

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
REGULATIONS - 2021
CHOICE BASED CREDIT SYSTEM
M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Graduates of the programme M E Construction Engineering & Management will

PEO1	Excel in research or 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 for 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):

POs describe what students are expected to know or be able to do by the time of post-graduation from the program. The Program Outcomes of M.E Construction Engineering and Management are as follows:

The students will able to

POs		Courses
PO 1	An ability to independently carry out research /investigation and development work to solve practical problems.	Modern Construction Materials, Advanced Construction Techniques, Contract Laws and Regulations, Digital Design and Construction, Quantitative Techniques in Management, Computer Applications in Construction Engineering and Planning, Statistical Methods for Engineers, Research Methodology and IPR Seminar/ Industrial Training & Thesis.
PO 2	An ability to write and present a substantial technical report/document	Construction Management Studio Laboratory, Statistical Analysis For Construction Engineers, Advanced Construction Engineering and Experimental Techniques Laboratory, Industrial Training & Thesis.
PO 3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program.	Design of Energy Efficient Buildings, Project Safety Management, Environmental Impact Assessment For Construction Engineers, Shoring, Scaffolding and Formwork, Lean Construction Concepts, Tools & Practices

PO 4	Utilize skill and apply advance knowledge of Planning, Analysis and Design fundamentals appropriate to the discipline and to the field problems	Project Formulation and Appraisal, Construction Planning, Scheduling and Control, Quality control and assurance in construction, Supply chain management and Logistics in construction, Digital Design and Construction, Maintenance, Repair and Rehabilitation Of Structures Construction Management Studio Laboratory, Statistical Analysis For Construction Engineers, Advanced Construction Engineering and Experimental Techniques Laboratory, Seminar/ Industrial Training/ & Thesis.
PO 5	Address modern issues and understanding of the various civil engineering of professional, ethical, legal, security and social issues and responsibilities.	Construction Project Management, Human Resources Management in Construction, Sustainable Construction, Environmental Impact Assessment For Construction Engineers, Advanced Data Analysis, Contract Laws and Regulations, Advanced Construction Techniques, Modern Construction Materials
PO 6	Understanding of Construction Engineering and Management principles and apply these to one's work (Entrepreneurship), as a member and leader in a team, to manage projects. Recognize the need for and have an ability to engage in continuing professional development throughout their life.	Organizational Behavior, Economics and Finance Management in Construction, Maintenance, Repair and Rehabilitation Of Structures, Resource Management and Control in Construction, System Integration in Construction, Supply chain management and Logistics in construction, Seminar / Industrial Training & Thesis

PROGRAM SPECIFIC OUTCOMES (PSOs):

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

PSO1	Knowledge of Construction Engineering and Management discipline	In-depth knowledge in the construction management, engineering and technologies necessary to formulate, plan, schedule and execute construction projects.
PSO2	Critical analysis of Construction management problems and innovation	Critically analyze and solve construction engineering and management problems by applying the modern tools and concepts of Construction Engineering & Management and make innovative advances in theoretical and practical.
PSO3	Conceptualization and evaluation of engineering solutions to Construction Issues	Conceptualize the problems in construction industry and develop appropriate solutions which are technically feasible and economically viable with due consideration of sustainability.

PEO / PO Mapping:

PEO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
I.	3	3	2	3	2	2	1	2	3
II.	2	2	1	2	3	3	3	2	1
III.	1	2	1	3	3	3	2	3	1
IV.	2	1	2	2	2	1	2	3	2
V.	1	3	3	2	1	2	2	2	3

Tentative

Mapping of Course Outcome and Programme Outcome

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

Tentative

PROFESSIONAL ELECTIVE COURSES (PEC)

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

Tentative

ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
M. E. CONSTRUCTION ENGINEERING AND MANAGEMENT
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA AND SYLLABUS

SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE- GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA4159	Statistical Methods for Engineers	FC	4	0	0	4	4
2.	CN4101	Modern Construction Materials	PCC	3	0	0	3	3
3.	CN4102	Project Formulation and Appraisal	PCC	3	1	0	4	4
4.	CN4103	Construction Equipment and Management	PCC	3	0	0	3	3
5.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
6.		Professional Elective I	PEC	3	0	0	3	3
7.		Audit Course I*	AC	2	0	0	2	0
PRACTICALS								
8.	ST4161	Advanced Construction Engineering and Experimental Techniques Laboratory	PCC	0	0	4	4	2
9.	CN4111	Technical Seminar	EEC	0	0	2	2	1
TOTAL				20	1	6	27	22

* Audit Course is optional

SEMESTER II

S NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CN4201	Advanced Construction Techniques	PCC	3	0	0	3	3
2.	CN4202	Construction Planning, Scheduling and Control	PCC	3	0	0	3	3
3.	CN4203	Contract Laws and Regulations	PCC	3	0	0	3	3
4.		Professional Elective II	PEC	3	0	0	3	3
5.		Professional Elective III	PEC	3	0	0	3	3
6.		Audit Course II*	AC	2	0	0	2	0
PRACTICALS								
7.	CN4211	Construction Management Studio Laboratory	PCC	0	0	4	4	2
8.	CN4212	Statistical Analysis for Construction Engineers Laboratory	PCC	0	0	4	4	2
TOTAL				17	0	8	25	19

* Audit Course is optional

SEMESTER III

S NO.	COURSE CODE	COURSE TITLE	CATE- GORY	PERIODS PER WEEK			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
3.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
4.	CN4311	Practical Training (4 Weeks)	EEC	0	0	0	0	2
5.	CN4312	Project Work I	EEC	0	0	12	12	6
TOTAL				9	0	12	21	17

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	CN4411	Project Work II	EEC	0	0	24	24	12
TOTAL				0	0	24	24	12

TOTAL CREDITS :70

FOUNDATION COURSES (FC)

S NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			L	T	P		
1.	MA4159	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.	CN4101	Modern Construction Materials	3	0	0	3	1
2.	CN4102	Project Formulation and Appraisal	3	1	0	4	1
3.	CN4103	Construction Equipment and Management	3	0	0	3	1
4.	ST4161	Advanced Construction Engineering and Experimental Techniques Laboratory	0	0	4	2	1
5.	CN4201	Advanced Construction Techniques	3	0	0	3	2
6.	CN4202	Construction Planning, Scheduling and Control	3	0	0	3	2
7.	CN4203	Contract Laws and Regulations	3	0	0	3	2
8.	CN4211	Construction Management Studio Laboratory	0	0	4	2	2
9.	CN4212	Statistical Analysis For Construction Engineers	0	0	4	2	2
TOTAL CREDITS						25	

