



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

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SCHOOL OF BUILDING & ENVIRONMENT

Department of Architecture

Board of Studies meeting for M.Arch.(Building Management) held on 02-07-2020

Venue: Virtual meet in ZOOM platform

Time: 9:20 AM – 12:00 PM

Members present:

External Members	Internal Members	Signature
AR. SARATH C KANTH Design Tech Architects Chennai	DR. DEVYANI GANGOPHAHY Dean & Head Department of Architecture School of Building & Environment	
Signature 	DR. SURESH KUPPUSAMY Senior Professor & Design Chair Department of Architecture	
	AR. SUKIRTHA SURESH Associate Professor	
	AR. RAMESH KUMAR.A Associate Professor	

Special invitees present:

S.No	Name and Designation	Signature
1.	AR. EBIN HARRISON Associate Professor	
2.	AR. SURYA RAJKUMAR Associate Professor	

The proposed curriculum and syllabus 2020 for M.Arch. (Building Management) was accepted with the suggestions made by the external member as given below in the minutes of meeting.

Minutes of the Board of Studies 2020 meeting

A Board of Studies meeting was held as Virtual mode in ZOOM platform on 2nd July 2020 with the following agenda:

1. Welcome address, Opening remarks on the proposal to introduce REGULATION 2020 and the methodology adopted.
2. Comparative analysis of existing R 2015 and proposed R 2020 curriculum structure, R 2020 curriculum structure and Salient Features of Regulation 2020.
3. Detailed discussions on the proposed syllabus (from semester 1 to semester 4) and proposed Regulation 2020.
4. Any other matter with the permission of Chair.

Agenda notes for (R15 / 2) / 1 - Welcome address, Opening remarks on the proposal to introduce REGULATION 2020 and the methodology adopted.

Dr. Devyani gangopadhyay welcomed the Board of Studies External member Ar. Sarath C Kanth and thanked him for accepting the invitation of SIST at a very short notice. She informed the member about the purpose of Board of Studies meeting with particular reference on the revision in M.Arch Building Management course. The syllabus is revised every 5 years to update the course with recent advancements on tools, techniques, and software's knowledge and to rectify the shortfalls in the current course structure. After the welcome note and introduction, the external committee member Ar.Sarath expressed his appreciation about the course that the M.Arch Building Management course is really doing good. Thanking note was given to the committee member by Dr.Devyani.

Dr. Devyani presented the Regulations 2015 - a retrospective, the good practices in the current curriculum about the importance of Dissertation and Pre-Thesis, documentation and analysis in Building management Studio, Professional training of 30 working days and providing common elective subjects to widen the professional choice. She further added the scope of improvement in the regulations 2015 to provide more importance in project scheduling, the need for more quantitative analysis modules and software's workshop for making the course more practical oriented and there is lack of knowledge in technology and sequencing of construction activities. Finally the methodology adopted in the formulation of the new regulations 2020 syllabus and curriculum is coordinated by Ar.Sukirtha Suresh with the discussions and comments from core committee under the guidance of our Design chair Dr.Suresh Kuppuswamy and myself.

Agenda notes for (R2020) / 2 - Comparative analysis of existing R 2015 and proposed R 2020 curriculum structure, R 2020 curriculum structure and Salient Features of Regulation 2020



Ar. Sukirtha Suresh presented the concepts involved in the proposed Regulations 2020 curriculum. She informed in tune with the SIST's requirement, the syllabus 2020 included the Programme educational Objectives (PEO), Programme outcomes and Programme specific outcomes (PSO) for all the courses and detailed for M.Arch Building Management. Course. She further discussed on the comparative analysis of R 2010, R 2015 and R 2020 and briefed on the inclusion of new theory and practical subjects, the subjects that are merged, the shifting of subject to other semesters.

After the detailed discussion on the comparative analysis of the current and proposed regulations, the external committee member Ar.Sarath remarked on the merging of all the building services to one semester is fine. The external member further added his query about the focus of the our Building Management course to be focused in one segment or to be focused on all the segments referred with the course focus of Building economics at NICMAR and Building services and Energy analysis at SPA, Newdelhi. The external committee member also highlighted his thought on the proposed curriculum of regulations 2020 that it has covered everything and its good thing to have choice based subjects as electives.

