academic studies of 5th semester in Materials and Methods in Building Construction – V and Building Structures -IV.

3. Discussion on innovations in green sustainable materials and techniques of construction and passive energy systems.

Assignment-3: Projects

One major project and one minor/time problem to be tackled in the semester. Projects shall be of urban scale with multiple functions and a need for imagery as one of the architectural goals. It encompasses response to the local context, locally adapted passive design features and cooling systems, natural cooling systems, materials and sustainable architectural design and systems (Activity 1). Museums, art galleries, theme-based hotels, transport interchanges, terminals and shopping, Industrial structures areas can be chosen.

Project work could be done in 3 stages of activity interspersed with seminars.

1) Introduction to the initial design parameters which include choice of;
    a. *Geography/situation (context),*
    b. *User Group/development model,*
    c. *Development guidelines (byelaws).*
2) Approaches and strategies to address issues of community, public and private realms, edge conditions, communication and connectivity. This could result in the generation of diagrams/models exploring attitudes to site, allocation of built and unbuilt volumes and communication and connectivity.
3) The design shall be sensitive to the needs of disabled, aged people and children.
4) The design shall also be sensitive to existing social and economic systems at the site for e.g. existing informal settlements, markets, land usage patterns, etc. The design should consider the existing site complexes and issues and inclusive of the same.
5) The student shall consider appropriate application of passive design principles (ventilation, insulation, shading, thermal mass etc.), passive, natural and sustainable cooling systems along with sustainable active cooling systems.

It is recommended that site sizes should not be larger than 1 acre to allow for intensive study. However the Design studio faculty shall determine the extent of the site size.

Projects shall be of urban scale with multiple functions; identity of public building (aesthetics, symbolic character, meaning, and environmental response) will be one of the architectural goals. Museums, art galleries, theme- based hotels, transport interchanges, terminals, shopping areas, informal markets can be chosen. Design emphasis shall be on the use of innovations in green materials and techniques of construction. Concurrently or sequentially, another project shall be attempted with utilities and service dominant buildings with a focus on sustainable systems like pharmaceutical manufacturing units or medical facilities or traditional skill based workshops or communities e.g., weaving,

potter community, waste picker community, etc.. Consultants in the field of utilities and services shall be called as part of studio review.

Alternatively projects involving large span structures like industrial structures may be attempted. Design emphasis shall be on the skins and support of structural systems and resulting architectural form, space and experience.

NOTE:

- One major project and one minor/ time problem to be tackled in the semester.
- Detailing of architectural features of the major project like entrance lobby, skylights and staircases has to be attempted.
- Submission shall comprise duly drawn/drafted site plans, elevations, section views, models etc.

SHAPE OF THINGS TO COME – 6TH SEMESTER

This studio should equip a student to tackle the 6th Semester program like Institutional projects of higher learning, vocational training or a small-scale campus.

Teaching-Learning Process	Discussions, presentations, and case studies will cover three typologies. The portfolio covering all the assignments shall be presented for term work.

Course outcome (Course Skill Set)

the student will be able to:

- Get an introduction into the field of Architectural Design with respect to sustainable Design solutions.
- Make responsible choices for design development.
- Get a perspective on design of multi functional spaces in formal and informal settlements.

Assessment Details (both CIE and SEE)

(methods of CIE need to be defined topic wise i.e.- Studio discussions, Reviews, Time problems, test, Seminar or micro project)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 50% marks individually both in CIE and 40 % marks in SEE to pass. Semester End Exam (SEE) is conducted for 100 marks (Viva-voce) and a minimum of 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. Based on this grading will be awarded.

Continuous Internal Evaluation:

Methods suggested:

1. Studio discussions, Reviews, Time problems, CIE tests, Seminar or micro project, Quiz, report writing etc.
2. The class teacher has to decide the topic for the Design and Seminars if any, in the beginning only. The teacher has to announce the methods of CIE for the subject in advance in writing.

Semester End Examination:

1. The student needs to submit his/her works done throughout the semester, including rough sheets for the Viva examination, at least one day prior to the Viva work examination to the course teacher/coordinator.
3. The Viva-voce will be evaluated by an external teacher appointed by the University along with Course teacher or an internal examiner.
4. The SEE marks list generated is to be signed by both internal and external examiners and submitted to VTU in the sealed cover through the Principal of the institution.

Suggested Learning Resources:

Books

1. Richard Patrick Parlour (200); "Building services: A Guide to Integrated Design: Engineering for Architects"; 3rd Edition - Integral Publishing.
2. Paul Tymkow; Building Services Design for Energy Efficient Buildings.
3. Russell Fortmeyer, Charles Linn; Kinetic Architecture: Designs for Active Envelopes.
4. Michael Fox; Interactive Architecture: Adaptive World (Architecture Briefs).
5. Prof. A.K.Bansal ; Solar Passive Design.

Web links and Video Lectures (e-Resources):

- https://ndl.iitkgp.ac.in
- https://www.youtube.com/watch?v=rRtFCvzf-Ow
- https://www.youtube.com/watch?v=5DsP-qH_PBM
- https://www.youtube.com/watch?v=c2FYFuML71Y
- https://www.youtube.com/watch?v=26QcRDAGWLY

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Research and document a building or a campus or a gated community which has implemented several sustainable passive design techniques and approaches (such as waste water, storm water, passive design, energy generation, materials, etc).

V Semester

Materials and Methods in Building Construction -V			
Course Code	**21ARC52**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:3	SEE Marks(VIVA)	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	-

Course objectives:

This course will further student's understanding of the logic and details of construction technologies of complex systems and their impact on production of complex buildings. This course will also bring in the aspect of environmental impact, energy intensiveness, carbon emissions and circularity (recyclability) of each material studied.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. The subject teacher to link the studio work with on site work by arranging site visits in the nearby areas.
2. The Subject teacher to highlight the techniques of various types of steel trusses including PEMB structures.

Module-1

1) **Introduction to Steel plane Trusses:** Construction of Steel trusses for various spans, ridged truss, saw tooth truss with lattice girders, roof lighting, aluminium sheet and profiled MS sheet cladding and roof fixing details**.** Energy intensiveness and recyclability of steel as a material can be studied.

2) **Detailing of Steel trusses:** Tubular and L-angle trusses with 8-16m spans.

Teaching-Learning Process	Minimum one plate on each construction topic. Site visits to be arranged by studio teachers. Study of material applications in the form of a portfolio.

Module-2

3) **Introduction to pre-engineering metal buildings -** its manufacturing and assembly process, details, market study and most importantly the materials energy intensiveness and its impact on the environment.

4) **Detailing of a Pre-engineered building:** Including Roof fixing details with aluminium sheet and profiled MS sheet cladding.

5) **Introduction to large span roofs:** Shell roof, vaults folded plate, geodesic domes, space frame, tensile structures, pneumatic structures, etc.

Teaching-Learning Process	Minimum one plate on each construction topic. Site visits to be arranged by studio teachers. Study of material applications in the form of a portfolio.

Module-3

6) **Detailing of hyperbolic paraboloid shell roof:** Principles and methods of construction including form-work techniques and reinforcement details.

7) **Detailing of folded plate and cylindrical shell roof:** Principles and methods of construction including form-work techniques and reinforcement details.

8) **Detailing of a geodesic domes:** Principles and methods of construction with explorations using physical models.

Teaching-Learning Process	Minimum one plate on each construction topic. Site visits to be arranged by studio teachers. Study of material applications in the form of a portfolio.

Module-4

9) **Detailing of a space frame;** Principles and methods of construction with explorations using physical models.

10) Tensile structures and pneumatic structures: Principles and methods of construction with explorations using physical models.

Teaching-Learning Process	Minimum one plate relating to each construction topic. Site visits to be arranged by studio teachers. Study of material applications in the form of portfolio.

Module-5

11) **Plastics as a building material:** types, properties, use, energy intensiveness, environmental impact assessment and recycling and up cycling of plastics such as polycarbonates, acrylics, PVC polymer films, and fibre reinforced plastic**.** Application and details.