LIST OF PROFESSIONAL ELECTIVE COURSES [PEC]**SEMESTER I, ELECTIVE I**

S. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1.	CN4071	Advanced Concrete Technology	3	0	0	3	3
2.	CN4001	Human Resources Management in Construction	3	0	0	3	3
3.	CN4002	Construction Project Management	3	0	0	3	3
4.	CN4003	Sustainable Construction	3	0	0	3	3

SEMESTER II, ELECTIVE II

S. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1.	CN4072	Economics and Finance Management in Construction	3	0	0	3	3
2.	CN4004	Design of Energy Efficient Buildings	3	0	0	3	3
3.	CN4005	Project Safety Management	3	0	0	3	3
4.	CN4006	Computer Applications in Construction Engineering and Planning	3	0	0	3	3

SEMESTER II, ELECTIVE III

S. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1.	CN4007	Quantitative Techniques in Management	3	0	0	3	3
2.	CN4008	Resource Management and Control in Construction	3	0	0	3	3
3.	CN4009	Shoring, Scaffolding and Formwork	3	0	0	3	3
4.	CN4010	System Integration in Construction	3	0	0	3	3

SEMESTER III, ELECTIVE IV

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1.	CN4011	Advanced Data Analysis	3	0	0	3	3
2.	CN4073	Lean Construction Concepts, Tools and Practices	3	0	0	3	3
3.	CN4012	Environmental Impact Assessment For Construction Engineers	3	0	0	3	3
4.	ST4073	Maintenance, Repair and Rehabilitation of Structures	3	0	0	3	3

SEMESTER III, ELECTIVE V

S. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
			L	T	P		
1.	CN4013	Quality Control and Assurance in Construction	3	0	0	3	3
2.	CN4074	Organizational Behaviour	3	0	0	3	3
3.	CN4014	Digital Design and Construction	3	0	0	3	3
4.	CN4075	Supply Chain Management and Logistics in Construction	3	0	0	3	3

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

S. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			L	T	P		
1.	RM4151	Research Methodology and IPR	2	0	0	2	1
TOTAL CREDITS						2	

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			L	T	P		
1.	CN4111	Technical Seminar	0	0	2	1	1
2.	CN4311	Practical Training (4 weeks)	0	0	0	2	3
3.	CN4312	Project Work I	0	0	12	6	3
4.	CN4411	Project Work II	0	0	24	12	4
TOTAL CREDITS						21	

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

S. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	AX4091	English for Research Paper Writing	2	0	0	0	1/2
2.	AX4092	Disaster Management	2	0	0	0	
3.	AX4093	Constitution of India	2	0	0	0	
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0	

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	12	13	00	00	25
3.	PEC	03	06	06	00	15
4.	RMC	02	00	00	00	02
5.	OEC	00	00	03	00	03
6.	EEC	01	00	08	12	21
7.	Non Credit/ Audit Course	✓	✓	00	00	
	TOTAL CREDITS	22	19	17	12	70

Tentative

OBJECTIVES :

- This course is designed to provide the solid foundation on topics in various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modeling. It is framed to address the issues and the principles of estimation theory, testing of hypothesis, correlation and regression, design of experiments and multivariate analysis.

UNIT I ESTIMATION THEORY**12**

Estimators : Unbiasedness, Consistency, Efficiency and sufficiency – Maximum likelihood estimation – Method of moments.

UNIT II TESTING OF HYPOTHESIS**12**

Sampling distributions - Small and large samples -Tests based on Normal, t, Chi square, 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 co-efficient.

UNIT IV DESIGN OF EXPERIMENTS**12**

Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design - 2^2 Factorial 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**OUTCOMES :**

After completing this course, students should demonstrate competency in the following topics:

- Consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation and Central Limit Theorem.
- Use statistical tests in testing hypotheses on data.
- Concept of linear regression, correlation, and its applications.
- List the guidelines for designing experiments and recognize the key historical figures in Design of Experiments.
- Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality.

The students should have the ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools.

REFERENCES :

1. Gupta.S.C., and Kapoor, V.K., "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand and Sons, 2020.
2. Jay L. Devore, "Probability and statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, 2014.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2016.

- Johnson, R.A. and Wichern, D. W. "Applied Multivariate Statistical Analysis", 6th Edition, Pearson Education, Asia, 2012.
- Rice, J.A. "Mathematical Statistics and Data Analysis", 3rd Edition, Cengage Learning, 2015.

CN4101

MODERN CONSTRUCTION MATERIALS

L T P C
3 0 0 3

OBJECTIVE:

- To study and understand the properties of modern construction materials used in construction such as special concretes, metals, composites, water proofing compounds, non-weathering materials, and smart materials.

UNIT I STRUCTURAL MATERIALS 9

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

UNIT II NON-STRUCTURAL MATERIALS, ASSOCESSORIES AND FINISHES 9

Introduction of Non-Structural Materials and Criteria for Selection - Types and properties of Water Proofing Materials – Types of Non-weathering Materials and its uses – Types of Polymer Floor Finishes - Paint - Tiles - Acoustic Treatment materials - Dry Walls - Anchors.

UNIT III COMPOSITES 9

Types of Plastics – Polymer - Properties & Manufacturing process – Advantages of Reinforced polymers – Types of FRP – FRP on different structural elements – Applications of FRP - Bituminous Materials - Glass - Closure - Environmental Concerns.

UNIT IV 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, Geo Polymer Concrete, Alternate Materials to concrete on high performance & high Strength concrete.

UNIT V SMART AND INTELLIGENT MATERIALS 9

Types & Differences between Smart and Intelligent Materials – Special features – Nano Concrete - Nano Technology in Construction - Case studies showing the applications of smart & Intelligent Materials.

TOTAL: 45 PERIODS

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 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:

- Ganapathy, C. "Modern Construction Materials", Eswar Press, 2015.
- Santhakumar A.R. "Concrete Technology", Oxford University press, New Delhi.

3. Ashby, M.F. and Jones D.R.H.H. "Engineering Materials 1: An introduction to Properties, applications and designs", Elsevier Publications, 2005.
4. N.Subramanian, "Building Materials Testing and Sustainability", Oxford Higher Education, 2019.
5. Shetty M.S, Concrete Technology: Theory and Practice, S.Chand & Company Ltd., 2005.