Furthermore the external committee member Ar.Sarath enquired to Dr.Devyani about the criteria for joining the M.Arch Building Management course and he wished to have a mix of candidates from civil engineering to learn more on managing of whole project in a more analytical approach. Dr.Devyani welcomed the suggestion. Ar.Sarath finalized on the changes are perfectly good and mix of all is good work. The focus can be to certain subjects required like Project Scheduling, Building services, Building economics and life cycle of building can be as elective. It is a good system to introduce electives in semester 3 and 4 to give strength to electives.

Agenda notes for (R2020) / 3 – Detailed discussions on the proposed syllabus (from semester 1 to semester 4) and proposed Regulation 2020.

Ar. Ramesh Kumar presented the detailed syllabus of all the subjects in semester 1. He highlighted the introductive of unit 5 included as constructive assignment to give exposure on the case studies or hands on exposure. He further explained the detailed syllabus of all the subjects in semester 1 and the importance of new course Construction technology for providing knowledge in technology and sequencing of construction activities, Research methodologies in built environment for introducing research activities in the early semester of the course, financial management for broader understanding on the project evaluation of feasibility and life cycle costing for linking up two different stake holders promoter and buyer, the practical subject for introducing project management software 1 to equip with the knowledge on the software's widely available.

After the detailed discussion on the semester 1 subjects, the BOS external committee member Ar.Sarath opened up with his suggestions to bring in industrial exposure to collaborate with industries for sponsored research projects and for all the constructive assignments and projects, the student can work on one small project to integrate



between the subjects. Further the member added to include Energy management software's also in project management workshops.

Ar. Ramesh Kumar presented the detailed syllabus of all the subjects in semester 2. The BOS external committee member Ar.Sarath opened up with his suggestions to do project scheduling with limited resources in their Management studio because often project scheduling does not show on the resource constraints. The member added his comment on the subject Quantitative techniques for which the subject faculty from mathematics or civil engineering need to integrate and work out the statistics to be applicable for Building science. Further the member added a point to expose the students to more software's so that each group of students can explore and share their knowledge with rest of the class.

Ar. Sukirtha continued with the detailed discussion of the subjects in semester 3 and 4, the introduction of two new subjects the operations management, cost accounting and cost benefit analysis. The BOS external committee member Ar.Sarath opened up with his suggestions to mention the size of the company in which the students need to do their professional training. Further the member added a point in finalizing the dissertation topic before they proceed to professional training which helps the student to identify the right choice of the company.

Ar.Sukirtha enquired to the external member for the passing criteria can we mention one publication is mandatory for the candidate in the regulations. The external member Ar.Sarath commented instead of having a rule, the dissertation work is as good as a paper and he suggested to compile all the dissertation work into a journal.

Thereafter the discussion continued with the detail discussions on elective subjects by Ar.Ramesh kumar and Ar.Sukirtha. The BOS external committee member Ar.Sarath opened up with his suggestion to have expert's lectures from industry and government for all the elective subjects. Rework on the subject responsible community action to facilitate large community of people. He further added some of the elective subjects like Building energy analysis and management can be toned down as a principle to go about as a policy and application just as pin-pointed and also suggested to include facility management as an elective because it is important for post occupancy of buildings. Our external committee member Ar.Sarath finally confirmed with the curriculum and appreciated that the elective subjects have become business verticals for the aspirants.

Vote of Thanks

Ar. Ramesh kumar thanked the expert member Ar. Sarath C Kanth for accepting the invitation of SIST in attending the BOS at a short notice. He thanked him for his valuable suggestions on the agenda items presented. He also thanked the Management, Chancellor Mam and President Sir for the support on conducting the BOS in the licensed digital platform, our Dean and Head, Dr. Devyani Gangopadhyay, Senior professor and Design chair Dr.Suresh Kuppusamy, Ar. Ebin Horrison, Ar. Sukirtha Suresh for coordinating the syllabus revision as Core committee and Ar.Surya Rajkumar for their contribution towards the conduct of this BOS meeting.




