nostrand Reinhold.
6. *Manual on Solar Passive Architecture-IIT Mumbai and Mines*. New Delhi - 1999
7. Smith, P.F.(2005). *Architecture in a Climate of Change. (Revised Ed.)*.Architectural Press.
8. Sophia and Stefan Behling (1996). *Solar power, the Evolution of Solar Architecture*. New York: Prestel.
9. Szokolay, S.V.(2008).*Introduction to Architectural Science – The basis of Sustainable Design*. Routledge.

Date : April, 2014

PPB 501 - Professional Practice and Ethics

Name of the Module :	Professional Practices and Ethics
Module Code	: PPB 501
Semester	: X
Credit Value	: 12
Module Leader	: Mr. Chimi
Module Tutor	:

General Objectives of the Module:

This Module covers various aspects of professional practice and informs the students about current professional practice guidelines, codes, ethics as well as norms of professional fees and scale charges and the role and relevance of professional bodies. Further, the module deals with the legal system with its means; contracts, arbitration and conflict resolution. It is further enriched with the study of relevant codes, bye laws, and regulations. Case study of projects and preparation of report are essential for the successful completion of the module.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Define and explain the effective working, role responsibility of Architect.
2. Identify and solve the elementary issues concerning professional practice.
3. Explain role of professional and statutory bodies in the conduct of professional practice.
4. Use the code of conduct and ethics in professional practice.
5. Explain the important legislations concerning architectural practice in Bhutan as well as International laws
6. Follow the professional practice guidelines, codes, ethics as well as norms of professional fees and professional bodies.

7. Describe contracting, conflict resolution and arbitration and law suits in the process of execution along with rules, codes and regulations.
8. Conduct a case study on an assigned project and prepare a report.

Learning and Teaching Approach Used: (3 - 0 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment - 50marks

1. Assignments -30 mark.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -20 marks.

Semester End Examination - 50 marks

1. Written examination (3 hrs. duration) – 50 marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:

- 1. Introduction to the Architectural Profession:** Importance of Architectural Profession – Role of Architects in Society – Alternatives open on entering the profession – Registration of Architects –Architect’s office and its management (location, organization structure, responsibility towards employees, consultants and associates, elementary accounts, tax liabilities).
- 2. Professional Ethics and Code of Conduct:** Role of Bhutan Institute of Architects – Architects Act of Bhutan, Architects under Construction Development Board., Indian Institute of Architect, AIA,RIBA. COA and Architect Act1972 (intent, objectives, provisions with regard to architectural practice) – Council of Architecture (role and functions) – Importance of ethics in professional practice (Council of Architecture guide lines) – Code of conduct for Architects as prescribed by Council of Architecture, punitive action for professional misconduct of an Architect.
- 3. Architect’s Services & Scale of Fees:** Mode of engaging an Architect – Comprehensive services, partial services and specialised services – Scope of work of an Architect – Schedule of services – Scale of fees (Council of Architecture norms) – Mode of payment – Terms and conditions of engagement.
- 4. Architectural Competitions:** Importance of Architectural competitions – Types of competitions (open, limited, ideas competition) – Single and two stage competitions – Council of Architecture guidelines for conducting Architectural competitions –International Competitions (case studies).
- 5. Contract & Arbitration:** Contents of Contract document (Articles of Agreement, Terms and Conditions of Contract, Important clauses – Appendix) – Arbitration (Definition, Advantages of arbitration, Sole and joint arbitrators, Role of umpires, Award, Conduct of arbitration

proceedings) – Arbitration clause in contract agreement (role of Architect, excepted matters) – case studies.

6. **Tender:** Types of Tenders-Open and closed tenders-Conditions of tender-Tender documents-Tender notice-Concept of EMD-Submission of tender-Tender scrutiny-Tender analysis-Recommendations- E tendering (advantages, procedure, conditions).
7. **Legal Aspects & Legislation:** Copy rights and patenting – (provisions of copy right acts in Bhutan, India and abroad, copy right in architectural profession) – Easement – (meaning, types of casements, acquisition, extinction and protection) - Persons with Disabilities Act (provisions, responsibilities of Architect and local body on creating barrier free environment).
8. **New Trends in Project Formulation and Execution :** Turn key offer (Expression of interest, Request for Proposal Document, Conditions for inviting turn key offer, finalisation of the bidder) – Current practices in Project execution [Build operate and Transfer (BOT), Build Operate Lease and Transfer (BOLT) and Build Operate and Own (BOO) and others – case studies.
9. **Implications of Globalisation in Architectural Practice:** Globalisation (meaning, advantages) – WTO and GATS and their relevance to architectural profession in India – Prerequisites for Indian Architects to work in other countries –Preparedness and infrastructure requirements for global practice – Entry of foreign Architects in India (views for and against) – Information Technology and its impact on architectural practice.
10. **Emerging Specialisations for an Architect:** Construction management (Role, function, and responsibilities of a construction manager) – Project management (Concept, Objectives, Planning, Scheduling, Controlling and Role and Responsibilities of project manager) – Suitability of Architect as construction / project manager – Programme evaluation review Techniques (event, activity, dummy network rules, graphical guidelines for network – PERT network

Reading List:

1. *Architectural Competition guidelines*. Thimphu: Construction Development Board,2010.
2. *Bhutan building Rules*. Thimphu: MoWHS,2002.
3. Beatson, J. and Reynell, W.(2010). *Anson's Law of Contract*. (29th Ed.). Oxford:Oxford Univ. Press.
4. Correa, C.M. (2002), *Intellectual Property Rights, The WTO, and Developing Countries: The TRIPS*. New York: Zed Books .
5. Charles L. K., et al (2003). *Problems in Contract Law: Cases and Materials*. Aspen Law & Business.
6. Dr. B.C. Punmia and K.K. Khandelwal (1987).*Project Planning and Control with PERT / CPM*. New Delhi: Laxmi Publications.
7. *Hand book on Professional Practice*. Publications of COA ,The Architects publishing Corporation of India, Bombay ,1987.
8. J.J. Scott (1985). *Architect's Practice*. London: Butterworth..
9. Prof.Madhav Deobhakta, Ar.Meera Deobhakta,(2007). *Architectural Practice in India*. COA.
10. *Publications of Council of Architecture-Architects (Professional conduct) Regulations 1989*.COA.
11. Roshan Namavathi (1984).*Professional Practice*. Mumbai: Lakshmi Book Depot.

Date : April, 2014.

ATH 501 - Architectural Thesis

Name of the Module :	Architectural Thesis
Module Code :	ATH 501
Semester :	IX
Credit Value :	0
Module Leader :	Mr. Dhrubaraj Sharma
Module Tutor :	

General Objectives of the Module:

This module introduces students to the skills, methods, and practices of architectural thesis work which they will carry out in the 10th semester.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Relate the past design assignment to the Architectural thesis.
2. Execute the process involved in an architectural as well as research thesis.
3. Explore for various thesis topics and seek information on them from outside agencies and prepare a thesis synopsis with the coordinator.