CO – PO Mapping –MODERN CONSTRUCTION MATERIALS

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

CN4102

PROJECT FORMULATION AND APPRAISAL

L T P C
3 1 0 4

OBJECTIVE:

- To study and understand the formulation, costing of construction projects, appraisal, finance and private sector participation.

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.

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 - BOT, BOLT, BOOT - - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.

TOTAL: 60 PERIODS

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 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, 1986.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992
3. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation Review, McGraw Hill Publishing Company Ltd., New Delhi. 2006.
4. United Nations Industrial Development Organisation (UNIDO) Manual for the Preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1987.
5. Raina V.K, "Construction Management Practice – The inside Story", Tata McGraw Hill Publishing Limited, 2005

CO – PO Mapping - PROJECT FORMULATION AND APPRAISAL

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

CN4103**CONSTRUCTION EQUIPMENT AND MANAGEMENT****L T P C
3 0 0 3****OBJECTIVE:**

- To study and understand the various types of equipments used for earthwork, tunneling, drilling, blasting, dewatering, material handling conveyors and its applications in construction projects.

UNIT I CONSTRUCTION EQUIPMENT SELECTION**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.

UNIT III OTHER CONSTRUCTION EQUIPMENTS**9**

Equipment for Dredging, Trenching, Drag line and clamshells, Tunneling – 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 CONCRETING EQUIPMENTS**9**

Aggregate production- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Pumping Equipment – Ready mix concrete equipment, Concrete pouring 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.

TOTAL: 45 PERIODS

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 equipments
 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. and AviadShapira., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2010.
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, Khanna Publishers, New Delhi, 2001.
4. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 2010.
5. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2008

CO – PO Mapping - CONSTRUCTION EQUIPMENT AND MANAGEMENT

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

RM4151

RESEARCH METHODOLOGY AND IPR

L T P C
2 0 0 2

UNIT I RESEARCH DESIGN**6**

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES**6**

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING**6**

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS**6**

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V PATENTS**6**

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL :30 PERIODS**REFERENCES**

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

ST4161 ADVANCED CONSTRUCTION ENGINEERING AND EXPERIMENTAL TECHNIQUES LABORATORY**L T P C
0 0 4 2****A) ADVANCED CONSTRUCTION ENGINEERING LABORATORY****OBJECTIVE:**

- To provides a thorough knowledge of material selection through the material testing based on specification

LIST OF EXPERIMENTS

1. Mix design of concrete as per IS, ACI & BS methods for high performance concrete.
2. Flow Characteristics of Self Compacting concrete.
3. Effect of minerals and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability.
4. NDT on hardened concrete - UPV, Rebound hammer and core test.
5. Permeability test on hardened concrete (RCPT) – Demonstration

TOTAL :30 PERIODS**OUTCOMES:**

On completion of the course the student will be able to

- CO1** Do the mix proportion using IS and ACI codal provisions.
- CO2** Test the concrete in a non-destructive manner using rebound hammer.
- CO3** Know the permeability characteristics of concrete.

B) EXPERIMENTAL TECHNIQUES LABORATORY**OBJECTIVE:**

- To provide a detailed account of modern experimental techniques in construction Engineering research.
- To introduce the basic working principles, the operational know how, and the strength and limitations of the techniques.

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

OUTCOMES:

- On completion of the course, the student is expected to be able to
 - CO1** Gain practical knowledge by applying the experimental methods to correlate with the theory.
 - CO2** Learn the usage of electrical and optical systems for various measurements.
 - CO3** Apply the analytical techniques and graphical analysis to interpret the experimental data

CO – PO Mapping - ADVANCED CONSTRUCTION ENGINEERING AND EXPERIMENTAL TECHNIQUES LABORATORY

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	3	2	3
CO2	3	-	-	-	-	3
CO3	2	-	2	-	2	2

CN4111

TECHNICAL SEMINAR

L T P C
0 0 2 1

OBJECTIVE:

- To work on a specific technical topic in Construction Engineering and Management in order to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.

SYLLABUS: The students will work for two hours per week guided by a group of staff members. They 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

OUTCOME:

- CO1** Identify latest developments in the field of Structural Engineering
- CO2** Acquire technical writing abilities for seminars, conferences and journal publications
- CO3** Use modern tools to present the technical details

CO – PO MAPPING – SEMINAR

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	2	2	3
CO2	2	2	-	1	2	-
CO3	2	-	-	-	-	2

CN4201**ADVANCED CONSTRUCTION TECHNIQUES****L T P C**
3 0 0 3**OBJECTIVE:**

- To study and understand the latest construction techniques applied to engineering construction for sub structure.
- To study and understand the latest construction techniques applied to engineering construction for super structure.
- To study and understand the latest construction techniques applied to engineering construction for special structures.
- To study and understand the latest construction techniques applied to engineering construction for rehabilitation and strengthening techniques.
- To study and understand the latest construction techniques applied to engineering construction for demolition techniques.

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 - well points - 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, sky scrapers - 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 – Support structure for heavy equipment and machinery in heavy industries – 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**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, 1992.
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, 1995.
5. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 2008.

CO – PO Mapping - ADVANCED CONSTRUCTION TECHNIQUES

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

CN4202**CONSTRUCTION PLANNING, SCHEDULING AND CONTROL****L T P C
3 0 0 3****OBJECTIVE:**

- To study and understand the concept of planning.
- To impart concepts in Network representation and analysis.
- To impart concepts in Precedence Network analysis.
- To impart concepts in resource scheduling.
- To learn Concepts in project monitoring and controlling

UNIT I CONSTRUCTION PLANNING**9**

Basic Concepts in the Development of Construction Plans – Choice of Technology and Construction Method – Defining Work Tasks and Work Break down Levels – 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-Arrow 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.

TOTAL: 45 PERIODS

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
CO3	Evaluate the project budget required for the particular construction project
CO4	Recognize the various quality control tool required in the construction industry
CO5	Explain the different databases that can be maintained in a construction industry using computers.