Minutes approved by:



Dr. Devyani Gangopadhyay
Dean & Head, Department of Architecture,
School of Building & Environment

Internal Member



Dr. Suresh Kuppaswamy
Senior Professor & Design Chair,
School of Building & Environment

Internal Member



Ar. Sarath C Kanth
Design Tech Architects, Chennai
External Expert Member



3rd sem

SARA5301	CONSTRUCTION OPERATIONS MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To acquire vital competencies in production, operations & distribution management, leading to an improvement in job skills.
- Apply concepts of operations management such as Warehouse Planning, Operations & Supply Chain Strategies, and New Product Development.
- Learn to create a balance between operations and supply expertise and general business knowledge by disseminating new techniques in the area of operations management.

UNIT 1	OPERATIONS PLANNING	9 Hrs
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Introduction to OM, facilities and capacity planning plant lay-out design SLP, ALDEP, CORELAP, learning curves and location analysis; Production shop - types, assembly line, and theory of constraints; Material requirement planning (MRP) - master production schedule (MPS), bill of material (BOM), and planning process; Aggregate planning - medium term capacity management, manipulation of demand and supply, chase and level strategies; Business Economics.

UNIT 2	OPERATIONS SCHEDULING	12 Hrs
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Operations scheduling - job order scheduling, heuristics for decision rules, Decision Analysis & Modelling ,Moore's, Johnson's procedure, Economic Common Cycle Scheduling (ECC scheduling).

UNIT 3	INVENTORY MANAGEMENT	9 Hrs
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Introduction to inventory management - ABC analysis, Economic Order Quantity (EOQ) Models and it's variants, inventory control under uncertainty; Logistics Management, Supply Chain Management, Warehouse Management, Value Engineering Concepts,

UNIT 4	PRODUCTIVITY	9 Hrs
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Productivity and work-study - time study, Just in Time (JIT), Kanban System, method study, wage incentive plans, work sampling; Break even analysis; Forecasting.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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ABC analysis for a small project and logistics planning with application of relevant concepts.

Max. 45 Hours

COURSE OUTCOMES

CO1	Interpret the planning of operations as per demand and supply.
CO2	Predict the flow of materials and effectively take decisions for streamlining operations.
CO3	Skillfully plan and control the process of transformed resources as they move through supply networks, and operations.
CO4	Demonstrate the application of the strategic concepts from the perspective of an organization or business unit level.
CO5	Assess productivity with different methods and analysis.
CO6	Analyze and evaluate business operations using basic quantitative analysis techniques.

TEXT / REFERENCE BOOKS

1. Stephen P. Adams, E., Ebert, R. (1994). *Production and operations management*. Delhi: Prentice Hall of India.
2. Bedi, K. (2004). *Production and operation management*. New Delhi : Oxford University Press.
3. Buffa,E.,Sarin,R.(2007).*Modern production / Operations management*. New Delhi : John Wiley & Sons.
4. Chase,R., Jacobs, R. and Aquilano, N. (2012). *Operations Management or Competitive Advantage*, New Delhi :Tata McGraw -Hill.
5. Goldratt, E., Cox, J. (1992), *The Goal*. Barrington: North River Press.
6. Krajewslci, L., Ritzman, L. (2005). *Operations management-Strategy and analysis*. New Delhi :Pearson Education.
7. Mahadevan, B.(2015). *Operations Management: Theory and Practice*, New Delhi : Pearson India Education Services Pvt. Ltd.
8. Panneerselvam, R. (2012). *Productions and Operations Management*, New Delhi: PHI Learning Pvt. Ltd.
9. Stevenson, W. (2012). *Operations management*. New York : McGraw-Hill.

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SBAA5341	COST MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- The objective of the course is to familiarize the fundamentals of cost concepts and their applications in the various phases of the project cycle of construction projects.
- To provide a basic knowledge to carry out the evaluation of projects, computation of Profit on projects, systems and equipments and evaluation of project investment decisions.

UNIT 1	FUNDAMENTALS OF COSTING	9 Hrs
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Cost concepts- cost, costing, cost accounting, cost unit, cost centre. Elements of cost, Classification of cost. Methods of costing. Techniques of costing . Cost Sheet.

