DEPARTMENT OF CIVIL ENGINEERING

ANNA UNIVERSITY, CHENNAI

OUR VISION:

Department of Civil Engineering, Anna University, shall strive hard to develop and impart technical knowledge and professional skills required for Civil Engineering practice through excellence in teaching, research and consultancy to address sustainable infrastructure development needs at local, national and international levels.

OUR MISSION:

Department of Civil Engineering, Anna University shall contribute to technological and social development by

1. Providing a firm scientific and technological base in Civil Engineering to achieve self-reliance
2. Providing quality education through innovation in teaching practices at par with global standards.
3. Nurturing leadership and entrepreneurship qualities with ethical values.
4. Developing and disseminating latest knowledge and technologies in emerging areas of Civil Engineering.
5. Sharing intellectual resources and infrastructure facilities through collaborative partnership.
6. Ensuring supporting conditions for enhancing the employability skills.

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

REGULATIONS - 2023

CHOICE BASED CREDIT SYSTEM

M.E. CONSTRUCTION ENGINEERING & MANAGEMENT (FULL-TIME)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Graduates of the programme M. E. Construction Engineering and Management will

PEO1 Excel in research and will succeed in Construction Engineering and Management profession in the government, public and private sector organizations.

PEO2 Have a sound knowledge in statistics, project management and construction engineering fundamentals required solving real time construction Engineering and Management problems using modern equipment and software tools.

PEO3 Become entrepreneurs and develop processes and construction technologies through innovation, by integrating their knowledge in multidisciplinary management to meet the needs of society and formulate solutions that are technically sound, economically feasible, and socially acceptable.

PEO4 Have professional and ethical attitude, effective communication skills, teamwork skills, leadership quality, multidisciplinary approach and an ability to relate Construction Engineering and Management issues in broader social context.

PEO5 Have competence of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career.

PROGRAMME OUTCOMES (POs):

Graduates of the programme M. E. Construction Engineering and Management will be able to

PO#	Graduate Attribute	Programme Outcome
1	Research Aptitude	An ability to independently carry out research / investigation and development work to solve practical problems.
2	Technical Documentations	An ability to write and present a substantial technical report/document.
3	Technical Competence	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the programme. The mastery should be at a level higher than the requirements in the appropriate bachelor programme.
4	Critical Analysis of Construction Management-related Problems	Critically analyse complex Construction Engineering-related problems and apply independent judgment for synthesizing information.
5	Conceptualization and Evaluation of Innovative Engineering Solutions to Construction Management Issues	Conceptualize and solve Construction Management-related problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety and socio-cultural factors.
6	Life-long Learning	Recognize the need for independent, life-long learning and adapt to emerging technologies in Construction Engineering and solutions to novel problems.

PEO / PO Mapping:

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
PEO1	3	2	2	3	2	3
PEO2	3	2	3	2	3	2
PEO3	3	3	3	2	3	3
PEO4	2	2	2	3	3	3
PEO5	2	1	3	3	1	3

• 1-low, 2-medium, 3-high

MAPPING OF COURSE OUTCOME AND PROGRAMME OUTCOME:

		Course Name	PO1	PO2	PO3	PO4	PO5	PO6
YEAR 1	SEMESTER I	Statistical Methods for Engineers	3	3	3	3	2	2
		Modern Construction Materials	2	2	2	3	3	2
		Project Formulation and Appraisal	2	2	3	3	3	2
		Construction Equipment and Management	3	3	3	2	2	2
		Professional Elective I	-	-	-	-	-	-
		Research Methodology and IPR	-	-	-	-	-	-
		Advanced Construction Engineering and Experimental Techniques Laboratory	2	2	3	3	3	2
		Technical Seminar	3	3	3	3	2	3
	SEMESTER II	Advanced Construction Techniques	1	1	3	3	1	2
		Construction Planning, Costing, Scheduling and Control	3	2	2	3	2	3
		Contract Laws and Regulations	3	3	3	3	2	1
		Computer Applications in Construction Management	3	1	1	2	2	2
		Professional Elective II	-	-	-	-	-	-
		Professional Elective III	-	-	-	-	-	-
		Statistical Laboratory for Construction Engineering and Management	3	2	3	3	3	2
YEEAR 2	SEMESTER III	Professional Elective IV	-	-	-	-	-	-
		Professional Elective V	-	-	-	-	-	-
		Practical Training (4 weeks)	3	2	2	3	2	2
		Project Work I	3	3	2	3	3	3
	SEMESTER IV	Project Work II	3	2	3	3	3	3

• 1-low, 2-medium, 3-high

MAPPING FOR PROFESSIONAL ELECTIVE COURSES [PEC]

S. No.	Course Title	PO1	PO2	PO3	PO4	PO5	PO6
1.	Advanced Concrete Technology	3	3	3	2	3	2
2.	Advanced Data Analysis	2	2	2	3	3	2
3.	Construction Project Management	2	1	2	1	1	1
4.	Design of Energy Efficient Buildings	3	2	3	3	1	1
5.	Economics and Finance Management in Construction	1	2	1	2	2	2
6.	Environmental Impact Assessment for Construction Engineering	3	2	3	2	3	1
7.	Human Resources Management in Construction	2	2	1	2	2	2
8.	Lean Construction Concepts, Tools and Practices	2	1	1	3	2	2
9.	Maintenance, Repair and Rehabilitation of Structures	3	3	3	2	3	2
10.	Management Information Systems	2	2	2	2	3	3
11.	Organizational Behaviour	3	2	3	2	3	2
12.	Project Safety Management	2	1	2	2	1	1
13.	Quality control and assurance in construction	3	2	3	2	2	1
14.	Quantitative Techniques in Management	2	1	1	2	2	1
15.	Resource Management and Control in Construction	1	2	2	3	3	2
16.	Shoring, Scaffolding and Formwork	3	3	2	1	1	1
17.	Supply chain management and Logistics in construction	1	3	3	3	2	2
18.	Sustainable Construction	2	1	2	2	1	1
19.	System Integration in Construction	3	2	3	2	3	2

• 1-low, 2-medium, 3-high

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT (FULL-TIME)
REGULATIONS - 2023
CHOICE BASED CREDIT SYSTEM
CURRICULUM AND SYLLABI FOR SEMESTERS I TO IV

SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA3161	Statistical Methods for Engineers	FC	4	0	0	4	4
2.	CN3101	Modern Construction Materials	PCC	3	0	0	3	3
3.	CN3102	Project Formulation and Appraisal	PCC	3	1	0	4	4
4.	CN3103	Construction Equipment and Management	PCC	3	0	0	3	3
5.	RM3151	Research Methodology and IPR	RMC	2	1	0	3	3
6.		Professional Elective I	PEC	3	0	0	3	3
PRACTICALS								
7.	ST3161	Advanced Construction Engineering and Experimental Techniques Laboratory	EEC	0	0	4	4	2
8.	CN3111	Technical Seminar	EEC	0	0	2	2	1
			TOTAL	**18**	**2**	**6**	**26**	**23**

SEMESTER II

S NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CN3201	Advanced Construction Techniques	PCC	3	0	0	3	3
2.	CN3202	Construction Planning, Costing, Scheduling and Control	PCC	3	0	4	7	5
3.	CN3203	Contract Laws and Regulations	PCC	3	0	0	3	3
4.	CN3204	Computer Applications in Construction Management	PCC	2	0	2	4	3
5.		Professional Elective II	PEC	3	0	0	3	3
6.		Professional Elective III	PEC	3	0	0	3	3
PRACTICALS								
8.	CN3211	Statistical Laboratory for Construction Engineering and Management	PCC	0	0	4	4	2
			TOTAL	**17**	**0**	**14**	**27**	**22**

SEMESTER III

S NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective IV	PEC	3	0	0	3	3
2.		Professional Elective V	PEC	3	0	0	3	3
PRACTICALS								
3.	CN3311	Practical Training (4 weeks)	EEC	0	0	0	0	2
4.	CN3312	Project Work I	EEC	0	0	12	12	6
			TOTAL	**6**	**0**	**12**	**18**	**14**

SEMESTER IV

S NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	CN3411	Project Work II	EEC	0	0	24	24	12
			TOTAL	**0**	**0**	**24**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR AWARD OF THE DEGREE: 71 CREDITS

FOUNDATION COURSES (FC)

S NO.	COURSE CODE.	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			L	T	P		
1.	MA3161	Statistical Methods for Engineers	4	0	0	4	1

PROFESSIONAL CORE COURSES (PCC)

S NO.	COURSE CODE.	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			L	T	P		
1.	CN3101	Modern Construction Materials	3	0	0	3	1
2.	CN3102	Project Formulation and Appraisal	3	1	0	4	1
3.	CN3103	Construction Equipment and Management	3	0	0	3	1
4.	ST3161	Advanced Construction Engineering and Experimental Techniques Laboratory	0	0	4	2	1
5.	CN3201	Advanced Construction Techniques	3	0	0	3	2
6.	CN3202	Construction Planning, Costing, Scheduling and Control	3	0	4	5	2
7.	CN3203	Contract Laws and Regulations	3	0	0	3	2
8.	CN3204	Computer Applications in Construction Management	2	0	2	3	2
9.	CN3211	Statistical Laboratory for Construction Engineering and Management	0	0	4	2	2
					TOTAL CREDITS	**26**	

PROFESSIONAL ELECTIVES COURSES [PEC]

S NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	CN3051	Advanced Concrete Technology	3	0	0	3
2. .	CN3001	Advanced Data Analysis	3	0	0	3
3.	CN3002	Construction Project Management	3	0	0	3
4.	CN3003	Design of Energy Efficient Buildings	3	0	0	3
5.	CN3004	Economics and Finance Management in Construction	3	0	0	3
6.	CN3005	Environmental Impact Assessment for Construction Engineering	3	0	0	3
7.	CN3006	Human Resources Management in Construction	3	0	0	3
8.	CN3007	Lean Construction Concepts, Tools and Practices	3	0	0	3
9.	ST3051	Maintenance, Repair and Rehabilitation of Structures	3	0	0	3
10.	CN3008	Management Information Systems	3	0	0	3
11.	CN3009	Organizational Behaviour	3	0	0	3
12.	CN3010	Project Safety Management	3	0	0	3
13.	CN3011	Quality Control and Assurance in Construction	3	0	0	3
14.	CN3012	Quantitative Techniques in Management	3	0	0	3
15.	CN3013	Resource Management and Control in Construction	3	0	0	3
16.	CN3052	Shoring, Scaffolding and Formwork	3	0	0	3
17.	CN3014	Supply Chain Management and Logistics in Construction	3	0	0	3
18.	CN3015	Sustainable Construction	3	0	0	3
19.	CN3016	System Integration in Construction	3	0	0	3

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

SL NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			L	T	P		
1.	RM3151	Research Methodology and IPR	2	1	0	3	1
					TOTAL CREDITS	3	

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			L	T	P		
1.	ST3161	Advanced Construction Engineering and Experimental Techniques Laboratory	0	0	4	2	1
2.	CN3111	Technical Seminar	0	0	2	1	1
3.	CN3311	Practical Training	0	0	0	2	3
4.	CN3312	Project Work I	0	0	12	6	3
5.	CN3411	Project Work II	0	0	24	12	4
					TOTAL CREDITS	23	

SUMMARY:

S.NO.	NAME OF THE PROGRAMME: M.E CONSTRUCTION ENGINEERING AND MANAGEMENT					
	SUBJECT AREA	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1.	FC	04	00	00	00	04
2.	PCC	10	16	00	00	26
3.	PEC	03	06	06	00	15
4.	RMC	03	00	00	00	03
5.	EEC	03	00	08	12	23
	Total Credit	**23**	**22**	**14**	**12**	**71**

MA3161 STATISTICAL METHODS FOR ENGINEERS L T P C
4 0 0 4

UNIT I ESTIMATION THEORY 12

Estimators: Unbiasedness, Consistency, Efficiency and Sufficiency–Maximum Likelihood Estimation – Method of moments.