Learning and Teaching Approach Used: (1 - 0 - 0)

Students are introduced to their respective thesis guides. A student is expected to do his/ her basic data collection for research works.

Lectures	:	1 hour/semester
Tutorial	:	Nil
Studio	:	Nil

Assessment: Nil

Subject Matter:

1. The introduction to thesis shall include the process and steps involved in a thesis project.
2. **Topics of Study:**
The main areas of study and research can include advanced architectural design, including contemporary design processes, urban design including urban-infill, environmental design, landscape design, housing etc. However, the specific thrust should be architectural design of built environment.
3. **Method of Submission:**
The Thesis synopsis shall be submitted in the form of a report with its aims objectives and methodology.
4. Students should get their thesis topic/project approved by the coordinator and the Department.

Reading List:

It depends as per the requirement of Topic/project and suggested by the supervisor/guide of Thesis.

Date: April, 2014

B. Arch. (Fifth Year) – Tenth Semester

Total number of Contact Hours = 21/week, Total Credits =60

SN.	Code	Name of the Module	Contact Hours			No. of Credits	Marks			
			L	T	P/S		Theory		Studio/Practical	
							CA	EX	CA	EX
1	MGT401	Management	3	1	0	12	30	70		
2		Departmental Elective-III	3	1	0	12	100			
3	ATH501	Architectural Thesis	15*	0	12	36			150	200
Total			6	2	12	60				

*lecture =15hours in a semester.

MGT 401 - Management

Name of the Module :	Management
Module Code :	MGT 401
Semester :	X
Credit Value :	12
Module Leader :	Mr. Ugyen Dorji
Module Tutor :	(By Civil Engineering Department)

General Objective of the Module:

The objective of this module is to introduce techniques of construction project management, various construction equipment and methods to carry out the real time projects.

Learning Outcomes:

Upon successful completion of the module the student will be able to:

1. Introduce the various project planning, budgeting, scheduling, and resource allocation.
2. Plan and monitor the various activities of a construction project.
3. Terminate a construction project.
4. Calculate the output of the construction equipment.
5. Select appropriate construction equipment required for a project.
6. Manage project personnel, materials and equipment.

Learning and Teaching Approach used: (3 - 0 - 0)

The concepts of the construction project management techniques, construction equipment and construction techniques are introduced through lectures with examples and their application to real time problems. The students are encouraged to visit the ongoing project sites, etc.

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Continuous Assessment – 30 marks

1. Term test - 10 Marks.

2. Class Tests: 10 Marks
3. Assignments/ Case study: 10 Marks

Semester End Examination – 70 marks

1. Written examination (3 hrs duration) - 70 Marks

Students must obtain 40% each in CA theory and Semester end examination. The overall pass mark for the module is 50%.

Pre-requisite: None

Subject Matter:

Part-A: Project Management:

- 1. The World of Project Management:** Project – Project Management vs General Management – Three Goals of a Project – Life Cycle of Project – Selection of Projects – Confronting uncertainty: the management of risk – Project Portfolio Process.
- 2. The Manager, the Organisation, and the Team:** PM's roles – System vs Analytical Approach – Micromanagement – PM's responsibilities to the project – Irrational Optimism and sub-optimisation – Selection of a project manager – Project management as a profession – Types of project Organisation – project staff office – Project team conflicts and problems.
- 3. Planning the Project:** Contents of a project plan – Overview of planning process (nuts and bolts) - Project launch meeting – Sorting of project – Project action plan – work breakdown structure – multidisciplinary teams (balancing pleasure and pain) – Integration management - Concurrent engineering – Interface coordination - Design structure matrix – Empowerment of work teams.
- 4. Budgeting the Project:** Methods of Budgeting – Impact of budget cuts – Activity vs programme budgeting – Improving budget estimates – budget uncertainty and risk management – Causes for change and handling changes - Six sub-processes of risk management - Failure Mode and Effect Analysis
- 5. Scheduling the Project:** PERT and CPM Networks – Language of PERT/CPM – Building the network – Finding the critical path and critical time – Calculating slack,– Microsoft project (MSP)/Primavera Planner – Project uncertainty and risk management – Project simulation – Traditional statistics vs. simulation – Gantt chart – Extensions to PERT/CPM network.
- 6. Allocating Resources to the Project:** Resource Loading – Charismatic (VP) – Resource levelling and uncertainty – Resource constrained planning – Project crashing – CPM Cost Model – Priority rules for allocating scarce resource to projects – Criteria of priority rules – Resource allocation and the project life cycle – Goldratt's critical chain – Project buffer – Feeding buffer – Student's syndrome – Multitasking.
- 7. Monitoring and Controlling the Project:** Plan-Monitor-Control Cycle – Data collection – Data analysis – Reporting and report types – Meetings – Virtual reports and meetings – Earned value – Project control and its purposes – Types of project control system – Tools for control – Scope creep and change control – Project updating – Safety engineering in projects – Cause-safety measures – Industrial Acts of Bhutan.
- 8. Evaluating and Terminating the Project:** Evaluation criteria – Project auditing – Audit process (financial vs project audits, timing and value of project audits) – Audit report – Project termination – Types of project termination – Termination process – Project final report.
- 9. Equipment Management:** Classification of equipment – Factors influencing the selection of equipment – Balancing of construction equipment – Economic life of construction equipment.

10. Personnel Management: Objectives and functions of personnel management – Wages & incentives and types – Good incentive plan – Methods of wage payment.

11. Material, Purchase and Storage Management: Objectives and functions of material management – Purchasing – Objectives and functions of purchasing management – Steps in purchasing materials – Centralized and decentralized purchasing – Stock taking – Inventory control and its functions – Classification of inventory control – Economic ordering quantity – ABC analysis and policies – Storing – Functions of storage management – Store location.

Reading Lists:

1. Mantel, S.J., Meredith, J.R., Shafer, S.M. and Sutton, M.M. (2005). *Core Concepts of Project Management*. (2nd Ed.). New York: John Wiley & Sons Inc.
2. Gido, J. And Clements, J. P. (1999). *Successful Project Management*. (1st Ed.). Ohio: International Thomson Publishing.
3. Purifoy, R.L. (1970). *Construction Planning Equipment & Methods*. (2nd Ed.). Delhi: McGraw Hill.
4. Punmia, B.C. and Khandelwal, K.K. (2000). *Project Planning and Control*. (3rd Ed.). Delhi: Laxmi Publishers.
5. Varma, M. (1989). *Construction Planning and Equipment*. Delhi: Metropolitan Co.
6. Kohli, U. and Chitkara, K. K. (2004). *Project Management Handbook*. Delhi: Tata McGraw Hill.
7. Burke, R. (2004). *Project Management*. Delhi: Wiley International.
8. Lier, P.P. (2004). *Engineering Project Management*. Delhi: Vikas Publishing
9. Heerkens, G.R. (2003). *Project Management*. Delhi: Tata McGraw Hill.
10. Ray, R. (1997). *Storage Management*. (1st Ed.). Mumbai: Himalaya Publishing House.

