

UNIVERSITY OF KERALA

**B. ARCH. DEGREE COURSE
(2013 SCHEME)**

**SYLLABUS FOR
V SEMESTER**

SCHEME -2013

V SEMESTER

Course No	Course Title	Credits	Hours/ week			Duration of Exam	Marks			Total
			L	T	P		W	J	S	
13AR1501	Architectural Design IV	5			10			250	250	500
13AR1502	Building Materials and Construction -IV	4	1		3	4	100		100	200
13AR1503	History of Architecture - IV	2	2			3	100		50	150
13AR1504	Sustainable Development	2	2			3	100		50	150
13AR1505	Interior Design	4	1		3	4	100		100	200
13AR1506	Building Services II Electrification	2	2			3	100		50	150
13AR1507	Building Services III HVAC	2	2			3	100		50	150
13AR1508	Structural Design - IV	3	2	1		3	100		50	150
Total		24	12	1	16					1650

13AR1501 ARCHITECTURAL DESIGN – IV

Teaching Scheme: 0(L) - 0(T) - 10(P)

Credits: 5

Course Objective:

- *To introduce the design of multi functional spaces with complex features incorporating built and un-built spaces.*
- *To learn the procedure of documenting and preparing measured drawing of buildings.*

The students are required to do one major project and one minor project.

Major Project – Projects may be High rise apartments, buildings for recreation, assembly buildings, institution/education use etc.

Short Project – Documentation Camp – Documentation camp consists of preparation of measured drawings of selected buildings / historic places inside and around the state of Kerala.

Note: *Students are required to give importance to climate responsive & environment friendly buildings, meet the needs of physically challenged. Importance should be given to regional, time factors in the built form. The design shall be explained through study models. Preference shall be given for manual drafting.*

References:

1. Mills E. D., *Planning: Architect's Handbook*, 10/e, Butterworths, 1985.
2. De Chiara J. and J. H. Callender, *Time Saver Standards for Building Types*, McGraw Hill, 2001.
3. Neufert E., P. Neufert, and J. Kister, *Neufert Architects' Data*, Wiley- Blackwell, 2012.
4. Ramsey C. G., H. R. Sleeper, *Architectural Graphic Standards*, 11/e, Wiley, 2008.
5. BIS, Various Codes of Practice and National Building Code of India

Internal Continuous Assessment (Maximum Marks - 250) (Group 1 Subject)

20% - Tests (minimum 2)

70% - Class work

10% - Regularity in the class

University Examination Pattern:

Course work will be assessed by a panel of Jury. (Maximum Marks - 250)

Course Outcome:

- *The students shall be able to design multi functional spaces involving built and un-built spaces.*
- *The students shall be aware of the procedure of documenting and preparing measured drawing of buildings.*

13AR1502 BUILDING MATERIALS AND CONSTRUCTION – IV

Teaching Scheme: 1(L) - 0(T) - 3(P)

Credits: 4

Course Objectives:

- *To introduce the study of building materials, their applications and construction methods.*
- *To familiarize the students with market study of building components and details.*
- *To understand conventional as well as vernacular and traditional building materials and practices.*
- *To understand prevailing BIS specifications.*

Module – I

Wood Substitutes:

Industrial products as substitutes for natural hard wood. Characteristics, physical properties, areas of application, available forms and sizes of: Veneers and veneer ply woods, particle board, hard board, fiber board, block board, lamina-boards, glulam, laminates, cement particle board, e-board, bamboo ply, etc.

Exercise: Market survey of wood substitutes

Module – II

Vertical Transportation Systems:

Study the various means of vertical transportation such as ramps, stairs, step ladders, ladders, elevators and escalators. Planning of vertical transportation systems – design parameters.

Ramps: Planning of ramps, slope, finishes, safety precautions and need for constructing ramps.

Stairs: Planning staircases - Standards, rules and regulations.

Components of stairs. Stair plans- stairs with straight, circular and curved flights.

Construction details of Wood stair, Concrete stair, Steel stair and Composite stair.

Construction details of Ladders.