UNIT II TESTING OF HYPOTHESIS 12

Tests based on Normal, *t*, χ^2 and *F* distributions for testing of means, variance and proportions – Analysis of *r x c* tables – Goodness of fit.

UNIT III CORRELATION AND REGRESSION 12

Multiple and Partial Correlation - Method of Least Squares- Plane of Regression - Properties of Residuals - Coefficient of Multiple Correlation - Coefficient of Partial Correlation - Multiple Correlation with total and partial correlations - Regression and Partial correlations in terms of lower order coefficients.

UNIT IV DESIGN OF EXPERIMENTS 12

Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT V MULTIVARIATE ANALYSIS 12

Random vectors and Matrices – Mean vectors and Covariance matrices – Multivariate Normal density and its properties – Principal components: Population principal components – Principal components from standardized variables.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: Obtain the value of the point estimators using the method of moments and method of maximum likelihood.

CO2: Use various test statistics in hypothesis testing for mean and variances of large and small samples.

CO3: Determine the regression line using the method of least square and also to calculate the partial and multiple correlation coefficient for the given set of data points.

CO4: Test the hypothesis for several means using one way, two way or three way classifications.

CO5: Get exposure to the principal component analysis of random vectors and matrices.

REFERENCES:

1. Devore, J.L., “Probability and Statistics for Engineering and the Sciences”, Thomson and Duxbury, Singapore, 6th Edition, Boston, 2004.
2. Gupta, S.C., and Kapoor, V.K., “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, Eleventh Edition, Reprint, New Delhi, 2019.
3. Johnson, R. A. and Gupta, C. B., “Miller & Freund’s Probability and Statistics for Engineers”, Pearson Education, Asia, Eighth Edition, New Delhi, 2015.
4. Johnson, R.A., and Wichern, D.W., “Applied Multivariate Statistical Analysis”, Pearson Education, Sixth Edition, New Delhi, 2013.
5. Spiegel, M.R. and Stephens, L.J.,” Schaum’s outlines on Statistics”, Tata McGraw-Hill, 6th Edition, New York, 2018.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	2
CO2	3	3	3	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	3	3	2	2
CO5	3	3	3	3	2	2
Avg	**3**	**3**	**3**	**3**	**2**	2

• 1-low, 2-medium, 3-high

CN3101 MODERN CONSTRUCTION MATERIALS L T P C
3 0 0 3

UNIT I SPECIAL CONCRETES 9

Concretes – Behavior of concretes – Properties and Advantages of High Strength and High Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self-compacting concrete, Geopolymer concrete, Alternate Materials to concrete on high performance & high Strength concrete.

UNIT II METALS 9

Types of Steels – Manufacturing process of steel – Advantages of new alloy steels – Extraction of Aluminium- Properties and advantages of aluminum and its products – Types of Coatings & Coatings to reinforcement – Applications of Coatings.

UNIT III COMPOSITES 9

Polymers – Types of Plastics – Properties & Manufacturing process – Advantages of Reinforced polymers – Types of FRP – FRP on different structural elements – Applications of FRP.

UNIT IV OTHER MATERIALS 9

Types and properties of Water Proofing Compounds – Types of Non-weathering Materials and its uses – Types of Flooring and Facade Materials and its application, Bituminous materials, Glass, Ceramics, Paints and Varnishes.

UNIT V SMART AND INTELLIGENT MATERIALS 9

Types & Differences between Smart and Intelligent Materials – Special features – Case studies showing the applications of smart & Intelligent Materials, Nano materials in construction.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to be able to

CO1 Explain the various types of special concretes
CO2 Select the different processing of steel and aluminium, and applications of coating
CO3 Explain the manufacturing process and applications of polymer composites
CO4 Identify the different flooring materials and application of façade materials
CO5 Apply the knowledge of smart and intelligent materials in construction field

REFERENCES:

1. Ganapathy, C. “Modern Construction Materials”, Eswar Press, 2015.
2. Ashby, M.F. and Jones D.R.H.H. “Engineering Materials 1: An introduction to Properties, applications and designs”, Elsevier Publications, 2005.
3. Santhakumar A.R. “Concrete Technology”, Oxford University press, New Delhi, 2018.
4. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001
5. Shetty M.S, Concrete Technology: Theory and Practice, S.Chand & Company Ltd., 2017.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	3	3	3	2
CO2	1	1	2	2	2	2
CO3	2	2	2	3	3	2
CO4	2	2	2	3	3	2
CO5	2	2	3	3	3	2
Avg	**2**	**2**	**2**	**3**	**3**	**2**

• 1-low, 2-medium, 3-high

CN3102 PROJECT FORMULATION AND APPRAISAL L T P C
3 1 0 4

UNIT I PROJECT FORMULATION 12

Project – Concepts – Capital investments - Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required- Case studies for Feasibility Report and DPR.

UNIT II PROJECT COSTING 12

Project Cash Flows– Principles – Types – New Project and Replacement Project – Biases in Cash flow Estimation – Time Value of Money – Present Value – Future Value – Single amount - Annuity – Cost of Capital – Cost of Debt, Preference, Equity – Proportions- Cost of Capital Calculation – Financial Institutions Considerations.

UNIT III PROJECT APPRAISAL 12

NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in Practice.

UNIT IV PROJECT FINANCING 12

Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators – Ratios- financial cost-benefit analysis, social-cost benefit analysis

UNIT V PRIVATE SECTOR PARTICIPATION 12

Private sector participation in Infrastructure Development Projects – Different PPP models; Project Structuring, Financing aspects, Appraisal, Risk Assessment and Risk management, Concession agreements and post project ownership

TOTAL: 60 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Perform Formulations of Projects
CO2 Analyze Project Costing
CO3 Evaluate the Project Appraisal
CO4 Apply Project Financing
CO5 Perform Private Sector Participation & Implementation

REFERENCES:

1. Barcus, S.W. and Wilkinson.J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1995.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 2017.
3. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation Review, McGraw Hill Publishing Company Ltd., New Delhi. 2019.
4. United Nations Industrial Development Organisation (UNIDO) Manual for the Preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 2007.
5. Raina V.K, "Construction Management Practice – The inside Story", Tata McGraw Hill Publishing Limited, 2019.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	3	3	2
CO2	1	3	2	2	3	2
CO3	2	2	3	3	3	2
CO4	2	1	2	3	3	3
CO5	2	2	3	3	3	2
Avg	**2**	**2**	**3**	**3**	**3**	**2**

• 1-low, 2-medium, 3-high

CN3103 CONSTRUCTION EQUIPMENT AND MANAGEMENT L T P C
3 0 0 3

UNIT I CONSTRUCTION EQUIPMENTS AND MANAGEMENT 9

Identification – Planning of equipment – Selection of Equipment - Equipment Management in Projects - Maintenance Management – Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management.

UNIT II EQUIPMENT FOR EARTHWORK 9

Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders – Dozer, Excavators, Rippers, Loaders, trucks and hauling equipment, Compacting Equipment, Finishing equipment – Case studies on Earthwork equipment.

UNIT III OTHER CONSTRUCTION EQUIPMENT 9

Equipment for Dredging, Trenching, Drag line and clamshells, Tunneling – Jacking Equipment – Equipment for Drilling and Blasting - Pile driving Equipment - Erection Equipment - Crane, Mobile crane - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Equipment for Demolition.

UNIT IV ASPHALT AND CONCRETE PLANTS 9

Aggregate production- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment– Ready mix concrete equipment, Concrete pumping equipment - Asphalt Plant - Asphalt Pavers - Asphalt compacting Equipment.

UNIT V MATERIALS HANDLING EQUIPMENT 9

Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors – Material Handling Cranes- Industrial Trucks – Aerial Transporting Equipment.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Develop knowledge on planning of equipment and selection of equipment
CO2 Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment
CO3 Develop the knowledge on special construction equipment
CO4 Apply the knowledge on asphalt and concrete plants
CO5 Apply the knowledge and select the proper materials handling equipment

REFERENCES:

1. Peurifoy, R.L., Schexnayder, C., Schmitt, R.L. and Aviad Shapira., Construction Planning, Equipment and Methods, 9th Edn. McGraw Hill, Singapore, 2018.
2. Granberg G.,Popescu M Construction Equipment and Management for Engineers Estimators and Owners, Taylor and Francis Publishers, New York, 2006
3. Deodhar, S.V. Construction Equipment and Job Planning, 4th Edn. Khanna Publishers, New Delhi, 2020.
4. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 2018.
5. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2008.
6. Dr. Mahesh Varma., Construction Equipment and its Planning and Application, Metro-politan Book Company, New Delhi., 2003.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	3	2
CO2	2	3	2	3	2	2
CO3	3	2	3	2	3	1
CO4	3	3	1	3	2	2
CO5	3	3	3	2	1	2
Avg	**3**	**3**	**3**	**2**	**2**	**2**

• 1-low, 2-medium, 3-high

RM3151 RESEARCH METHODOLOGY AND IPR L T P C
2 1 0 3

UNIT I RESEARCH PROBLEM FORMULATION 9

Objectives of research, types of research, research process, approaches to research; conducting literature review- information sources, information retrieval, tools for identifying literature, Indexing and abstracting services, Citation indexes, summarizing the review, critical review, identifying research gap, conceptualizing and hypothesizing the research gap

UNIT II RESEARCH DESIGN AND DATA COLLECTION 9

Statistical design of experiments- types and principles; data types & classification; data collection - methods and tools

UNIT III DATA ANALYSIS, INTERPRETATION AND REPORTING 9

Sampling, sampling error, measures of central tendency and variation,; test of hypothesis- concepts; data presentation- types of tables and illustrations; guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript; guidelines for writing thesis, research proposal; References – Styles and methods, Citation and listing system of documents; plagiarism, ethical considerations in research

UNIT IV INTELLECTUAL PROPERTY RIGHTS 9

Concept of IPR, types of IPR – Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, applicability of these IPR; , IPR & biodiversity; IPR development process, role of WIPO and WTO in IPR establishments, common rules of IPR practices, types and features of IPR agreement, functions of UNESCO in IPR maintenance.