Date : April, 2014

ATH 501 - Architectural Thesis

Name of the Module :	Architectural Thesis
Module Code :	ATH 501
Semester :	X
Credit Value :	36
Module Leader :	Mr. Dhrubaraj Sharma.
Module Tutor :	Minimum of two tutors.

General Objectives of the Module:

The Architectural Thesis is the culmination of the development of the student's knowledge, attitudes and skills in architecture for the past nine semesters. Students pick up a subject/project of their choice for the thesis, which they carry out under the supervision of their individual guides. The module demonstrates the competence of a final year Bachelor of Architecture course graduate's competence in handling a reasonably sized complex project. The module gives an opportunity to prove a student's ability to independently handle all phases of a building design. This module also introduces students to the skills, methods, and practices of advanced and independent research work

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Explain/provide critique on any Architectural project from concept till its approval.
2. Present and defend an architectural design project to a panel of jury with drawings and models.
3. Compile the design drawings along with models and three dimensional views from the conceptual stage till the final design.
4. Undertake a detailed investigation/ research on a topic of his/her choice (selective design) and come out with comprehensive design proposals/ findings.
5. Prepare construction and service details, interior layout of the proposals.
6. Design any scale of project individually.
7. Prepare a detail project report.

Learning and Teaching Approach Used: (1 - 0 - 12)

Students will finalize their thesis topic by the end of ninth semester, which they have to get approved from their guide before tenth semester. Students are required to formally present the progress of their work to the thesis guide/coordinator informal/formal review every week as per the manual prepared by thesis coordinator.

Lectures	:	15hour/semester
Tutorial	:	Nil
Studio	:	12 hours / week

Assessment:

Studio:

Continuous Assessment - 150marks

1. Studio assignment and projects - 120marks
2. Report: 30marks

Semester End external viva/Jury- 200 marks

1. Design Portfolio presentation

Students must obtain 40% each in Continuous Assessment and Semester End external viva.

The overall pass mark for the module is 50%.

Pre-requisite –Architectural Design – VI (ADE 510)

Subject Matter:

1. The thesis project shall include an individual's work on Architecture topic selected by the students and approved by the department.
2. **Topics of Study:**
The main areas of study and research can include advanced architectural design, including contemporary design processes, urban design including urban-infill, rural settlements, environmental design, conservation and heritage precincts, landscape design, housing etc. However, the specific thrust should be architectural design of built environment.
3. **Method of Submission:** The Thesis Project shall be submitted in the form of drawings, project report, models, slides; C.D's and reports, as required for the project.

4. Finalization of an evolution of detailed drawings, final models (hard copy) and ancillary soft copy renditions using appropriate design and rendering computer software.

Reading List:

It depends from individual to individual as per the requirement of Topic and suggested by the supervisor/guide of Thesis.

Date : April, 2014.

ELECTIVES (I, II and III)

Electives modules shall be offered on the basis of availability of expertise both within the college as well as from outside. The endeavour shall be to offer a wide variety for students to choose from commensurate with their abilities and interests.

ELECTIVE-I(Seventh Semester).

SN.	Code	Name of the Module	Contact Hours			No. of Credits
			L	T	P/S	
1	DCA401	Development of Contemporary Architecture	3	1	0	12
2	VAR401	Vernacular Architecture	3	1	0	12
5	RPD401	Real Estate Planning and Development	3	1	0	12

DCA 401 - Development of Contemporary Architecture

Name of the Module : Development of Contemporary Architecture

Module Code : DCA 401

Semester : VII

Credit Value : 12

Module Leader : Mr. Chimi

Module Tutor :

General Objectives of the Module:

This module gives a basic understanding of the various theories, principles, styles and traits of Architecture that emerged in the wake of the industrial revolution, continuing up to the present time. The socio-political and economic context, scientific inventions and technological improvements that trigger the emergence of various movements, and the cross-disciplinary interaction with other visual art forms and philosophies is illustrated through works of leading architects.

This module is also designed to understand the relation between digital technology, media and Architecture. It also looks at how technology enables critical engagement with Architecture and is addressed through theories and practices proposed by contemporary Architects.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Identify the architectural movements according to predominant characteristics, both stylistic and philosophical.
2. Explain each movement in relation to the intention and spirit it encompasses, the context that shaped the movement and achievements.
3. Describe the philosophy and contribution of leaders of each movement.
4. Explain various types of architectural projects based on characteristics and significant features.
5. Describe the contribution of each movement in development of contemporary architecture.
6. Relate the process of industrial development/production system/information revolution in development of building typologies.
7. Arrange the movements in chronological order and scrutinize their interrelationships.
8. Identify relevance of traditional techniques and design concepts in contemporary architecture.
9. Investigate various theories of media and its influence on the perception of space.
10. Determine various aspects of Digital Architecture and its exploration through emerging phenomena that relies on abstraction of ideas.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment – 100 marks

1. Assignments -50 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15marks.
3. Test-5marks
4. Semester End Report/presentation - 30 marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter:

1. **Introduction:** Investigation of contemporary theories of media and their influence on the perception of space and Architecture. Technology and Art – Technology and Architecture – Technology as Rhetoric – Digital Technology and Architecture
2. **Birth of postmodernism** – Historicism, anti-modernism, deconstruction, architecture in the age of electronic media, emerging concepts; Present revolution in science and technology, emerging concepts of human habitat, possible changes and future possibilities in architecture.
3. **Aspect of Digital Architecture:** Aspects of Digital Architecture – Design and Computation – Difference between Digital Process and Non-Digital Process – Architecture and Cyber Space – Qualities of the new space – Issues of Aesthetics and Authorship of Design – Increased Automatism and its influence
4. **Contemporary Process:** Emerging phenomena such as increasing formal and functional abstractions – Diagrammatic Reasoning – Diagrams and Design Process – Animation and Design – Digital Hybrid.

5. **Geometries and Surfaces:** Fractal Geometry – Shape Grammar - Hyper Surface - Liquid Architecture – Responsive Architecture. Search for new forms, rationalism, Engineering tradition - Reinforced and ferro concrete; Arts and Craft Ideals and Art Nouveau movement; American development – Chicago School , Louis Sullivan , architectural system of Frank Lloyd Wright: grammar of Prairie houses; Responses to mechanisation – Deutscher Werkbund and Futurism, De Stijl and Amsterdam School; New space conceptions , Cubism; Le Corbusier’s quest for ideal form; Bauhaus movement and International style, Walter Gropius, Mies Van de Rohe, Philip Johnson etc.;
6. **Regional Identity** - Movements in Scandinavia and Japan; Modernity and Tradition in the regional context especially contemporary South East Asian, Chinese, Japanese and Latin American Architecture;
7. **Seminar:** Students would make presentation on the ideas and works of the world famous architects. The proposal must be discussed with module faculty prior to presentation.

