SYLLABUS

OF

M. TECH

(Construction Technology and Management)

II YEAR

DEPARTMENT OF CIVIL ENGINEERING

INTEGRAL UNIVERSITY LUCKNOW

SYLLABI AND EVALUATION SCHEME

M. Tech. (Construction Technology & Management)

(w.e.f. 2020-21)

Semester – III

S. No.	Course Category	Code No	Name of Subject	Periods			Credits	Evaluation Scheme				Subject Total
				L	T	P	C	Continuous Assessment (CA)			Exam ESE	
								UE	TA	Total		
1	DE		Elective –I	3	1	-	4	40	20	60	40	100
2	DE		Elective –II	3	1	-	4	40	20	60	40	100
3	DC	CE653	Sustainable Design & Value Analysis	3	1	-	4	40	20	60	40	100
4	DC	CE654	Directed Study	-	-	-	4	-	-	-	100	100
5	DC	CE699	M.Tech Dissertation	-	-	-	4	-	-	60	40	100
Total							**20**					**500**

Semester – IV

S. No.	Course Category	Code No	Name of Subject	Periods			Credits	Evaluation Scheme				Subject Total
				L	T	P	C	Continuous Assessment (CA)			EXAM ESE	
								UE	TA	Total		
1	DC	CE699	M.Tech Dissertation	-	-	-	4	-	-	60	40	100
2	DC	CE699	M.Tech Dissertation	-	-	-	4	-	-	60	40	100
3	DC	CE699	M.Tech Dissertation	-	-	-	4	-	-	60	40	100
4	DC	CE699	M.Tech Dissertation	-	-	-	4	-	-	60	40	100
Total							**16**					**400**

TA- Teacher Assessment; **ESE –** End Semester Examination; **CT-** Cumulative Test.
Note: Duration of ESE shall be 03 (Three) hours per subject

M. Tech (Construction Technology & Management)

List of the Elective Paper:

Elective – I

CE544	Urban Transportation System Planning
CE641	Ready Mix Concrete Design and Quality Control
CE642	Maintenance & Rehabilitation of Structures
CE643	Prefabricated Structures
CE644	Solid & Hazardous Waste Management

Elective – II

CE647	Transportation Economics
CE648	Principles of Affordable Housing
CE649	Building Services & Maintenance Management
CE650	Construction Information Systems

Integral University, Lucknow

Effective from Session:							
Course Code	CE544	**Title of the Course**	Urban Transportation System Planning	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	**3**	**1**	**0**	**4**
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	To develop the understanding of Transport planning and its characteristics of different types of Transportation systems along with design and logistics optimization techniques.						

Course Outcomes	
CO1	Understand historical development, Acts, classification, planning of roads in India and transport modes
CO2	Perform travel behavior analysis with the study of travel demand.
CO3	Understand basic requirement and methods for transport planning
CO4	Design the public transport system
CO5	Understand legislation and policies affecting logistics

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Introduction to transportation planning; systems approach to transportation planning; types of models; Transportation Systems, urbanization and transportation systems, concept of travel demand and supply; Hierarchy of roads and Capacity: Concept of PCU, capacity and level of service, factors affecting capacity and level of service; capacity of rural and urban roads.	08	1
2	Transport System	Socio-economic, land use, network, and transport system characteristics affecting transportation planning; study area definition, zoning principles, cordon and screen lines, data collection through primary and secondary sources, sampling techniques;	08	2
3	Transportation Planning & Surveys	Transportation planning surveys, transportation planning process; trip generation, modal split, and trip assignment;integration of different modes; travel demand management measures.	08	3
4	Transport Facility Design	Public Transportation and Transport Facility Design: Technology in transportation, public transport systems, design of parking facilities, design of pedestrian facilities, design of cycle tracks, design of bus facilities, terminal and its functions, transit planning, transit demand, transit route network.	08	4
5	Freight Transport	Logistics concepts, important decision areas in logistics, logistics service providers, brief descriptions of legislations, policies and emerging issues affecting logistics, third party logistics, benchmarking, reverse logistics, city logistics, ITS application, e–logistics Determinants of freight demand, distribution channels, and distribution costs.	08	5

Reference Books:

P. Chakroborty and A. Das, Principles of Transportation Engineering, Prentice Hall of India Pvt. Ltd., 2003.

B.G. Hutchinson, Principles of Urban Transport Systems Planning, McGraw- Hill Book Co., New York, 1974.