UNIT 2	COST ESTIMATES	9 Hrs
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Methods of estimating cost of construction for various work, cost indices, rate of labour and material, analysis of rates , preparation of abstract of estimated cost, use of CPWD schedule of rates, Deriving construction cost as per Bill of quantities .Construction Economics-Elasticity of demand, theory of production, costs analysis, contractors costs, perfect competition, monopoly, monopolistic.

UNIT 3	PREREQUISITES OF CONTRACT COSTING	12 Hrs
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Definition, Essential Requirements, Trade usages, Forms of contract, Termination of Contracts, Labour Contract Negotiated Contracts, Schedule of Prices Contracts, Package Deal Contracts, Demolition Contracts, Responsibilities of the Engineer, Contractor and Owner, Earnest Money and Security Deposits, Mobilization Fund, Tender, Opening of Tenders, Scrutiny of Tenders, Acceptance of Tender, Revocation of Tender, Tender form, Unbalance Tender, Liquidated Damages, Advertisement, contract Documents, Qualification of Contractors, Direct and Indirect Costs, Basic price Contracts. Conditions of Contract: Definition, Object, Importance, Peculiarities, General Provisions, Typical Clauses of the Conditions of Contract, Conditions of Contract in Outlines. Rate Analysis: Purposes of Rate Analysis, Factors affecting, importance, Schedule of Rates, Task works per Day, Rate analysis of typical Items.

UNIT 4	CONTRACT COSTING	9 Hrs
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Contract costing- procedure for recording costs, methods of calculating profit on an incomplete contract. Cost plus contract- escalation clause- retention money- -Percentage completion method – completed contract method.

UNIT 5	CONSTRUCTIVE LEARNING	6 Hrs
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Assignments on Risk Associated with national and international contracts.

Max. 45 Hours

COURSE OUTCOMES

CO1	Interpret cost component and computation of cost of a service or a project.
CO2	Predict the cost of the component of a project after considering qualitative and quantitative factors.
CO3	Skillfully able to compute the profitability of a project
CO4	Demonstrate how to be a successful entrepreneur
CO5	Assess best and successful project
CO6	Analyse and evaluate domestic and global competition in building management.

TEXT / REFERENCE BOOKS

1. Rangwala S.C. (2004) *Estimating ,Costing and Contracts*.Charotar Publications.
2. Dutta B.N.(2006) *Estimating and Costing in Civil Engineering: Theory and Practice, including Specifications and Valuation*. UBS Publication.
3. M. Chakraborty. (2006) *Estimating and Costing*. Authors' Publication.
4. Namavati R.(2010) *Theory & Practice of Valuation*. Lakhani Book Depot.
5. Ramachandran. R. & Srinivasan R. (2004) *Cost Accounting*. Chennai: Sriram publication.
6. Ghosh T. Banerjee & Bansal K. (2001) *Principles and Practice of Accounting*. New Delhi: Galgotia Publishing Company.
7. Hansen, M..(2007). *Managerial accounting*. Haryana: Thomson Publishing House.
8. Mittal, D. and Luv M. (2001) *Cost accounting* .New Delhi : Galgotia Publishing Company.
9. Shankamarayana, H.&Ramanath, H. (2011) *Financial Accounting for management*. New Delhi : Cengage India.
- 10.Singh H. (1993).*Construction management and accounts*. New Delhi : Tata McGraw Hill.
- 11.Venkatasivakumar V. (2011) *Cost accounting management*. Chennai : Pearson.

Devaraj

4th Sem

SARA5401	COST BENEFIT ANALYSIS FOR BUILDING & INFRASTRUCTURE PROJECTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To understand the financial and economic analysis of projects and concept of individual versus social welfare in large infrastructure and construction projects.
- To understand the various parameters and process for Social Cost benefit Analysis.
- To explore the different tools and techniques for financial and economic appraisal.