UNIT V PATENTS 9

Patents – objectives and benefits of patent, concept, features of patent, inventive steps, specifications, types of patent application; patenting process - patent filling, examination of patent, grant of patent, revocation; equitable assignments; Licenses, licensing of patents; patent agents, registration of patent agents.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, the student can

CO1: Describe different types of research; identify, review and define the research problem

CO2: Select suitable design of experiment s; describe types of data and the tools for collection of data

CO3: Explain the process of data analysis; interpret and present the result in suitable form

CO4: Explain about Intellectual property rights, types and procedures

CO5: Execute patent filing and licensing

REFERENCES:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).
2. Soumitro Banerjee, “Research methodology for natural sciences”, IISc Press, Kolkata, 2022,
3. Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.
4. David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.
5. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.

ST3161 ADVANCED CONSTRUCTION ENGINEERING AND EXPERIMENTAL TECHNIQUES LABORATORY

L T P C
0 0 4 2

A) ADVANCED CONSTRUCTION ENGINEERING LABORATORY

LIST OF EXPERIMENTS:

1. Mix design and testing of concrete.
2. Effect of mineral and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability.
3. Flow characteristics of self compacting concrete.
4. Permeability tests on hardened concrete and RCPT
5. NDT on hardened concrete - UPV, rebound hammer and core test.
6. NDT on Welded steel connections (Demonstration)

TOTAL: 30 PERIODS

COURSE OUTCOMES:

On completion of this course, the student is expected to be able to:

CO1 Prepare mix proportion using IS and ACI codal provisions for conventional and SCC mix using mineral and chemical admixtures

CO2 Prepare the self-compacting concrete and study it’s flow characteristics

CO3 Identify the proper portion of mineral and chemical admixture for concrete

CO4 Test the concrete characteristic using non-destructive testing

CO5 Analyze the permeability characteristics of concrete

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	3	3	2
CO2	3	1	3	3	3	2
CO3	2	1	3	3	3	2
CO4	2	2	3	3	3	2
CO5	2	1	3	3	3	2
Avg	**2**	**2**	**3**	**3**	**3**	**2**

• 1-low, 2-medium, 3-high

B) ADVANCED EXPERIMENTAL TECHNIQUES LABORATORY

LIST OF EXPERIMENTS:

1. Determination of elastic constants - Hyperbolic fringes.
2. Determination of elastic constants - Elliptical fringes.
3. Strain gauge meter - Determination of Young's modulus of a metallic wire.
4. Ultrasonic interferometer - Ultrasonic velocity in liquids.
5. Electrical conductivity of metals and alloys with temperature-four probe method.
6. Resistivity measurements.
7. NDT - Ultrasonic flaw detector.
8. Calibration of proving ring and LVDT.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

On completion of this course, the student is expected to be able to:

CO1 Gain practical knowledge by correlating theory with experimental methods
CO2 Learn the usage of electrical and optical systems for various measurements
CO3 Describe and explain the working principles of various measurement techniques
CO4 Identify the strength and limitation of each technique, to choose the right technique
CO5 Apply the analytical techniques and graphical analysis to interpret the experimental data

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	3	3	2
CO2	3	1	3	3	3	2
CO3	2	1	3	3	3	2
CO4	2	2	3	3	3	2
CO5	2	1	3	3	3	2
Avg	**2**	**2**	**3**	**3**	**3**	**2**

• 1-low, 2-medium, 3-high

CN3111 **TECHNICAL SEMINAR** **L T P C**
0 0 2 1

GUIDELINES: The students will work under the guidance of a group of staff members. The students will be asked to talk on any topic of their choice related to construction engineering and management and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

TOTAL: 30 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Identify latest developments in the field of Construction Engineering
CO2 Identify latest developments in the field of Construction Management
CO3 Presentation Skills and ability to answer the queries during Interaction
CO4 Acquire technical writing abilities for seminars, conferences and journal publications
CO5 Use modern tools to present the technical details

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	3
CO2	2	3	3	3	2	3
CO3	2	3	3	3	2	3
CO4	3	3	3	3	2	3
CO5	3	3	3	3	2	3
Avg	3	3	3	3	2	3

• 1-low, 2-medium, 3-high

CN3201 ADVANCED CONSTRUCTION TECHNIQUES L T P C
3 0 0 3

UNIT I SUB STRUCTURE CONSTRUCTION 9

Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - Dewatering for underground open excavation.

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 9

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES 9

Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, Tall buildings - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes –Erection of articulated structures and space decks.

UNIT IV REHABILITATION AND STRENGTHENING TECHNIQUES 9

Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.

UNIT V DEMOLITION 9

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Understand the modern construction techniques used in the sub structure construction.
CO2 Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings
CO3 Understand the concepts used in the construction of special structures
CO4 Knowledge on various strengthening and repair methods for different cases.
CO5 Identify the suitable demolition technique for demolishing a building.

REFERENCES:

1. Jerry Irvine, Advanced Construction Techniques, CA Rocket, 1984.
2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 2007.
3. Peter H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.Press, 2008.
4. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 2001.
5. Sarkar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 2008.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	2	2	2	2
CO2	1	1	3	3	1	2
CO3	1	1	3	3	1	2
CO4	1	1	3	3	1	2
CO5	1	1	3	3	1	2
Avg	1	1	3	3	1	2

• 1-low, 2-medium, 3-high

CN3202 CONSTRUCTION PLANNING, COSTING, SCHEDULING AND CONTROL

L T P C
3 0 4 5

UNIT I CONSTRUCTION PLANNING 9

Basic Concepts in the Development of Construction Plans – Choice of Technology and Construction Method – Defining Work Tasks – Defining Precedence Relationships among Activities – Estimating Activity Durations – Estimating Resource Requirements for Work Activities – Coding Systems - Planning Project Schedule and Budget.

UNIT II NETWORK REPRESENTATION AND ANALYSIS 9

Duration Estimation – Gantt / Bar Chart – Types of Network and Techniques – Introduction to Floats, Types of Floats, usage of Floats for Project Decisions- Presenting Project Schedules – Scheduling for Activity-on-Node and with Leads, Lags, and Windows – Critical Path Method (CPM) Network Analysis - PERT Network Modeling and Time Analysis - Case Illustrations.

UNIT III PRECEDENCE NETWORK ANALYSIS 9

Introduction to Precedence Diagramming method (PDM) - PDM network representation, Procedure and Analysis, Issues in PDM, Case Illustrations, Defining Relationship, Project Monitoring and Control Process.

UNIT IV SCHEDULING PROJECT WORK AND RESOURCE SCHEDULING 9

Work Scheduling Fundamentals – Bar chart method of Work scheduling – Network Based Project Scheduling – Line of Balance Scheduling for Repetitive Projects - Scheduling with Uncertain Durations – Resources Scheduling Considerations – Crashing and Time/Cost Trade-offs- Case Illustrations – Use of Project management Software for scheduling Process.

UNIT V PROJECT MONITORING AND CONTROLLING 9

The Cost Control Approach – Direct and Indirect Cost Control – Activity Cost Control – Financial Accounting Systems and Cost Accounts – Control of Project Cash Flows- Performance Control using Earned Value Management Concepts – Time progress monitoring and Controlling – Time Reduction Techniques – Guidelines for reviewing project Time and Cost Progress.

THEORY: 45 PERIODS

LIST OF EXPERIMENTS

1. Quantity takeoff, Preparation and delivery of the bid or proposal of an engineering construction project.
2. Design of a simple equipment information system for a construction project.
3. Scheduling of a small construction project using Primavera scheduling systems including reports and tracking.
4. Scheduling of a small construction project using tools like MS project scheduling systems including reports and tracking.
5. Simulation models for project risk analysis.
6. Virtual progress tracking of small construction project using Navisworks.
7. Model a simple building using Building information Modelling (BIM).

PRACTICAL : 60 PERIODS

TOTAL : 105 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Identify and estimate the activity in the construction
CO2 Schedule the networking of activities using critical path method and PERT method
CO3 Schedule the networks using Precedence network analysis
CO4 Schedule the project work and also to allocate resource and cost crashing, and explain the different databases used in a construction industry using computers.
CO5 Monitor and control the cost and time progress

REFERENCES:

1. Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth- Heinemann, USA , 2017.
2. Chitkara K K., Construction project management, planning, scheduling and control ,McGraw Hill (INDIA) publishers, New Delhi, Fourth edition 2019.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2008.
4. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopaedia of terms and Applications, Wiley, New York, 1995.
5. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985 (Digitized in 2007).
6. Jerome D. Wiest – “A management guide to PERT/CPM”- 2012.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	3	3	2
CO2	3	2	2	3	1	3
CO3	3	2	3	2	3	3
CO4	3	2	1	3	2	1
CO5	2	3	2	3	2	3
Avg	**3**	**2**	**2**	**3**	**2**	**3**

• 1-low, 2-medium, 3-high

CN3203 CONTRACT LAWS AND REGULATIONS L T P C
3 0 0 3

UNIT I CONSTRUCTION CONTRACTS 9

Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts.

UNIT II TENDERS 9

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamilnadu Transparency in Tenders Act.

UNIT III ARBITRATION 9

Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs.

UNIT IV LEGAL REQUIREMENTS 9

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations.

UNIT V LABOUR REGULATIONS 9

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Design the construction contracts
CO2 Develop a skill for the tendering process.
CO3 Explain the duties of the arbitrator.
CO4 Develop an idea on the various legal requirements to be met in relation to land and construction.
CO5 Identify and apply the provisions provided in the labour welfare schemes.

REFERENCES:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, 2000.
2. Jimmie Hinze, Construction Contracts, McGraw Hill, 3rd Edition, 2013.
3. Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985.
4. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited,5th Edition 2019.
5. Dharmendra Rautray, Principles of Law of Arbitration in India, Wolters Kluwer, 2018.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	2	2	2
CO2	3	3	3	3	2	1
CO3	3	3	3	3	2	1
CO4	2	2	2	2	2	1
CO5	3	2	2	3	2	2
Avg	3	3	3	3	2	1

• 1-low, 2-medium, 3-high

CN3204 COMPUTER APPLICATIONS IN CONSTRUCTION MANAGEMENT **L T P C**
2 0 2 3

UNIT I INTRODUCTION **6**
Overview of IT Applications in Construction – Construction process – Computerization in Construction – Developing application with database software.

UNIT II OPTIMIZATION TECHNIQUES **6**
Linear and Integer Programming - Branch and Bound Techniques – Application to Equipment Replacement, Material Transportation and Work Assignment Problems – Software applications.

UNIT III INVENTORY MODELS **6**
Deterministic and Probabilistic Inventory Models - Case Study- Software applications.

UNIT IV SCHEDULING APPLICATIONS **6**
PERT and CPM - Advanced planning and scheduling concepts –BIM based planning, scheduling, visualization and control of construction projects - BIM and AR/VR integration - Case Studies.

UNIT V INDUSTRIAL ENGINEERING PROBLEMS **6**
Sequencing problems – Johnson's procedure, 'n' jobs and 'm' machines, Two jobs 'm' machine, Graphical procedure - Simulation – Enterprises – Introduction to ERP and EIP systems.