REFERENCES:

- Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth-Heinemann, USA , 2017.
- Chitkara k k., Construction project management, planning, scheduling and control ,McGraw Hill (INDIA) publishers, New Delhi, third edition 2014.
- Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
- Calin M. Popescu, ChotchaiCharoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopaedia of terms and Applications, Wiley, New York, 1995.
- Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

CO – PO Mapping - CONSTRUCTION PLANNING, SCHEDULING AND CONTROL

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

OBJECTIVE:

- To study the various types of construction contract and their legal aspects and provisions..
- To learn concepts in Tenders.
- To learn concepts in Arbitration.
- To learn concepts in legal requirements
- To study the concepts in labour regulations.

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**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, 4th Edition 2015.
5. DharmendraRautray, Principles of Law of Arbitration in India, Wolters Kluwer, 2018.

CO – PO Mapping - CONTRACT LAWS AND REGULATIONS:

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

CN4211**CONSTRUCTION MANAGEMENT STUDIO LABORATORY****L T P C
0 0 4 2****OBJECTIVE:**

- This course gives an exposure to students in utilizing the sophisticated spread sheets programs,
- This course gives an exposure to students in utilizing the estimation software.
- This course gives an exposure to students in utilizing the Project management softwares

LIST OF EXPERIMENTS

1. Scheduling of a small construction project using Primavera scheduling systems including reports and tracking.
2. Scheduling of a small construction project using tools like MS project scheduling systems including reports and tracking.
3. Simulation models for project risk analysis.
4. Virtual progress tracking of small construction project using Navisworks
5. Model a simple building project using Building information Modelling (BIM)

TOTAL:60 PERIODS**OUTCOME:**

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

CO1	Prepare the proposal for a construction project
CO2	Schedule and Track the activities a construction project
CO3	Develop a simulation model for analysing the project risk

CO – PO Mapping - CONSTRUCTION MANAGEMENT STUDIO LABORATORY

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

CN4212**STATISTICAL ANALYSIS FOR CONSTRUCTION
ENGINEERS LABORATORY****L T P C
0 0 4 2****OBJECTIVE:**

- To provide hands on training in basic spread sheet software.
- To provide hands on training in advanced spread sheet software.
- To provide hands on training in data analytical tools.

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**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 and interpretation of results
CO2	Solve Linear Programming Problems, transportation and assignment problems by appropriate techniques and evaluate the behaviour under different range of parameters
CO3	Perform network analysis and decision making in project management

CO – PO Mapping - Statistical Analysis for Construction Engineers Laboratory

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

CN4311**PRACTICAL TRAINING (4 Weeks)****L T P C
0 0 0 2****OBJECTIVE:**

- To train the students in the field work so as to have a firsthand knowledge of practical problems related to Construction Management in carrying out engineering tasks.

SYLLABUS: 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.

OUTCOME:

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

CO1	Describe 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

CO – PO Mapping - PRACTICAL TRAINING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	2	1	3
CO2	2	1	3	-	-	-
CO3	3	-	3	2	2	2

OBJECTIVES:

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS:

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical 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**OUTCOME:**

- On completion of the course, the student will be able to
-

CO1	Apply the knowledge gained from theoretical and practical courses in solving problems
CO2	Recognize the importance of literature review
CO3	Report and present the findings of the work conducted.

CO – PO Mapping - PROJECT WORK I

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	-	3
CO2	3	-	-	3	2	2
CO3	2	2	3	2	2	-

OBJECTIVES:

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze the research problem.
- To develop skills to discuss the test results, and make conclusions.

SYLLABUS:

The student should continue the phase I work on the selected topic as per the formulated methodology/ Undergo internship. 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

OUTCOME:

- On completion of the course, the student will be able to

CO1	Discover potential research areas in the field of Structural Engineering.
CO2	Apply the knowledge gained from theoretical and practical courses to be creative, well planned, organized and coordinated
CO3	Report and present the findings of the work conducted.

CO – PO Mapping - PROJECT WORK II

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	3	3
CO2	3	-	-	2	2	2
CO3	2	-	2	-	2	-

CN4071**ADVANCED CONCRETE TECHNOLOGY**
L T P C
3 0 0 3
OBJECTIVE:

- To study the properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete.

UNIT I CONCRETE MAKING MATERIALS**9**

Aggregates classification IS Specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates. Cement, Grade of cement, Chemical composition, Testing of concrete, Hydration of cement, Structure of hydrated cement, special cements. Water Chemical admixtures, 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- changes in Mix design for special materials.

UNIT III CONCRETING METHODS**9**

Process of manufacturing of concrete, methods of transportation, placing and curing, cracking, plastic shrinkage, Extreme weather concreting, special concreting methods. Vacuum dewatering – Underwater Concrete

UNIT IV SPECIAL CONCRETES**9**

Light weight concrete Fly ash concrete, Fiber reinforced concrete, Sulphur impregnated concrete, Polymer Concrete – High performance concrete. High performance fiber reinforced concrete, Self-Compacting-Concrete, Geo Polymer Concrete, Waste material-based concrete – Ready mixed concrete.

UNIT V TESTS ON CONCRETE**9**

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage – Durability of concrete. Non-destructive Testing Techniques microstructure of concrete

TOTAL: 45 PERIODS**OUTCOMES:**

- On completion of the course, the student is expected to be able to
- | | |
|------------|--|
| CO1 | Develop knowledge on various materials needed for concrete manufacture |
| CO2 | Apply the rules to do mix designs for concrete by various methods |
| CO3 | Develop the methods of manufacturing of concrete. |
| CO4 | Explain about various special concrete |
| CO5 | Explain various tests on fresh and hardened concrete |

REFERENCES:

1. Gambhir.M.L., Concrete Technology, McGraw Hill Education, 2006.
2. Gupta.B.L., Amit Gupta, "Concrete Technology, Jain Book Agency, 2010.
3. Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London.
4. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2003.
5. Job Thomas., Concrete Technology, Cengage learning India Private Ltd, New Delhi, 2015.

CO-PO MAPPING

CO	PO					
	1	2	3	4	5	6
1	3	-	-	2	2	-
2	3	2	2	-	-	2
3	3	-	-	-	2	3
4	3	-	-	2	2	-
5	3	2	-	-	-	3
Avg	3	2	2	2	2	2.67

CN4001 HUMAN RESOURCES MANAGEMENT IN CONSTRUCTION

L T P C
3 0 0 3

OBJECTIVE:

- To teach the various aspects of manpower management and to help the student further develop their management, team building and leadership skills so as to increase their effectiveness in their job performance on international projects.