UNIT 1	SCOPE OF CBA	9 Hrs
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Concept and rationale - social and economic perspective -welfare criterion. Scope of CBA, SCBA, objectives of CBA, steps/procedures of CBA;

UNIT 2	PARAMETERS OF CBA	12 Hrs
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Issues involved in CBA, SCBA -shadow price and externalities, distribution of project net benefits (referent and non-referent groups); Consumer and producer surplus, valuation of rated goods and services, methods of non-market valuation;

UNIT 3	PROCESS OF CBA	9 Hrs
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Process of CBA, SCBA- least cost analysis (Life Cycle Costing); With and without project analysis, Deriving social cost of project using conversion factor; Identifying and deriving benefits to society; Social discount rate.

UNIT 4	FINANCIAL AND ECONOMIC APPRAISAL	9 Hrs
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Calculating ENPV or EIRR; Applying distribution analysis, risk analysis; Case studies -road, power, investment region. Financial and economic appraisal.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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Exercises will be in the form of group work/and or individual assignments. Each group shall have its own unique real life ongoing project for study. Groups are encouraged to have diverse projects so that peculiarities in specific projects are explored by entire class. All group members are encouraged to deliver presentations along with written assignments.

Max. 45 Hours

COURSE OUTCOMES

CO1	Outline the scope of SCBA.
CO2	Get exposure to the issues in SCBA, its various components and valuation.
CO3	Understanding the process of SCBA and its benefits to society.
CO4	Apply quantitative techniques for financial appraisal.
CO5	Formulate a real analysis model after analysis.
CO6	Perform an economic appraisal.

TEXT / REFERENCE BOOKS

1. Anthony, E.(2001).*Cost benefit analysis- Concepts and practices*. New Delhi.: Boardman, Prentice-Hall of India,
2. Asian Development Bank (2013) *Cost-benefit analysis for development: A practical guide*. Mandaluyong City, Philippines: Asian Development Bank.
3. Campbell H., Brown, R. (2003). *Benefits-cost analysis- financial and Economic appraisal using spreadsheets*, Singapore: Cambridge,
4. Campbell, H., Brown R.(2016) *Cost- Benefit Analysis - Financial and economic appraisal using spread sheets*, Oxfordshire: Routledge.



ELECTIVES

SARA7403	LEAN CONSTRUCTION MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To provide exposure to the students on the principles and techniques of lean construction.
- To enhance their skills by training in lean project management software.
- To appreciate Lean management and develop a lean culture.

UNIT 1	INTRODUCTION TO LEAN PRINCIPLES	9 Hrs
Introduction — productivity measurement in projects and work diagnostics; Mapping of lean principles into construction; Lean construction — fundamental concepts; Lean thinking and culture;		
UNIT 2	PROJECT LIFE CYCLE AND LEAN PROJECT DELIVERY SYSTEM	9 Hrs
Project life cycle and lean project delivery system; Lean tools, techniques and measures; Collaborative planning and last planner system; Location based management system;		
UNIT 3	LEAN IN DESIGN AND LEAN TOOLS	12 Hrs
Lean in design and supply chain management; Lean enablers and integration; Application in lean project management software - Master planning; Value Stream Mapping, Visual Management, 5S		
UNIT 4	PLANNING AND PROJECT PERFORMANCE	9 Hrs
Framework for pull planning and constraint analysis; Look ahead planning, weekly work plans , Standup Meetings, Learning PPP, Key performance indicators for plan reliability and project performance.		
UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
Design of pull planning charts, weekly work plans and look ahead charts for display using a case study.		

Max. 45 Hours

COURSE OUTCOMES

CO1	Develop lean thinking and map lean culture in project delivery.
CO2	Interpret the Lean delivery systems.
CO3	Demonstrate skill in applying Lean planning tools.
CO4	Develop pull planning and other visual charts for follow up of project schedules and targets.
CO5	Understand Lean in supply chain management.
CO6	Investigate the key performance indicators and analyze project performance after implementation of lean management techniques.