THEORY: 30 PERIODS

LIST OF EXPERIMENTS:
1. Formulate a relation Database Management system for a simple construction project using MS Access.
2. Formulate a LPP, and solve using MS Excel Solver.
3. Prepare a sample inventory control technique for a simple construction project using MS Excel.
4. Schedule a simple construction project using CPM and PERT and perform schedule performance analysis over Microsoft project.
5. Using graphical method, perform sequencing operations for two jobs and 'm' machines.
6. Prepare a simple simulation experiment and solve using MS Excel.
7. Using BIM Tools, perform an automated Quantity Takeoff for a simple construction project.

PRACTICAL : 30 PERIODS

TOTAL : 60 PERIODS

COURSE OUTCOME:
- On completion of the course, the student is expected to be able to

CO1 Use of software's in construction Industry.
CO2 Apply various optimization techniques.
CO3 Apply Deterministic and Probabilistic Inventory Models.
CO4 Analyze the scheduling concepts.
CO5 Solve problems using simulation and ERP systems.

REFERENCES:

1. Billy E. Gillet., Introduction to Operations Research – A Computer Oriented Algorithmic Approach, McGraw Hill, 2008.
2. Feigenbaum, L., Construction Scheduling with Primavera Project Planner Prentice Hall Inc., 2002.
3. Ming Sun and Rob Howard, "Understanding I.T. in Construction, Spon Press, Taylor and Francis Group, 2004.
4. Paulson, B.R., Computer Applications in Construction, McGraw Hill, 1995.
5. Tarek Hegazy, Computer-Based Construction Project Management, Pearson New International Edition, 2013.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	1	2	1
CO2	3	1	1	2	2	3
CO3	2	1	1	3	2	3
CO4	2	1	1	3	3	3
CO5	3	2	1	3	2	2
Avg	**3**	**1**	**1**	**2**	**2**	**2**

• 1-low, 2-medium, 3-high

CN3211 STATISTICAL LABORATORY FOR CONSTRUCTION ENGINEERING AND MANAGEMENT **L T P C**
0 0 4 2

LIST OF EXPERIMENTS:

1. Descriptive Statistics: frequency distribution, Applications (Charts, Graphs etc.)
2. Use of statistical packages Correlation, ANOVA , Cross Tabulation, *t*- Test and Simple and Multiple Regression
3. Solving Linear Programming Problems, Transportation and Assignment Models
4. Solving Network Flow Models
5. Solving Decision making Problems in Project Management

TOTAL: 60 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Formulate descriptive statistics with charts and graphs using spreadsheet softwares.
CO2 Interpret the data using various statistical analysis.
CO3 Solve Linear Programming Problems, transportation and assignment problems by appropriate techniques and evaluate the behaviour under different range of parameters.
CO4 Create network flow models and apply operational research techniques.
CO5 Perform decision making in project management.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	3	3	2
CO2	3	3	2	3	3	2
CO3	3	2	3	3	3	2
CO4	3	2	3	3	3	2
CO5	3	3	3	3	3	2
Avg	**3**	**2**	**3**	**3**	**3**	**2**

• 1-low, 2-medium, 3-high

CN3311 PRACTICAL TRAINING (4 WEEKS) **L T P C**
0 0 0 2

GUIDELINES: The students individually undertake training in reputed engineering companies doing construction during the summer vacation for a specified duration of four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Describe the real-time challenges and procedures in the construction industry.
CO2 Realize the various functions of construction activities
CO3 Develop skills in facing and solving the problems experiencing in the Construction Management field
CO4 Presentation of work carried out in Practical Training.
CO5 Report Preparation

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	3	2	2
CO2	2	2	2	3	2	2
CO3	3	2	2	3	2	2
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
Avg	**3**	2	2	3	2	2

• 1-low, 2-medium, 3-high

CN3312 **PROJECT WORK I** **L T P C**
0 0 12 6

GUIDELINES: The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of construction engineering and management. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 180 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Apply the knowledge gained from theoretical and practical courses by providing solutions
CO2 Summarize the importance of literature review
CO3 Identify the problem
CO4 Solve the identified problem based on the formulated methodology
CO5 Interpret and present the findings of the work conducted

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
Avg	**3**	**3**	**2**	**3**	**3**	**3**

• 1-low, 2-medium, 3-high

CN3411 **PROJECT WORK II** **L T P C**
0 0 24 12

GUIDELINES: The student should continue the Project Work I on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 360 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Discover the potential research areas.
CO2 Apply the knowledge gained from theoretical and practical courses to be creative, well planned, organized and coordinated.
CO3 Identify the problem
CO4 Solve the identified problem based on the formulated methodology
CO5 Interpret and present the findings of the work conducted

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	3	3	3
CO2	3	2	2	3	3	3
CO3	2	2	2	3	3	3
CO4	3	2	3	3	3	3
CO5	3	2	3	3	3	3
Avg	**3**	**2**	**3**	**3**	**3**	**3**

• 1-low, 2-medium, 3-high

PROFESSIONAL ELECTIVE COURSES

CN3051 **ADVANCED CONCRETE TECHNOLOGY** **L T P C**
3 0 0 3

UNIT I CONCRETE MAKING MATERIALS **9**

Aggregates: Classification, IS specifications, Properties, Grading, Methods of combining, Testing - Cement: Grade, Chemical composition, tests - Hydration of cement - Structure of hydrated cement - Special cements - Water - Chemical admixture - Mineral admixture.

UNIT II MIX DESIGN **9**

Principles of concrete mix design - Methods of concrete mix design: IS method, ACI method, DOE method - Mix design for special concretes - Statistical quality control - Sampling and acceptance criteria as per IS 456 - 2000.

UNIT III CONCRETING METHODS 9

Extreme weather concreting - Vacuum dewatering - Underwater Concreting - 3D printing - Curing methods - Maturity of concrete.

UNIT IV SPECIAL CONCRETES 9

Light weight concrete - Fiber reinforced concrete - Polymer concrete - High performance concrete - Self-compacting concrete - Geopolymer concrete - Waste material-based concrete - Ready mixed concrete - Roller compacted concrete.

UNIT V TESTS ON CONCRETE 9

Hardened concrete: Strength, Elastic properties, Creep and shrinkage - Durability of concrete - Permeability - Chemical attack - Acid attack - Frost damage - Alkali silica reaction - Corrosion tests - Non-destructive testing techniques - Microstructure of concrete.

TOTAL: 45 PERIODS

COURSE OUTCOME:

On completion of the course, the student is expected to be able to:

CO1 Explain the properties of the constituent materials of concrete
CO2 Understand the factors influencing concrete mix and apply the guidelines to do mix designs for concrete by various methods
CO3 Explore the various methods of concreting and curing
CO4 Define special concretes and their applications for practical purpose
CO5 Study the behavior of concrete at its hardened state, describe and carry out tests relevant to the use of concrete on site

REFERENCES:

1. Gambhir M. L. “Concrete Technology”, Fifth Edition, McGraw Hill Education, 2017.
2. Gupta B. L. and Amit Gupta, “Concrete Technology”, Jain Book Agency, 2010.
3. Neville A. M., “Properties of Concrete”, Prentice Hall, London, 2019.
4. Shetty M. S., “Concrete Technology”, Revised Edition, S. Chand and Company Ltd., Delhi, 2019.
5. Job Thomas, “Concrete Technology”, Cencage Learning India Private Ltd., New Delhi, 2015.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	2	2	2
CO2	2	3	3	2	3	3
CO3	3	3	3	2	3	3
CO4	3	3	3	2	2	2
CO5	3	3	3	2	3	2
Avg	**3**	**3**	**3**	**2**	**3**	**2**

• 1-low, 2-medium, 3-high

CN3001 ADVANCED DATA ANALYSIS L T P C
3 0 0 3

UNIT I STATISTICAL DATA ANALYSIS 9

Data and Statistics- Review of Basic Statistical Measures-Probability Distributions-Testing of Hypotheses-Non-Parametric Tests.

UNIT II BASIC CONCEPTS 9

Introduction – Basic concepts – Uni-variate, Bi-variate and Multi-variate techniques – Types of multivariate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation – Approaches to multivariate model building.

UNIT III REGRESSION AND FACTOR ANALYSIS 9

Simple and Multiple Linear Regression Analysis – Introduction – Basic concepts – Multiple linear regression model – Least square estimation – Inferences from the estimated regression function – Validation of the model. Factor Analysis: Definition – Objectives – Approaches to factor analysis – methods of estimation – Factor rotation – Factor scores - Sum of variance explained – interpretation of results. Canonical Correlation Analysis - Objectives – Canonical variates and canonical correlation – Interpretation of variates and correlations.

UNIT IV DISCRIMINANT AND CLUSTER ANALYSIS 9

Discriminant Analysis - Basic concepts – Separation and classification of two populations - Evaluating classification functions – Validation of the model. Cluster Analysis – Definitions – Objectives – Similarity of measures – Hierarchical and Non – Hierarchical clustering methods – Interpretation and validation of the model.

UNIT V ADVANCED TECHNIQUES 9

Conjoint Analysis – Definitions – Basic concepts – Attributes – Preferences – Ranking of Preferences – Output of Conjoint measurements – Utility - Interpretation. Multi-Dimensional Scaling – Definitions – Objectives – Basic concepts – Scaling techniques – Attribute and Non-Attributes based MDS Techniques – Interpretation and Validation of models. Advanced Techniques – Structural Equation modeling

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Describe the different statistical analysis techniques.
CO2 Students will be able to formulate hypothesis
CO3 Explore the basic concepts of statistical analysis
CO4 Develop regression and factor analysis model and its interpretation
CO5 Create discriminant and cluster analysis model and its interpretation

REFERENCES:

1. Joseph F Hair, Rolph E Anderson, Ronald L. Tatham& William C. Black, Multivariate Data Analysis, Pearson Education, New Delhi, 2005.
2. Barbara G. Tabachnick, Linda S.Fidell, Using Multivariate Statistics, 6th Edition, Pearson, 2018.
3. Richard A Johnson and Dean W.Wichern, Applied Multivariate Statistical Analysis, Prentice Hall, New Delhi, 2007.
4. David R Anderson, Dennis J Sweeney and Thomas A Williams, Statistics for Business and Economics, Thompson, Singapore, 2017.
5. Howard E.A. Tinsley & Steven D. Brown, Handbook of Applied Multivariate Statistics & Mathematical modeling, Academic Press, 2000.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	2	3	3	2
CO2	2	1	2	3	3	2
CO3	1	1	2	3	3	2
CO4	2	2	2	3	3	2
CO5	2	2	2	3	3	2
Avg	**2**	**2**	**2**	**3**	**3**	**2**

• 1-low, 2-medium, 3-high

CN3002 CONSTRUCTION PROJECT MANAGEMENT L T P C
3 0 0 3

UNIT I THE OWNERS' PERSPECTIVE 9

Introduction - Project Life Cycle - Types of Construction - Selection of Professional Services - Construction Contractors - Financing of Constructed Facilities - Legal and Regulatory Requirements - Changing Environment of the Construction Industry - Role of Project Managers.