L.R. Kadiyali, Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2000.

G. E. Gray and L. A. Hoel, Public Transportation, Prentice Hall, New Jersey, 1992.

e-Learning Source:

https://nptel.ac.in/courses/105107067/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1
CO2	2	2	1	0	0	0	0	0	0	0	1	1	1	1	1
CO3	2	1	2	0	0	0	0	0	1	0	1	0	1	0	0
CO4	2	0	2	0	1	1	1	0	0	0	1	0	0	0	0
CO5	1	1	1	0	1	0	1	0	0	0	1	0	0	0	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	CE641	**Title of the Course**	Ready Mix Concrete Design and Quality Control	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	• To develop knowledge of Ready mix concrete production as a quality control manager as well as concrete production plant manager • To develop the understanding of different preproduction elements like source selection etc. • To develop the understanding of different constituent material and its behavior • To develop the understanding of concrete production and its delivery.						

Course Outcomes	
CO1	Knowing the principals of strength and durability of concrete, learner will be able to distinguish between alternatives and can select suitable material
CO2	Knowing the quality requirement of concrete making materials, Learner will be able to satisfy it by following sampling procedure and design the concrete mix with required attributes
CO3	Given the properties cement and aggregates, learner will be able to prepare a quality assurance plan and ensure the application of it
CO4	Given the properties fine aggregates, mixing water and concrete, learner will be able to prepare quality assurance plan and perform quality verification using different tests
CO5	Given the production and delivery conditions, learner will be able to calculate the effective production on RMC plant and optimize delivery schedule with financial efficiency

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Material Properties	Cement; Introduction, Portland cement, chemical composition of raw materials, composition of Cement clinker, Hydration of cement, rate of hydration, water requirement for hydration. Aggregates; Introduction, classification of aggregates, characteristic of fine aggregate and coarse aggregate. Water; Introduction, basic properties. Concrete Admixtures; Introduction, effect on strength/characteristics of concrete, physical and chemical properties. Concrete; Introduction, water-cement ratio, gel-space ratio, strength of concrete, maturity, Permeability.	08	CO1
2	Pre-Qualification of Source	Procurement, Storage and Sampling: Source selection, sampling, storage and precautions for cement, aggregates, water, concrete admixtures and concrete. Mix design, Combined grading of aggregates, Moisture content of aggregates, Mix proportion per batch of mixing plant, admixtures for concrete and its use.	08	CO2
3	Quality Control	Testing/checking of materials and test/check frequency Cement; Physical tests- Fineness, Soundness, Standard consistency, Setting time, Compressive strength, Chemical Analysis, Status of Stock record. Test on Coarse/Fine Aggregate; Alkali reactivity, Chloride and Sulphate, Deleterious Material, Crushing Value, Abrasion value, Impact value, 10% fines value, Soundness, Size and Gradation, Flakiness/elongation value.	08	CO3
4	Testing of Material	Specific gravity and water absorption, Density and moisture content, Freedom from impurities. Water; Physical and chemical test, cleaning of storage tanks, Storage adequacy. Concrete; Weigh Mixture, batching plant, Small concrete mixture, vibrators, calibration of Mixtures and Plant. Laboratory Tests Slump test, compressive strength test, Flexural Modules, NDT, Permeability test.	08	CO4
5	Machine Use Optimization	Lead time, plant capacity, TM capacity, working hour, TM availability, city/Govt restrictions.	08	CO5

