

M.E. Degree
in
CONSTRUCTION ENGINEERING AND MANAGEMENT

CURRICULUM & SYLLABUS (CBCS)

(For students admitted from the Academic Year 2022-2023)



DEPARTMENT OF CIVIL ENGINEERING

St. XAVIER'S CATHOLIC COLLEGE OF ENGINEERING

CHUNKANKADAI, NAGERCOIL – 629 003.

KANYAKUMARI DISTRICT, TAMIL NADU, INDIA

St. XAVIER'S CATHOLIC COLLEGE OF ENGINEERING
Chunkankadai, Nagercoil – 629 003.
AUTONOMOUS COLLEGE AFFILIATED TO ANNA UNIVERSITY
ACADEMIC REGULATIONS 2022
M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT CURRICULUM
CHOICE BASED CREDIT SYSTEM

INTRODUCTION

In consonance to the vision of our College,

An engineering graduate we form would be a person with optimal human development, i.e. physical, mental, emotional, social and spiritual spheres of personality.

He/she would be also a person mature in relationships, especially knowing how to treat everyone with respect, including persons of complementary gender with equality and gender sensitivity guided by clear and pro-social values.

He would be patriotic and would hold the Indian Constitution and all the precepts it outlays close to his heart and would have a secular spirit committed to safeguard and cherish the multi-cultural, multi-religious and multi-linguistic ethos of Indian Society.

Academically, he/she would be a graduate with a strong engineering foundation with proficient technical knowledge and skills. He would have enough exposure and experience into the ethos of relevant industry and be industry ready to construct a successful career for himself and for the benefit of the society.

He would have been well trained in research methodology and would have established himself as a researcher having taken up many research projects, with sound ethical standards and social relevance. He would be a person with a passion for technical innovations committed to lifelong learning and research.

He would be well prepared and confident to develop ingenious solutions to the problems people face as an individual and as a team and work for the emancipation of our society with leadership and courage.

Construction Engineering and Management is a sub-discipline of Civil Engineering in which Civil engineers are trained to become competent construction managers who can guide the development of infrastructures. The curriculum provides the students to gain knowledge and skills using modern engineering equipment and software tools by applying appropriate techniques. Graduates can identify, formulate and solve engineering problems in the domain of Construction Engineering .

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I.	Excel in research or will succeed in Construction Engineering and Management profession in the government, public and private sector organizations.
II.	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.
III.	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.
IV.	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..
V.	Have competence of excellence, leadership, written ethical codes and guidelines, and the life- long learning needed for a successful professional career.

II. PROGRAMME OUTCOMES (POs)

PO#	Graduate Attribute
1	Independently carry out research/investigation and development work to solve practical problems.
2	Write and present substantial technical report/document.
3	Demonstrate a degree of mastery over the area of Construction Engineering and Management.
4	Effectively formulate, plan, schedule, arrive quantities and cost and control quality for the existing and new construction projects.
5	Solve problems in Construction Engineering and Management using modern Engineering tools, software and equipments by applying appropriate techniques.
6	Function effectively as a professional with ethical attitude, effective communication skills, leadership skills and multi-disciplinary approach to solve Construction Engineering and Management issues to broader social context.

PEO's – PO's MAPPING

PEO	PO					
	1	2	3	4	5	6
I	2	-	3	1	-	2
II	3	2	3	3	3	1
III	3	3	3	3	2	2
IV	1	2	2	1	1	3
V	3	2	3	3	3	3

PROGRAMME ARTICULATION MATRIX

Year	Semester	Course Name	PO					
			1	2	3	4	5	6
I	I	MA22107	3	-	1	-	1	-
		CM22102	1	2	2	2	2	3
		CM22101	1	2	2	2	2	3
		CM22103	3	2	2	-	2	2
		RM22101	3	2	-	-	-	2
		CM22104	3	3	2	-	-	3
I	II	CM22202	2	3	2	1	2	-
		CM22203	2	-	2	3	-	-
		CM22204	-	1	1	-	-	2
		CM22201	3	2	2	-	2	2
		CM22205	2	2	2	3	3	1
		RM22201	2	2	-	-	2	2