Reading List:

1. Ali Rahim (2002). *Contemporary Techniques in Architecture*. John Wiley & Sons.
2. Bhatt, V. and Scriver, P.(2007) *After the Masters (Contemporary Indian Architecture (Reprint)*. Mapin Pub.
3. Jencks, C. and Kropf, K.(2006). *Theories & Manifestoes of Contemporary Architecture*.(2nd Ed.).Wiley Academy.
4. John Beckman (1998). *The Virtual Dimension, Architecture, Representation and Crash Culture*. Princeton Architecture Press.
5. Marcos Novak (2000). *Invisible Architecture: An Installation for the Greek Pavilion*. Venice Biennale.
6. Peter Herrle and Stephanus Schmitz.(2009).*Constructing Identity in Contemporary Architecture: Case Studies from the South*. LIT Verlag Münster.
7. Schirmbeck, E.(1987). *Idea, Form & Architecture - Design Principles in Contemporary Architecture*. Van Nostrand Reinhold Company.
8. William J. Mitchell (1995). *The Logic of Architecture: Design, Computation and Cognition*. Cambridge: MIT Press.

Date : April, 2014

VAR 401 - Vernacular Architecture

Name of the Module :	Vernacular Architecture
Module Code :	VCR 401
Semester :	VII
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

This module gives a basic understanding of the various man-made and natural forces behind the evolution of traditional Architecture. This also aids to understand the overlapping and the influence of anthropology, sociology and culture in the architecture style and character of a region.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Define the approaches, definition, concepts and typologies of the Vernacular Architecture of a region to have better understanding, comprehension and interpretation.
2. Identify the role of locally available or indigenous materials and climate in the Architecture expression of various part of Bhutan.
3. Determine the western influence on Vernacular Architecture.
4. List out the elements and character of vernacular architecture in the public buildings and palaces, etc.
5. Classify the various Vernacular Architecture forms in the various regions of the country.
6. Explain the impact of western influences and its solutions.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment – 100 marks

1. Assignments -50 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15marks.
3. Test-5marks
4. Semester End Report/presentation - 30 marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter:

1. **Introduction:** Definition and classification of Vernacular Architecture – Vernacular Architecture as a process – Survey and study of Vernacular Architecture: methodology- Cultural and contextual responsiveness of Vernacular Architecture.
2. **Approaches and Concepts:** Different approaches and concepts to the study of vernacular architecture: an over view – Aesthetic, Architectural and anthropological studies in detail
3. **Traditional Principles of Planning:** Forms spatial planning, cultural aspects, symbolism, colour, art, materials of construction and construction technique of the vernacular architecture; western rammed earth house, eastern and central stone masonry, northern nomadic and southern huts and construction details.
4. **Western Influences on Vernacular Architecture:** Construction materials and Techniques and their consequences.
5. **Secular Architecture:** Dzongs, temples, monasteries, palaces, stupas and houses and huts.

Reading List:

1. Amos Rappoport (1989). *House Form & Culture*. Prentice Hall Inc.
2. Amos Rappoport (2007). *Human aspects of urban form: towards a man-environment approach to urban form and design.*(Reprint). Pergamon Press.
3. Department of Works Housing and Roads (1993). *An Introduction to Traditional Architecture of Bhutan*. Singapore: Wah Mee Press Pte Ltd.
4. G.H.R. Tillotsum (1989). *The tradition of Indian Architecture Continuity, Controversy Change since 1850*. Delhi:Oxford University Press.
5. Paul Oliver (1997). *Encyclopedia of Vernacular Architecture of the World*. Cambridge University Press.
6. Richardson,V. (2001). *New Vernacular Architecture*. Laurance King Publishing.
7. R W Brunskill.(2000). *Vernacular Architecture: An Illustrated Handbook*.(4th Ed.). Faber.

Date : April, 2014

RPD401- Real Estate Planning and Development

Name of the Module :	Real Estate Planning and Development
Module Code :	RPD401
Semester :	VII
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

The purpose of the module for an Architect is to gain an understanding of the economic forces that drive the value of real estate, be it old or new, in the market. Students at the fourth year level will learn the concepts, tools and techniques for evaluating individual real estate assets designed by them, viz. housing, hotel, recreation complex, institutions, terminal complex, etc. This is mainly focused to familiarize students about multidisciplinary factors and complexities involved in Real Estate sector development to equip them to deal effectively in it.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Identify and solve the issue of real estate market.
2. Explain the time value of money and the valuation decision, methods and techniques,
3. Describe urban land market.
4. Explain the Globalization and its impact on real estate sector development in the world.
5. Explain Legal and financial issues and innovative Delivery mechanism
6. Define the financial mathematics, accounting data, economic concepts, legal matters concerning land and property.
7. Apply the valuation methodology for its use in tax authority, land acquisition, advising owner or buyer of a property, arbitration in proprietary disputes.

8. Integrate and apply theory, principles and knowledge contained in real estate foundation with the modern design of mixed use development

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment – 100 marks

1. Assignments -50 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15marks.

3. Test-5marks

4. Semester End Report/presentation - 30 marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter

1. **Introduction:** Supply and demand scenario in housing , commercial and social infrastructure. Economy and real estate. Globalization and its impact on real estate development.
2. **Land:** Urban land market. Role of government and private sector in land assembly and development. Supply of serviced land. Valuation- Guideline value, Land value speculation.
3. **Legal Issue:** Land assembly and Development. Land Acquisition Act. Urban Land Ceiling Act Transfer of Development Rights. Lease- hold and –Public Private Partnership Model
4. **Finance:** Role of government/ Public sector. Role of banks and Housing Finance Institutions, World Bank, ADB etc. Tax exemptions, holiday incentives. Retail financing. Project financing
5. **Real Estate Development and Supply:** Role of Public sector. Role of Private sector. Joint sector development. Public private partnership model in planning. Development and supply of Real estate. Selected example and case studies. Role of promoters, architects and Funding Institutions in designs and development of Real Estate. Market segment, pricing and marketing. Case studies.

Reading List:

1. Amit Singh Sisodiya, Janardhan Rao, N.(Dec.2007). *Indian Reality: Changing landscape*.
2. Datta, S.(2004). *Valuation of real Property*. New Delhi: Eastern Law House.
3. Kahr,J. and Thomsett, M.C. (2005).*Real Estate Market Valuation and Analysis*. New Delhi: Wiley Publishers.
4. Kenneth. M.L.(1997). *Real Estate Valuation, Principles and applications*. Irwin: KML Publishing.
5. Ko Wang, and Marvin L. Wolverton .(2002).*Real Estate Valuation Theory*. Springer.
6. *Modern Real estate practice (2002)*. New York: Dearborn Trade publishing.
7. Rangawal, S.C. (2003). *Valuation of Real Properties*. Charotar Publishing House.