Reference Books:
"Properties of Concrete", Naville, A.M., Longman, India
"Concrete Technology", Naville, A.M., Longman, India
"Concrete Technology", Gambhir, M.L., TMH, New Delhi, India
e-Learning Source:
https://nptel.ac.in/courses/105102012/
IS:2430-1986 (Reaffirmed-2005)
IS:2386-1963 (Reaffirmed-2002)
IS:1199-1959 (Reaffirmed-2004)

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	0	0	0	0	2	1	1	0	0	0	2	0	0	0
CO2	0	0	3	3	0	0	0	0	0	0	1	1	0	0	0
CO3	3	0	3	3	0	0	0	0	0	0	0	0	0	0	0
CO4	3	0	3	3	0	0	0	0	0	0	0	0	0	0	0
CO5	3	0	0	0	0	3	0	3	0	0	0	3	0	0	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	CE642	**Title of the Course**	Repair & Rehabilitation of Structures	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	To provide knowledge of ready-mix concrete and an overview of quality control measures.						

Course Outcomes	
CO1	To understand the importance of maintenance of structures
CO2	To learn various distress and damages to concrete and masonry structures
CO3	To study the various types and properties of repair materials
CO4	To learn various repair techniques of damaged structures, corroded structures
CO5	To asses the damage to structures using various tests

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction to Concept of Maintenance	Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection,Damage assessment and Evaluation models, causes of deterioration. Case studies of historical constructions.	08	1
2	Quality Assurance	Quality assurance for concrete construction concrete properties – strength, permeability, thermal properties and cracking. –Effects due to climate, temperature, chemicals, corrosion – design and construction errors – Effects of cover thickness and cracking.	08	2
3	Materials for Repairing	Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fiber-reinforced concrete. Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coating and catholic protection.	08	3
4	Requirement Assessment	Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure. Engineered demolition techniques for Dilapidated structures – case studies.	08	4
5	Rehabilitation of Structures	Aging of structures - performance of structures - need for rehabilitation - Distress in concrete / steel structures- damage - source - cause - effects - case studies – Damagetesting methods - NDT – Core samples - Rehabilitation methods - Repair and maintenance of buildings - Seismic strengthening	08	5

Reference Books:

Concrete Technology – Theory and Practice, Shetty, M. S, S.Chand and Company, New Delhi, 1992.

Learning from failures– Deficiencies in Design, Construction and Service – R& D Centre (SDCPL), Raikar, R.,Raikar Bhavan, Bombay, 1987.

Maintenance and Repairs of Buildings, P.K.Guha, New Central Book Agency (P)Ltd, Kolkata.

Concrete Bridge Practice Construction, Maintenance and Rehabilitation, V K Raina, 2nd Edition, Shroff Publishersand Distributors.

e-Learning Source:

https://nptel.ac.in/courses/105/106/105106202/

https://nptel.ac.in/courses/105104030/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	0	0	0	0	0	0	0	0	1	2	1	0
CO2	2	2	1	1	0	0	0	0	0	0	0	0	1	0	0
CO3	2	2	2	1	0	0	0	0	0	0	0	1	1	0	0
CO4	3	2	1	2	1	0	0	0	0	0	0	0	0	0	0
CO5	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	CE643	**Title of the Course**	Prefabricated & Precast Structures	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	To provide knowledge of design of prefabricated and precast structures.						

Course Outcomes	
CO1	An understanding of the advanced principles of design of prefabricated structures
CO2	To analyze the prefabricated load carrying members
CO3	An understanding of applications of prestressing
CO4	To design and detailing of precast joints
CO5	To analyze the production technology of prefabrication