12) **Waterproof components:** Water Proofing elements, construction chemicals and additives, adhesives, Polystyrenes, sealants. Detailing of waterproofing of basement, toilets, terrace garden, plaster of Paris, gypsum, French drains etc.

13) Environment friendly materials: Bamboo**,** Adobe, Stabilised Mud Block, Green

	innovations and materials developed out of waste, sustainable materials available in the current market, study of case studies of sustainable institutional/public buildings. Designing and detailing utilising above materials.
Teaching-Learning Process	Minimum one plate relating to each construction topic. Site visits to be arranged by studio teachers. Study of material applications in the form of portfolio.

Course outcome (Course Skill Set)

1. The students will be able to understand the structural possibilities to cover large spans with different trusses.
2. The students will be able to appreciate and use different materials in building construction.

Assessment Details (both CIE and SEE)

(methods of CIE need to be define topic wise i.e.- Submission of construction drawing sheets, Journal of materials, Multiple Choice Question, Quizzes, Open book test, Seminar or micro project)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 50% marks individually both in CIE and 40 % marks in SEE to pass. Semester End Exam (SEE) is conducted for 50 marks (Viva-voce) and a minimum of 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. Based on this grading will be awarded

Continuous Internal Evaluation:

1. Methods suggested: Submission of Construction sheets, Journal of Materials, Test, Written Quiz, Seminar, report writing etc.
2. The class teacher has to decide the topics for the test, Written Quiz, and Seminar. In the beginning, only the teacher has to announce the methods of CIE for the subject.

Semester End Examination:

1. The student need to submit his/her works done throughout the semester, including rough sheets for Viva - voce examination, atleast one day prior to Viva voce examination to the course teacher/coordinator.

2. The work will be evaluated by an external teacher appointed by the University along with Course teacher or an internal examiner.

Suggested Learning Resources:

Books

1) Emitt& Gorse (2006), "Barry's Advanced Construction of Buildings", Second Edition, Wiley India Pvt. Ltd.
2) Francis, D.K. (2008), "Building Construction Illustrated", Fourth Edition, Wiley India Pvt. Ltd.
3) Mackay, J.K. (2015), "Building Construction", Fourth Edition, Pearson India.
4) Roy Chudley (2014), "Construction Technology" Second Edition, Pearson India.
5) Barry R. (1999) – Volume 3 & 4, "The Construction of Buildings", Fourth Edition, East-West Press Pvt Ltd., New Delhi.
6) Lyons Arthur (2014), "Materials for Architects and Builders", Fifth Edition: 2014, Routledge.

Varghese P.C. (2015), "Building Materials", Second Edition, PHI Learning Pvt. Ltd.

Web links and Video Lectures (e-Resources):

- https://ndl.iitkgp.ac.in
- https://www.youtube.com/watch?v=m3WsWcObNJo
- https://www.youtube.com/watch?v=kFjhz9aEvdo
- https://www.youtube.com/watch?v=nukB3qDckaE
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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1- Site visit and study large span trusses through sketches, photos, make a report of the study.

Activity 2- Observe and understand technical construction methods and materials for space frames, tensile and pneumatic structures and document the same in a report.

Activity 3 – Site visit to a basement construction for water proofing. Discuss with an expert and document the findings in a report.

V Semester

History of Architecture -V			
Course Code	**21ARC53**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3

Course objectives:

To provide an introduction to the culture and architectural currents of Western Architecture during Renaissance, Baroque, Neo Classical and Modern periods. To identify the socio-cultural changes aptly reflected in the typology of buildings through this phase.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Use of theory, activities, sketches, drawings, assignment and tutorial for teaching.
2. Evaluation by quiz, tests, classroom activities.

Module-1

1) **Introduction to Renaissance Architecture:** Background and influences on Renaissance Architecture. Characteristics of Renaissance Architecture in general. Monumental, public and residential spaces.

2) **Renaissance Architecture Examples:** St Andrea, Mantua and Palazzo Rucellai by Leon Alberti, Villa Rotunda (Capra) by Palladio, (New) St Peters' Rome by Michelangelo and others, St Paul's London by Sir Christopher Wren. Baroque Architecture: General characteristics of Baroque. Eg: St Peters' Piazza by Bernini. Monumental, public and residential spaces.

3) **1750-1900 Transitional Period Architecture:** A brief account of the situation before the changeover to Modern architecture in Europe. Palladian Revival in Britain, Greek revival and Gothic Revival. Transitional Period Examples: Chiswick House, London, Mere worth castle, Kent, St Pancras Church, London, West Minister Palace, London, Arc de Triomphe, Paris. Monumental, public and residential spaces.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the buildings, style of architecture. 2) The students need to sketch the buildings for its unique qualities. 3) Quizzes, models, seminars from students can be encouraged.

Module-2

4) **Impact of Industrial Revolution in Europe**: The Social, economic and political changes effected, new requirements, functions, new materials and technological developments. New proto types- Ex. Bridges, Expositions, Factories and Railway stations-Use of metal and glass. palace. Monumental, public and residential spaces.

5) **Early Modern Architecture I**: Modern movement-Arts and crafts, Art-Nouveau, Italian futurism-The Chicago School and rise of early sky scrapers-Ex Monadnock building, Carson pierre Scott, store in New York-Public and private spaces Casa Mila, , Sagrada Familia church etc.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the buildings, style of architecture. 2) The students need to sketch the buildings for its unique qualities. 3) Quizzes, models, seminars from students can be encouraged.

Module-3

6) **Early Modern Architecture II:** Destijl movement, Brutalian and Bahaus, Schroder House, Ronchamp, Modern sky scraper, Mies Van der Rohe (Glass and Steel), Bahaus School design-Examples for the above movements for Public and private spaces and Monumental approach(eg Sky scrapers)- IIT Campus buildings- Public and private spaces.

7) **Modern Architecture III:** Influence of concepts and ideas generated by FL Wright - Robie House, Falling Waters, Guggenheim Museum, Johnson Wax Tower. Le Corbusier-Villa Savoy, Domino House, Five points of Architecture. Mies Van der Rohe-Less is more, minimalism, Glass and steel tower - Seagram.

8) **Modern Architecture IV:** Walter Gropius, Bahaus building, Fagus shoe Factory, Harward campus, Team approach. Louis Sullivan-Chicago Auditorium, Wain Wright Building, Theory of Sky scrapers. Alvar Aalto and his works.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the buildings, style of architecture. 2) The students need to sketch the buildings for its unique qualities. 3) Quizzes, models, seminars from students can be encouraged.

Module-4

9) **Modern Architecture V:** International style, works of Eero Sarinen- TWA and Kennedy Airports. Richard Neutra- Lovell Beach House. Phillip Johnson- Glass House, Museum Building. Oscar Niemeyar-Work in Brazilia- Legislature building and Church. Monumental, public and private spaces.

10) **Modern Movement-VI:** New Ideas – Archigram Britain-Walking City, Floating City etc. Kenzo Tange- Japan-Floating City and Shimbon Office Building. Moshe Safdie- Housing in Isreal. Sir Buck Minster Fuller-US Pavilion in Expo-67, Dymaxion Car, Bucki Dome- Public and private

Building and spaces.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the buildings, style of architecture. 2) The students need to sketch the buildings for its unique qualities. 3) Quizzes, models, seminars from students can be encouraged.

Module-5

11) **Modern Movement-VII:** Brutalism- Works of Le Corbusier, Peter and Allison Smith, James Sterling-Udse of Raw concrete, Ron champ, Nun's Quarters-Lyon, Library-Oxford University, elementary School by Smithsons- development of Corporate Sky Scrapers- New York- Having multiple uses and tinted glass cladding, Rock Feller Centre-New York-Public and Private examples.

12) **Modern Movement-VIII:** Parallel movement-Soviet Union of 1920‟s- Constructivist movement, Modernism and works of Vladimir Tatlin- contributions of Engineers like Pierre Luigi Nervi-Rome Olympic Buildings, Pirelli Tower Italy, Gustave Eiffel-Eiffel Tower, bridges, Statue of Liberty base, Candela etc.

NOTE: Progressive Marks A) individual presentation by a Student on one topic. B) Group studies of chosen issues. C) Impact of modernism on India.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the buildings, style of architecture. 2) The students need to sketch the buildings for its unique qualities. 3) Quizzes, models, seminars from students can be encouraged.