Elevators: Planning and grouping of elevators. Elevator design parameters. Quality of elevator service. Different types of elevators – passenger elevators, observation elevators, hospital elevators and freight elevators.

Escalators: Planning and details of escalators. Comparison with elevator in terms of its use.

Discussion: Recent developments in vertical transportation.

Exercise: Documentation of traditional wood stair and steel stair.

Drawings: RCC Staircase, Elevator (Typical) and escalator.

Module – III

Roof systems:

Introduction to roof systems of buildings. Flat roof, Sloping roof and Curved roof.

Deciding the slope or curvature of roof.

Wooden rafter framing: Roof terminology. Different types of rafter framing and their construction details. Wood trusses. Construction details of joints and connections of members. Construction details of traditional wood roofs of Kerala.

Structural Steel roof framing: Steel rigid frames, Different types of Steel trusses and their construction details. Construction details of joints and connections of members

Introduction to Space frames.

Roof cover- various options. Vernacular roof covers like thatch, hay etc.

Discussion: Planning a good roof system. Use roof tops to cater certain functional needs.

Exercise: Documentation of traditional roof systems of Kerala.

Drawings: Wood trusses and steel trusses.

Module – IV

Applied finishes - Wall finishes:

Mortar & Plaster: Cement mortar, lime plaster and gypsum plaster. Fire resistant plaster, X-Ray shielding plaster and acoustic plaster. Plaster lath and accessories. Plaster over masonry and ceiling.

Paints, Distempers and varnishes: Characteristics of an ideal paint.

Classification – various types of paints, their characteristics and purpose. Composition of paints. Painting process. Application of paints. Defects in painting works.

Wall cladding- stone cladding, tile cladding, and metal cladding. Stucco finish.

Discussion: Applied finishes and building maintenance.

Exercise: Market survey of materials for applied finishes.

References

1. Parker H., *Materials and Methods of Architectural Construction*, John Wiley & Sons, Canada, 1958.
2. McKay W. B., *Building Construction*, Orient Longman 21, London, 1938-44.
3. Barry R., *The Construction of Buildings (Vol. I-II)*, 6/e, Affiliated East-West Press Pvt. Ltd., New Delhi, 1996.
4. Simmons H L., *Construction – Principles, Material & Methods*, 7/e, John Wiley & Sons Inc., New York, 2001.

5. Ching F. D. K., *Building Construction Illustrated*, 4/e, Wiley, New Delhi, 2012.
6. Relevant BIS codes.
7. Harold R. J., *Construction Materials for Architecture*, Krieger Pub Co, 1992.
8. Varghese P.C., *Building Materials*, Prentice Hall of India Pvt. Ltd, New Delhi, 2010.
9. Smith R. C. and T. L. Honkala, *Principles and Practices of Light Construction*, Prentice Hall, Englewood, 1986.
10. Lyons A., *Materials for Architects and Builders*, Elsevier Butterworth- Heinemann, 2004.

Internal Continuous Assessment (*Maximum Marks - 100*) (*Group 1 Subject*)

20% - Tests (minimum 2)

70% - Class work

10% - Regularity in the class

University Examination Pattern:

Examination duration: 4 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A:

Question 1. (40 marks) - Eight Short answer questions of 5 marks each. All questions are compulsory. There should be two questions from each module.

Question 2. (10 marks) – Questions for 10 marks from module I and II. Candidates have to answer any one out of the two.

Question 3. (10 marks) – Questions for 10 marks from module III and IV. Candidates have to answer any one out of the two.

Part B:

Question 4. (20 Marks) – Drawing: Candidates have to answer any one full question out of the two from module II.

Question 5. (20 Marks) – Drawing: Candidates have to answer any one full question out of the two from module III.

Course outcome:

Upon completion of the course, the student of architecture shall have acquired knowledge to design buildings with more than one floor. The student shall acquire knowledge in both conventional as well as vernacular building practices.