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction and Classification	Introduction, Types of fabrication – Modular co-ordination, components, prefabrication systems and structural schemes; Design considerations; Economy of prefabrication; prefabrication of load carrying members;	08	1
2	Designing of Precast and Pre-fabricated Structures	Disuniting of structures; Design of cross section of load carrying members; Structural behavior of precast structures.Handling and erection stresses	08	2
3	Application of Pre-stressing	Methods of Pre-stressing, Application of pre-stressing of roof members; floor systems; Two-way load bearing slabs, wallpanels, hipped plate and shell structures	08	3
4	Joints in Precast Constructions	Dimensioning and detailing of joints for different structural connections; construction and expansion joints, types of joints,standards for joints.	08	4
5	Production, Transportation & Erection	Organization of production, storing and erection equipment; Shuttering and mould design – Dimensional tolerances; Erection of R.C. structures, Total prefabricated buildings.	08	5

Reference Books:

"Prefabrication with Concrete", A.S.G Bruggeling, G.F Huyghe, CRC Press, January 1991

"Building Design & Erection Using Prefabricated Concrete", IS 8916

"Design of Pre-stressed Concrete", R.L Gilbert, N.C Mickeborough,Taylor & Francis

Architectural Precast Concrete, Pre-stressed Concrete Institute, third edition 2007.

e-Learning Source:

https://nptel.ac.in/courses/105106117/

https://nptel.ac.in/courses/124107001/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	0	0	0	0	0	0	0	0	0	1	1	1	0
CO2	2	2	1	0	0	0	0	0	0	0	0	1	1	1	0
CO3	2	1	2	0	0	0	0	0	1	0	0	0	1	0	0
CO4	2	1	2	0	1	1	1	0	0	0	0	0	0	0	0
CO5	2	1	1	0	1	0	1	0	0	0	0	0	0	0	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

2-

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:							
Course Code	CE644	**Title of the Course**	Solid And Hazardous Waste Management	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	To provide knowledge of disposal and treatment of construction and demolition wastes.						

Course Outcomes	
CO1	Understand the basic concept behind Solid Waste Management and its origin
CO2	Analysis of the requirement and discard pattern of various level society and mitigate the wastage of materials
CO3	Study and scope of various environment legislations
CO4	Understand the treatment processes of construction and demolition waste
CO5	Understand and implement the concept of Solid Waste Management for Hazardous and Non-hazardous waste at different level of society.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Construction and Demolition	Origin, characteristics, Quantity and Analysis; Effects of Construction and Demolition Wastes; Storage, Collection,Transportation of Solid wastes;	08	1
2	Solid Waste Transformation	Product recovery processes; Sanitary landfills; Legislation in solid waste. Hazardous waste: definition, generation,classification; Magnitude of problem; Risk assessment;	08	2
3	Legislations	Environmental Legislation; Characterization and site assessment; Waste minimization and resource recovery; Storage andTransportation of Hazardous wastes;	08	3
4	Treatment of Construction and Demolition Waste	Hazard in processing and treatment; Physical, Chemical, Thermal and Biological processes; Hazardous waste disposal;	08	4
5	Disposal of Construction and Demolition Wastes	Land fill disposal and land storage; Advantages and disadvantages, Ground water contamination; Containment; Remedialalternatives,	08	5

Reference Books:

Design, Construction and Monitoring of Landfills, Bagchi, A.Wiley Interscience.

Hazardous and Industrial Waste Treatment, Haas, C.N. and Vamos, R.J., Prentice Hall.

Hazardous Waste Management Engineering, Martin, E.J.and Johnson, J.H.,Van Nostrand.

Hazardous Waste Management, 2nd Ed., Wentz,C.A., McGrawHill, 1995.

Biological Treatment of Hazardous Wastes, Lewandowski, G.A. and DeFilippi, L.J.,John Wiley & Sons, INC..