Course outcome (Course Skill Set)

1) The students will be able to learn and compare various styles of Architecture.
2) The students will be able to appreciate the scale of buildings.
3) The students will be able to link the development from pre history to modern times.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks (25 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 40% (20 Marks out of 50)in the semester-end examination(SEE), and a minimum of 50% (50 marks out of 100) in the CIE (Continuous Internal Evaluation) and a minimum of 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. Based on this grading will be awarded.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

- At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

7. The question paper will have ten questions. Each question is set for 20 marks.
8. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Theory paper will be out of 100 marks and will be **scaled down to 50 marks.**

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Suggested Learning Resources:

Books:

1) Frampton Kenneth; "Modern Architecture – A Critical History".
2) Fletcher, Bannister; "A History of Architecture".
3) Siegfried Gideon; "Time, Space and Architecture".

Web links and Video Lectures (e-Resources):

- https://ndl.iitkgp.ac.in
- https://www.youtube.com/watch?v=1ek1SI1oAwU
- https://www.youtube.com/watch?v=sY7ZpGriNZA
- https://www.youtube.com/watch?v=8iGx5Z6CW9w
- https://www.youtube.com/watch?v=h-MXnqqNfOY

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1) Sketching of the historical buildings from a Book.
2) Group or Individual seminar on a building.
3) Quizzes, debates on a selected topic.

V Semester

Sociology & Building Economics			
Course Code	**21HUM54**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3

Course objectives:

To familiarize students with the basic concepts of sociology and economics and their influence on architecture and the environment and vice versa.

To guide students in critically analyzing common social and economic narratives to catalyse them to work towards just architectural endeavours.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Use of social theories to understand group behaviour, attitude, values and beliefs,
2. Using case study methods to make concepts or contexts clear.
3. Evaluation by quiz, tests, classroom activities.

Module-1

1. **Introduction to Sociology**: Definition of Sociology; Nature, Scope and Utility of Sociology; Branches of Sociology; Relation of Sociology and its branches to architecture and the built environment.

2. **Elements of Society**: Biosocial and Socio cultural associations; Definitions of sociological terms: society, community, family, culture; Difference between society and community; Different family structures and architectural responses to different family types in and outside India (examination of different housing typologies responding to different family types – traditional and contemporary); Relation between culture and built form (exploration of architectural examples.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the concepts in sociology. 2) The students need to do assignments for better understanding of the concepts. 3) Quizzes, debates, seminars from students can be encouraged.

Module-2

3. **Communities**: Origin, growth and nature of settlements and communities. Their characteristics and spatial patterns.
4. **Urban and Rural Communities**: Definitions of the terms "urban" and "rural". The social, economic, ecological and spatial characteristics associated with urban and rural settlements Social, ecological and economic relations and interdependencies between urban and rural settlements. Urban sociology and rural sociology.
5. **Cities and Society**: Urbanization – definition; causes and effects (exploring social, and economic factors influencing migration to urban areas) (Theory 1). Effects of urbanization on rural areas. Impact of growing urbanization on urban life, viz. health, housing, transportation. Different types of migration. The impact of migration on urban form. The origin and characteristics of slums in European, American and Indian cities. Official definition of slums as per Census of India. Understanding cities as socio-ecological systems (Theory 2). Governmental and non-governmental approaches to engaging with issues regarding slums in Indian cities.
6. **Social Research**: The need for research; the research process; ethics of social research; scope of social research. Difference between methodology and methods. Types of research methods: qualitative, quantitative, mixed research methods. Sources of research data: primary and secondary sources. Secondary data sources include literature review, official and unofficial documents. Primary data sources use methods such as field surveys, questionnaires, different types of interviews (open-ended / closed / structured / semi- structured), Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal techniques[2]and case study approach.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the concepts in sociology. 2) The students need to do assignments for better understanding of the concepts. 3) Quizzes, debates, seminars from students can be encouraged.

Module-3

7. **Economics**: Definition of economics; Definitions of terms: Goods; Utility, Value, Price and Wealth. The relationship of economics with the built environment and land use.
8. **Economic organization of society**: Different economic systems: capitalism; socialism, communism, mixed-economies. Primary, secondary and tertiary sectors of economy: agriculture, mining, manufacturing, banking, marketing, transport and service sectors. Factors of production: land, labour, capital and entrepreneurship. Relevance of factors of production to architecture and construction practice.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the concepts in sociology. 2) The students need to do assignments for better understanding of the concepts. 3) Quizzes, debates, seminars from students can be encouraged.

Module-4	
9. **Economics and the market**: Production and Consumption, wants and needs and their characteristics. Concepts of economics: Opportunity cost; Laws of supply and demand; Laws of increasing, diminishing and constant returns; Standard of living. Analysis of the housing market in Indian cities to understand the dynamics of urban housing supply and demand in formal and informal settlements. Analysis of affordable housing.	
Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the concepts in Economics. 2) The students need to do assignments for better understanding of the concepts. 3) Quizzes, debates, seminars from students can be encouraged.
Module-5	
10. **Urban land values**: Various social, ecological, and economic factors affecting the value of urban land in formal and informal spaces. Difference between land use and land cover. Studying the characteristics of developed land in the city and real estate development vision prevailing in cities (Activity 2) .The Bid Rent theory that defines the relationship between location and land value. Theoretical city models based on land use and land value. 11. **Building Costs**: Cost and cost indices. Total cost of construction. Time value of money. Different sources of financing for buildings.	
Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the concepts in Urban Economics. 2) The students need to do assignments for better understanding of the concepts. 3) Quizzes, debates, seminars from students can be encouraged.

Course outcome (Course Skill Set)

1) The students will be able to apply the sociological issues in Architecture practice.
2) The students will be able to evaluate the importance of Economics in building construction.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks (25 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 40% (20 Marks out of 50)in the semester-end examination(SEE), and a minimum of 50% (50 marks out of 100) in the CIE (Continuous Internal Evaluation) and a minimum of 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. Based on this grading will be awarded.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

- At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Theory paper will be out of 100 marks and will be **scaled down to 50 marks.**

Suggested Learning Resources:

Books

1. Openstax College (2012) Introduction to Sociology. Openstax College.
2. Samuelson, P. and Nordhaus, W. (2010) Economics. Mcgraw-Hill Education.
3. Yin, Robert K. (2014) Case Study Research Design and Methods (5th Ed.). Thousand Oaks, CA:Sage.
4. Groat, Linda N. and David Wang (2013) Architectural Research Methods (2nd Ed.). John Wiley & Sons.
5. Jones, Paul (2011). The Sociology of Architecture: Constructing Identities. Liverpool, University Press.
6. Niva, V., Taka, M., &Varis, O. (2019). Rural-urban migration and the growth of informal settlements: A socio-ecological system conceptualization with insights through a "water lens". *Sustainability*, *11*(12), 3487.