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 organisation 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

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

- Charles D Pringle, Justin Gooderilongenect, Management, CE Merrill Publishing Co. 2001.
- Dwivedi R.S, Human Relations and Organisational Behaviour, Macmillian India Ltd.,2005.
- Josy .J, Familaro, "Handbook of Human Resources Administration", McGraw-Hill Intemational Edition, 2007
- D. Longford M.R. Hancock, R. Rellows& A. W. Gale, Human Recourse Management In Construction.– Longman Group Limited , fourth impression 2000.
- Carleton Counter II and Jill Justice Coulter, "The Complete Standard Hand Book of Construction Personnel Management ", Prentice Hall, Inc., New Jersey, 1989.

CO – PO Mapping - HUMAN RESOURCES MANAGEMENT IN CONSTRUCTION

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

CN4002**CONSTRUCTION PROJECT MANAGEMENT****L T P C**
3 0 0 3**OBJECTIVE:**

- To study the various management techniques for successful completion of construction projects.

UNIT I FUNDAMENTALS OF CONSTRUCTION PROJECT MANAGEMENT 9

Introduction of construction Project Management – Construction Scope – Construction Project Characteristics - Project development and Life Cycle – Construction Project Management Practice - Roles and Functions and Responsibility of Construction Managers and Major causes of Project failure.

UNIT II PLANNING AND ORGANIZING CONSTRUCTION PROJECT 9

Construction Project organization – Planning Project work Scope and integration Processes - Defining Project Activities - Scheduling Project - CPM, PERT, Precedence Network Analysis – Planning and organizing project resources such as manpower, material, equipment, Time and cost for construction site.

UNIT III DESIGN AND CONSTRUCTION PROCESS 9

Design and Construction as an Integrated System – Innovation, Economic and Technological Feasibility - Design Methodology - Functional Design - Construction Site Environment - Case Studies - Project Clearance requirement, Procedure and Necessary Documentation for Major Works Like Dams, Multistoried Structures, Ports, Tunnels.

UNIT IV PROJECT RESOURCES UTILIZATION**9**

Labor productivity variations, productivity improvement - work study. Materials purchase & inventory control - Construction Equipment - Choice of Equipment and Standard Production Rates – Time management and Cost management - Measuring project progress & performance – Tools and Techniques

UNIT V RISK MANAGEMENT AND PROJECT CONTROLLING**9**

Risks management at construction site - Controlling resource productivity – Schedule and Cost Controlling system – Earned value management system – Project Management Information systems.

TOTAL: 45 PERIODS**OUTCOME:**

- On completion of the course, the student is expected to be able to
- CO1** Explain the stages involved in a project and analyze the obligatory services to be taken up while performing a construction activity.
- CO2** Apply the scheduling techniques for planning construction project.
- CO3** Develop the ability to integrate design and construction Process
- CO4** Analyzing Resources utilization and resource productivity.
- CO5** Assess the risk and controlling systems using project management Information system.

REFERENCES:

- Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 3rd Edition, 2014.
- Choudhury S, Project Management, McGraw-Hill Publishing Company, New Delhi, 2017.
- Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2nd edition, 2000.
- Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 4th Edition, 2013.
- Kumar Neeraj Jha, Construction Project Management Theory and Practices, Pearson, 2012.

CO – PO Mapping - CONSTRUCTION PROJECT MANAGEMENT

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	3	1	2
CO2	3	-	2	-	3	3
CO3	1	3	-	2	1	3
CO3	2	1	2	3	1	-
CO3	3	1	2	-	3	3

CN4003**SUSTAINABLE CONSTRUCTION**
L T P C
3 0 0 3
OBJECTIVE:

- To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

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.

UNITII 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.

UNITIII 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

UNITV 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

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 - SUSTAINABLE CONSTRUCTION

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	3	1	2
CO2	-	1	2	-	3	3
CO3	1	3	-	2	2	3
CO3	2	2	2	3	1	-
CO3	3	1	2	-	3	3

CN4072 ECONOMICS AND FINANCE MANAGEMENT IN CONSTRUCTION L T P C
3 0 0 3

OBJECTIVE:

- To study the basic concepts of construction economic and finance.
- To study the concepts of comparing alternatives proposals.
- To study the concepts of evaluating alternative investments.
- To study the concepts of funds management.
- To study the concepts of management of accounting.

- 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 – GST– Input Tax Credit (ITC) – Assessment and Administration of GST – 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

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:

- Blank, L.T., and Tarquin,a.J Engineering Economy,4th Edn. Mc-Graw Hill Book Co., 1988
- Collier C and GlaGola C Engineering Economics & Cost Analysis, 3rd Edn. Addison Wesley Education Publishers.,1998.
- Patel, B M Project management- strategic Financial Planning, Evaluation and Control, Vikas Publishing House Pvt. Ltd. New Delhi, 2000
- Shrivastava,U.K., Construction Planning and Management,2nd Edn. Galgotia Publications Pvt. Ltd. New Delhi., 2001.
- Steiner, H.M. Engineering Economic principles, 2nd Edn. McGraw Hill Book, 1996

CO – PO Mapping - ECONOMICS AND FINANCE MANAGEMENT IN CONSTRUCTION

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

OBJECTIVE:

- This course aims to provide an understanding of the concept of energy consumption in buildings.
- To provide an understanding of the concept of passive solar heating and cooling.
- To provide an understanding of the concept of day lighting and electrical lighting.
- To provide an understanding of the concept of heat control and ventilation.
- To provide an understanding of the design a energy efficient building based on climatic zones.

UNIT I INTRODUCTION**9**

Climate adapted and climate rejecting buildings – Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Greenhouse 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 – Design responses to 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.

UNIT III DAYLIGHTING AND ELECTRICAL LIGHTING**9**

Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials – Glazing Spectral Response – 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 – Electric Task Lighting – Electric Light Zones – Power Adjustment Factors.

UNIT IV HEAT CONTROL AND VENTILATION**9**

Hourly Solar radiation – 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**

Energy efficiency – 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

OUTCOME:

On completion of this 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 Non-Conventional Energy Sources, 2009.

CO – PO Mapping - DESIGN OF ENERGY EFFICIENT BUILDINGS

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

CN4005**PROJECT SAFETY MANAGEMENT****L T P C**
3 0 0 3**OBJECTIVES:**

- To study and understand the various safety concepts and requirements applied to construction projects.

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 - Occupational Safety and Health Administration Manuals, Laws and Act - Indian and International Practices.