13AR1503 HISTORY OF ARCHITECTURE IV

Teaching Scheme: 2(L) - 0(T) - 0(P)

Credits: 2

Course Objective:

- *To introduce to the students the world architectural scenario from around 1850 AD to around 1947 AD.*
- *To induce an appreciation to the importance of history of architecture and its relationship to the development of any place.*
- *To develop awareness about the precious architectural past we had and how to build our future based on that tradition, wisdom and technical knowledge.*

Module – I

Industrial revolution; consequence and impact on architecture: Socio economic and cultural change, Shift in building technology, Influence of modern building materials; Steel, RCC etc.

Works and contributions of: Eaton Hodgkinson, Joseph Paxton, (eg. The Crystal Palace), Gustave Eiffel (eg. Eiffel Tower), Antoni Gaudi (eg. Casa Mila, Sagrade Familia Church), William L Baron (Home Insurance Building- first American skyscraper), Charles Renne Macintosh (Glasgow School of Art), Louis Sullivan (Wainwright Building).

Module – II

Isms in Architecture:

Neo Classicism (Palladian architecture, eg. Altes Museum by Karl Friedrich Schinkel)

Arts and Craft Movement (Willam Morris, eg. The Red House by Phillip Webb)

Art Nouveau (Decorative art, eg. Casa Mila by Antonio Gaudi)

BAUHAUS (eg. Bauhaus building by Walter Gropius)

Expressionism (eg; Einstein tower by Erich Mendelsohn)

Modernism (Cubist influences, Philosophies of Le Corbusier (eg; Villa Savoye), Mies Van Der Rohe (eg. Barcelona Pavilion), Louis Kahn (Kimbell Art Museum)

Organic Architecture (eg. Falling Water by Frank Lloyd Wright).

Module – III

British Colonial architecture in India: Introduction to British colonial architecture in India. The styles and trends of architecture brought by British to Indian cities like Delhi, Calcutta, Mumbai & Chennai, their evolution and impact. The characteristics of British Colonial Architecture with examples from work of Edwin Lutyens.

Module – IV

Colonial architecture in Kerala: Introduction, Characteristics (eg. Hill Palace, Thripunithura, Kerala secretariat building (old block), Latin Arch Bishops House in Thiruvananthapuram, Bolgatty Palace-Kochi, V.J.T Hall - Thiruvananthapuram)

Vernacular influence on Colonial style (eg. Napier Museum, Fine Arts College, Thiruvananthapuram), Public Library, Thiruvananthapuram.)

Evolution of Colonial bungalow (eg. Residency House- Thycaud, Thiruvananthapuram, Residency Bungalow-Kollam).

References:

1. Morris A. E. J., *History of Urban Form: Before the Industrial Revolution*, Longman, 1994.
2. Scully V. J., *Modern Architecture and Other Essays*, Princeton University Press, 2003.
3. Ford E. R., *The Details of Modern Architecture, Vol I & II*, MIT Press, 2003.
4. Frampton K., *Modern Architecture, A Critical History*, Thames and Hudson, 2007.
5. Sir Banister Fletcher, *A History of Architecture*, 20th Edition, Architectural Press, 1921.
6. History of World Architecture series, Faber & Faber, 1987
7. Pehnt W., *Encyclopaedia of Modern Architecture*, Thames and Hudson, 1963.
8. Scriver P. and P. Vikramaditya, *Colonial Modernities: Building, Dwelling and Architecture in British India and Ceylon*, Routledge, 2007.
9. Desai M., M. Desai and J. Lang, *The Bungalow in the twentieth Century India*, Ashgate Publishing Ltd., 2012.
10. Lang J., M. Desai and M. Desai, *Architecture and Independence: The Search for Identity in India 1880 – 1980*, Oxford University Press, 2000.
11. Irving R. G., *Indian Summer: Lutyens, Baker and Imperial Delhi*, New Haven, 1981.
12. King A. D., *The Bungalow: The Production of a Global Culture*, Routledge, 1984.
13. Dutta A., *Representing Calcutta: Modernity, Nationalism and Colonial Uncanny*, Wiley online, Vol 63 Issue 2, 2010.
14. Thampuran A., *Thiruvananthapuram - Montage of Heritage Buildings*, 2011.
15. *Heritage of Kerala* by Information and Public Relation Department, Govt. of Kerala.
16. Gomez F. T., *Cities of Dreams: Examining the Ideology of Colonial Architecture in India*, McNair Scholars Research Paper, 2009.
17. Tadgell C., *The History of Architecture in India: From the Dawn of Civilisation to the End of Raj*, Architecture Design and Technology Press, 1990.