7. DePaul, M. (2012). Climate change, migration, and megacities: addressing the dual stresses of mass urbanization and climate vulnerability. Paterson Review of International Affairs, 12, 145-162.
8. Shah, A., &Lerche, J. (2020). Migration and the invisible economies of care: Production, social reproduction and seasonal migrant labour in India. Transactions of the Institute of British Geographers, 45(4), 719-734.
9. Marschall, S. (1998). Architecture as empowerment: The participatory approach in contemporary architecture in South Africa. Transformation, (35).
10. Mann, Thorbjoern (1992) Building Economics for Architects. Wiley.
11. Du Plessis, C. (2008). Understanding cities as social-ecological systems.
12. McHale, M. R., Pickett, S. T., Barbosa, O., Bunn, D. N., Cadenasso, M. L., Childers, D. L., ...& Zhou, W. (2015). The new global urban realm: complex, connected, diffuse, and diverse social-ecological systems. *Sustainability*, *7*(5), 5211-5240.
13. Douthwaite, R. (1993). *The Growth Illusion: How Economic Growth Has Enriched the Few, Impoverished the Many, and Endangered the Planet*. Council Oak Books, 1350 East 15th Street, Tulsa, OK 74120. (Chp 14)
14. Gibson-Graham, J. K., Hill, A., & Law, L. (2016). Re-embedding economies in ecologies: resilience building in more than human communities. *Building Research & Information*, *44*(7), 703-716.
15. Nagendra, H., Sudhira, H. S., Katti, M., &Schewenius, M. (2013). Sub-regional assessment of India: effects of urbanization on land use, biodiversity and ecosystem services. In Urbanization, biodiversity and ecosystem services: Challenges and opportunities (pp. 65-74). Springer, Dordrecht.
16. Schumacher, E. F. 1973. Small is beautiful; economics as if people mattered. New York: Harper & Row.
17. Jackson, Tim. 2016. Prosperity without Growth. 2nd ed. London, England: Routledge.
18. Raworth, K. (2017). Doughnut economics: seven ways to think like a 21st-century economist. London: Random House.
19. Meadows, D. H., & Randers, J. (2013). Limits to growth. Chelsea Green Publishing

Web links and Video Lectures (e-Resources):

- https://ndl.iitkgp.ac.in
- https://www.youtube.com/watch?v=azZ7cEa-V7A
- https://www.youtube.com/watch?v=lUUgIE9HZLE&list=PLVLoWQFkZbhXhD4Aj5QnT1lBvPleHOM8e
- https://www.youtube.com/watch?v=DQq-zJPSf4U
- https://www.youtube.com/watch?v=IyLwxnGVZjI

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Introduction to life cycle costs of a building: This aims at expanding the definition of costs as being solely economic in nature. It aims to trigger thinking that encapsulates the environmental costs of buildings in addition to economic costs.

Activity 2: Initiating understanding towards economy driven development:
Students are asked to read article/articles that critiques conventional notions of city development and emphasises the need for people and ecology centric development.
eg: https://thewire.in/urban/our-cities-prioritise-real-estate-over-ecological-sustainability
Students are then divided in groups and asked to analyse the driving factors for these social, ecological and economic injustices provoked by such activities and propose alternatives to evade the negative implications of the development activity they read about.

V Semester

Building Services –III

(AIR-CONDITIONING, MECHANICAL TRANSPORTATION and FIRE PROTECTION)

Course Code	**21ARC55**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3

Course objectives:

To develop the knowledge and skills required for understanding the mechanical services in buildings and their integration with architectural design.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Use of theory, activities, sketches, drawings, assignment and tutorial for teaching.
2. Evaluation by quiz, tests, classroom activities.

Module-1

MECHANICAL VENTILATION AND AIR-CONDITIONING - Introduction

1) **Social and Environmental Issues related to conventional Refrigeration and Air-conditioning:** Climate Change and energy poverty implications of energy consumption and refrigerants use by conventional Vapor-Compression based RAC technologies, role of air conditioning in accelerating fossil fuel extraction and precipitting the humanitarian injustices of the exploitative coal mining economy, Global and Indian environmental, energy efficiency and green building policies, laws and rules warranting a trajectory shift in the RAC economy, introduction to Thermal comfort as an 'ends' and cooling systems as a 'means', Socio-economic and environmental benefits of a Negawatt approach to energy conservation vs. a Megawatt approach towards power generation. (Activity 1) (Activity 2)

2) **Introduction to Mechanical Ventilation:** Need for mechanical ventilation for spaces like Basements, Kitchen, Toilets, etc. Guidelines as per NBC / ISHRAE: Types of ventilation systems.

3) **Introduction to Systems for Thermal Comfort:** Psychrometric processes for achieving thermal comfort, Direct and Indirect Evaporative Cooling (Sensible Cooling)**, Air-conditioning (Cooling and Dehumidification)**, Air & Refrigeration cycles, Basics of Load Calculations, Zoning and Air Distribution, Heating system (Activity 3) (Activity 4) (Activity 5)

Teaching-Learning Process	1) The subject teacher can use PPTs & Videos to teach basics of the topics 2) The students need to work on the assignments given by the teacher. 3) Quizzes, models, seminars from students can be encouraged.

Module-2	
COOLING SYSTEMS **4) Cooling System Design Process:** Integrated building cooling system design - exploring the hierarchy of priority between thermal load reduction, passive cooling, low carbon cooling technologies and renewable energy integration. Methodology for selecting climate and context appropriate sustainable cooling system: i.e. selecting the optimal (a combination of) cooling technologies with lowest environmental impact and life-cycle cost from direct/indirect evaporative cooling, radiant cooling, structure cooling, solar VAM air conditioning or natural-refrigerant based vapor compression air conditioning through: tools for predicting thermal comfort in buildings, principles and tools for climate analysis, psychrometric processes of conventional and sustainable cooling technologies and representation on psychrometric chart. **5) Climate Friendly Cooling Systems:** a) Direct and Indirect Evaporative Cooling Systems: Estimating supply air temperature of direct and indirect evaporative cooling systems, calculating water requirements and cooling effect ('equivalent tonnage') of, estimating air handling unit requirements, air flowrate and fan power requirements for evaporative cooling systems, estimating energy and climate impact benefits, understanding hybrid evaporative + vapour compression air conditioning systems, b) Structure and Radiant Cooling Systems: estimating thermal comfort conditions and operative temperature achieved, calculating radiant surface area or structure cooling coil length requirements, calculating cooling effect ('equivalent tonnage'), estimating air handling unit requirements for dedicated outdoor air system (DOAS), understanding spatial design implications and civil-work requirements for various radiant/structure cooling variants, estimating energy and climate impact benefits, understanding hybrid structure/radiant cooling + vapour compression air conditioning systems. (Activity 6) (Activity 7) **6) Climate Polluting Air Conditioning systems:** Conventional Window, Split, Packaged, Basics of Centralized Air- conditioning system, Water & Air Cooled Chillers, Air Handling Units, Basics of duct sizing and routing, preferred locations of equipment and Architectural Requirements of various equipment. Illustration of duct layout through a small example. (Activity 8) **7) Specialized Air Conditioning Systems:** Clean Rooms, Server, Hub & UPS Rooms, Operation Theatres etc.	
Teaching-Learning Process	1) The subject teacher can use PPTs & Videos to teach basics of the topics 2) The students need to work on the assignments given by the teacher. 3) Quizzes, models, seminars from students can be encouraged.

Module-3	
MECHANICAL TRANSPORTATION SYSTEMS IN BUILDINGS **8) Elevators:** Types of Elevator systems, design considerations like Peak Handling capacity, Average Waiting Time, Lift speed etc., Architectural Requirements & Details for Elevator shaft - Elevator pit - Elevator Machine Rooms, Automatic Rescue Device for Elevators , Elevator car interiors, Possible Location and arrangements of Elevators in a building. Lift Acts and National Building Code. **9) Escalators &Travelators:** Applications, Calculation of Traffic capacity, Location and arrangements of escalators and travelators, inclination factor.	
Teaching-Learning Process	1) The subject teacher can use PPTs & Videos to teach basics of the topics 2) The students need to work on the assignments given by the teacher. 3) Quizzes, models, seminars from students can be encouraged.
Module-4	
FIRE SAFETY IN BUILDINGS & PASSIVE FIRE PROTECTION **10) Introduction:** Classification of fire, causes & hazards**;** Grading of structural elements for its fire resistance as per NBC. Classification of building types as per NBC and brief description of characteristics of combustible and non combustible materials. **11) Concepts in passive fire protection in buildings**: Escape routes, fire driveways, fire refuge area, fire assembly areas, pressurization, travel distance, fire tower and compartmentation, fire signage's etc.	
Teaching-Learning Process	1) The subject teacher can use PPTs & Videos to teach basics of the topics 2) The students need to work on the assignments given by the teacher. 3) Quizzes, models, seminars from students can be encouraged.
Module-5	
ACTIVE FIRE PROTECTION AND FIRE SAFETY IN HIGH RISE BUILDINGS **12) Active fire control:** Basic concepts in fixed fire fighting installations, Fire sprinklers, Fire Hydrants, Automatic fire detection and alarm systems. **13) National Building Code Requirements for Fire Safety**: Rules for Fire Protection and Fire Fighting Requirements for High Rise Buildings in India.	
Teaching-Learning Process	1) The subject teacher can use PPTs & Videos to teach basics of the topics 2) The students need to work on the assignments given by the teacher. 3) Quizzes, models, seminars from students can be encouraged.