TEXT / REFERENCE BOOKS

1. Alston, F. (2017), *Lean implementation; Applications & hidden costs*. London: CRC Press.
2. Fidelis, A. Emuze, Tare is io A. Saurin (2015). *Value and waste in lean construction*. London : Routledge, Taylor and Francis.
3. Forbes, L., Ahmed, S. (2011). *Modern construction – Lean project delivery and integrated practices*. CRC Press, New York.
4. Luis Alarc6n (1997). *Lean construction*. New York: Routledge, Taylor and Francis.
5. Shang Gao, Sui Pheng Low (2014). *Lean construction management: The Toyota Way*. Springer.
6. Tapping, D., Luyster, T. and Shuker, T. (2002). *Value stream Management*, New York:Productivity Press.
7. Rafael Sacks , Samuel Korb , Ronen Barak ((2017) *Building Lean, Building BIM: Improving Construction the Tidhar Way*.London : Routledge, Taylor and Francis.

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SARA7402	ENVIRONMENTAL COMPLIANCE AND MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- The course aims to develop competence to understand the environmental compliances and management systems for buildings and infrastructure projects
- To expose students to policies, standards and procedures, related to environmental compliance requirements.
- To develop the necessary skills and sensitivity towards sustainability of built-environment

UNIT 1	INTERNATIONAL AGENDA AND SUSTAINABLE DEVELOPMENT	9 Hrs
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International agreements agendas and protocols; Earth Summit at Rio, 1992 and subsequent developments, Agenda 21; UNFCCC; Copenhagen Accord; Montreal Protocol; Kyoto protocol- CDM, J.I.; Case studies in India under CDM; COPs / United Nations Climate Change Conferences.

Sustainable Development; Concept & elements of sustainable development; Carrying capacity concept and indicators of carrying capacity demonstrated examples; Ecological footprint concept, carbon footprint & sustainability, measures for footprint reduction, learning to use online calculators.

UNIT 2	POLLUTION MANAGEMENT & RENEWABLE ENERGY SOURCES	9 Hrs
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Air & Noise Pollution Management; Air pollutants- indoor, outdoor ; sources; nature; National Ambient Air Quality Standards & for Noise; Air pollution prediction modelling- concept, basic equation, fugitive dust modelling, line modelling, plume modelling, samples-GLC contour maps; Mitigating air and noise pollution in construction projects; Construction and demolition pollution control practices;

Renewable Energy & Green belt designing; Alternate sources of power generation , renewable energy; Solar power-methods of generation, applicability, calculations; Green belt design concepts - choosing location, width and plants according to bio indication, pollution tolerance and agro climatic zones.

UNIT 3	WATER, WASTE WATER & SOLID WASTE MANAGEMENT	12 Hrs
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Water and wastewater management; Assessment of water consumption and waste water generation for different types of buildings; Permissions for water withdrawal for infrastructure projects from Central Ground Water Authority/ Board; Waste water treatment systems (definitions, processes, advantages and disadvantages)- BOD, COD, water quality limits as per Schedule VI and classification of water as per CPCB; Water harvesting- Solid Waste Management; Solid waste generation assessment; - technologies & innovations; Conventional & modern solid waste treatment systems; Area required and methods of composting, vermi-composting; landfill location and features; Biogas plants.

UNIT 4	STATUTORY ACTS & REGULATIONS & EIA	9 Hrs
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Statutory Acts, regulations & Notifications; Environment (Protection) Act 1986; Environment (Protection) Rule, 1986, as Amended to date; other acts, NOC's and Authorities which grant NOCs;. Environmental Impact assessment- methods, procedures, legal framework of EIA; EIA Notification 2006, as amended to date; Steps of environmental clearance (EC); Authorities jurisdictions to grant EC and their scope; Applicability of forest clearance; Formats- Form 1, 1 A; Understanding TOR; Understanding EIA; Generic structure of EIA; Baseline data generation- parameters and methods/ sources for climate, micro meteorology, air, water, noise, soil, drainage, topography, flora, fauna, socio economics, demography, industries, natural phenomenon; EMS - ISO 14001; Scope and Implementation.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	9 Hrs
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Case studies of EIA as relevant to construction projects; Case study and filling of Form 1 & 1A.