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**

Owners and Designers – Roles and responsibility in ensuring safety – Preparedness – Role of designer in ensuring safety – Safety clause in design document.

TOTAL: 45 PERIODS**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. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997.
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.
3. Sathyanarayanan Rajendran and Mandi Kime, Construction Project Safety-Management Best-Practices Handbook, 2013.
4. Safety, Health and Environmental Handbook, CPWD, 2019.
5. Bhattacharjee S.K. Safety Management in Construction (Principles and Practice), Khanna Publishers, New Delhi 2011

CO – PO Mapping - PROJECT SAFETY MANAGEMENT

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

CN4006**COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING****L T P C
3 0 0 3****OBJECTIVE:**

- To study and understand the optimization techniques, inventory models and scheduling techniques applied to construction engineering.

UNIT I INTRODUCTION**9**

Overview of IT Applications in Construction – Construction process – Computerization in Construction – Computer aided Cost Estimation – Developing application with database software.

UNIT II OPTIMIZATION TECHNIQUES**9**

Linear, Dynamic and Integer Programming - Branch and Bound Techniques – Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems – Software applications.

UNIT III INVENTORY MODELS**9**

Deterministic and Probabilistic Inventory Models - Software applications.

UNIT IV SCHEDULING APPLICATION**9**

PERT and CPM - Advanced planning and scheduling concepts – Computer applications – Case study.

UNIT V OTHER PROBLEMS**9**

Sequencing problems – Simulation – Enterprises – Introduction to ERP systems.

TOTAL : 45 PERIODS**OUTCOME:**

- On completion of this 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:

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

CO – PO Mapping - COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING

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

CN4007**QUANTITATIVE TECHNIQUES IN MANAGEMENT****L T P C****3 0 0 3****OBJECTIVE:**

- To study the various quantitative methods applied to the elements of management, effect of production management, finance management, decision theory and managerial economics.

UNIT I OPERATIONS RESEARCH**9**

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

UNIT II PRODUCTION MANAGEMENT**9**

Inventory Control - EOQ Model - Quantity Discounts - Safety Stock – 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**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:

- Frank Harrison, E., The Managerial Decision-Making Process, Houghton Mifflin Co., Boston, 1999.
- Hamdy A. Taha, Operations Research: An Introduction, Prentice Hall, 2010.
- Levin, R.I., Rubin, D.S., and Stinson J., Quantitative Approaches to Management, McGraw Hill College, 1993.
- Tang S.L., Irteishad U. Ahmad, Syed M. Ahmed, Ming Lu, Quantitative Technique for Decision making in Construction, Hongkong University Press, HKU, 2004.
- Vohra, Nd., Quantitative Techniques in Management, Fifth Edition, Tata McGraw-Hill Company Ltd, 2017.

CO – PO Mapping - QUANTITATIVE TECHNIQUES IN MANAGEMENT

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

CN4008 RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION**L T P C****3 0 0 3****OBJECTIVE:**

- To impart the concepts of resource planning
- To impart the concepts of labor management.
- To impart the concepts of material and equipment.
- To impart the concepts of time management.
- To impart the concepts of resource allocation and resource leveling in construction.

UNIT I	RESOURCE PLANNING	9
Resource Planning, Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control, Types of resources, manpower, Equipment, Material, Money, Time.		
UNIT II	LABOUR MANAGEMENT	9
Systems approach, Characteristics of resources, Utilization, measurement of actual resources required, Tools for measurement of resources, Labour, Classes of Labour, Cost of Labour, Labour schedule, optimum use Labour.		
UNIT III	MATERIALS AND EQUIPMENT	9
Material: Time of purchase, quantity of material, sources, Transportation, Delivery and Distribution Equipment: Planning and selecting by optimistic choice with respect to cost, Time, Source and handling.		
UNIT IV	TIME MANAGEMENT	9
Personnel time, Management and planning, managing time on the project, forecasting the future, Critical path measuring the changes and their effects – Cash flow and cost control.		
UNIT V	RESOURCE ALLOCATION AND LEVELLING	9
Time-cost trade off, Computer application – Resource levelling, resource list, resource allocation, Resource loading, Cumulative cost – Value Management.		

TOTAL : 45 PERIODS

OUTCOME:

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

CO1	Identify the different types of resources in a construction industry
CO2	Evaluate the labour productivity and the influencing factors
CO3	Calculate the equipment output and its operation condition of construction equipment
CO4	Describe the terms of cash inflow, cash outflow and balance sheet
CO5	Categorize the time and cost related informations in a construction sector.

REFERENCES:

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

CO – PO Mapping - RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION

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

OBJECTIVE:

- To disseminate knowledge about detailed planning.
- To disseminate knowledge about materials used in formwork.
- To disseminate knowledge about design of formwork and shores.
- To disseminate knowledge about erection of form work.
- To disseminate knowledge about design of formwork for domes, shells and tunnels.

UNIT I PLANNING, SITE EQUIPMENT & PLANT FOR FORM WORK 9

Introduction - Forms for foundations, columns, beams walls 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 - 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 FORM WORK 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.

UNIT V FORMS FOR DOMES AND TUNNELS, SLIP FORMS 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

OUTCOME:

On completion of this 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. Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996
3. Michael P. Hurst, Construction Press, London and New York, 2003.
4. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw - Hill, 1996.
5. Kumar NeerajJha, Formwork for Concrete Structures, 2017

CO – PO Mapping - SHORING, SCAFFOLDING AND FORMWORK

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

CN4010**SYSTEM INTEGRATION IN CONSTRUCTION**

L T P C
3 0 0 3

OBJECTIVE:

- To understand how the various systems that constitute a building design which are interwoven and integrated with a view to achieving a high-performance building;
- To understand about the various environmental factors.
- To understand about the various services.
- To understand about the various maintenance.
- To understand various concepts in safety planning.