8. *Real Estate Development – Principles and process – 3rd edition (2000)*. Washington DC: Urban Land Institute.
9. *Real estate developers Law book (2007)*. Ocala: Atlantic publishing company.

Date : April, 2014

ELECTIVES-II: (Ninth Semester).

SN.	Code	Name of the Module	Contact Hours			No. of Credits
			L	T	P/S	
1	HTA504	Architectural Conservation	3	1	0	12
2	CNT501	Construction Technologies	3	1	0	12
3	DRM501	Disaster Resistant Structure and Management	3	1	0	12

HTA 504- Architectural Conservation

Name of the Module : Architectural Conservation

Module Code : HTA 504

Semester : IX

Credit Value : 12

Module Leader : Mr. Chimi

Module Tutor :

General Objectives of the Module:

The module gives a basic understanding of the value and significance of heritage resources with emphasis on architectural heritage. The aim of this module is to prepare students to take care of various types of historic fabric, carry out condition survey and suggest authentic and appropriate conservation measures as per prescribed norms and standards. Behaviour of various types of historic fabric under different conditions and causes of deterioration are discussed. Remedial measures and degrees of desirable interventions are illustrated through case studies. Various acts and charters as well as criteria for classification and gradation of heritage structures are introduced. To get the exposure to authentic conservation measures, visits are generally organized to conservation and restoration sites.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Explain the significance of built and natural heritage resources in Bhutan and other parts of world.
2. Evaluate, classify and grade the various heritages in Bhutan like Dzongs, monastires and stupas according to the significance and value.
3. Carry out documentation and inspection of heritage structures and prepare condition survey report.
4. Identify causes of deterioration and suggest remedial measures.

5. Provide guidelines for designing a new building in a historic context or extension of a historic structure.
6. Implement design guidelines for adaptive reuse of historic structures.
7. Formulate design guidelines for management, presentation and interpretation of heritage sites.
8. Interpret acts, norms and principles related to historic conservation in a specific context.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment – 100 marks

1. Assignments -50 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15marks.

3. Test-5marks

4. Semester End Report/presentation - 30 marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter:

1. **Introduction to Conservation:** Understanding Heritage. Types of Heritage. Heritage conservation- Need, Debate and purpose. Defining Conservation, Preservation and Adaptive reuse. Distinction between Architectural and Urban Conservation. International agencies like ICCROM , UNESCO and their role in Conservation
2. **Conservation in Bhutan:** Dzong conservation – temple, monasteries and monument –Role of Department of Cultural heritage: MoHCA - Government policies and legislations – Inventories and projects- Select case studies of sites - Craft Issues of conservation.
3. **Conservation Practice:** Listing of monuments- Documentation of historic structures- Assessing architectural character –Historic structure report- Guidelines for preservation, rehabilitation and adaptive re-use of historic structures- Case studies -seismic retrofit and disabled access/ services additions to historic buildings-Heritage site management
4. **Urban Conservation:** Over view of urban history of Bhutan, Indian and World. - Understanding the character and issues of historic cities – Select case studies of towns - Historic places and heritage precincts.
5. **Conservation Planning:**Conservation as a planning tool - Financial incentives and planning tools such as Transferable Development Right(TDR)-urban conservation and heritage tourism- Case studies of sites.- Conservation project management.

Reading List:

1. Bernard, M. F.(2007).*Conservation of Historic Buildings.*(3rd Ed.). Routledge.
2. Canni,(1976). *Recycling Cities – Cutler and Cutter.* Massachussets.

3. Chang Dorji (2006). *Clear Exposition of Bhutanese Architecture*. Thimphu: ILCS,MoWHS.
4. Croci, G. (2007)*The Conservation and Structural Restoration of Architecture Heritage: Theory and Practice.(Reprint)*. Computational Mechanics Publications.
5. Donald Appleyard.(1979).*The Conservation of European Cities.(Reprint)*.Massachusetts: M.I.T. Press.
6. James M. Fitch (1990) *Historic Preservation: Curatorial Management of the Built World*. Virginia: Virginia University Press.
7. Kain Roger (1981).*Planning for Conservation*.New York: St. Martin.
8. Martin E. W. (1997).***Conserving Buildings: A Manual of Techniques and Materials.(Revised Ed.)***.Wiley.
9. Tyler, N., Ligibel, T.J. and Tyler, I.R.(2009). *Historic Preservation: An Introduction to Its History, Principles, and Practice.(2nd Ed.)*. W. W. Norton & Company.
10. Worskett Roy.(2008).*Character of Towns an Approach to Conservation.(Reprint)*.London: Architectural Press.

References/Additional Reading list:

1. Department of Works Housing and Roads (1993). *An introduction to Traditional Architecture of Bhutan*. Singapore: Wah Mee Press Pte Ltd.

Date : April, 2014

CNT 501- Construction Technologies

Name of the Module :	Construction Technologies
Module Code :	CNT501
Semester :	IX
Credit Value :	12
Module Leader :	Mr. Chimi
Module Tutor :	

General Objectives of the Module:

The module is offered to sensitize students on advancements in construction technology in terms of newer materials construction system practices involved and important equipment and devices through sound theoretical knowledge and through visits to construction yards.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Classify the property of alternative building materials
2. Explain the classification of buildings for various technology options and major parts that requires such technology.
3. List out the various equipment used in the construction industry and the criteria for choice of equipment.

4. Describe the overview of construction management, planning and scheduling
5. Differentiate the cost parameter of traditional and alternate building materials.
6. Apply the alternate building materials in architectural design solution.
7. Explain and draw the detail of cost effective building construction technology in various parts of the building.
8. Make a comparative study the cost and time parameter of appropriate building technology in a specific building.
9. Critically appraise a building having appropriate building technology.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment – 100 marks

1. Assignments -50 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15marks.

3. Test-5marks

4. Semester End Report/presentation - 30 marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter:

1. **General Building Requirements:** Classification of buildings - Sites and Services - Requirements of parts of buildings.
2. **Construction Systems:** Planning - Cast in situ construction (ready mixed pumped etc.) Reinforced concrete and prestressed concrete constructions precast concrete and pre-fabrication system - Modular coordination – Structural schemes.
3. **Construction Practice:** Manufacture, storage, transportation and erection of precast component forms, moulds and scaffoldings in construction - safety in erection and dismantling of constructions.
4. **Construction Equipment:** Uses of the following: Tractors, bulldozers, shovels, cableways and belt conveyors, batching plants - Transit mixers and agitator trucks used for ready mix concrete pumps Guniting equipment - Air compressors - welding equipment - cranes and other lifting devices Choice of construction equipment for different types of works.
5. **Construction Management:** Overview of construction management topics including estimating, cost control, quality control, safety, productivity, value engineering, claims, and legal issues - planning and scheduling.

Reading List:

1. Bhatia, G (2003). *Laurie Baker*. Penguin.
2. Mohan Rai.(2010).*Building materials in India, 50 years: a commemorative volume*. Building Materials and Technology Promotion Council, Ministry of Urban Affairs & Employment, Govt. of India, 1998.