Course outcome (Course Skill Set)

1) The students will be able to learn and compare various aspects of air conditioning. Vertical transport systems and fire safety in buildings.
2) The students will be able to incorporate these systems in an architectural design
3) The students will be able to appreciate the importance of the specialists and will be able to coordinate them while designing a building..

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks (25 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 40% (20 Marks out of 50)in the semester-end examination(SEE), and a minimum of 50% (50 marks out of 100) in the CIE (Continuous Internal Evaluation) and a minimum of 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. Based on this grading will be awarded.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

- At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Theory paper will be out of 100 marks and will be **scaled down to 50 marks.**

Suggested Learning Resources:

Books

1) Roy J Dossat , "Principles of Refrigeration" 1961, John Wiley & Sons.
2) ManoharPrasad , "Refrigeration & Air Conditioning Data Hand book" 2013, New Age International, 2nd edition.
3) Don Kundwar , "Refrigeration and Air Conditioning", 2016, DhanpatRai& Co. (P) Limited.
4) "National Building Code of India (NBC)", 2016, Bureau of Indian Standards
5) Walter T. Grondzik, Alison G. Kwok, "Mechanical and Electrical Equipment for Buildings", 2010; 11th edition, Wiley Publication.
6) Shan K. Wang , "Handbook of Air Conditioning and Refrigeration", 2000, McGraw-Hill Edu.
7) "National Building Code of India (NBC) 2016"; Part 8 Section 3 and 5 & Part 3 & 4, BIS.
8) NFPA 101
9) IS Codes -
    - 1391 (Part 1 & 2) : 1992 - Specification for room air conditioners
    - 8148 : 2003 - Specification for packaged air conditioners
    - 4591 : 1968 - Code of practice for installation and maintenance of escalators
    - 14671 : 1999 - Hydraulic lifts
    - 14665 : 2000 - Traction lift
    - 15259 : 2002 - Home Lifts
    - 15330 : 2003 - Lifts for handicapped persons; IS codes for Fire Services

Web links and Video Lectures (e-Resources):

- https://ndl.iitkgp.ac.in
- http://fairconditioning.org/knowledge-resources/#209-active-cooling
- https://www.youtube.com/watch?v=E1VY4s-yiQo
- https://www.youtube.com/watch?v=4z_odywmsyM
- https://www.youtube.com/watch?v=ofT7PLlaxIE
- https://www.youtube.com/watch?v=1pGx6XmGEnE&t=36s
-

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Acitivty 1: Air Conditioners' Other 'Side': To experience the heat released by AC's into the atmosphere, Students will realize that our urban 'thermal-excess-comfort' is causing great discomfort to all the invisible, silenced, excluded, marginalized (further details found in Fairconditioning's Pedagogy Manual for Architecture Teachers - Active Cooling Module: http://fairconditioning.org/knowledge-resources/#209-active-cooling

Activity 2: AC vs Fan: Energy Consumption - To compare the energy consumption of a fan vs a room air conditioner, Students will realize that an air conditioner consumes much more energy than a ceiling fan. (further details found in Fairconditioning's Pedagogy Manual for Architecture Teachers - Active Cooling Module: http://fairconditioning.org/knowledge-resources/#209-active-cooling

Activity 3: Psychrometric Pathway Plot for Cooling of Air - To plot the psychrometric pathway for cooling air, Students will develop a deep understanding of psychrometry and variables in the psychrometric chart (further details found in Fairconditioning's Pedagogy Manual for Architecture Teachers - Psychrometry Module: http://fairconditioning.org/knowledge-resources/#206-psychrometry

Activity 4: C ooling Load Estimation of a Space - To estimate the AC Tonnage (TR) required for combatting the typical fresh-air cooling load in a bedroom, Students will understand the procedure to be followed in calculating heat load requirements of a built space (further details found in Fairconditioning's Pedagogy Manual for Architecture Teachers - Psychrometry Module: http://fairconditioning.org/knowledge-resources/#206-psychrometry

Activity 5: Air Volume to be Cooled in Buildings - To critique the idea of cooling the entire volume of building when the volume 'used' by persons is a small fraction, Students will realize that cooling the entire volume is an inefficient way of cooling the building. Instead air vent nozzles can be used to cool certain points in buildings.

Activity 6: Air: Insulator & Coolant? - To critique air as a cooling medium, Students will realize that air conditioning is an inefficient method to cool buildings (further details found in Fairconditioning's Pedagogy Manual for Architecture Teachers - Sustainable Cooling Technology Module: http://fairconditioning.org/knowledge-resources/#232-sust-cooling-technologies

Activiy 7: Radiant Cooling Effect from a Pre-cooled Room - To experience the radiant cooling effect from a pre cooled room, Students will comprehend the cooling effect from radiant cooling systems. (further details found in Fairconditioning's Pedagogy Manual for Architecture Teachers - Sustainable Cooling Technology Module: http://fairconditioning.org/knowledge-resources/#232-sust-cooling-technologies

Activity 8: Carbon offsets from AC's. To estimate the number of trees required to offset GHG emissions of refrigerants from ACs installed in college buildings. Students will realize that offsetting carbon emissions from air conditioners by planting trees is an impractical solution.

V Semester

Building Structure -IV			
Course Code	**21ENG56**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks(VIVA)	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	--

Course objectives:

1. *To Gain understanding of Steel Structural Systems including composite construction and fundamental principles and structural behaviour of steel buildings in withstanding gravity, lateral (seismic and wind), and other environmental forces.*
2. *To understand the process of the design of structural steel systems and the design of simple steel structures.*

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1) The teacher can use PPTs, Videos to discuss Structural Steel and its application in buildings.
2) The students need to sketch various Structural Steel components in a simple on building
3) Quizzes, models, seminars from students can be encouraged

Module-1

1) Structural Steel: Different kinds of Steel, their Basic characteristics of Steel & Light Gauge Steel materials.

2) Concepts of design of Steel Structures: Introduction to the concept of Working Stress Design and Load and Resistance Factor Design.

3) Steel Structural Systems: Introduction to Rigid Portal Frames design of a one story industrial building 18M X 48m with two-bay mezzanine office floor. Project work to include a framing plan for both the industrial building and the mezzanine, an approximate design of structural frame elements, columns and beams. Introduction to available sections in structural steel used in the design of frame elements (Indicative).

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the subject/concepts 2) The students need to visit sites to understand the Concepts of Design. 3) Quizzes, models, seminars from students can be encouraged.

Module-2

4) Introduction to National Building Code: IS 800: Criteria & Design to satisfy ECBC and National Building Codes and Standards, Dead and Live load calculations as per IS875 (Part1&2). Determine the general loads to be considered in the design of the structure, based on the type of occupancy for each area specified.

5) Rigid Frames design-1: Properties of Indian standard rolled steel section and general framing arrangement of beams and columns for the one story 18M X 48m industrial building.

6) Rigid Frames design-2: Design of Rigid frame including selection of frames according to the span, spacing and frame configuration using steel manuals.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the NB Codes. 2) The students need to visit sites to understand the Concepts of Rigid frames. 3) Quizzes, models, seminars from students can be encouraged.

Module-3

7) Composite Flooring Systems: Discussion on steel-concrete composite construction using steel beams, metal decking and concrete, including the role of shear connectors' attachment to the beam for composite action.

8) Composite flooring systems design for mezzanine: Loading and Analysis (Moment diagram to be provided) and design of composite steel decking with concrete topping.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the subject/concepts 2) The students need to visit sites to understand the Concepts composite flooring system. 3) Quizzes, models, seminars from students can be encouraged.

Module-4

9) Rigid frame elements design-1: Steel Structural Column design using IS special publication for the design of steel structures [SP-6 (1)].

10) Rigid frame elements design-2: Steel Structural Beams and trusses design using IS special publication for the design of steel structures [SP-6 (1)].