UNIT II ORGANIZING FOR PROJECT MANAGEMENT 9

Project Management – Modern trends - Strategic Planning - Effects of Project Risks on Organization - Organization of Project Participants -Traditional Designer-Constructor Sequence - Professional Construction Management - Owner-Builder Operation - Turnkey Operation - Leadership and Motivation for the Project Team.

UNIT III DESIGN AND CONSTRUCTION PROCESS 9

Design and Construction as an Integrated System - Innovation and Technological Feasibility - Innovation and Economic Feasibility - Design Methodology - Functional Design - Construction Site Environment.

UNIT IV LABOUR, MATERIAL AND EQUIPMENT UTILIZATION 9

Historical Perspective - Labour Productivity - Factors Affecting Job-Site Productivity - Labor Relations in Construction - Problems in Collective Bargaining - Materials Management - Material Procurement and Delivery - Inventory Control - Tradeoffs of Costs in Materials Management - Construction Equipment - Choice of Equipment and Standard Production Rates - Construction Processes Queues and Resource Bottlenecks.

UNIT V COST ESTIMATION 9

Costs Associated with Constructed Facilities - Approaches to Cost Estimation - Type of Construction Cost Estimates - Effects of Scale on Construction Cost - Unit Cost Method of Estimation - Methods for Allocation of Joint Costs - Historical Cost Data - Cost Indices - Applications of Cost Indices to Estimating - Estimate Based on Engineer's List of Quantities - Estimation of Operating Costs.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Identify the stages involved in a project and analyze the obligatory services to be taken up while performing a construction activity.
CO2 Apply the professional skills acquired in managing a construction project.
CO3 Develop the ability to attain an equilibrium among Innovation, Technology and Economic feasibility.
CO4 Cultivate an idea on effective resource utilization and identify factors affecting job productivity.
CO5 Estimate the cost of construction project.

REFERENCES:

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 3rd Edition, 2014.
2. Choudhury S, Project Management, McGraw-Hill Publishing Company, New Delhi, 2017.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2nd edition, 2000.
4. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology,4th Edition, 2013.
5. Prasanna Chandra Project Planning, Analysis, Selection, Implementation and review, Tata Mcgraw Hill, 8th Edition, 2017

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	1	1	1
CO2	3	1	2	2	2	1
CO3	3	3	2	1	3	2
CO4	2	1	2	1	3	2
CO5	3	1	2	1	3	2
Avg	**2**	**1**	**2**	**1**	**1**	**1**

• 1-low, 2-medium, 3-high

CN3003 DESIGN OF ENERGY EFFICIENT BUILDINGS L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Green house Effect – Convection – Measuring latent and sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams – Sun Protection – Types of Shading Devices –Energy conservation strategies.

UNIT II PASSIVE SOLAR HEATING AND COOLING 9

General Principles of passive Solar Heating – Key Design Elements – Sunspace – Direct gain – Trombe Walls, Water Walls – Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Principles – Case studies – Courtyards – Roof Ponds – Cool Pools – Predicting ventilation in buildings – Window Ventilation Calculations – Room Organization Strategies for Cross and Stack Ventilation – Radiation – Evaporation and dehumidification – Wind Catchers – Mass Effect – Zoning – Load Control – Air Filtration and odor removal – Heat recovery in large buildings.

UNIT III DAYLIGHTING AND ELECTRICAL LIGHTING 9

Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials– Day lighting – Sources and concepts –Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design – Electric Lighting – Light Distribution – Electric Lighting control for day lighted buildings – Switching controls – Coefficient of utilization – Calculation of Day light factors.

UNIT IV HEAT CONTROL AND VENTILATION 9

Heat insulation – Terminology – Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings – Influence of Design Parameters – Mechanical controls – Examples. Ventilation – Requirements – Minimum standards for ventilation – Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation – Calculation of probable indoor wind speed.

UNIT IV DESIGN FOR CLIMATIC ZONES 9

An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials – Passive Downdraft Evaporative Cooling – Design of Energy Efficient Buildings for Various Zones – Cold and cloudy – Cold and sunny – Composite – Hot and dry – Moderate – Warm and humid – Case studies of residences, office buildings and other buildings in each zones – Commonly used software packages in energy efficient building analysis and design - Energy Audit – Certification.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Explain environmental energy supplies on buildings
CO2 Explain the passive solar heating, cooling system
CO3 Discuss the various aspects of day-lighting and electrical lighting in a building
CO4 Predict and design building ventilation and heat control for indoor comfort
CO5 Design a building for climatic zone and apply simulation programs of buildings to perform energy calculations

REFERENCES

1. Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, 2018.
2. Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) 1995
3. Residential Energy: Cost Savings and Comfort for Existing Buildings by John Krigger and Chris Dorsi, Published by Saturn Resource Management, 2013.
4. Brown, G.Z. and DeKay, M., Sun, Wind and Light - Architectural Design Strategies, John Wiley and Sons Inc,3rd Edition, 2014
5. Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of NonConventional Energy Sources, 2009.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	2	1	1
CO2	3	2	3	3	1	1
CO3	3	2	3	3	1	1
CO4	2	2	3	3	1	1
CO5	3	2	3	3	1	2
Avg	**3**	**2**	**3**	**3**	**1**	**1**

• 1-low, 2-medium, 3-high

CN3004 ECONOMICS AND FINANCE MANAGEMENT IN CONSTRUCTION L T P C
3 0 0 3

UNIT I BASIC PRINCIPLES 9

Time Value of Money – Cash Flow diagram – Nominal and effective interest- continuous interest . Single Payment Compound Amount Factor (P/F,F/P) – Uniform series of Payments (F/A,A/F,F/P,A/P)– Problem time zero (PTZ)- equation time zero (ETZ). Constant increment to periodic payments – Arithmetic Gradient(G), Geometric Gradient (C).

UNIT II COMPARING ALTERNATIVES PROPOSALS 9

Comparing alternatives- Present Worth Analysis, Annual Worth Analysis, Future Worth Analysis, Rate of Return Analysis (ROR) and Incremental Rate of Return (IROR)Analysis, Benefit/Cost Analysis, Break Even Analysis.

UNIT III EVALUATING ALTERNATIVE INVESTMENTS 9

Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – Value Added Tax (VAT) – Inflation.

UNIT IV FUNDS MANAGEMENT 9

Project Finance – Sources of finance - Long-term and short -term finance, Working Capital Management, Inventory valuation, Mortgage Financing - International financial management- foreign currency management.

UNIT V FUNDAMENTALS OF MANAGEMENT ACCOUNTING 9

Management accounting, Financial accounting principles- basic concepts, Financial statements – accounting ratios - funds flow statement – cash flow statement.

TOTAL : 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Describe the basic principles of Economic in construction
CO2 Evaluate alternate proposals
CO3 Evaluate alternative investments
CO4 Select best source of finance for a project
CO5 Manage the finance and accounting

REFERENCES:

1. Blank, L. and Tarquin,A. Engineering Economy,9th Edn. Mc-Graw Hill Book Co., 2023.
2. Collier, C.A. and Glagola, C.R. Engineering Economics and Cost Analysis, 3rd Edn. Addison Wesley Education Publishers.,1998.
3. Patel, B M Project management- Financial Evalu ation with Strategic Planning, Networking and Control, 2nd Edn. Vikas Publishing House Pvt. Ltd. New Delhi, 2010.
4. Shrivastava,U.K., Construction Planning and Management, 2nd Edn. Galgotia Publications Pvt. Ltd. New Delhi., 2001.
5. Steiner, H.M. Engineering Economic Principles, 2nd Edn. Mc-Graw Hill Book, 1996.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	1	1
CO2	1	2	1	2	2	3
CO3	1	2	1	2	2	2
CO4	1	2	1	1	1	1
CO5	1	3	1	1	1	1
Avg	**1**	**2**	**1**	**2**	**2**	**2**

• 1-low, 2-medium, 3-high

CN3005 ENVIRONMENTAL IMPACT ASSESSMENT FOR CONSTRUCTION ENGINEERING

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 9

Sustainable Development challenges and need - Key approaches for Impact Assessment – EIA approach: historical development - Legal and Regulatory aspects in India - Types and Objectives, Components, Process of EIA.

UNIT II PREDICTION AND ASSESSMENT 9

Prediction and Assessment: tools - impact on air, water, soil & Noise - Role of Biodiversity impact Assessment - Identification, Prediction and Evaluation of Impacts on Biodiversity - Techniques of Biodiversity impact assessment - EIA Report Preparation - Environmental Management Plan: Preparation and implementation - Mitigation and Rehabilitation plans

UNIT III HEALTH AND SOCIO-ECONOMICIMPACT ASSESSMENT 9

Health Assessment: Impact of Environment on Health - Developing framework for Health impact analysis, tools and techniques - Socio-Economic Impact Assessment: Overview and Scope of Social Impact Assessment - SIA model and the planning process - Land acquisition: Legal aspects, Resettlement & Rehabilitation and Development.

UNIT IV INTEGRATED ANALYSIS 9

Integrated Analysis of Environmental, Social and Health Impacts - Challenges for Integrated Approach - Scope for Integrated approach in economic analysis - CBA , Social CBA ,and Cost effectiveness Analysis - Analytic Hierarchy process based Approach

UNIT V IMPACT OF INFRASTRUCTURE AND ENVIRONMENTAL SERVICES 9

EIA for Mining, extraction of natural resources and power generation – Case studies - Primary Processing and Material production - Material Processing, Manufacturing/Fabrication - Service Sectors - Physical Infrastructure including Environmental Services - Building and Construction Projects - Area Development Projects and Townships - Strategic Environmental Assessment, Technological Assessment

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to be able to

CO1 Apply the knowledge of science and engineering fundamentals in sustainable development challenges.

CO2 Explain the identification, prediction and evaluation of impacts that will be caused by projects or industries on biodiversity.

CO3 Identify the legal requirements of environmental impact assessment for projects.

CO4 Develop the ability to perform integrated analysis by considering environmental, social and health impacts.

CO5 Select appropriate methods for environmental impact assessment for Infrastructure and environmental service.

REFERENCES

1. Canter, L.W., “Environmental Impact Assessment”, McGraw Hill, New York, 1996.
2. Anjaneyulu, Yerramilli, and ValliManickam, “Environmental impact assessment methodologies”, Hyderabad: BS Publications, 2022.
3. Lawrence, D.P., “Environmental Impact Assessment – Practical Solutions to recurrent problems”, Wiley-Interscience, New Jersey, 2003.
4. Petts, J., “Handbook of Environmental Impact Assessment’, Vol., I and II, Blackwell science, London, 1999.
5. World Bank – Source Book on Environmental Impact Assessment, 2010.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	2	2	1
CO2	3	3	3	2	2	1
CO3	3	2	3	2	3	1
CO4	3	2	3	2	3	1
CO5	3	2	2	2	3	1
Avg	**3**	**2**	**3**	**2**	**3**	**1**

• 1-low, 2-medium, 3-high

CN3006 HUMAN RESOURCES MANAGEMENT IN CONSTRUCTION LT P C
3 0 0 3

UNIT I MANPOWER PLANNING 9

Manpower planning and forecasting – Recruitment, selection process-Sources- Induction-Orientation and Training -Manpower Planning process - Organising, Staffing, directing, and controlling — Factors influencing supply and demand of human resources – Role of HR manager – Personnel Principles.