Practical Management of Chemicals and Hazardous Wastes: An Environmental and Safety Professional's Guide,Kuhre, W.L., Prentice Hall.

e-Learning Source:

https://nptel.ac.in/courses/105106056/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	0	0	0	0	0	0	0	0	1	2	1	0
CO2	3	2	1	0	0	0	1	0	0	0	0	0	1	0	0
CO3	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0
CO4	3	1	0	0	1	0	1	0	0	0	0	0	0	0	0
CO5	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

2-

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:							
Course Code	CE647	**Title of the Course**	Transportation Economics	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	To study various econometric factors governing development of infrastructure i.e.transportation						

Course Outcomes	
CO1	Understand various principles of transport economics
CO2	Evaluate various demand forecasting methods
CO3	Understand the investment policy and pricing
CO4	Apply basic econometric methods to the analysis of transportation data
CO5	Evaluate economic policies that affects the transportation system

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Transport Economics	Overview of basic components of transport, transport and economic development, transport and urban development, Economic theory, transport as an economic activity, demand and supply issues in transportation sector, cost of transport, pricing of transport, law of diminishing returns, demand, supply, equilibrium, elasticity, consumer surplus, costs, pricing and subsidy policies.	08	1
2	Demand for Transportation	Demand forecasting methods, factors influencing transport demand, direct and cross-price elasticities of demand, factors that cause shifts in demand function. Main causes of traffic congestion, mechanisms to deal with traffic congestion - congestion pricing, road space rationing, capacity expansion.	08	2
3	Costs of Transport	Direct and External costs of transport, concept of generalized costs, social aspects of transport, joint and common costs of infrastructure, short-term and long-term costs of supply, Congestion costs, External costs. Pricing principles: - the marginal cost pricing rule, Efficient pricing, cost complexities and cost recovery, Peak-load pricing, Second-best pricing, Transport subsidies, and Price discrimination.	08	3
4	Regulation of Supply of Transport Capacity	Command and control type of regulation, fiscal measures such as road pricing and environmental taxation, Safety andeconomic regulations in the context of transport services provided by public, issues of social, geographical and temporal equity.	08	4
5	Appraisal and Evaluation of Transport Projects	Feasibility and evaluation, cost, impacts and performance levels, evaluation of alternatives, analysis techniques, cost-benefitanalysis, social and financial benefits, valuation of time, measures of land value and consumer benefits from transportation projects, prioritization of projects, multi-criteria decision assessment.	08	5

Reference Books:
Emile Quinet and Roger Vickerman, Principles of Transportation Economics, Edward Elgar Publishing.
Kenneth A. Small and Erik Verhoef, The Economics of Urban Transportation, Routledge.
Patrick McCarthy, Transportation Economics, Blackwell Publishing.
Kenneth J. Button, Transport Economics, Edward Elgar Publishing.
e-Learning Source:
https://nptel.ac.in/courses/105104098/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	0	0	0	0	0	0	0	0	1	1	1	1	0
CO2	2	2	1	0	1	0	0	0	1	0	2	1	1	1	0
CO3	2	2	0	0	0	0	0	0	0	0	2	0	1	1	0
CO4	1	3	1	0	0	0	0	0	1	0	1	0	1	1	0
CO5	1	1	1	0	1	0	0	0	1	0	1	0	1	1	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	CE648	**Title of the Course**	Principles of Affordable Housing	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	• To give the knowledge if Affordable Housing and give an idea about current trends and its feasibility • To give an idea of role of financial institution in Affordable Housing Sector • To have knowledge of various alternative building materials that can be used in construction. • To apply the knowledge of low cost term in Infrastructure services specially sanitation, energy etc • To give the knowledge of various schemes launched by central Govt and Central Govt for urban poor.						

Course Outcomes	
CO1	To enable the student to understand the meaning of Affordability and trends in present scenario
CO2	To enable the student to understand the role of financial institutions in promotion of Affordable Housing
CO3	To give the Knowledge of use of Alternative construction material in low cost housing.
CO4	To impart the knowledge of low cost sanitation and its optimization
CO5	To give the knowledge of various schemes started by State Govt. and Central Govt.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction and Overview	Introduction and overview, current trends in affordable housing, project feasibility, affordable housing policy, practice and issues, affordable housing development process.	08	CO1
2	Financial Planning	Financing affordable housing, site planning, architecture and cost of new and rehabilitated affordable housing, nonprofit housing development, future of affordable housing production.	08	CO2
3	Alternative Building Materials for Low Cost Housing	Introduction, substitutes of scarce materials, industrial wastes, agricultural waste, strategies for promotion of alternative building materials.	08	CO3
4	Low Cost Infrastructural Services	Introduction, present scenario, low cost sanitation, domestic waste disposal, water supply, energy.	08	CO4
5	Housing Scenario for Urban Poor	Approaches and strategies for housing urban poor, Adoption of innovative and cost effective construction Technology.	08	CO5