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss the subject/concepts 2) The students need to visit sites to understand the Concepts of Design.. 3) Quizzes, models, seminars from students can be encouraged.

Module-5

11) Drawings and Specifications for the Rigid frame design: Structural design criteria, including loads used, calculations, drawings and detailing, and steel tonnage calculation.

12) **Field Inspection of Steel Construction Site:** ***The project work to include documentation and a report about the observations, learning and findings at Site***

Teaching-Learning Process	Minimum one plate on loading calculation on each Structural steel topic

Course outcome (Course Skill Set)

1) The students will be able to learn the importance of Structural steel in a building.
2) The students will be able to analyse structural steel system in buildings.
3) The students will be able to understand the IS Codes and expect the structural drawings for buildings are complied with the codes.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 50% marks individually both in CIE and 40 % marks in SEE to pass. Semester End Exam (SEE) is conducted for 50 marks (Viva-voce) and a minimum of 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. Based on this grading will be awarded

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

- At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The student needs to submit his/her works done throughout the semester, including rough sheets for the Viva examination, at least one day prior to the Viva work examination to the course teacher/coordinator.
1. The Viva-voce will be evaluated by an external teacher appointed by the University along with Course teacher or an internal examiner.
2. The SEE marks list generated is to be signed by both internal and external examiners and submitted to VTU in the sealed cover through the Principal of the institution.

Suggested Learning Resources:

Books

1) Martin Bechthold, Daniel L Schodek, STRUCTURES - PHI Learning Private limited

Web links and Video Lectures (e-Resources):

- https://ndl.iitkgp.ac.in
- https://www.youtube.com/watch?v=GDs1HiWPZ2U
- https://www.youtube.com/watch?v=KWnBNf1INfs
- https://www.youtube.com/watch?v=_JMtIkNkzbk
- https://www.youtube.com/watch?v=l0s9CVmusmY
- https://www.youtube.com/watch?v=2Wamzp4TaOE

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1) Site visit to evaluate rigid frames in a building.
2) Seminar by students in groups on their learnings.

V Semester

Building Information Modelling			
Course Code	21ARC57	CIE Marks	100
Teaching Hours/Week (L:T:P: S)	0:0:4:0	SEE Marks	--
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	-

Course objectives:

To develop awareness and familiarity with Advanced Computer applications in Architecture and to equip students with skills required in using digital tools to conceive, develop and present architectural ideas.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1) The teacher can use PPTs, Videos to discuss commands, tools and other application in making a 3D drawing.
2) The students need to practice the commands and tools in a simple building drawing.
3) Quizzes, virtual models, seminars from students can be encouraged.

Module-1

1) **Introduction to advanced popular 3D modelling software**– e.g. 3DStudio Max, Maya, Rhinoceros and other appropriate software. Introduction to online resources, blogs, tutorials.
2) **Concepts of NURBS modelling** :(curves and surfaces), curve / surface editing, solid modelling, layer management, etc.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss commands, tools and other application used for 3D modelling software. 2) The students need to practice the commands and tools in a simple building drawing.

	3) Practice the use of software to develop skills in NURBS modelling.
Module-2	
3) **Classroom exercise to demonstrate 3D modelling of transformed/ modified/complex 3D objects**: for e.g. twisted tower, deformed cube, sliced cylinder. Introduction to file conversions and interdependencies between 3D modelling software and 2D drafting software, e.g. Rhinoceros to AutoCAD, or any other relevant CAD software. Conversion of 3D model(of transformed/modified objects) to 2D drawings (e.g. plan, section, elevation) **4) Conversion of Architecture/interior design project into NURBS modelling project:** For e.g. measured drawing of classroom, Architecture School, computer room etc.	
Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss commands, tools and other application used for a 3D Object drawing. 2) The students need to practice the commands and tools in a complex building drawing. 3) Practice the use of software to develop skills in NURBS modelling.
Module-3	
5) **Working on 3D modelling & Visualisation software with rendering:** such as 3DS Max OR Maya or any other appropriate software. **Concepts of solid modelling**: polygonal modelling, modifier, application of materials, simple timeline animations. **Techniques of 3D visualisations** – Introduction to tool settings in 3D rendering engines for photo-realistic rendering. Application of materials and Simple Timeline animations, For e.g. using VRay, Maxwell, Flamingo, Mental Ray or any other appropriate software, Classroom demonstration of objects, of simple Architecture design projects.	
Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss commands, tools and other application used for a 3D drawing. 2) The students need to practice the commands and tools in a simple building drawing. 3) Practice the use of software to develop skills in rendering.
Module-4	
6) **Working on Graphics/Vector/Image editing software**: To present Architecture design studio projects –Introduction to publishing tools for creating presentations and portfolios.	
Teaching-Learning	1) The teacher can use PPTs, Videos to discuss commands, tools and other application used for an image editing exercise.

Process	2) The students need to practice the commands and tools in a simple building drawing. 3) Practice the use of software to develop skills in Graphics presentation. .

Module-5

7) **Project 1** – Classroom exercise to convert architecture design project 2D drawings (of semester 3 / 4 OR any simple one to three-storied building) into 3D model using relevant software. Project to be rendered using an appropriate 3D visualisation software

8) **Project 2** – Classroom demonstration/exercise of image rendering/collage using Graphics/Image editing software (for e.g., adding context to visualisations), foreground, backgrounds etc.

   Project to include presentation of final outcomes in the form of drawing panels, booklets, posters.

9) Usage of software/tools to assess the life-cycle carbon footprint of buildings including emissions from cooling systems and refrigerant use, and analyzing trade-offs between increased embodied carbon emissions for high thermal mass, high caliber insulation, glazing and other materials and reduced operational phase carbon emissions through increased energy efficiency.

Teaching-Learning Process	1) The teacher can use PPTs, Videos to discuss commands, tools and other application used for a class room exercise in 3D visualization modelling. 2) The students need to practice the commands and tools in a simple building drawing. 3) Practice the use of different software to create 3D drawing. 4) Crate awareness on the softwares used in the analysis of Green Buildings.

Course outcome (Course Skill Set)

1) The students will be able to develop the skills in CAD and other software in 3D designing.
2) The students will be able to use the learnings for their academic projects in higher classes.

Assessment Details (both CIE and SEE) `

(methods of CIE need to be defined topic wise i.e.- Studio/lab discussions, Reviews, Time problems, test, Seminar or micro project)

The weightage of Continuous Internal Evaluation (CIE) is 100% and there is no Semester End Exam (SEE) .The student has to obtain a minimum of 50% marks in CIE and is conducted for 100 marks. Based on the CIE marks grading will be awarded.

Continuous Internal Evaluation:

Methods suggested:

1. Studio discussions, Reviews, Time problems, CIE tests, Seminar or micro project,Quiz, report writing etc.
2. The class teacher has to decide the topic for the Design and Seminars if any, in the beginning only. The teacher has to announce the methods of CIE for the subject in advance in writing.

Semester End Examination:

1. There is no Semester End Exam (SEE) The CIE marks list generated is to be signed by the internal examiners and submitted to VTU as per the procedure through the Principal of the institution.

Suggested Learning Resources:

Books

1. Internet resources, blogs, and learning resources on the web of popular 3D modelling software and NURBS modelling,
2. Vector/Graphics/Image editing software

Web links and Video Lectures (e-Resources):

- https://ndl.iitkgp.ac.in
- https://www.youtube.com/watch?v=92VvxRtZ_Tk
- https://www.youtube.com/watch?v=wY3rezjj9es
-

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1) Working on a 3D drawing of a building of the Institute.
2) Group work on a Campus design with rendering.

V Semester

Elective-3			
Course Code	**21ARC58**	CIE Marks	100
Teaching Hours/Week (L:T:P: S)	2:0:0:0	SEE Marks	--
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	-

Course objectives:

1) To gain experience in aspects of Architecture not offered in the regular curriculum.
2) To study particular areas of the curriculum in greater depth.
3) To explore career opportunities in the allied fields.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1) The teacher may use conventional method or an innovative method to deal with the subject.
2) The students need to work with hands on experiences to gain an expertise of the chosen field.
3) The teacher needs to use performance assessments to develop real life skills in the students.

a) ALTERNATE BUILDING TECHNOLOGY AND MATERIAL

OBJECTIVE:

1. Introduce students to overall understanding of Building Technology and Material.
2. Introduce details of Building Material and Alternate Techniques of Building.
3. Introduce students with relevant examples.