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 – Heating Ventilation and Air-conditioning 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 PLANNING**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**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

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

CO – PO Mapping - SYSTEM INTEGRATION IN CONSTRUCTION

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

CN4011**ADVANCED DATA ANALYSIS****L T P C****3 0 0 3****OBJECTIVE:**

- To learn concepts of data for construction management.
- To learn concepts of various data analysis.
- To learn concepts of regression and factor analysis.
- To learn concepts of discriminant and cluster analysis.
- To learn concepts of advanced multivariate data analysis techniques

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

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:

- Joseph F Hair, Rolph E Anderson, Ronald L. Tatham & William C. Black, Multivariate Data Analysis, Pearson Education, New Delhi, 2005.
- Barbara G. Tabachnick, Linda S. Fidell, Using Multivariate Statistics, 6th Edition, Pearson, 2012.
- Richard A Johnson and Dean W. Wichern, Applied Multivariate Statistical Analysis, Prentice Hall, New Delhi, 2005.
- David R Anderson, Dennis J Sweeney and Thomas A Williams, Statistics for Business and Economics, Thompson, Singapore, 2002.
- Howard E.A. Tinsley & Steven D. Brown, Handbook of Applied Multivariate Statistics & Mathematical modeling, Academic Press, 2000.

CO – PO Mapping - ADVANCED DATA ANALYSIS

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

OBJECTIVE:

- To impart knowledge about the basics of lean construction.
- To impart knowledge about the lean principles.
- To impart knowledge about the core concepts of lean construction.
- To impart knowledge about the lean tools and techniques.
- To impart knowledge about the basics of lean implementation in the construction industry.

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**OUTCOME:**

On completion of this 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., and Tzortzopoulos, 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 - LEAN CONSTRUCTION CONCEPTS, TOOLS & PRACTICES

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

CN4012 ENVIRONMENTAL IMPACT ASSESSMENT FOR CONSTRUCTION ENGINEERS L T P C 3 0 0 3

OBJECTIVE:

- To impart the knowledge and skills required for understanding the various impacts of infrastructure projects on the environment.
- To impart the knowledge about prediction and assessment of EIA.
- To impart the knowledge of health and socio economic impact assessment.
- To impart the knowledge and expose the students to the various methodologies available to assess.
- To impart the knowledge to develop the skill to prepare Environmental Impact Assessment report

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 - Post Project Audit.

UNIT III HEALTH AND SOCIO-ECONOMIC IMPACT 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 - Emerging Dimensions and future Directions.

UNIT V IMPACT OF INFRASTRUCTURE AND ENVIRONMENTAL SERVICES**9**

Case Studies: EIA for Mining, extraction of natural resources and power generation - 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 and Risk Assessment.

TOTAL: 45 PERIODS**OUTCOME:**

- 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

- Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York, 1996.
- Anjaneyulu, Yerramilli, and ValliManickam, "Environmental impact assessment methodologies", Hyderabad: BS Publications, 2007.
- Lawrence, D.P., "Environmental Impact Assessment – Practical Solutions to recurrent problems", Wiley-Interscience, New Jersey, 2003.
- Petts, J., "Handbook of Environmental Impact Assessment", Vol., I and II, Blackwell science, London, 1999.
- World Bank – Source Book on Environmental Impact Assessment, 2010

CO – PO Mapping - ENVIRONMENTAL IMPACT ASSESSMENT FOR CONSTRUCTION ENGINEERS

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

ST4073 MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To study the damages, repair and rehabilitation of structures

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, causes of deterioration. Non-destructive Testing Techniques

UNIT II STRENGTH AND DURABILITY OF CONCRETE**9**

Quality assurance for concrete based on Strength and Durability - Thermal properties, microstructure of concrete – packing density- Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion

UNIT III REPAIR MATERIALS AND SPECIAL CONCRETES**9**

Repair materials-Variou repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials, Special mortars and concretes- Polymer Concrete and Mortar, Quick setting compounds, Grouting materials-Gas forming grouts, Sulfoalumate grouts, Polymer grouts, Acrylate and Urethane grouts, Bonding agents-Latex emulsions, Epoxy bonding agents, Protective coatings-Protective coatings for Concrete and Steel, FRP sheets

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

Concrete protection methods – reinforcement protection methods- self regulating anode - Corrosion protection techniques – Corrosion inhibitors, concrete coatings-Corrosion resistant steels, Coatings to reinforcement, cathodic protection, 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. Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns) Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing, Strengthening, Beam shear strengthening, Flexural strengthening

TOTAL: 45 PERIODS**OUTCOMES:**

- On completion of the 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:

- Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann,Elsevier,New Delhi 2012
- DovKominetzky.M.S., - Design and Construction Failures, Galgotia Publications Pvt.Ltd., 2001
- Ravishankar.K., Krishnamoorthy.T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, 2004.
- Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
- Hand Book on “Repair and Rehabilitation of RCC Buildings” – Director General works CPWD ,Govt of India , New Delhi – 2002
- BS EN 1504 - Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity

CO-PO MAPPING

CO	PO					
	1	2	3	4	5	6
1	3	-	2	2	2	-
2	3	-	-	2	2	-
3	3	-	2	-	2	2
4	3	-	-	3	-	2
5	3	2	1	-	2	3
Avg	3	2	1.67	2.33	2	2.33

CN4013

QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION

L T P C

3 0 0 3

OBJECTIVE:

- To study the concepts of quality management in construction.
- To study the concepts of quality systems.
- To study the concepts of quality planning.
- To study the concepts of quality assurance and control techniques in construction.
- To study the concepts of quality improvement techniques.

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 standards - Quality system standard – ISO 9000 family of standards – Requirements – Preparing Quality System Documents – Quality related training – Implementing a Quality system – Third party Certification – Emission Norms – BS Norms.

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 - Factors influencing construction quality – 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.

TOTAL: 45 PERIODS

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:

- Hutchins.G, ISO 9000: A Comprehensive Guide to Registration, Audit Guidelines and Successful Certification, Viva Books Pvt. Ltd., 1994.
- James, J.O' Brian, Construction Inspection Handbook – Total Quality Management, Van Nostrand, 1997
- KB Rajoria, Deepak Naryan, Deepak Gupta, Practices in construction, CBS Publishers & Distributors Pvt. Ltd., ISBN:978-93-90709-33-5, 2021.
- Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, McGraw Hill, 2001
- Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longman Ltd, 1998.

CO – PO Mapping - QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION

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

CN4074**ORGANIZATIONAL BEHAVIOUR****L T P C
3 0 0 3****OBJECTIVE:**

- To learn basic concepts of organizational behavior.
- To gain a solid understanding of human behavior in the workplace from an individual.
- To gain a solid understanding of human behavior in the workplace in group.
- To learn the concepts of Leadership and power.
- To learn the dynamics of organizational behavior.

UNIT I INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR**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.