3. M. Mohsin (1983). *Project Planning and Control*.(4th Ed.). New Delhi: Vikas Publishers
4. Nissen, H.(2010). *Industrialized Building and Modular Design*.(Reprint). London: Cement & Concrete Association.
5. R. Chudley (2012). *Advanced Construction Technology*.(5th Ed.).Pearson.
6. Schittich, S.(2007). *Cost Effective Buildings*. Amazon.
7. Stephen Emmitt and Christopher Gorse.(2010).*Barry's Advanced Construction of Buildings*. John Wiley & Sons.

Date : April, 2014

DRM 501 - Disaster Resistant Structure& Management

Name of the Module :	Disaster Resistant Structure and Management
Module Code :	DRM501
Semester :	IX
Credit Value :	12
Module Leader :	Dr. Cheki Dorji
Module Tutor :	

General Objectives of the Module:

Knowledge of disaster related issues are one of the most important prerequisites for Architects and Planners. Various types of disasters, their causes of occurrence, post-disaster implications need to be exposed to the students. This should be followed by the knowledge on design issues for pre-disaster measures as well as post-disaster mitigations and management.

Learning Outcomes:

Upon successful completion of this module, the student will be able to:

1. List out the causes and consequences of disasters and increase awareness to disaster resistant design issues as a significant source of inspiration to facilitate the integration of structure and structural design.
2. Describe various categories of disaster, natural and man-made.
3. Categorize the seismic related disaster, and other categories of disasters.
4. Design disaster resistant architectural forms and structural systems.
5. Classify geological issues, architectural design issues and structural issues are covered followed by discussion on spatial and structural retrofitting measures.
6. Explain the causes, effects and design issues for mitigation related to all other types of disasters.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Practical	:	Nil

Assessment:**Theory:****Continuous Assessment – 100 marks**

1. Assignments -50 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Mid-term test -15marks.

3. Test-5marks

4. Semester End Report/presentation - 30 marks

Students must obtain 40% each Continuous Assessment. The overall pass mark for the module is 50%.

Pre-requisite – None

Subject Matter:**PART I: DISASTER RESISTANT STRUCTURE:**

- 1. Introduction:** Types of major natural disasters and their causes, Indian peninsula & its disaster prone areas – disaster mapping, Record of past major disasters – Global and Indian scenario, Social & Economic consequences of disasters
- 2. Causes and Effects of Natural Disaster:** Earthquake Structure of earth, plate tectonics, waves generated by ground motion and their characteristics and its effect-- Ground rupture and Ground failure, - Liquefaction, - Landslides, fire, tsunami. Engineering Seismology - Measurement of Earthquakes, -Seismograph, -Seismograph, Scales, magnitudes and intensities. Basic terms-fault line, focus, epicentre, focal depth, peak ground acceleration, Seismic Zoning & Micro Zoning Tsunami; Cyclone and storm surge.
- 3. Behaviour of Buildings During Earthquake:** Inertia forces on structures Flow of inertia forces to foundations - Effect of deformations in structures -Horizontal and vertical shaking - Effect of Architectural configurations on building during earthquake -Size, shape, volume - Horizontal layout - Vertical layout - Building forms - Adjacency of buildings -Twisting of buildings during earthquake Dynamic characteristics of building and its relation to build forms Symmetry - Regularity - Stiffness - Flexibility - Strength - Time period - Damping –Ductility - Material and method of construction Special aspects : Torsion- Appendages –Staircases- Pounding- Repair and maintenance Behaviour of Non Structural Elements in a building during earthquake
- 4. Earthquake Design:** Earthquake Design for Masonry buildings, Earthquake Design for RCC buildings. Indian Seismic codes, effect of earthquake on non-engineered structures, Seismic Design philosophy.

PART II: DISASTER MANAGEMENT:

- 5. Natural Hazards and Building Safety:** Natural hazards – Brief description on cause and formation of flood, cyclone, earthquake, tsunami and landslides. Zoning and micro zoning of vulnerable areas- Vulnerability atlas of India.
- 6. Man Made Hazards And Building Safety:** Man made hazards – Fire, gas, chemical leakages, pollution, and health hazards. – Vulnerability analysis and risk assessment.
- 7. Seismic Up gradation of Different Existing Built form:** Introduction of seismic repairs and Retrofitting- Vulnerability assessment of existing built form - Damaged buildings.- Undamaged buildings- Cost- benefit and decision making about retrofitting.

8. **Issues in Earthquake Prone Areas:** Techno- Legal and Techno- Financial issues . Proposed amendments to TP Act- implications and accountability.
9. **Disaster Management:** Case Studies: Pre disaster phase - Disaster phase - Post disaster Phase - Case studies – Social responsibilities of Architects

Reading List:

1. *Ansal, A. and Kluwer (2004). Recent Advances in Earthquake Geotechnical Engineering and Micro zonation.* Academic Publishers.
2. Belen Garcia, (2000). *Earthquake Architecture.* New York: Loft Publications.
3. Bozorgnia, Y. (2004). *Earthquake Engineering: from Engineering Seismology to Performance-based Engineering.* CRC Press.
4. David J. Dowrick.(2009).*Earthquake Resistant Design and Risk Reduction.(2nd Ed.).* John Wiley & Sons.
5. Dowrick, D.J. (1997). *Earthquake Resistant Design, for Engineers and Architects. (2nd Ed.).* John Wley & Sons.
6. Erdey, C.K, (2007). *Earthquake Engineering: Application to Design.* John Wley & Sons.
7. Mary C. Comerio (2001). *Disaster Hits Home, New policy for Urban Housing recovery.* London: Oxford University press.
8. Naseem Ahmed (2003). *Managing Disasters.* New Delhi: Kilaso Books.
9. Nott, J. (2006). *Extreme Events: A Physical Reconstruction and Risk Assessment.* Cambridge University Press.
10. Tarnath B.S.(2005). *Wind and Earthquake resistant buildings.* Marcel Dekkar.

References/Additional Reading list:

1. *Earthquake Resistant Design and Construction of buildings – Code of Practice – Bureau of Indian Standards, 1993.*
2. *Guidelines for Earthquake Resistance Housing.* BMPTC, 2000.