Reference Books:

"handbook of low cost housing",Lal A.K, New Age Publications

"principles of Low cost housing",Sonikya Wole, Springer

"making more affordable: the role of intermediate tenures", Monk Sarah, Jhon Wiley Inc.

e-Learning Source:

https://nptel.ac.in/courses/124107001/

https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/124107001/lec4.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1	2	3	2	1	1	0	0	0	0	0	0
CO2	1	2	1	2	1	2	1	1	1	0	0	0	0	0	0
CO3	1	1	1	1	2	1	1	1	1	0	0	0	0	0	0
CO4	1	2	2	2	2	1	1	1	1	0	0	0	0	0	0
CO5	1	1	2	3	2	2	1	2	1	0	0	0	0	0	0

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	CE649	**Title of the Course**	Building Services & Maintenance Management	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	It aims at enunciating the purpose of providing effective housing solutions for urban poor.						

Course Outcomes	
CO1	Comprehend various methods of building maintenance.
CO2	Understand different building services including new methodologies
CO3	Understand the different methods of repair and formwork
CO4	Plan and design various building services required in residential and commercial buildings.
CO5	Design of engineering services in a building

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction	Orientation and Planning - Grouping and circulation - lighting and ventilation - Termite proofing of buildings- Lightning protection of buildings - Fire protection of buildings - Vertical transportation Prefabrication systems in residential buildings: Planning and modules and sizes of components in prefabrication – Shell structures - Domes - Folded plate structures - Skeletal and space frame structures.	08	1
2	Building Services	Grain storage structures- Earthquake resistant structures - Air-conditioning and heating - Acoustics and Sound insulation – Plumbing services Formwork and false work - Temporary work systems, construction planning and site constraints; Materials and construction of the common formwork and false work systems; Special, and proprietary forms; Concretepressure on forms.	08	2
3	Formwork Design	Design of timber and steel forms; Loading and moment of formwork; Types of beams, decking and column formwork; Design of decking; False work design; Effects of wind load, foundation and soil on false work design; The use and applications ofspecial forms; Sequence of construction; Safety use of formwork and false work.	08	3
4	Functional Planning of Buildings, Optimization of Space	Spatial Synthesis graphical techniques, heuristic procedures, formulation of linear and nonlinear optimization problem. Spacerequirements and relationships for typical buildings, like residential offices, hospitals, etc.	08	4
5	Engineering Services in a Building as a Systems	Lifts, escalators, cold and hot water systems, waste water systems, and electrical systems. Building Maintenance: Scheduledand contingency maintenance planning M.I.S. for building Maintenance standards. Economic maintenance decisions.	08	5

Reference Books:

"Building Construction, Arora and Bindra, Dhanpat Rai, 2012.

National Building Code of India, Bureau of Indian Standards, 2005.

Formwork for Concrete, Cleaver, Austin, C.K., Hume Press Ltd., London, 1996

Formwork for Concrete Structures, Robert L. Purifoy and Garold D. Oberiender, McGraw-Hill, 1996.

e-Learning Source:

https://nptel.ac.in/courses/105102176/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	0	0	0	0	0	0	0	0	1	2	1	1
CO2	2	2	1	1	0	0	0	0	0	0	0	0	1	0	2
CO3	2	2	2	1	0	0	0	0	0	0	0	1	1	0	2
CO4	3	2	1	2	1	0	0	0	0	0	0	0	0	0	3
CO5	2	2	0	1	0	0	0	0	0	0	0	0	0	0	2

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:							
Course Code	CE650	**Title of the Course**	Construction Information Systems	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	To study the concepts of information systems and their applications, system development and information systems, implementation and control, and system audit.						