Max. 45 Hours

COURSE OUTCOMES

CO1	Articulate the importance of International agreements, agendas and protocols with respect to sustainability.
CO2	Understand pollution management and also identify the various renewable energy sources.
CO3	Outline the quality, quantity and treatment process of potable water, waste water and solid waste management in large projects.
CO4	Learn to make strategic decisions with respect to environmental compliance.
CO5	Appreciate the different policies, standards, procedures involved in environmental clearance for projects.
CO6	Develop the various formats relating to environmental compliance requirements practically applicable for projects, and develop competence in their application.

TEXT / REFERENCE BOOKS

1. Bert P. Krages II (2000) *Total Environmental Compliance: A Practical Guide for Environmental Professionals*, London: CRC Press Published.
2. Christopher Sheldon, Mark Yoxon (2001) *Installing Environmental Management Systems: A Step-by-Step Guide-* Oxfordshire: Routledge;



SARA7303	ADVANCED BUILDING MATERIALS & CONSTRUCTION TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To understand the different construction techniques and their contextual applications.
- To outline the applications of different materials in construction.
- To develop skill in construction detailing of new materials and methods.

UNIT 1	ADVANCED STRUCTURAL SYSTEMS	12 Hrs
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Properties, Application, specification and standards (Indian and International) Shell structure, Domes, Space frames, shell barrel vault, folded plate, tensile structure and Pneumatic structure. Working Details and Case studies.

UNIT 2	ADVANCED BUILDING MATERIALS AND TECHNOLOGIES	9 Hrs
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Introduction, Eco block, Insulated concrete forms(ISF), hydra form, prefabs/Structural insulating panels, Cellulose insulation, adobe, rammed earth, earth sheltered and recycled materials. Properties, Application, specification and standards (Indian and International) Bio materials from Industrial waste, mining waste, mineral waste, agricultural waste. Working Details and Case studies.

UNIT 3	FACADE TECHNOLOGIES	9 Hrs
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Conventional and advanced facades, Double-skin and punctual façades, thermally dynamic facades with PCM & Free-form façades, pneumatic facades with efficient structural systems like diagrids, exo-skeleton, space trusses. Ecological, low energy and cybernetic building. System features of intelligent buildings, I- Facades, advanced embedded photovoltaic cells, micro wind mills and heat filter membranes in facades, BIQ building algae panels, hydroponics, and nanoscale materials and so on. Construction of Facades, Key Design Basis – Structural Integrity, Strength, Deflection, Earthquake & Natural disasters, Thermal performance - Design for safety - Design for serviceability. Codes & Regulations - Allowable limits - Need for Façade Testing - Façade testing & certification - Weather performance, Structural load, Seismic floor displacement, Acoustic performance, Fire test, Thermal & U-Value test - on-site tests

UNIT 4	NEW EMERGING MATERIALS AND TECHNIQUES	9 Hrs
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Properties, Application, specification and standards (Indian and International) Teflon, special glasses, Aluminium composite panels, GFRG panels , Engineered wood products, EPS products, Mivan Technology, Nano technology applications in construction. Working Details and Case studies.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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Drawings and sketches of construction and working details of various materials and techniques with due importance to the stages involved in the process.

Max. 45 Hours

COURSE OUTCOMES

CO1	Understand the different structural systems available worldwide and the standards applicable.
CO2	Outline the different techniques and systems of using green building materials.
CO3	Outline the application of various bio products available for reuse.
CO4	Analyse the properties and use of various emerging materials and their techniques in application.
CO5	Comprehend procedures, standards, codes and working details of material application.
CO6	Evaluate the usability of different products in different situations for proper selection of apt products and techniques.

TEXT / REFERENCE BOOKS

1. William P. Spence (2016) *Construction Materials, Methods, and Techniques* . London: Cengage Learning Custom Publishing
2. Charles J. Kibert (2016) *Sustainable Construction: Green Building Design and Delivery*. New Jersey: John Wiley & Sons Publishing.
3. Ross Spiegel, DruMeadows (2004) *Green Building Materials: A Guide to Product Selection and Specification* Alexandria VA: John Wiley & Sons Publishing.
4. Louise Jones. (2008) *Environmentally Responsible Design: Green and Sustainable Design for Interior Designers* .New Jersey: John Wiley & Sons Publishing.
5. Sylvia Leydecker (2008) *Nano Materials: in Architecture, Interior Architecture and Design* .Switzerland: Birkhauser Publishing.