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	MA22107	Statistical Methods for Construction Engineers	FC	3	1	0	4	4
2	CM22102	Construction Planning, Scheduling and Control	PCC	3	1	0	4	4
3		Professional Elective I	PEC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
4	CM22101	Modern Structural Materials and System Design	PCC	3	0	2	5	4
PRACTICAL COURSES								
5	CM22103	Advanced Construction Engineering and Experimental Techniques Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT								
6	RM22101	Research Methodology	RMC	2	0	0	2	2
7	CM22104	Technical Seminar	EEC	0	0	2	2	1
MANDATORY COURSES								
8		Audit Course I	AC	2	0	0	2	0
TOTAL				16	2	8	26	20

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	CM22202	Economics and Finance Management in Construction	PCC	3	1	0	4	4
2	CM22203	Advanced Construction Techniques and Equipment	PCC	3	0	0	3	3
3	CM22204	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
THEORY COURSES WITH PRACTICAL COMPONENT								
6	CM22201	Computer Applications in Construction Engineering and Planning	PCC	3	0	2	5	4
PRACTICAL COURSES								
7	CM22205	Construction Management Studio Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
8	RM22201	Research Tool Laboratory	RMC	0	0	4	4	2
MANDATORY COURSES								
		Audit Course II	AC	2	0	0	2	0
TOTAL				20	1	10	31	24

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
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
EMPLOYABILITY ENHANCEMENT COURSES								
	CM22301	Practical Training (4 weeks during summer vacation)	EEC	-	-	-	-	2
	CM22302	Project Phase I	EEC	0	0	6	6	3
TOTAL				9	0	6	15	14

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
EMPLOYABILITY ENHANCEMENT COURSES								
	CM22401	Project Phase II	EEC	-	-	24	24	12
TOTAL						24	24	12

Total Credits= 70

SUMMARY

M.E. Construction Engineering and Management						
Sl. No.	Subject Area	Credits per Semester				Total Credits
		I	II	III	IV	
1	FC	4	-	-	-	4
2	PCC	10	16	-	-	26
3	PEC	3	6	6	-	15
4	OEC	-	-	3	-	3
5	EEC	1	2	5	12	20
6	RMC	2	-	-	-	2
Total		20	24	14	12	70

AUDIT COURSES (AC)

Sl. No.	Course Code	Course Title	Category	Periods per week			Total Contact Periods	Credits
				L	T	P		
1	AC22101	English for Research Paper Writing	AC	2	0	0	2	0
2	AC22102	Constitution of India	AC	2	0	0	2	0
3	AC22201	Disaster Management	AC	2	0	0	2	0
4	AC22202	ew;wkpo; ,yf;fpak;	AC	2	0	0	2	0

PROFESSIONAL ELECTIVE I – SEMESTER I

Sl. No.	Course Code	Course Title	Category	Periods per week			Total Contact Periods	Credits
				L	T	P		
1	SE22111	Advanced Concrete Technology	PEC	3	0	0	3	3
2	CM22112	Construction Project Management	PEC	3	0	0	3	3
3	CM22113	Design of Energy Efficient Buildings	PEC	3	0	0	3	3
4	CM22114	Shoring, Scaffolding and Formwork	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVES II – SEMESTER II

Sl. No.	Course Code	Course Title	Category	Periods per week			Total Contact Periods	Credits
				L	T	P		
1	SE22221	Maintenance and Rehabilitation of Structures	PEC	3	0	0	3	3
2	CM22222	Project Formulation and Appraisal	PEC	3	0	0	3	3
3	CM22223	Modern Construction Materials	PEC	3	0	0	3	3
4	CM22224	Construction Quality Control, Assurance and Safety Management	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVES III – SEMESTER II

Sl. No.	Course Code	Course Title	Category	Periods per week			Total Contact Periods	Credits
				L	T	P		
1	CM22231	Construction Personnel Management	PEC	3	0	0	3	3
2	CM22232	Safety in Construction	PEC	3	0	0	3	3
3	CM22233	Human Resources Management in Construction	PEC	3	0	0	3	3
4	CM22234	Cost Management of Engineering Projects	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVES IV – SEMESTER III

Sl. No.	Course Code	Course Title	Category	Periods per week			Total Contact Periods	Credits
				L	T	P		
1	CM22341	Project Safety Management	PEC	3	0	0	3	3
2	CM22342	Resource Management and Control in Construction	PEC	3	0	0	3	3
3	CM22343	Quantitative Techniques in Management	PEC	3	0	0	3	3
4	CM22344	Organizational Behaviour	PEC	3	0	0	3	3