TOTAL : 45 PERIODS**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:

- Stephen P. Robins, "Organisational Behavior", PHI Learning / Pearson Education, 15th edition, 2012.
- Fred Luthans, "Organisational Behavior", McGraw Hill, 12th Edition, 2005.
- Schermerhorn, Hunt and Osborn, "Organisational Behavior", John Wiley, 12th Edition, 2011.
- Udai Pareek, "Understanding Organisational Behaviour", 2nd Edition, Oxford Higher Education, 2008.
- Mc Shane & Von Glinov, "Organisational Behaviour", 6th Edition, Tata McGraw Hill, 2012.

CO – PO Mapping - ORGANIZATIONAL BEHAVIOUR

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

CN4014**DIGITAL DESIGN AND CONSTRUCTION****L T P C
3 0 0 3****OBJECTIVE:**

- To learn basic concepts of BIM for construction.
- To learn and acquire knowledge in BIM based construction design process.

- To understand the challenges in BIM implementation
- To learn and acquire knowledge in BIM based construction automation technologies.
- To learn and acquire knowledge in Modern Digital Technologies in Construction

UNIT I INTRODUCTION TO BIM FOR CONSTRUCTION

Fundamentals of BIM – terminology, CAD & BIM. IFCs, schemas, interoperability, parametric modeling.

UNIT II DEVELOPMENT OF DESIGN PROCESS

BIM-based design process and analysis - design coordination. BIM-based construction process – 4D, 5D, nD BIM.

UNIT III CHALLENGES IN BIM IMPLEMENTATION

BIM-based operation issues – facility management. Drivers and barriers in BIM adoption, BIM global practices.

UNIT IV CONSTRUCTION AUTOMATION

Automation in design and construction, virtual experiments – augmented reality, virtual reality, use of sensors in construction.

UNIT V MODERN DIGITAL TECHNOLOGIES IN CONSTRUCTION

Robots in construction, autonomous robots, 3D printing technology in construction. Drones for Construction monitoring, Internet of Things, Smart Manufacturing, etc.

OUTCOME:

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

CO1	To create BIM model
CO2	To develop the construction design process using BIM
CO3	To identify the challenges in BIM implementation
CO4	To use automation techniques in construction
CO5	To implement modern digital technologies in construction

REFERENCES:

1. Daniotti, Bruno, Gianinetto, Marco, Della Torre, Stefano (Eds.), Digital Transformation of the Design, Construction and Management Processes of the Built Environment, Research for Development, Springer Open ,2020.
2. Dominik Holzer, The BIM Manager's Handbook: Guidance for Professionals in Architecture, Engineering, and Construction, Wiley, 2016.
3. Erica Epstein, Implementing Successful Building Information Modeling, Artech House, 2012.
4. Javad Majrouhi Sardroud, Automation in Construction Management, Scholars' Press, 2014.
5. Thomas R. Kurfess, Robotics and Automation Handbook, CRC Press, 2018.

CO – PO Mapping - DIGITAL DESIGN AND CONSTRUCTION

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

CN4075 SUPPLY CHAIN MANAGEMENT AND LOGISTICS IN CONSTRUCTION L T P C 3 0 0 3

OBJECTIVE:

- To gain knowledge about construction supply chain management.
- To understand the concepts of strategic perspectives.

- To understand the concepts of integrated data management.
- To understand the concepts of construction logistics and sustainability.
- To understand the concepts of logistics operations.

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 HOURS

OUTCOME:

- On completion of this 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 - SUPPLY CHAIN MANAGEMENT AND LOGISTICS IN CONSTRUCTION

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

AUDIT COURSES

AX4091

ENGLISH FOR RESEARCH PAPER WRITING

L T P C
2 0 0 0

OBJECTIVES

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING

6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS

6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS

6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS

6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS

6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

OUTCOMES

CO1 – Understand that how to improve your writing skills and level of readability

CO2 – Learn about what to write in each section

CO3 – Understand the skills needed when writing a Title

CO4 – Understand the skills needed when writing the Conclusion

CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

AX4092

DISASTER MANAGEMENT

L T P C
2 0 0 0

OBJECTIVES

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION

6

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS

6

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA

6

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT

6

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT

6

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

OUTCOMES

- CO1: Ability to summarize basics of disaster
- CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "New Royal book Company, 2007.
3. Sahni, Pardeep Et. Al. , " Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

AX4093

CONSTITUTION OF INDIA

L T P C
2 0 0 0

OBJECTIVES

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, □Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

- The Constitution of India, 1950(Bare Act), Government Publication.
- Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1st Edition, 2015.
- M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
- D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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நற்றமிழ் இலக்கியம்

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UNIT I**சங்க இலக்கியம்**

6

1. தமிழின் துவக்க நூல் தொல்காப்பியம்
– எழுத்து, சொல், பொருள்
2. அகநானூறு (82)
– இயற்கை இன்னிசை அரங்கம்
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195)

UNIT II

அறநெறித் தமிழ்

6

1. அறநெறி வகுத்த திருவள்ளுவர்
 - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புரவறிதல், ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து
 - ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

UNIT III

இரட்டைக் காப்பியங்கள்

6

1. கண்ணகியின் புரட்சி
 - சிலப்பதிகார வழக்குரை காதை
 - சமூகசேவை இலக்கியம் மணிமேகலை
 - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV

அருள்நெறித் தமிழ்

6

1. சிறுபாணாற்றுப்படை
 - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஓளவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
 - அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)
 - இயமம் நியமம் விதிகள்
4. தர்மச்சாலையை நிறுவிய வள்ளலார்
5. புறநானூறு
 - சிறுவனே வள்ளலானான்
6. அகநானூறு (4) - வண்டு
நற்றிணை (11) - நண்டு
கலித்தொகை (11) - யானை, புறா
ஐந்திணை 50 (27) - மான்
ஆகியவை பற்றிய செய்திகள்

UNIT V

நவீன தமிழ் இலக்கியம்

6

1. உரைநடைத் தமிழ்,
 - தமிழின் முதல் புதினம்,
 - தமிழின் முதல் சிறுகதை,
 - கட்டுரை இலக்கியம்,
 - பயண இலக்கியம்,
 - நாடகம்.
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,

7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL: 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University) - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia) - <https://ta.wikipedia.org>
3. தர்மபுர ஆதீன வெளியீடு
4. வாழ்வியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம் - தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்

Tentative