Internal Continuous Assessment (Maximum Marks - 50) (Group 2 Subject)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, quiz, seminar, term-project, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of Two Parts

Part A (40 marks) - Eight Short answer questions of 5 marks each. All questions are compulsory. There should be two questions from each module.

Part B (60 Marks) – Two Questions from each module. Candidates have to answer any one full question out of the two from each module. Each question carries 15 marks.

Course Outcome:

Knowledge about the history of a culture, its building art and construction techniques helps an architecture student to develop designs that are rooted in the country. Upon completion of the course, the student will be able to develop a keen appreciation of our heritage buildings leading to the understanding that architecture is the product of a particular culture, time and place.

13AR1504 SUSTAINABLE DEVELOPMENT

Teaching Scheme: 2(L) - 0(T) - 0(P)

Credits: 2

Course Objective:

- *To understand the concept of Sustainability and to appraise the global sustainability challenges*
- *To understand the critical role of architects and stakeholders in construction industry towards contributing to the global sustainable development*
- *To familiarize the alternate methods of judicious use of resources.*

Module – I

Introduction and Global scenario

Concepts of Sustainability, Energy and Global Environment, Global Warming and Climate Change

Brundtland Commission Report (1983), Rio Declaration (1992), Kyoto Protocol (1997)

Concept of Sustainable Development, Goals and Means of Development, Human Development Index.

Module – II

Planning and Design for sustainability

Sustainable Architecture: Use of Materials, Concept of Embodied Energy, Ecological footprint

Energy use in Buildings, Alternate and renewable sources of Energy

Sustainable Site Planning, Sustainable Cities, Sustainable Transportation

Concept of Green Buildings Different Rating systems TERI GRIHA, LEED, Merits and demerits.

Module – III

Conservation of natural resources:

Water: Global water scenario, Reasons for scarcity, Ground water depletion, Need for water conservation, Use of water in buildings, Water recycling, Grey water, Black water, Water efficient landscaping, Xeriscape

Rain water Harvesting: Capacity calculations for water harvesting tanks, Water Collection from roof, filtering rain water,

Environmental impacts of Urbanization, Agriculture, Mining, Fisheries, Industries etc.

Module – IV

Pollution and waste Management

Pollution, Water, air, land and noise pollution, Sources and control of pollution, Solid Waste Management, Types of Waste, Household waste: recycling techniques, Composting, Biogas plant. Construction waste, Hazardous waste, Electronic waste, Hospital waste etc.

Town/ City level waste management.

References:

1. Amartya Sen, *Development as Freedom*, Oxford University Press, 2001.
2. Baker, Nick and Steemers, Koen, *Energy and Environment in Architecture* E& FN, Spon. London 1999.
3. Bansal Naveendra K., Hauser Gerd and Minke Gernot, *Passive Buildings Designs: Handbook of Natural Climatic Control* Elsevier Science, Amsterdam 1997.
4. Givoni B. Man, *Climate and Architecture* Elsevier, Amsterdam, 1986.
5. Goulding, John, R, Lewis, Owen J and Steemers, Theo C. *Energy in Architecture* Bastford Ltd., London, 1986.
6. Nicholas Stern *The Economics of Climate Change*, Cambridge University Press, 2007.
7. Rees, W.E. *Our Ecological footprint: Reducing Human Impact on Earth*, Routledge, 2007.
8. Rogers, Jalal & Boyd *An Introduction to Sustainable Development*, Earthscan, 2008
9. Schumacher E. F., *Small is Beautiful: Economics as if People Mattered*, Random House, 2011.
10. TERI *Sustainable Building Design Manual Vol 1 & 2*, TERI, New Delhi, 2004.
11. The United Nations *Earth summit: Agenda 21*, UN, 1993.
12. Watson Donald *Climatic Design : Energy Efficient Building Principles & Practices*, Mc Graw Hill Book Company, New York, 1983.
13. World Commission on Environment and Development *Our Common Future* Oxford University Press, 1987.