OUTLINE:

1. Introduction to building material: Soil, types of soil, characteristics of soil, simple tests conducted at site, Bamboo as building construction material, properties, types, joinery details with examples.
2. Masonry wall- SMB (Stabilised Mud Blocks), Hollow clay blocks, Cement blocks – Making of blocks, Properties, Specifications and Applications with examples.
3. Mud wall, Rammed Earth Wall- Making of wall, Properties, Specification and Application with examples.
4. Alternate method for Foundation, Lintel and Chajja. Roof-Dome, Arch Panel Roof, Vault using SMB, Clay blocks with examples .
5. Concept of Ferro Cement structure, Building Components made out of Ferro cement such as Roof, Wall, Staircase with examples.

NOTE: Field visits to be arranged by teachers. Group work could be encourage.

REFERENCES:

1. K S Jagadish, "Building with Stabilised Mud"; IK International Publishing House PVT Ltd.
2. K S Jagadish, B V Venkatarama Reddy, K S NanjundaRao, "Alternative Building Materials and Technology"; New Age International Publishers.
3. Jules J A Janssen , "Building with Bamboo-A Handbook".
4. Chris Van Uffelen , "Bamboo Architecture and Design(Architecture and materials)".

5. Laurie Bakers work.
6. Documentation "Earth Architecture", Auroville.

Hassan Fathy's work.

b) DIGITAL ARCHITECTURE

OBJECTIVE:

Digital Architecture strategically utilizes digital media in the process of its

architectural design. Provide students with a strong foundation in the process of

Digital design.

Training tools to comprehend Conceptual Design through the early design stage, design-development, analysis and representation of architectural spaces.

OUTLINE:

This course uses **theoretical and practical study** to examine how digital tools and processes can be developed and applied to design built environments. Vis-à-vis Architects conventional approach of Architects.

a) Introduction to Digital Architecture:

Exploration of new design process in architecture, Exploration and case study of various available Design process involving digital media.

SESSIONAL WORK:

Cases study of available approaches on utilisation of Design tools leading to presentation of case studies and examining pros & cons and suitability of various Design approaches.

b) Parametric Architectural Geometry

Explore parametric software as a first stage of learning software for replicating ideas in to 2D & 3D forms.

SESSIONAL WORK: Students will be given different small exercises which will be based on the primary stage form development in the parametric software.

c) Geometrical explorations`

Explore the relationships and dependencies of progression concepts and architecture. The exploration will be based on geometrical ideologies to develop relationships and new design process for form generation.

The exercise will explore generative design methodologies through the application progression techniques.

SESSIONAL WORK: Students will work on geometric transformations and an approach for

form generation

d) Simulation, Visualisation

Explore simulation and visualisation, as a first stage of learning software leading to digital publication

SESSIONAL WORK: Students will be given small exercises which will be based on the primary stage form development for visualisation & Publication of creative process and outputs with Desktop and Web tools.

Software: Any relevant and appropriate 3D-modelling , visualisation software can be used forsessional work

REFERENCES:

1) Contemporary techniques in Architecture – by Ali Rahim
2) Digital Tectonics, Digital Cities AD: Architectural Design – Prof. Neil Leach

Digital to from control to design –by Michael Meredith

c) ARCHITECTURAL LIGHTING DESIGN

CONTACT PERIODS: 3 (Lecture) per week PROGRESSIVE MARKS: 50

OBJECTIVE: *This course surveys the scope and possibilities of integrating light in architecture*.

OUTLINE:

Architectural spaces are designed for a specific purpose, and are sometimes constructed through a specific theme to create such experiences. The aspect of light in architecture is a crucial element in the fabrication of such spatial experiences as illustrated below:

1. Introduction: Quantitative vs Qualitative aspects of lighting design.
2. Experiencing Architecture: Fundamentals and factors that shape spatial experiences ranging from emotion, memory, imagination, aesthetics, culture etc.
3. Seeing Form-Space Relationships in developing lighting strategies.
4. Relationship between man, light and space.
5. A primer to Place-Making through light in architecture.
6. Light in Architecture – Conceptual proposal of lighting design for an architectural space using Perception Based Approach.

METHODS:

Presentations by staff to introduce the concepts; Student presentations to take the discussions further. Practical understanding in principles of light and perception through visualisations/calculations/mock-ups.

Students will work on related assignments. They will develop ideas and concepts for lighting projects.

ASSESSMENT:

The group/individual assignments will be assessed via mock-ups, presentations and reports.

REFERENCE:

1. Boyce, Peter R.,(2014),"Human Factors in Lighting"; CRC Press, 3rd Edition.
2. Cuttle, Christopher(2015),"Lighting Design: A Perception Based Approach"; Routledge, 1st Edition.
3. Michel, Lou. (1995), "Light: The Shape of Space: Designing with Space and Light"; Van Nostrand Reinhold.
4. Steffy, Gary R.(2008), "Architectural Lighting Design" by Wiley.
5. Tanizaki, Junichiro,(1977), "In Praise of Shadows"; Leete'S Island Books, 1st Edition.

Zumthor, Peter(2006), "Atmospheres"; Birkhäuser Architecture, 5th Edition

OPEN ELECTIVE:

The college has the discretion to offer an open elective in the areas/subject/field other than already covered under the syllabus. The college can decide to offer need based electives depending on the availability of the expertise. However, the college will require to submit the title of such electives with the course outline stating learning objectives and mode of delivering the content to the Registrar/ Registrar (evaluation) within the 15 days of the commencement of the semester.

Teaching-Learning Process	1) The teacher may use conventional method or an innovative method to deal with the subject. 2) The students need to work with hands on experiences to gain an expertise of the chosen field. 3) The teacher needs to use performance assessments to develop real life skills in the students.

Course outcome (Course Skill Set)

1) To develop desired knowledge and skill in a particular domain of Architecture
2) To develop an understanding of the processes required for the particular subject.
3) To develop an expertise in the chosen field for career enhancement.

Assessment Details (CIE)

(methods of CIE need to be defined topic wise i.e.- Studio/ Class room/Tutorial discussions, Reviews, Time problems, test, Seminar or micro project)

The weightage of Continuous Internal Evaluation (CIE) is 100% and there is no Semester End Exam (SEE) .The student has to obtain a minimum of 50% marks in CIE and is conducted for 100 marks. Based on the CIE marks grading will be awarded.

Continuous Internal Evaluation:

Methods suggested:

1. Studio discussions, Reviews, Time problems, CIE tests, Seminar or micro project, Quiz, report writing etc.
2. The class teacher has to decide the course of learning for the Elective subject, in the beginning only. The teacher has to announce the methods of CIE for the subject in advance in writing.

Semester End Examination:

1. There is no Semester End Exam (SEE) The CIE marks list generated is to be signed by the internal examiners and submitted to VTU as per the procedure through the Principal of the institution.

Suggested Learning Resources:
Books

Web links and Video Lectures (e-Resources):

- https://ndl.iitkgp.ac.in
- https://www.youtube.com/watch?v=bsQBSVJoV04
- https://www.youtube.com/watch?v=HaGFrVGMzb4
- https://www.youtube.com/watch?v=tKcyrlysQwA
- https://www.youtube.com/watch?v=N3HX2yEnCas
- https://www.youtube.com/watch?v=yTOD2emZUSM
- https://www.youtube.com/watch?v=4ORbpY6d9Zk
- https://www.youtube.com/watch?v=slEvHTzAXhE

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1) Students need to explore and meet an expert to understand the subject in a greater depth.
2) Students need to work with hands on experiences to develop desired skills in the field.