SARA7304	INFRASTRUCTURE DEVELOPMENT AND MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To introduce the basic concepts related to large scale infrastructure development activities
- To develop awareness and expertise in effective management of infrastructure developments projects with the knowledge in planning, management and effective delivery of large scale infra projects.

UNIT 1	INTRODUCTION TO INFRASTRUCTURE	9 Hrs
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Overview of infrastructure, Introduction to infrastructure business – Study of various types of infrastructure sectors – Energy (oil and gas, renewable energy, thermal power, hydroelectric power, nuclear power)- building infrastructure - transportation (highways, railways, water ways, airways) power and telecom sectors – Rural, Urban infrastructure and irrigation sectors (dam channels and canals etc.), players and phases in infrastructure projects.

UNIT 2	PROJECT FINANCE AND APPRAISAL	12 Hrs
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Infrastructure Project Feasibility – Appraisal and Due Diligence; Life cycle perspective of Infrastructure; Project Implementation approach - Project Finance and public private partnerships (PPP's) – Special Purpose Vehicle (SPV), VGP's; Cash Flow projections, Net Present Value (NPV), Internal Rate of Return (IRR) - social cost benefit assessment of infrastructure – short run cost functions; budget and revenues from usage - Life cycle costs, taxes and finance; Long run investment decisions and cost functions; Decision Analysis.

UNIT 3	FINANCIAL INSTITUTIONS AND POLICIES	9 Hrs
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Government policies and regulations; 5 year plan and impact on infrastructure development - Infrastructure institutions – Infrastructure financing; means; investment norms and regulations.

UNIT 4	PROJECT STRUCTURING AND RISK	9 Hrs
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Infrastructure Project Management; Project Planning and Management; Strategic Planning; Risk & Sensitivity Analysis techniques; Typical DPR structures - Construction and Economic risks; Political and Social Risks; Project Life cycle, approaches project formulation and structuring, elements of Bids Process Management and risk management.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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Analysing and presenting various types of infrastructure projects for a hypothetical situation with the financial proposal and the execution strategy. List and present the various financial institutions with their investment strategies for the infrastructure projects.

Max. 45 Hours

COURSE OUTCOMES:

CO1	Familiarizing the various types of infrastructure projects and their nature compared to building projects.
CO2	In-depth understanding on project financing appraisal process for infrastructure projects
CO3	Analysing the project finance strategies for different types of projects with decision-making analysis as a process.
CO4	Knowledge on the various types of financial institutions and their policies on funding infrastructure projects.
CO5	Understanding and application of various planning and management techniques to mitigate risks in the execution of infrastructure projects.
CO6	Comprehensive understanding of planning, bidding, funding and execution of infrastructure projects through case study and analysing the investment strategies.

TEXTS / REFERENCE BOOKS

1. Prof.Ashish H. Makwana, Prof. Yogesh K. Alwani, Prof.Kunal. P. Shukla, Dr.Jayeshkumar and R.Pitroda, Infrastructure Engineering and Management, LAP Lambert Academic Publishing, 2008.
2. Donald Coffelt and Chris Hendrickson, Fundamentals of Infrastructure Management, 2017. Pittsburgh, Pennsylvania, USA.
3. S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
4. Grig N.S., "Infrastructure Engineering and Management", Wiley – Interseience,1988.
5. P. Chandra, Projects planning, analysis, selection, financing, implementation, and review, Tata McGraw-Hill, New Delhi, 2009.
6. Alvin S. Goodman and Makarand Hastak, ASCE Infrastructure Planning, Engineering and Economics, second Edition.,McGraw-Hill Professional,2015.
7. Hendrickson, C. and Mathews, H.S.,2011. Civil Infrastructure Planning, Investment and Pricing. Pittsburgh. PA: Carnegie-Mellon University
8. India Infrastructure Reports (latest as available) from various agencies such as CRISIL, Knight Frank, EY and PWC.
9. Department of Commerce, Ministry of commerce and Industry, Government of India. Sectorwise report from India. Brand Equity Foundation (IBEF); Available at <http://www.ibef.org/industry.aspx>