Date : April, 2014

ELECTIVES-III(TENTH SEMESTER)

SN.	Code	Name of the Module	Contact Hours			No. of Credits
			L	T	P/S	
1	BAS501	Building Automation and Intelligent Building Systems	3	1	0	12
2	EPD501	Ergonomics & Product Design	3	1	0	12
3	SBM501	Safety Systems and Building Management	3	1	0	12

BAS 501- Building Automation and Intelligent Building System

Name of the Module :	Building Automation and Intelligent Building System Module
Code :	BAS 501
Semester :	X
Credit Value :	12
Module Leader :	Mr. Dhruvaraj Sharma
Module Tutor :	

General Objectives of the Module:

The module brings out the need and functional requirement of automation system in built environment. Artificial intelligence, decision based support system in the core building services area are the also covers. The scope of the module is to cover the important features of the building automation, so that students can take up the module in future in Post graduate level.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Classify the building automated system according to its application.
2. Relate the application of the building automation system with the functional component of building services.
3. Establish the essential linkage among life **Safety, Security, Access Control**.
4. Identify the key component of building management system.
5. Evaluate the building management system for any given building.
6. Arrange the expert system development stages and co-relate with space and function of building.
7. Identify the application of AI in the field of Building Automation and management system.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment – 100 marks

1. Assignments -50 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15marks.

3. Test-5marks

4. Semester End Report/presentation - 30 marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter

1. **Concept of Building Automation:** Concept of Building Automation. Scope, the need, significance. Globalisation and impact of Building Automation on Built form.

2. **Basic Principles of Control System:** Basic principles of Building Automation, Different control systems, Security and remote monitoring of managed services.
3. **Energy Efficiency and Performance Monitoring:** Concept, methods and options. Integration with non-conventional sources of energy.
4. **Control Systems:** Access Control system, Lighting Control system, Elevator HVAC Control system, Fire Control system, Security and services, Building Management system.
5. **Application** of expert system in building automation; Stages in development of expert system, expert system application in Architecture; Computerizing building management information
6. **Case Studies and Seminar:** Study of selected projects, Literature and library study, Assignment / seminar.

Reading List:

1. Atkins, B. (2007). *Intelligent Building*. Springer.
2. Atkins, B. (2009). *Total Facilities Management*. Springer.
3. Benjamin Franklin (2002). *Feedback control of dynamic systems*. PHI Publications.
4. Carlson, R.A. and Giandomenico, R.A.(2010). *Understanding Building Automation System*. Amazon.
5. C.L.Wadhwa (1997). *Generation and Utilization*. New Age Publication.
6. Katsuhiko Ogata (2001). *Modern Control Engineering*. Prentice Hall.
7. Merz, H. (2012). *Building Automation*. Springer.
8. Wang, S. (2009). *Intelligent Building and Building Automation*.(4th Ed.). Taylor & Francis.

Date : April, 2014

EPD 502 - Ergonomics & Product Design

Name of the Module : Ergonomics & Product Design

Module Code : EPD 502

Semester : X

Credit Value : 12

Module Leader : Mr. Chimi

Module Tutor :

General Objectives of the Module:

This module introduces the students to the concept of ergonomics and different aspects of man – machine interaction so that they can apply the same in the product design. The entire process of designing a product right from preparation of design brief, conducting market survey, understanding users' aspiration, choosing material and appropriate technology, product testing and strategies of marketing are discussed sequentially by citing practical examples from the industry. The students are also encouraged to select any product of their choice do a detail analyses of the pros and cons of the same and come up with some design innovations at the end.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Explain the definition and genesis of the term ergonomics and product design.

2. List out the basic conceptual difference in present day and traditional tools of product design.
3. Classify the various domain of ergonomics
4. Describe the various methods of man – machine interaction and the designer’s priorities
5. Identify various steps in the process of product designing, manufacturing and testing
6. Explain in details the various components of a product like display, control mechanism etc.
7. Explain the special characteristics of product design and marketing for rural areas
8. Describe various methods and techniques involved in furniture and product design.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment – 100 marks

1. Assignments -50 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15marks.

3. Test-5marks

4. Semester End Report/presentation - 30 marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter

1. **Introduction:** An brief introduction to Product Designing – Various elements – History of Product Design – Definition of Product Design, understanding of Product Design - Purpose of Product Design – Role of Product Designers.
2. **Human Factors:** Definition of human factors, Application of human factors data. Human activities, their nature and effects. Man-machine system and physical environment. Human performance and system reliability. Information input and processing. Human control systems. Applied anthropometry – Human response to climate.
3. **Aspects of Product Design:** Visual, Auditory, Tactual, Olfactory human mechanisms, Physical space and arrangement. Visual display, process of seeing, visual discrimination, quantitative and qualitative visual display, Alphanumeric and related displays, Visual codes and symbols.
4. **Product Design:** Form, Colour, Symbols, User specific criteria, Material, Technology and recyclability, Packaging. Multiple Utility oriented approach to Product Design.
5. **Steps of arriving at Product Pricing; Product marketing** - Publicity and Management, Characteristics of Rural Product Design and marketing and packaging strategies; Element design for the physically and mentally impaired; Design of a few household elements, tools and devices.
6. **Design Exercises:** Any of the following exercise be done in a semester.
 1. Design of Household elements, tools and devices – Spoon etc.
 2. Design of furniture – Chairs/Computer table, Kitchen racks, Cabinets etc.

3. Design of Industrial Product – Watch Dial, Gear Wheels, Automobile Headlights etc.

-Element design for the physically and mentally different people.

Reading List:

1. Andrew Alpern (2007). *Handbook of Speciality Elements in Architecture*.(Reprint).USA. McGrawhill Co.
2. Cushman, W.H. and Rosenberg, D.J.(2007). *Human Factors in Product Design*.(Reprint).Elsevier.
3. Francis D.K.Ching (1987).*Interior Design Illustrated*. New York: VNR Publications.
4. Helen Marie Evans and Carla Davis Dumesnil.(2010).*An invitation to Design*.(Reprint 2nd Ed.). Macmillan.
5. Patrick W. Jordan.(2003).*Designing Pleasurable Products: An Introduction to the New Human Factors*. CRC Press.
6. Waldemar Karwowski.(2010).*International Encyclopedia of Ergonomics and Human Factors, Second Edition - 3 Volume Set*.(2nd Ed.). CRC Press.

References/Additional Reading list:

1. Martin Z., Joseph Dechiara, Julius P. *Time saver for interior design and space planning*.(2nd Ed.). McGraw-Hill professional printing.
2. Michcal J. Crosbie, Donald W. (1997).*Time-Saver Standards for Architectural Design Data: The Reference of Architectural Fundamentals*. (7th edition). McGraw-Hill professional printing.

Date : April, 2014

SBM 501 - Safety Systems and Building Management

Name of the Module :	Safety Systems and Building Management
Module Code :	SBM502
Semester :	X
Credit Value :	12
Module Leader :	Mr. Dhrubaraj Sharma
Module Tutor :	

General Objectives of the Module:

The module is designed to impart basic knowledge in Safety, security and building automation and integrated building management systems.

Learning Outcomes:

After successful completion of this module, the student will be able to:

1. Explain the safety requirements for a high rise building.
2. Classify fire alarm systems and fire suppression systems and their installation.
3. Establish the essential linkage among life **Safety, Security, Access Control**.
4. Identify the key component of building management system.
5. List out various types of security systems and their application in building.
6. Explain the importance and objectives of an integrated building management system.