V Semester

Physical Education(Sport &Athletics/Yoga & NSS)			
Course Code	**21PE59/21YO59/21NS59**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks(VIVA)	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	--	Exam Hours	--

Course objectives:

Teaching-Learning Process (General Instructions)
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

Module-1

Teaching-Learning Process	
Module-2	
Teaching-Learning Process	
Module-3	
Teaching-Learning Process	
Module-4	
Teaching-Learning Process	
Module-5	
•	
Teaching-Learning Process	

Course outcome (Course Skill Set)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

13. First test at the end of 5th week of the semester
14. Second test at the end of the 10th week of the semester
15. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

16. First assignment at the end of 4th week of the semester
17. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

18. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Suggested Learning Resources:

Books

Web links and Video Lectures (e-Resources):

- https://ndl.iitkgp.ac.in
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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VI Semester

ARCHITECTURAL DESIGN - VI			
Course Code	**21ARC61**	CIE Marks	100
Teaching Hours/Week (L:T:P: S)	0:0:0:8	SEE Marks(VIVA)	100
Total Hours of Pedagogy	95	Total Marks	200
Credits	8	Exam Hours	-

Course objectives:

To enable the students to integrate design with history, theory, building construction and material science in a more informed way.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

4) The contents of the courses shall be taught in an application-oriented manner on a scientific and design basis. The course contents shall be taught and learned in lectures, seminars, labs or workshops, studio exercises and design projects, etc.
5) In-studio exercises the teachers shall take the lead to provide tasks and offer guidance for solutions finding. The students shall work either individually or in groups.
6) In design studios, the students contribute to the processing, analysis and solving of problems of direct professional practice, attended by faculty(s) entitled to conduct the studio and examine. The results shall be defended through drawings; models and reports and evaluated through periodic assessment and finally by a jury or panel, and finally, evaluated through periodic assessment and an end semester examination or viva voce.

OUTLINE:

To understand the role of built environments of increasing complexity by:

a) Intrinsic factors: Size, volume, levels, functional spaces or zones, structural possibilities
b) External factors: site, approach, traffic, climate change, ecology, services
c) Constraints: bye-laws, resource and planetary limits, budget, ideology, attitudes
d) Create an 'Identity' to the Campus through integration of the above.

MODES OF STUDY:

The aim of the studio is to explore STRUCTURING: structuring of a research or a case study, structuring of the program, spatial structuring and informal structuring.

Structuring of research: Case studies, reading material and site studies have to be a directed exercise with the involvement of tutors where visiting the project of concern would be of utmost importance. This studio is also about how one organizes research. It should be mandatory to use analytical models, diagrams to understand the chosen case study in terms of Design Intent, site and spatial structuring. There needs to be emphasis on Graphical consistency and legibility of the study. It is recommended to add a reading list as part of the studio to further enrich this discussion about institutions. Once a week, students could be asked to present the case studies and selected readings to the class.

Structuring program: Studying requirements from various point of views which include

relationship between requirements and values, requirements and phenomenology, area of the site and functional area requirements, issues of public and private domains, open and closed spaces, interrelationship between the various components, formal and informal, service requirements, relationship between whole and the part, requirement and climate etc. information resulting from this exercise becomes the individual's program for the project which can then lead to structuring of space.

PROJECTS

a). One major project and one minor/time project to be tackled in the semester. Institutional projects like facilities of higher learning, such as, Engineering college campus, medical college campus, management institute campus, hotel management institute, Law college campus, Dental college campus, Nursing college campus, Juvenile Correction Centre, etc.

b). The minor project could include a case study documentation of the project proposed for the design intervention. This work could be done in a group and as part of its findings shall be an outline program to be a major project.

In view of the current urban contexts where land is precious and resources are scarce, the project could also be institutional buildings on a small urban plot, on multiple levels and still engage with its context and establish an environment within that captures the essential nature of an institution. However, Project selection is left to the discretion of the tutors.

Project work could be done in 5 stages of activity jointly with research and analysis.

1. Introduction to the initial design parameters which include choice of:

    a. Geography/situation (context)
    b. Constraints (bye-laws, budget, ideology, attitudes, etc.)

2. Spatial structuring: To understand spatial structuring as a set of logical operations after an analytical understanding of the site, surroundings, program and intent expressing diversity of program and its resulting spatial variety and the relationship between the built and the unbuilt established through movement systems ,linkages and nodes etc.

3. Informal structuring: Architecture is an integrative discipline. Establishment of a structure enables reverse integration with other subjects where the students look beyond their studio offering a mechanism to observe the surroundings and document it, understand history and theory analytically, integrate design with building construction, climatic, environmental and material science in a more informed way.

4. The design exercise shall focus on ideas of scale, engagement (social, economic, political, and environmental), hierarchy, public/private space, and challenge the students to reflect on these as part of the design development. The emphasis should be to establish these larger goals as part of the discussion on the nature of an institution. The project and design development should focus on integrating sustainable design in every aspect and process possible, with an emphasis on reducing thermal locals and integrating ventilation, insulation, thermal mass, shading, cool roofs, passive/natural cooling and low energy, low-carbon active cooling technologies; local materials as much as possible; sustainable systems such as storm water harvesting, water recycling and reusing, waste management systems and renewable energy systems and above all response to site context and existing informal systems.

5. Goal of the studio shall be to see the architect as *instigator* - defining the nature of engagement with the city, through the articulation of the program and its relationship with the context. Studio must provoke students to define clearly their agenda and to think of architecture as an active, live engagement rather than a passive and inert one. By having students spell out a hypothesis it then doesn't matter what the type is. This prepares the students to frame a series of questions to address the problem at hand.

Assessment Details (both CIE and SEE)

(methods of CIE need to be defined topic wise i.e.- Studio discussions, Reviews, Time problems, test, Seminar or micro project)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 50% marks individually both in CIE and 40 % marks in SEE to pass. Semester End Exam (SEE) is conducted for 100 marks (Viva-voce) and a minimum of 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. Based on this grading will be awarded

Continuous Internal Evaluation:

Methods suggested:

1. Studio discussions, Reviews, Time problems, CIE tests, Seminar or micro project, Quiz, report writing etc.
2. The class teacher has to decide the topic for the Design and Seminars if any, in the beginning only. The teacher has to announce the methods of CIE for the subject in advance in writing.

Semester End Examination:

1. The student needs to submit his/her works done throughout the semester, including rough sheets for the Viva examination, at least one day prior to the Viva work examination to the course teacher/coordinator.

2. The Viva-voce will be evaluated by an external teacher appointed by the University along with Course teacher or an internal examiner.

3. The SEE marks list generated is to be signed by both internal and external examiners and submitted to VTU in the sealed cover through the Principal of the institution.

Suggested Learning Resources:

Books

1) Roger H. Clark and Michael Pause, " Precedents in architecture", 1984, John Wiley &Sons.
2) Geoffrey H Baker , "Le Corbusier an analysis of form", 1996, Van Nostrand Reinhold.
3) Herman Hertzberger, "Lessons for students in architecture", 1991, Delft University.
4) Charles Correa , "A Place in shade", 2010, Penguin India
5) Rem Koolhaas, "Conversation with students", 1996, Princeton Architectural Press.

Web links and Video Lectures (e-Resources):

- https://ndl.iitkgp.ac.in
- https://www.youtube.com/watch?v=FfJ6j0NjfDo
- https://www.youtube.com/watch?v=TY_aB4TLsUA
- https://www.youtube.com/watch?v=dRKVZZ9Srcc
- https://www.youtube.com/watch?v=_AOzpFXocKI

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Case study and document a campus in a nearby place.

Activity 2: Research and document a building or a campus or a gated community which has implemented several sustainable passive design techniques and approaches (such as waste water, storm water, passive design, energy generation, materials, etc).

VI Semester

Materials and Methods in Building Construction -VI			
Course Code	**21ARC62**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:3	SEE Marks(VIVA)	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	-

Course objectives:

To acquaint the students with construction practices pertaining to structural glazing, Metal Cladding and roofing systems and to study constructional systems and detailing of alternative material doors, windows and partition. This course will also examine their thermal properties, passive cooling possibilities, capabilities for mitigating climate change related impacts (heat, humidity and precipitation) and circularity (recyclability) of each material studied.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. The subject teacher to link the studio work with on site work by arranging site visits in the nearby areas.
2. The Subject teacher to highlight the uses of various types of Glass in a building.

Module-1