Course Outcomes	
CO1	Explain how information systems transform business
CO2	Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
CO3	Identify the impact information systems have on an organization
CO4	Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses
CO5	Explain how Quality assurance system benefit business

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to MIS	Dissemination of Information, History of Management Information Systems, Advantages and Disadvantages, Management information systems in construction industry, current integration of computer aided design (CAD).	08	1
2	Application of MIS in Project Management	Computerized project management systems, use of automated programs for planning, scheduling, estimating and controlling construction projects, data processing and applications in pricing.	08	2
3	Application of MIS in Construction Industry	Tendering, scheduling and cost control system, simulation of construction operations, internet technology, web applicationsin construction, use of project planner software.	08	3
4	Integrated Construction Management Information	System-Project Management Information System-Functional Areas, Finance, Marketing, Production, Personnel-Levels, DSS,EIS, ES-Comparison, Concepts and Knowledge Representation-Managing International Information System.	08	4
5	System Audit	System. Software Engineering Qualities-Design-Production, Service, Software Specification, Software metrics, Software Quality assurance-Systems Methodology-Objectives-Time and Logic, Knowledge and Human Dimension- Software LifeCycle Models-Verification and Validation.	08	5

Reference Books:

"Management Information Systems – Organization and Technology ", Kenneth C Laudon and Jane Price Laudon,Prentice Hall, 1996.

"Management Information System: Conceptual Foundations ", Gordon B. Davis, Structure and Development,McGraw Hill, 1974.

"Case Series for Management Information Systems ", Joyce J Elam, Simon and Schuster, Custom Publishing, 1996.

"Decision Support for managers ", Ralph H Sprague and Huge J Watson, Prentice Hall, 1996.

" Software Quality assurance and Management ", Michael W Evans and John J Marciniah, John Wiley And Sons ,1987

"Measuring Software Design Quality ", Card and Glass, Prentice Hall, 1990.

"Management Information Systems", Sadagopan S., Phi Learning, 1997.

e-Learning Source:

https://nptel.ac.in/courses/105103093/

https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/105104161/lec1.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	0	0	2	0	0	0	1	2	0	0	1	1	1
CO2	1	0	0	1	2	0	0	0	1	2	2	0	1	1	1
CO3	2	0	1	0	2	0	0	0	0	2	2	0	1	0	2
CO4	2	1	1	1	2	0	0	0	0	2	2	0	1	0	2
CO5	1	1	1	1	2	0	0	0	0	2	0	0	1	0	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	CE653	**Title of the Course**	Sustainable Design & Value Analysis	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	3	1	0	4
Pre-Requisite	Nil	**Co-requisite**	Nil				
Course Objectives	• To make them understand the need to bring sustainability & to develop sustainable architecture. • To comprehend the fundamentals of green building to attain sustainability. • To make them understand the need of solar panels along with IGBC rating system & guidelines. • To make them understand the Valuation of a Buildings using latest methods. • To make them capable to perform life cycle cast analysis pertaining to environ mate protection.						