Internal Continuous Assessment (Maximum Marks - 50) (Group 2 Subject)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, quiz, seminar, term-project, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of Two Parts

Part A (40 marks) - Eight Short answer questions of 5 marks each. All questions are compulsory. There should be two questions from each module.

Part B (60 Marks) – Two Questions from each module. Candidates have to answer any one full question out of the two from each module. Each question carries 15 marks.

Course Outcome:

Students should be able to judge the diverse development activities in the sustainability angle. They should develop a concern for the overall development of humankind and the future of the limited resources.

13AR1505 INTERIOR DESIGN

Teaching Scheme: 1(L) - 0(T) - 3(P)

Credits: 4

Course Objectives:

- *To provide a comprehensive introduction to designing of interior spaces.*

Module – I

Space : Space as raw material – Qualitative and quantitative study – Organization of space – Order, growth, division, sequence and scale.

Surfaces : Functions of surfaces – Ratio, proportion, colour, material, texture, dimensions of 2 D surfaces like walls, ceiling, floors, dividers etc.

Project : Design of murals / floor pattern / ceiling patterns for reception areas / Lounges for hotels, apartments, showroom etc.

Module – II

Principles of visual composition – Colour in interiors, Building elements in interiors, Human Perception of interiors- Views.

Project : Detailed case study of specific room in residences / hotels / offices etc., Preparation of interior view.

Module – III

Furniture – furnishings – Styles, materials, functions.

Design of interior spaces – Bedrooms, kitchen, living rooms, dining rooms, toilets, show windows, sales counters, toilets, reception desks, lobbies (Hotels, offices, hospitals) – Models showing interior spaces with colour scheme – furniture, accessories of any one space mentioned above..

Project : Design of interior spaces of hotels, offices, hospitals, show rooms etc.

Module – IV

Interior plantscaping – Plant materials, growth condition, maintenance, importance of plantscaping – Aesthetics, functional etc.

Exhibits in interiors – private and public interiors.

Latest trends in the choice of materials, finishes, etc, in interiors – Market surveys, field visits etc.

Project : Plantscaping of private and public interior spaces.

References:

1. Bapat S. V., *Basic Design & Anthropometry*, Pratima Bapat, Pune, 1993.
2. Bapat S. V., *Living Areas – Internal Spaces*, Pratima Bapat, Pune, 1993.
3. Halse A. O., *Use of Colours in Interiors*, McGraw Hill, 1968.
4. Ching F. D. K., *Interior Design Illustrated*, John Wiley, 2012.
5. Ashihara Y., *Exterior Design in Architecture*, Van Nostrand Reinhold Inc., 1970.
6. Pickering E., *Architectural Design*, John Wiley, 1933.
7. Ching, F. D. K., *Architecture - Form, Space & Order*, Van Nostrand Reinhold Inc., 1996
8. Barratt K., 'Logic and Design: In Art, Science & Mathematics, Design Books, 2005.

Internal Continuous Assessment (*Maximum Marks - 100*) (*Group 1 Subject*)

20% - Tests (minimum 2)

70% - Class work

10% - Regularity in the class

University Examination Pattern:

Examination duration: 4 hours

Maximum Total Marks: 100

The question paper shall consist of two parts.

Part A (20 marks) - 4 Short answer questions of 5 marks each. All questions are compulsory.

There should be one question from each module.

Part B (80 Marks) – One Drawing Question of 80 marks covering the syllabus of all the four modules.

Course Outcome:

At the end of the course the student shall have acquired the knowledge of designing interior spaces.