UNIT II ORGANISATION 9

Elements of an organisation- Management process in organisations- Planning- Organising-Staffing-Directing- Controlling – Delegation of authority – responsibility – accountability – lines and staff organization, Workforce diversity- international dimensions of Organisation- Organisational structure- determinants of organisational design

UNIT III HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR 9

Basic individual psychology – Approaches to job design and job redesign – Self managing work teams – Intergroup – Conflict in organizations – Leadership-Engineer as Manager –aspects of decision making – Significance of human relation and organizational – Individual in organization – Motivation – Personality and creativity – Group dynamics, Team working – Communication and negotiation skills.

UNIT IV WELFARE MEASURES 9

Establishing Pay plans - Basics of compensation - factors determining pay rate - Current trends in compensation - Job evaluation – Incentives- Practices in Indian organisations - Statutory benefits - non-statutory (voluntary) benefits - Insurance benefits - retirement benefits and other welfare measures to build employee commitment – Laws related to welfare measures.

UNIT V MANAGEMENT AND DEVELOPMENT METHODS 9

Management Development - On-the-job and off-the-job- Management Developments - Performance appraisal in practice. Managing careers: Career planning and development - Managing promotions and transfers. of operations – Developing policies, practices and establishing process pattern – Competency upgradation and their assessment – New methods of training and development – Performance Management.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Implement practices and techniques for evaluating performance, structuring teams, coaching and mentoring people,

CO2 Understand the role of the leader and leadership principles and attitudes

CO3 Demonstrate an understanding of professional and ethical responsibilities; and

CO4 Demonstrate commitment to quality, timeliness, and continuous improvement.

CO5 Clearly understand their future managerial role, with emphasis on the management of the human resources and with a multi-cultural perspective

REFERENCES

1. Dwivedi R.S, Human Relations and Organisational Behaviour, A Global perspective, 5th Edition, Macmillian India Ltd., 2008.
2. Joseph J. Famiularo, “Handbook of Human Resources Administration”, McGraw-Hill Intemational Edition, 2nd Edition 1986.
3. D. Longford, M.R. Hancock, R. Fellows & A. W. Gale, Human Resource Management In Construction CRC Press, 2014.
4. Carleton Counter II and Jill Justice Coulter, “The Complete Standard HandBook of Construction Personnel Management ", Prentice Hall, Inc., New Jersey, 1989.
5. Michael Armstrong, Stephen Taylor, Armstrong’s Handbook of Human Resource Management Practice, 15th Edition, CRC Press, 2020.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	2	2	1
CO2	3	3	1	1	1	2
CO3	2	2	2	1	2	2
CO4	1	1	1	1	1	3
CO5	3	3	1	3	3	3
Avg	2	2	1	2	2	2

• 1-low, 2-medium, 3-high

CN3007 LEAN CONSTRUCTION CONCEPTS, TOOLS AND PRACTICES L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Introduction and overview of the construction project management - Review of Project Management& Productivity Measurement Systems – Productivity in Construction– Daily Progress Report-The state of the industry with respect to its management practices –construction project phases - Essential features of contemporary construction management techniques - The problems with current construction management techniques– Current production planning.

UNIT II LEAN MANAGEMENT 9

Introduction to lean management – Toyota's management principle-Evolution of lean in construction industry - Production theories in construction –Lean construction value - Value in construction - Target value design – Lean project delivery system- Forms of waste in construction industry – Waste Elimination.

UNIT III CORE CONCEPTS IN LEAN 9

Concepts in lean thinking – Principles of lean construction – Variability and its impact – Traditional construction and lean construction – Traditional project delivery - Lean construction and workflow reliability – Work structuring – Production control.

UNIT IV LEAN CONSTRUCTION TOOLS AND TECHNIQUES 9

Value Stream Mapping – Work sampling – Last planner system – Flow and pull based production – Last Planner System – Look ahead schedule – constraint analysis – weekly planning meeting- Daily Huddles – Root cause analysis – Continuous improvement – Just in time.

UNIT V LEAN CONSTRUCTION IMPLEMENTATION 9

Lean construction implementation- Enabling lean through information technology – Lean in design - Design Structure Matrix Location Based Management System-BIM (Building Information Modelling) - IPD (Integrated Project Delivery) – Sustainability through lean construction approach

TOTAL : 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to be able to

CO1 Explains the contemporary management techniques and the issues in present scenario.
CO2 Apply the basics of lean management principles and their evolution from manufacturing industry to construction industry.
CO3 Develops a better understanding of core concepts of lean construction tools and techniques and their importance in achieving better productivity.
CO4 Apply lean techniques to achieve sustainability in construction projects.
CO5 Apply lean construction techniques in design and modeling

REFERENCES:

1. Corfe, C. and Clip, B., Implementing lean in construction: Lean and the sustainability agenda, CIRIA, 2013.
2. Shang Gao and Sui Pheng Low, Lean Construction Management: The Toyota Way, Springer, 2014.
3. Dave, B., Koskela, L., Kiviniemi, A., Owen, R., andTzortzopoulos, P.,Implementing lean in construction: Lean construction and BIM, CIRIA, 2013.
4. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.
5. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	3	2	2
CO2	2	1	1	3	3	2
CO3	2	1	1	3	1	2
CO4	3	1	1	3	2	3
CO5	2	1	1	3	2	2
Avg	**2**	**1**	**1**	**3**	**2**	**2**

1-low, 2-medium, 3-high

ST3051 MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES **L T P C**
3 0 0 3

UNIT I MAINTENANCE AND REPAIR STRATEGIES **9**

Maintenance, repair and rehabilitation, retrofit and strengthening - Need for rehabilitation of structures - Facets of maintenance, importance of maintenance, routine and preventive maintenance - Service life behaviour - Deterioration - Causes and effects - Non-destructive testing techniques.

UNIT II CONDITIONAL ASSESSMENT OF STRUCTURE **9**

Quality assurance for concrete - Non-destructive testing techniques - Inspection and maintenance - Thermal properties - Microstructure of concrete - Cracks: Types, Causes - Effects due to aggressive environment, Sustained elevated temperature, Corrosion on strength and durability - Maintenance safety rules.

UNIT III REPAIR MATERIALS **9**

Repair materials - Criteria for material selection, Methodology of selection - Quick setting compounds - Grouting materials: Gas forming grouts, Polymer grouts, Acrylate and urethane grouts - Bonding agents - Latex emulsions, Epoxy bonding agents - Protective coating for concrete and steel - FRP wrapping system for concrete.

UNIT IV PROTECTION METHODS AND STRUCTURAL HEALTH MONITORING **9**

Concrete protection methods - Reinforcement protection methods - Corrosion protection techniques: Corrosion inhibitors, concrete coatings - Corrosion-resistant steels - Coatings to reinforcement - Cathodic protection - Self-regulating anodes - Structural health monitoring.

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES **9**

Various methods of crack repair: Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays - Repair to active cracks - Repair to dormant cracks - Repair of structures distressed due to corrosion, fire and earthquake - Repair of damaged structural elements (slab, beam and columns) - Jacketing: Column jacketing, Beam jacketing, Beam-column joint jacketing, Reinforced Concrete Jacketing, FRP jacketing - Strengthening of structural elements - Engineered demolition - Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, the student is expected to be able to:

CO1 Explain the importance of maintenance assessment of distressed structures
CO2 Apply the knowledge on quality assurance for concrete based on strength and durability
CO3 Identify various repair materials and advancements in concrete
CO4 Explain the knowledge on concrete protection methods structural health monitoring
CO5 Select various strengthening and repair methods for different cases

REFERENCES:

1. Dodge Woodson, “Concrete Structures, Protection, Repair and Rehabilitation”, Butterworth-Heinemann, Elsevier, New Delhi, 2012.
2. DovKominetzky M. S., “Design and Construction Failures”, Galgotia Publications Pvt. Ltd., 2001.
3. Ravishankar K. and Krishnamoorthy T. S., “Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures”, Allied Publishers, 2004.
4. “Hand book on Seismic Retrofit of Buildings”, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
5. Hand Book on “Repair and Rehabilitation of RCC Buildings”, Director General Works CPWD, Govt. of India, New Delhi, 2002.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	2	2	2
CO2	2	3	3	2	3	3
CO3	3	3	3	2	3	3
CO4	3	3	3	2	2	2
CO5	3	3	3	2	3	2
Avg	**3**	**3**	**3**	**2**	**3**	**2**

• 1-low, 2-medium, 3-high

CN3008 MANAGEMENT INFORMATION SYSTEMS L T P C

3 0 0 3

UNIT I INTRODUCTION 9

Information Systems – Establishing the Framework – Business Models – Information System Architecture – Evolution of Information Systems – Database Management Systems

UNIT II SYSTEM DEVELOPMENT 9

Modern Information System – System Development Life Cycle – Structured Methodologies-Designing Computer Based Methods, Procedures, Control – Designing Structured Programs.

UNIT III INFORMATION SYSTEMS 9

Integrated Construction Management Information System – Project Management Information System – Functional Areas, Finance, Marketing, Production, Personnel – Levels, DSS, EIS, and ES – Comparison, Concepts and Knowledge Representation – Managing International Information System.

UNIT IV IMPLEMENTATION AND CONTROL 9

Control – Testing Security – Coding Techniques – Defection of Error – Validating – Cost Benefit analysis – Assessing the value and risk of Information System.

UNIT V SYSTEM AUDIT 9

Software Engineering qualities – Design, Production, Service, Software specification, Software Metrics, Software quality assurance – Systems Methodology – Objectives – Time and Logic, Knowledge and Human Dimension – Software life cycle models – Verification and Validation.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Apply the knowledge of engineering fundamentals in various information systems in management.
CO2 Design the structured programs by computer-based methods.
CO3 Explain management information system for projects.
CO4 Perform the validation of the computer model and assess the risk of information system.
CO5 Perform software quality assurance, verification and validation.

REFERENCES:

1. Card and Glass, Measuring Software Design Quality, Prentice Hall, 1990.
2. Gordon B. Davis, Management Information System: Conceptual Foundations, Structure and Development, McGraw Hill, 1985.
3. Joyce J Elam, Case series for Management Information Systems, Simon and Schuster, Custom Publishing, 1996.
4. Kenneth C Laudon and Jane Price Laudon, Management Information Systems - Organisation and Technology, Prentice Hall, 2015.
5. Michael W. Evans and John J Marciniah, Software Quality assurance and Management, John Wiley and Sons, 1987.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	2	1	1
CO2	3	3	2	2	1	3
CO3	2	2	1	3	3	3
CO4	2	1	1	2	3	2
CO5	3	2	2	3	3	3
Avg	**2**	**2**	**2**	**2**	**3**	**3**

• 1-low, 2-medium, 3-high

CN3009 ORGANIZATIONAL BEHAVIOUR L T P C
3 0 0 3

UNIT I FOCUS AND PURPOSE 9

Definition, need and importance of organizational behaviour –Nature and scope –Frame work – Organizational behaviour models.