Course Outcomes	
CO1	Learner will be able to understand the basic knowledge of sustainability & its challenges in construction industry.
CO2	Understand the need of energy efficient buildings to mitigate the harmful effects of non-ecofriendly materials.
CO3	Develop an innovative tool to safeguard & improve sustainable structures as per the national guidelines.
CO4	Create economic feasibility analysis to perform Value analysis of Buildings.
CO5	Understand the environmental social & management methods to economize infrastructure & society using life cycle cost analysis.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction to Concept of Sustainability	Sustainability, challenges in sustainable construction, design construction and equipment, materials and systems, maintenance and conservation, waste materials, site waste management, re-use and recycling of materials.	08	CO1
2	Energy Efficiency and Concept of Green Buildings	Energy efficient buildings, concepts of green and sustainable buildings, natural lighting, methods of ensuring natural ventilation, rainwater harvesting, norms of city development authorities for rainwater harvesting, various legislations concerned to green building.	08	CO2
3	Delivery of Green Buildings and Energy Efficiency	Solar panels, solar HVAC systems, legislations for alternative energy resources, sustainable building designs, functional planning of green buildings, rating system, BEE norms for energy efficient buildings, case studies.	08	CO3
4	Economic Performance Analysis	Cost-Benefit analysis, economic feasibility analysis; advanced conceptual estimating techniques, quick methods of determining approximate costs of a project, Valuation of Buildings.	08	CO4
5	Life Cycle Cost Analysis	Life cycle cost analysis- technique of economic evaluation that sums the costs of initial investments, replacements, operations, maintenance and repair investments, case studies, real-time analysis of life cycle costs of buildings.	08	CO5

Reference Books:

"Sustainable Facades: Design Methods for High-Performance Building Envelopes", Ajla Aksamija, Jhon Wiley & Sons Inc

"Sustainable Construction: Green Building Design and Delivery", Charles J. Kibert, Jhon Wiley & Sons Inc.

"Construction Cost Analysis and Estimating", Phillip F. Ostwald, Prentice Hall.

e-Learning Source:

https://nptel.ac.in/courses/105102195/

https://nptel.ac.in/courses/107103081/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	0	0	0	0	3	0	1	0	0	2	0	3	2	2
CO2	3	0	0	0	0	2	3	0	0	0	0	1	3	3	2
CO3	3	0	0	0	0	3	3	0	0	0	0	0	3	3	1
CO4	3	0	0	3	0	0	0	0	0	0	3	0	3	2	3
CO5	3	0	0	3	0	0	0	0	0	0	3	0	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	CE654	**Title of the Course**	Directed Study	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	0	0	0	4
Pre-Requisite	NIL	**Co-requisite**	NIL				
Course Objectives	• To make learner aware about the latest technology and engineering practices in industries.						

Course Outcomes	
CO1	Awareness regarding the latest technology, engineering methodology and practices being used in industries.

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	0	0	2	3	3	0	0	3	3	0	3	1	1	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	CE699	**Title of the Course**	M Tech dissertation	**L**	**T**	**P**	**C**
Year	II	**Semester**	III & IV	0	0	0	20
Pre-Requisite	------	**Co-requisite**	------				
Course Objectives	• To develop individuality and problem analysis skill. • To nurture ability to perform literature review. • To improve critical thinking ability for formulation of plan. • To develop skill to use various engineering and technological tools. • To develop skill to think critically on research results. • To enhance the writing skill for research paper and dissertation.						

Course Outcomes	
CO1	Capability to work independently on a research-based problem.
CO2	Skill to perform review of available literature effectively to present research gap.
CO3	Aptitude to plan methodology for the attainment of various research objectives.
CO4	Competency to apply of various engineering and technological tools to carry research.
CO5	Ability to conclude work using critical thinking.
CO6	Proficiency in preparing presentation and report.

Unit No.	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Undergo industrial training in any respective industry in order to get familiar with the latest technology, engineering techniques and practices being used in the industry. Have to absorb some skill from the training identifying the area of improvement. The concepts/skills must be clearly understood and presented by the student. A hard copy of the report should be submitted to the Department after the completion of directed study.	03hrs	CO1, CO2, CO3, CO4, CO5 and CO6

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	0	0	0	3	3	0	0	3	3	3	0	3	0	3	0
CO2	0	0	0	3	3	0	0	3	3	3	0	3	0	3	0
CO3	0	0	0	0	3	0	0	0	3	3	0	3	0	3	0
CO4	0	0	0	3	3	0	0	0	3	0	0	3	0	3	0
CO5	0	0	0	3	3	0	0	3	3	3	0	3	0	3	0
CO6	0	0	0	0	3	0	0	3	3	3	0	3	0	3	0

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**