13AR1506 BUILDING SERVICES - II (ELECTRIFICATION)

Teaching Scheme: 2(L) - 0(T) - 0(P)

Credits: 2

Course Objective:

- To understand the various components required in electricity distribution system.
- To develop the electrical layout diagram for building for the estimation and installation purpose.
- To identify the various types of light requirement for different purpose.
- To apply the fundamental of laws of illumination for analyze the light requirements of any space (both exterior and interior).
- To design the lighting scheme for interiors spaces.

Module – I

Electrical Services: Sources of Electricity, Electricity generation, Basic Electrical Distribution System –Substation, transformer, over head line, underground line. Single phase and three phase supply. Electrical distribution in building complexes.

Discussion: Arising need for solar power generation and wind power generation.

Exercise: Site visit to any power generation station.

Module – II

Distribution system: Domestic wiring system, Material, classification, merits and demerits.

Electrical accessories: Symbols and representation in architectural layout drawings, Single line wiring diagram. Safety aspects, protection of buildings against lightning, NBC Recommendations, Earthing, Short circuit and overloading.

Preliminary Estimation of Electrical & illumination works.

Module – III

Lighting: Fundamentals of lighting. General definition of terms related to optical sensitivity, visual performance & vision, Visual field, Application of lighting and illumination in Architecture. Artificial sources of light; Lamps and their characteristics: Incandescent lamp, Fluorescent lamp, Gas filled lamp, HID lamp. Neon lamp and LED lamp. Polar Curves Luminaries and their applications.

Discussion: Energy saving shall be the focus.

Module – IV

Illumination: Definition of Light power, light flux Light intensity, Laws of Illumination: inverse square law and Lambert's Cosine law. Application of law of illumination. General formula for illumination calculation of distributed source. Coefficient of utilization. Standard

level of illuminations for various tasks, Basic lighting design, Direct, Indirect and semi-direct lighting. General and local lighting, Glare and glare control.

Exercise: Lighting design of: Residential units, Shops & Restaurants, general office, conference hall, Art – gallery and Museum Parks & playgrounds Road/area lighting and Landscape Lighting..

References:-

1. Philips D., *Lighting in Architectural Design*, McGraw Hill, 1964.
2. Lal G.K., *Elements of Lighting*, 3-D Publishers, 1994.
3. Hopkinson R.G. and J.D. Kay, *The Lighting of Buildings*, Faber and Faber, 1969.
4. *The Lighting Handbook*, I.E.S., 2013.
5. International Lighting Review – Quarterly Journal.

Internal Continuous Assessment (Maximum Marks - 50) (Group 2 Subject)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, quiz, seminar, term-project, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of Two Parts

Part A (40 marks) - Eight Short answer questions of 5 marks each. All questions are compulsory. There should be two questions from each module.

Part B (60 Marks) – Two Questions from each module. Candidates have to answer any one full question out of the two from each module. Each question carries 15 marks.

Course Outcome:

Upon completion of the course, the student of architecture shall have acquired the concept of electrification. He shall be able to design a system with a concern over the limited use of energy. Energy saving shall be his main criteria.

13AR1507 BUILDING SERVICES - III (HVAC)

Teaching Scheme: 2(L) - 0(T) - 0(P)

Credits: 2

Course Objective :

- To identify the factors responsible for human comfort conditions.
- To identify the need for implementing mechanical systems for achieving human comfort.
- To identify different Air Conditioning equipments and their suitable location in buildings.
- To understand the environmental issues caused by these systems..

Module – I

Introduction: The scope and impact of Mechanical system- Impact of space planning - Impact on Architectural Design - Impact on High rise Buildings - Impact on construction cost – Impact on Global environment.

Mechanical Ventilation: Standard requirements of ventilation for different conditions of living and works. Conditions for comfort - Control of quality, quantity, temperature and humidity of air.

Discussion: Lessons from the past: Passive systems for thermal comfort implemented in various traditions.

Exercise: Document any traditional context where passive system for thermal comfort is implemented.

Module – II

Psychrometry: Introduction, meaning of air conditioning, different psychrometric properties, psychrometric processes, Psychrometric chart & its application.

Summer air conditioning system, winter air conditioning system, year round air conditioning system.