UNIT II INDIVIDUAL BEHAVIOUR 9

Personality : types –Factors influencing personality, theories–Types of learners –The learning process –Learning theories –Organizational behaviour modification –Misbehaviour: Types and Management Intervention - Emotions: Emotional Labour –Emotional Intelligence –Theories – Attitudes: Characteristics, Components, Formation, Measurement and Values - Perceptions : Importance , Factors influencing perception –Interpersonal perception -Impression Management Motivation –importance –Types –Effects on work behavior.

UNIT III GROUP BEHAVIOUR 9

Organization structure –Formation –Groups in organizations –Influence –Group dynamics – Emergence of informal leaders and working norms –Group decision making techniques –Team building -Interpersonal relations –Communication –Control.

UNIT IV LEADERSHIP AND POWER 9

Meaning –Importance–Leadership styles –Theories –Leaders Vs Managers –Sources of power – Power centers –Power and Politics.

UNIT V DYNAMICS OF ORGANIZATIONAL BEHAVIOUR 9

Organizational culture and climate –Factors affecting organizational climate –Importance of Job satisfaction –Determinants–Measurements – Influence on behavior - Organizational change – Importance –Stability Vs Change – Proactive Vs Reaction change– The change process – Resistance to change – Managing change - Stress - Work Stressors–Prevention and Management of stress – Balancing work and Life - Organizational development –Characteristics and objectives – Organizational effectiveness- Case studies of OD interventions in mega construction projects.

TOTAL : 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Identify the need and importance of organizational behavior and the framework of organizational models

CO2 Explain the various learning theories and develop alternative organizational behavior approaches in the workplace

CO3 Describe the importance of group dynamics and team building.

CO4 Explore the various leadership styles and politics.

CO5 Explain the dynamics of organization behaviour with balance of work life.

REFERENCES:

1. Stephen P. Robins, “Organisational Behavior”,Pearson Education, 18th edition, 2020.
2. Fred Luthans, “Organisational Behavior”, McGraw Hill, 12th Edition, 2005.
3. Schermerhorn, Hunt and Osborn, “Organisational Behavior”, John Wiley, 12th Edition, 2011.
4. Udai Pareek, “Understanding Organisational Behaviour”, 3rd Edition, Oxford Higher Education, 2011.
5. Mc Shane & Von Glinov, “Organisational Behaviour”, 6th Edition, Tata McGraw Hill, 2012.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	2	2
CO2	2	2	3	2	3	2
CO3	2	3	1	2	3	2
CO4	3	1	1	2	3	2
CO5	3	2	3	2	3	2
Avg	**3**	**2**	**3**	**2**	**3**	**2**

• 1-low, 2-medium, 3-high

CN3010 PROJECT SAFETY MANAGEMENT L T P C
3 0 0 3

UNIT I CONSTRUCTION ACCIDENTS 9

Accidents and their Causes – Human Factors in Construction Safety – Costs of Construction Injuries – Occupational and Safety Hazard Assessment – Legal Implications.

UNIT II SAFETY PROGRAMMES 9

Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives.

UNIT III CONTRACTUAL OBLIGATIONS 9

Safety in Construction Contracts – Substance Abuse – Safety Record Keeping.

UNIT IV DESIGNING FOR SAFETY 9

Safety Culture – Safe Workers – Safety and First Line Supervisors – Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel – Sub contractual Obligation – Project Coordination and Safety Procedures – Workers Compensation.

UNIT V OWNERS' AND DESIGNERS' OUTLOOK 9

Owner's responsibility for safely – Owner preparedness – Role of designer in ensuring safety – Safety clause in design document.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Develop the knowledge on accidents and their causes
CO2 Develop the knowledge about safety programmes safety programme job-site safety assessment
CO3 Apply the knowledge contractual obligations
CO4 Explain about designing for safety and safety procedures
CO5 Develop the knowledge owners' and designers responsibility

REFERENCES:

1. Patrick X.W. Zou ,Riza YosiaSunindijo, Strategic Safety Management in Construction and Engineering John Wiley & Sons, Ltd 2015
2. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997.
3. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.
4. Tamilnadu Factory Act, Department of Inspectorate of factories, Tamilnadu. Health Management, Prentice Hall Inc., 2001.
5. Bhattacharjee S.K. Safety Management in Construction (Principles and Practice), Khanna Publishers, New Delhi 2011

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1		1
CO2	2	1	2	2		1
CO3	1	1	1			1
CO4	1	1	2	1	1	1
CO5	1	1	2	1	1	1
Avg	**2**	**1**	**2**	**2**	**1**	**1**

• 1-low, 2-medium, 3-high

CN3011 QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION L T P C

3 0 0 3

UNIT I QUALITY MANAGEMENT 9

Introduction – Definitions and objectives – Dimensions of quality - Factors influencing construction quality – Responsibilities and authority – Methods to improve quality – Quality Process - Quality plan – Quality Management Guidelines – Quality circles.

UNIT II QUALITY SYSTEMS 9

Introduction – History of Quality standards - Quality system standard – ISO 9000 family of standards – Requirements – Preparing Quality System Documents – Quality related training – Implementing a Quality system – Third party Certification

UNIT III QUALITY PLANNING 9

Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – TQM – Traditional approach vs. Modern approach – Principles of TQM - Taguchi's concept of quality – Quality function deployment - Codes and Standards – Documents – Contract and construction programming – Inspection procedures - Processes and products – Total QA / QC programme and cost implication.

UNIT IV QUALITY ASSURANCE AND CONTROL 9

Objectives – Regularity agent, owner, design, contract and construction oriented objectives, Methods – Techniques and needs of QA/QC – Different aspects of quality – Appraisals – Sampling techniques – Sampling plan – Sampling Terms – AQL, LTPD, AOL– Critical, major failure aspects and failure mode analysis, – Stability methods and tools, optimum design – Reliability testing, reliability coefficient and reliability prediction – Failure rate – Mean time to failure – Mean time to repair – Mean time between failures.

UNIT V QUALITY IMPROVEMENT TECHNIQUES 9

Selection of new materials – Influence of drawings, detailing, specification, standardization – Bid preparation – Construction activity, environmental safety, social and environmental factors – Natural causes and speed of construction – Life cycle costing – Value engineering and value analysis- Six sigma concepts.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Achieve the knowledge of quality management guidelines, quality circles.
CO2 Apply the quality standards for preparing Quality system documents.
CO3 Explain the skill of preparing inspection procedures for quality planning.
CO4 Select the techniques and tools for Quality Assurance and Control in Construction Industry.
CO5 Achieve the knowledge of quality improvement techniques

REFERENCES:

1. Hutchins.G, ISO 9000: A Comprehensive Guide to Registration, Audit Guidelines and Successful Certification, Viva Books Pvt. Ltd., 1994.
2. James, J.O' Brian, Construction Inspection Handbook – Total Quality Management, Van Nostrand, 2012.
3. John L. Ashford, the Management of Quality in Construction, E & F.N.Spon, 2002.
4. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, McGraw Hill, 2001
5. Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longman Ltd, 2014.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	2	2	1
CO2	3	3	3	2	2	1
CO3	3	2	3	3	2	1
CO4	3	2	3	3	2	1
CO5	3	2	2	2	3	2
Avg	**3**	**2**	**3**	**2**	**2**	**1**

• 1-low, 2-medium, 3-high

CN3012 QUANTITATIVE TECHNIQUES IN MANAGEMENT L T P C
3 0 0 3

UNIT I OPERATIONS RESEARCH 9

Introduction to Operations Research - Linear Programming – Graphical and Simplex Methods, Duality and Sensitivity Analysis – Transportation and Assignment Problems.

UNIT II PRODUCTION MANAGEMENT 9

Inventory Control - EOQ Model - Quantity Discounts - Safety Stock – ABC Analysis - Replacement Theory–PERT and CPM – Simulation Models– Quality Control.

UNIT III FINANCIAL MANAGEMENT 9

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.

UNIT IV DECISION THEORY 9

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.

UNIT V MANAGERIAL ECONOMICS 9

Cost Concepts – Break-even analysis – Pricing Techniques – Game theory - Applications.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Apply the knowledge of science and engineering fundamentals in learning the concept of operations research and its practical applicability for solving challenges in construction.
CO2 Identify, formulate, plan and schedule construction engineering projects.
CO3 Apply the knowledge of financial management and cost concepts.
CO4 Design the required man, material, equipment, cost and time as per needs by proper decision rules.
CO5 Analyze the cost by break-even analysis and modern construction management software.

REFERENCES:

1. Frank Harrison, E., The Managerial Decision-Making Process, Houghton Mifflin Co., Boston, 1999.
2. Hamdy A.Taha, Operations Research: An Introduction, 10th Edn. Pearson, 2019
3. Levin, R.I, Rubin,D.S., and Stinson J., Quantitative Approaches to Management, McGraw Hill College, 1993.
4. Tang S.L., Irtishad U. Ahmad, Syed M. Ahmed, Ming Lu, Quantitative Technique for Decision making in Construction, Hongkong University Press, HKU, 2004.
5. Vohra, ND., Arora, H. Quantitative Techniques in Management, Sixth Edition, Tata McGraw-Hill Company Ltd, 2021.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	2	3	1
CO2	2	1	1	3	3	1
CO3	2	1	1	2	2	1
CO4	2	1	1	3	2	1
CO5	2	1	1	1	2	1
Avg	**2**	**1**	**1**	**2**	**2**	**1**

• 1-low, 2-medium, 3-high

CN3013 RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION L T P C
3 0 0 3

UNIT I RESOURCE PLANNING 9

Definition of Resource - Types of resources used in a construction project - manpower, Equipment, Material, Money, Time - Categorization of these resources - Study of different types of construction projects - variations in the scope/nature of these projects and their specific resource requirements - Resources required for different types of construction projects.

UNIT II MANPOWER MANAGEMENT 9

Planning Construction Manpower – Different categories of Manpower - Direct and Indirect Workers Requirement– Establishing Worker's Productivity Standards – Manpower Scheduling – Project Manpower Grouping – Allocating Labour during execution stage - Tools for measurement of resources – Labour Productivity Control – Monitoring and Recording workers' productivity Rate – Cost and controlling manpower costs, mobilisation and distribution and demobilisation. Defining Job requirements, training and incentive system.

UNIT III MATERIALS AND EQUIPMENT 9

Planning Construction Material – ABC Classification of Construction Materials – Material Usage – Material Provisioning Process – Planning Materials Inventory – Use of Operations Research in Time of purchase, quantity of material, sources, Transportation, Delivery and Distribution- Materials Productivity Control and Documentation. Planning Construction Equipment: Classification of Major and minor equipment – Planning, selecting and acquisition of equipment by optimistic choice with respect to cost, Time, Source and handling – Equipment Productivity Control and Documentation

UNIT IV TIME AND COST MANAGEMENT 9

Project work breakdown, Determining Activities Involved, Activity Duration and Costs, Planning Construction time and cost, Classification of Construction Costs, forecasting time buffers and contingencies for scheduling, Critical path measuring the changes and their effects – Project time and cost control tools and Work progress measurement.