Learning and Teaching Approach Used: (3 - 1 - 0)

Lectures	:	3 hours / week
Tutorial	:	1 hour / week
Studio	:	Nil

Assessment:

Theory:

Continuous Assessment – 100 marks

1. Assignments -50 marks.

By the end of the semester, students should submit atleast five assignments for this module.

2. Term test -15marks.
3. Test-5marks
4. Semester End Report/presentation - 30 marks

Students must obtain 50% in Continuous Assessment to pass this module.

Pre-requisite – None

Subject Matter

1. **Safety Requirements:** Minimum safety requirements for a building, particularly for a high rise building as per the National Building Code.
2. **Fire Alarm Systems:** Objectives of a Fire Alarm System, Essential components of a Fire Alarm System, Technology of detection, Type of Statutory Standards followed in direction, Explanation on the essential clauses, various types of technologies employed in the fire alarm system is designed and installed.
3. **Fire Suppression Systems:** Objectives of a Fire Suppression System, Explanation on fire triangle, Essential components of a Fire Suppression System, different types of Fire Suppression Systems, Type of Statutory Standards followed in Suppression, Explanation on the essential clauses and basic knowledge on how a Fire Suppression System is designed and installed.
4. **Security Systems:** Introduction to different types of Security Systems and why they are required. Introduction to Access Control, CCTV, Intruder Alarm and Perimeter protection Systems, Essential components of each system, various types of technologies employed in these Systems, basic knowledge on how they are designed and installed.
5. **Integrated Building Management System:** The objectives of the Integrated Building Management System (IBMS), the list of utility, safety and security systems that are generally monitored and controlled through IBMS, the various components of IBMS, types of integration with the utility, safety and security systems and the basic knowledge on how they are designed and installed.

Reading List:

1. Herman Kruegle.(2011)CCTV Surveillance: Video Practices and Technology.(2nd Ed.). Butterworth-Heinemann.
2. John L. Bryan.(2007). *Fire Suppression and Detection System*.(Reprint 3rd Ed.) Macmillan.
3. John E. Traister.(2007). *Design and Application of Security/Fire Alarm system*.(Reprint 2nd Ed.) McGraw-Hil.
4. Mike Constant and Peter Turnbull.(1994). *The Principles and Practice of Closed Circuit Television*. Paramount Publishing Limited.
5. *Rules of Automatic Sprinkler Installation (29th Ed)*Great Britain. Fire Offices' Committee,1968.
6. Vivian Capel.(1999). *Security Systems and Intruder Alarm*. Newnes.

References/Additional Reading list:

1. *IS 2189 – Selection, Installation and Maintenance of Automatic fire Detection and Alarm System – Code of Practice (3rd Ed.)*.Bureau of Indian Standards. New Delhi. (Reprint-2007).
2. *National Building Code of India 1983 (SP 7:1983 Part IV)*. Bureau of Indian Standards. New Delhi.(Reprint-2007).

Date : April, 2014

12. Appendices

APPENDIX: 1

Royal University of Bhutan
College of Science & Technology
Department of Architecture

INP 401 - Internship Programme manual

Training supervisor/mentor at work place:

Phone no.:

Email:

Module tutor at the college.

Phone no.:

Email:

Letter of commencement.-(*To be printed on the Office letter head*)

**Head of the Department,
Department of Architecture,
College of Science & Technology.
Rinchending,
Phuentsholing.**

Subject: internship commencement.

Sir,

It is to state that Mr./Ms. _____ regd. no.....a student of architecture has started his/her practical training/7th semester in this office under my direct supervision.

(Signature with stamp)

Date:

**Royal University of Bhutan
College of Science and Technology
Department of Architecture
INP 401 - Internship Programme**

Weekly work schedule

Name of the student: _____, **Registration No:** _____

Sl no	Date & day	WORKS carried out/Works out put	Learning remarks of the student
1	Monday		
2	Tuesday		
3	Wednesday		
4	Thursday		
5	Friday		
6	Saturday		

Note: All the works output will be supported by drawings, pictures

(Signature with stamp of the training coordinator)

Date:

EXTERNAL MARKING-(To be printed on the Office letter head)

To
Head of the Department
Department of Architecture,
College of Science and Technology
Rinchending,
Phuentsholing.

Subject: External Marking out of 100 for (To be awarded by training supervisor)

Sir,

It is to state that Mr./Ms. _____ regd. No. _____ form your instituting is undergoing his/her practical training in this office under my direct supervision. His/ Her performance is evaluated as under.

SL.No	Parameter of Evaluation	Maximum Marks	Obtained Marks
1	Punctuality & general behaviour	10	
2	Amount of work done	30	
3	Quality of work done	20	
4	Understanding of technical details etc. in drawing	20	
5.	Presentation/ communication skills & team work	20	
	Total	100	

(Signature with stamp of the Training Coordinator)

Date:

**Royal University of Bhutan
College of Science & Technology.
Department of Architecture.
INP 401 - Internship Programme**

INTERNAL MARKING

Internship & space study report (100 marks) to be evaluated by the College Evaluation committee.

Sl. No	Evaluation Area	Max Marks	Marks obtained
1	Cover page design, Abstract & Acknowledgement	10	
5	Introduction to the organization & the nature of job.	10	
6	Organogram & core functions of the office	10	
7	Technical drawings and field work details	30	
8	Space study analysis	20	
9	Observations and discussions	10	
10	Recommendations & lessons	10	
	Total Marks	100	

Internship & space study presentation (100 marks) to be evaluated by the College Evaluation committee.

Sl. No	Evaluation Area	Max Marks	Marks obtained
1	Introduction	10	
2	Proper use of Presentation Techniques	10	
3	Content (Technical + Field work carried out) & analysis of the space.	40	
4	Response to the Questions	20	
5	Language (Verbal clarity & communication)	10	
6	Confidence	10	
	Total Marks	100	

APPENDIX-2

Royal University of Bhutan
College of Science and Technology
Department of Architecture
ATH 501 - Architectural Thesis manual

Sl.no.	Registration no.	Name of the student	Name of the Thesis Guide	Thesis Topic
1				
2				
3				
4				
5				

Students are required to formally present the progress of their work to the thesis supervisor informal/formal review every week. An annual thesis manual with deadlines will be prepared for every 10th semester for effective learner engagement where different stages of presentations and progress will be monitored by the supervisor.

Architectural Thesis weekly progress report
To be evaluated by the individual thesis guide.

Sl.no.	Registration no.	Name of the student	Status of the progress: Excellent/Good/Satisfactory/Unsatisfactory	Remarks
1				
2				
3				
4				
5				

Architectural Thesis internal jury review report

(To be evaluated by the College & Department Evaluation committee.)

Sl. No	Evaluation Area	Max Marks	Marks Obtained
1	Introduction	10	
2	Proper use of Presentation Techniques	10	
3	Design Content & Approach: this shall include all the case studies, data collection conceptual/design drawings and scale model relevant to the stage of assessment.	40	
4	Innovative design solutions.	20	
5	Response to the Questions	20	
	Total Marks	100	