Module – III

Principles of refrigeration & Air -Conditioning - Different types of Air-Conditioning. - Cooling load Calculation.

Air Conditioning Equipments - Major equipment used in Air conditioning - their role and characteristics.

Exercise: Site visits to study various air conditioning systems.

Module – IV

Planning air conditioning system: Location with due consideration for reduction of heat gain, economy and energy saving. Layout of supply and return air ducts. - Schematic drawings showing the Air conditioning system of an office building, hotel, auditorium etc.

Exercise: Preparation of schematic air conditioning system layouts for an office building, hotel and auditorium.

References:-

1. Arora S. C. and S. Domkundwar, A Course in Refrigeration & Air conditioning, Dhanpat Rai and Company, 2002.
2. Ramsey C. G. and H. R. Sleeper, Architectural Graphic Standards (HVAC System), John Wiley & Sons, 2011.
3. *National Building code of India*, BIS, 2005.
4. Lang, V.P., *Principles of Air Conditioning*, Verlag Delmar Publishers, 1961.

Internal Continuous Assessment (Maximum Marks - 50) (Group 2 Subject)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, quiz, seminar, term-project, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of Two Parts

Part A (40 marks) - Eight Short answer questions of 5 marks each. All questions are compulsory. There should be two questions from each module.

Part B (60 Marks) – Two Questions from each module. Candidates have to answer any one full question out of the two from each module. Each question carries 15 marks.

Course Outcome:

Upon completion of the course, the student shall have acquired the concept of air conditioning and shall be able to recommend the most effective system for achieving thermal comfort inside a building.

13AR1508 STRUCTURAL DESIGN IV

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 3

Course Objective :

- *To understand various structural forms and their analysis*
- *To get familiarize with different computer software in Civil engineering.*
- *To give an insight into the various concrete making materials and their properties, and significance of concrete mix design.*

Module – I

Three hinged arches-Circular and parabolic shapes-Normal thrust and Radial shear-BMD two hinged arches-Circular and parabolic shapes-Normal thrust and Radial shear-BMD

Module – II

Analysis of Cable structures-Suspension bridges-Saddle and fixed pulley arrangement

Analysis of continuous beams, One leg frames, symmetric portal frames and sway frames using Kani's method

Module – III

Stiffness and Flexibility method of analysis- propped cantilever- continuous beams- B.M.D &S.F.D, Direct stiffness method-analysis of trusses.

Introduction to any one Structural analysis and design software package like STAAD PRO, ANSYS, NISA CIVIL etc. (one assignment should be given)

Module – IV

Concrete technology-Materials used and its properties-Mix proportion-Volume and weight batching-Water-cement ratio-Mixing and placing of concrete-Curing-Development of strength-Grade of concrete-Influence of water/cement ratio on strength-Workability-Segregation and bleeding of concrete-Introduction to reinforced cement concrete-Importance of mix design.

References:-

1. Reddy C. S., Basic Structural Analysis, Tata McGraw –Hill Education ,2001.
2. Punmia B. C., A. K. Jain and A. K Jain, *Theory of Structures (SMTS- II)*, Laxmi Publications Pvt. Ltd., 2004.
3. Kassimali A., *Analysis of Structures*, Cengage Learning,2010.

4. Vaidyanathan R. and P. Perumal, *Structural Analysis*, Vol-1,2, Laxmi Publications, 2004.
5. Shetty M. S., *Concrete Technology*, S. Chand & Company, 2013.

Internal Continuous Assessment (*Maximum Marks - 50*) (*Group 2 Subject*)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, quiz, seminar, term-project, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of Two Parts

Part A (40 marks) - Eight Short answer questions of 5 marks each. All questions are compulsory. There should be two questions from each module.

Part B (60 Marks) – Two Questions from each module. Candidates have to answer any one full question out of the two from each module. Each question carries 15 marks.

Course Outcome:

- *Upon completion of the course, the student shall be able to identify and analyse different structural forms.*
- *Students will be familiar with different computer based structural analysis software.*
- *Students will have a basic awareness of the uses and properties of various concrete making materials and significance of concrete mix design.*