UNIT V RESOURCE ALLOCATION AND LEVELLING 9

Problems in Time-cost trade-off – Project Crashing – Resource allocation, Resource loading, Resource levelling & Smoothening Problems- Representation in Gantt Chart - Cumulative Cost Graph - S Curve – Earned Value Problems.

TOTAL : 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Identify the different types of resources in a construction industry
CO2 Estimate manpower requirement, labour productivity and control
CO3 Selection and Estimation of construction Material and equipment
CO4 Prepare WBS for a Construction Project and Monitor Project Time and Cost
CO5 Determining Optimum Project time and cost and Assessing the Performance of Projects.

REFERENCES:

1. Sharma , S C., Construction equipment managaemnt , Khanna publishers, Delhi, 2016.
2. Kumar Neeraj Jha Construction project management , Pearson publishers, 2015.
3. Andrew,D., Szilagg, Hand Book of Engineering Management, 1982.
4. Oxley Rand Poslcit, Management Techniques applied to the Construction Industry,Granda Publishing Ltd., 1980.
5. Paul Netscher, Construction Project Management: Tips and Insights, Panet Publications, 2017.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	2	2	2	2
CO2	1	2	2	3	3	2
CO3	1	1	2	3	3	2
CO4	2	2	2	3	3	3
CO5	2	2	2	3	3	2
Avg	**1**	**2**	**2**	**3**	**3**	**2**

• 1-low, 2-medium, 3-high

CN3052 SHORING, SCAFFOLDING AND FORMWORK L T P C
3 0 0 3

UNIT I PLANNING, SITE EQUIPMENT & PLANT FOR FORMWORK 9

Introduction - Forms for foundations, columns, beams, walls, slabs etc., General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples. Overall Planning - Detailed planning - Standard units - Corner units - Pass units - Calculation of labour constants - Formwork hours - Labour Requirement - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork - Formwork accessories.

UNIT II MATERIALS ACCESSORIES PROPRIETARY PRODUCTS & PRESSURES 9

Lumber - Types - Finish - Sheathing boards- working stresses - Repetitive member stress - Plywood - Types and grades - Jointing Boarding - Textured surfaces and strength - Reconstituted wood - Steel - Aluminum - Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork – ACI- DIN18218 - Examples - Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls.

UNIT III DESIGN OF FORMS AND SHORES 9

Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each. Simple wood stresses - Slenderness ratio - Allowable load vs length behaviour of wood shores - Form lining Design Tables for Wall formwork - Slab Formwork - Column Formwork - Slab props - Stacking Towers - Free standing and restrained - Rosett Shoring - Shoring Tower - Heavy Duty props.

UNIT IV BUILDING AND ERECTING THE FORMWORK 9

Carpentry Shop and job mill - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Sky deck and Multiflex - Customized slab table - Standard Table module forms - Swivel head and uniportal head - Assembly sequence - Cycling with lifting fork - Moving with table trolley and table prop. Various causes of failures - ACI - Design deficiencies - Permitted and gradual irregularities- DIN18202 – Tolerance.

UNIT V FORMS FOR DOMES AND TUNNELS, SLIPFORMS AND SCAFFOLDS 9

Hemispherical, Parabolic, Translational shells - Typical barrel vaults Folded plate roof details - Forms for Thin Shell roof slabs design considerations - Building the forms - Placing concrete - Form removed -Strength requirements -Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction - Shafts. Slip Forms - Principles

-Types - advantages - Functions of various components - Planning -Desirable characteristics of concrete - Common problems faced - Safety in slip forms special structures built with slip form Technique - Types of scaffolds - Putlog and independent scaffold -Single pole scaffolds - Truss suspended - Gantry and system scaffolds.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Explain detail planning of formwork, plant and site equipment.
CO2 Select material accessories for formwork connection and analyze pressures on formworks.
CO3 Design the forms and shores.
CO4 Apply the knowledge of erecting forms for beams, slabs, columns, walls and causes of failures.
CO5 Apply the knowledge of forms and its erection for domes and tunnels, types of slip forms and scaffolds.

REFERENCES:

1. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996
2. Michael P. Hurst, Construction Press, London and New York, 2003.
3. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw - Hill, Indian Edition, 2015.
4. Kumar NeerajJha, Formwork for Concrete Structures, McGraw-Hill Education 2017.
5. Robert T. Ratay, Temporary Structures in construction, 3rd Edn. McGraw-Hill Education 2012.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	3	2	1
CO2	3	3	2	1	2	1
CO3	2	3	3	1	1	1
CO4	3	3	3	1	1	2
CO5	3	2	3	1	1	2
Avg	**3**	**3**	**2**	**1**	**1**	**1**

• 1-low, 2-medium, 3-high

CN3014 SUPPLY CHAIN MANAGEMENT AND LOGISTICS IN CONSTRUCTION L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Definition of Logistics and SCM: Evolution, Scope, Importance - Supply chain stages and decision phases process view of a supply chain - Supply chain flows- Examples of supply chains- Competitive and supply chain strategies- Achieving strategic fit- Expanding strategic scope- Drivers of supply chain performance- Framework for structuring drivers -Obstacles to achieving fit.

UNIT II STRATEGIC PERSPECTIVES 9

Challenge of construction logistics-Aggregating global products for just-in-time delivery to construction sites – Construction Logistics – Supply of bulk materials – Effective management of a construction project supply chain – Construction supply chain management strategy.

UNIT III INTEGRATED DATA MANAGEMENT 9

Impact of BIM and new data management capabilities on supply chain management in construction – Data management for integrated supply chains in construction

UNIT IV CONSTRUCTION LOGISTICS AND SUSTAINABILITY 9

Role of logistics in achieving sustainable construction – Resource efficiency benefits of effective logistics

UNIT V LOGISTICS OPERATIONS 9

Role of the construction logistics manager – Third party logistics operators in construction – Managing construction logistics for confined sites in urban areas - Consolidation centers in construction logistics – Delivery management systems.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Describe the conceptual and theoretical backgrounds of Supply Chain Management and logistics

CO2 Apply the strategy in logistics function ranging from planning to execution and control.

CO3 Identify the Impact of BIM and new data management capabilities on supply chain management in construction.

CO4 Analyse the implications of various strategic choices and decide a better course of action.

CO5 Understand the role of construction logistic Managers and Delivery management systems.

REFERENCES:

1. GregerLundesjö, Supply Chain Management and Logistics in Construction: Delivering Tomorrow's Built Environment, Kogan Page Publishers, 2015.
2. Supply Chain Management, Strategy, Planning, and operation – Sunil Chopra, Peter Meindl and Kalra, Pearson Education, 2011
3. A. Ravi Ravindran, Donald P. Warsing, Supply Chain Engineering: Models and Applications, CRC Press, 2012.
4. G Srinivasan, Quantitative Models in Operations and Supply Chain Management, PHI Learning (P) Ltd, New Delhi, 2010.
5. David J.Bloomberg, Stephen Lemay and Joe B.Hanna, Logistics, PHI 2010.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	3	2	1
CO2	3	3	2	1	2	1
CO3	2	3	3	1	1	1
CO4	3	3	3	1	1	2
CO5	3	2	3	1	1	2
Avg	3	3	3	2	1	1

• 1-low, 2-medium, 3-high

CN3015 SUSTAINABLE CONSTRUCTION L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials.

UNIT II MATERIALS USED IN SUSTAINABLE CONSTRUCTION 9

Construction materials and indoor air quality - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.

UNIT III ENERGY CALCULATIONS 9

Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use

UNITIV GREEN BUILDINGS 9

Control of energy use in building - ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling - Performance ratings of green buildings - Zero energy building

UNIT V ENVIRONMENTAL EFFECTS 9

Non-renewable sources of energy and Environmental aspects – energy norm, coal, oil, natural gas - Nuclear energy - Global temperature, Green house effects, global warming - Acid rain: Causes, effects and control methods - Regional impacts of temperature change.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Describe the various sustainable materials used in construction.
CO2 Explain the method of estimating the amount of energy required for building.
CO3 Describe the features of LEED, TERI and GRIHA ratings of buildings.
CO4 Explore the concept and performance of zero energy buildings.
CO5 Select less carbon emission materials for construction.

REFERENCES:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition, Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell, UK, 2016.
3. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
4. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.
5. New Building Materials and Construction World magazine

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	3	3	3	2
CO2	2	2	2	3	3	2
CO3	2	1	2	3	3	2
CO4	2	1	2	3	3	2
CO5	1	1	2	2	3	2
Avg	**2**	**1**	**2**	**3**	**3**	**2**

• 1-low, 2-medium, 3-high

CN3016 SYSTEM INTEGRATION IN CONSTRUCTION L T P C
3 0 0 3

UNIT I STRUCTURAL INTEGRATION 9

Structural System, Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and Specification.

UNIT II ENVIRONMENTAL FACTORS 9

Qualities of enclosure necessary to maintain a specified level of interior environmental quality – weather resistance – Thermal infiltration – Acoustic Control – Transmission reduction – Air quality – illumination – Relevant systems integration with structural systems.

UNIT III SERVICES 9

Plumbing – Electricity – Vertical circulation and their interaction – HVAC systems in Buildings and Implementation techniques in High Rise Buildings.

UNIT IV MAINTENANCE 9

Component longevity in terms of operation performance and resistance to deleterious forces - Planning systems for least maintenance materials and construction – access for maintenance – Feasibility for replacement of damaged components – equal life elemental design – maintenance free exposed and finished surfaces.

UNIT V SAFETY 9

Ability of systems to protect fire – Preventive systems – fire escape system design – Planning for pollution free construction environmental – Hazard free Construction execution for High Rise Buildings.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to

CO1 Integrate the various construction techniques and incorporate into the building process

CO2 Appreciate the requirements and elements of HVAC, mechanical, electrical, hydraulic and transportation services in buildings

CO3 Design and integrate services into high-rise buildings

CO4 Interpret the intricacies of physical installation of services and their critical sequence in the construction process.

CO5 Adopt an approach relating systems to aim for a high performance building in various categories of major use

REFERENCES

1. A.J.Elder and MartizVindenBarg, Handbook of Building Enclosure, McGraw-Hill Book Company, 1983.
2. David V.Chadderton, Building Services Engineering, Taylar and Francis, 2007.
3. Jane Taylor and Gordin Cooke, The Fire Precautions Act in Practices, 1987.
4. Peter R. Smith and Warren G. Julian, Building Services, Applied Science Publishers Ltd., London, 1993.
5. William T. Mayer, Energy Economics and Building Design, McGraw-Hill Book Company, 1983.

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	2	2
CO2	2	2	3	2	3	2
CO3	2	3	1	2	3	2
CO4	3	1	1	2	3	2
CO5	3	2	3	2	3	2
Avg	**3**	**2**	**3**	**2**	**3**	**2**

• 1-low, 2-medium, 3-high