PROFESSIONAL ELECTIVES V – SEMESTER III

Sl. No.	Course Code	Course Title	Category	Periods per week			Total Contact Periods	Credits
				L	T	P		
1	SE22351	Structural Health Monitoring	PEC	3	0	0	3	3
2	CM22352	Management Information Systems	PEC	3	0	0	3	3

3	CM22353	Fundamentals of Environmental Impact Assessment	PEC	3	0	0	3	3
4	CM22354	System Integration in Construction	PEC	3	0	0	3	3

SEMESTER I

MA22107	STATISTICAL METHODS FOR CONSTRUCTION ENGINEERS	L	T	P	C	
		3	0	1	4	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • 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. 						
<ul style="list-style-type: none"> • To acquaint the knowledge of testing of hypothesis for small and large samples which play an important role in real life problems. 						
<ul style="list-style-type: none"> • To address the issues and the principles of distributions, testing of hypothesis, correlation and regression, design of experiments and multivariate analysis. 						
UNIT I	THEORETICAL DISTRIBUTIONS					12
Discrete random variable – Probability mass function – Continuous random variable – Probability density function – Probability distribution – Cumulative distribution function – Properties - mean, variance - Special distributions: Binomial, Poisson and Normal distributions (Derivations not included).						
UNIT II	CORRELATION AND REGRESSION					12
Two dimensional discrete distribution – Joint probability mass function - Discrete marginal distribution – Covariance- Correlation – Karl Pearson’s coefficient of correlation and Spearman’s rank correlation – Linear regression – regression coefficients - Curve fitting by the method of least squares – fitting curves of the form $ax+b$, $ax^2 +bx+c$, ab^x and ax^b .						
UNIT III	TESTING OF HYPOTHESIS					12
Statistical hypothesis – Type I and Type II errors – Large sample tests based on Normal distribution for single mean and difference of means – Tests based on t distribution for single mean and equality of means – Test based on F distribution for equality of variances – Chi square test for single variance and goodness of fit – Independence of attributes – Contingency table: Analysis of r c tables.						
UNIT IV	DESIGN OF EXPERIMENTS					12
General principles – Analysis of variance (ANOVA) – One way classification – Completely randomized design (CRD) – Two way classification – Randomized block design (RBD) – Three way classification – Latin square design (LSD) – Two factor experiments: 22 factorial design.						
UNIT V	MULTIVARIATE ANALYSIS					12
Random vectors and random matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components: Population principal components –						

Principal components from standardized variables.	
TOTAL: 60 PERIODS	
COURSE OUTCOMES:	
Upon completion of the course, the students will.../ will be able to...	
CO1:	Define the basic concepts of standard distributions, correlation, statistical and multivariate techniques.
CO2:	Demonstrate the concepts of random variables, correlation and regression in engineering field.
CO3:	Explain statistical, multivariate techniques and principal components analysis.
CO4:	Apply the concept of distributions, correlation and curve fitting in engineering disciplines.
CO5:	Apply the concept of testing of hypothesis, analysis of variance and multivariate normality in real life problems.
REFERENCES:	
1	Gupta S.C., and Kapoor, V.K., “Fundamentals of Mathematical Statistics”, 12 th Edition, Sultan Chand and Sons, 2020.
2	Jay L. Devore, “Probability and statistics for Engineering and the Sciences”, 9 th Edition, Bostan, 2017.
3	Johnson R.A., Miller, I and Freund J., & Miller and Freund’s Probability and Statistics for Engineers, 9 th Edition, Pearson Education, Asia, 2016.
4	Richard A Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, 6 th Edition, New Delhi, 2023.
5	Rice J.A., Mathematical Statistics and Data Analysis, 3 rd Edition, Cengage Learning, 2015.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	1	-	1	-
CO2	3	-	1	-	1	-
CO3	3	-	1	-	1	-
CO4	3	-	1	-	1	-
CO5	3	-	1	-	1	-
Average	3	-	1	-	1	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Theoretical Distributions	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO4	-
Unit-II: Correlation and Regression	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO4	-
Unit-III: Testing of Hypothesis	2	1 either or	1(2) – CO1	1(2) – CO3	1 either or (16) – CO5	-
Unit-IV: Design of Experiments	2	1 either or	2(2) – CO1	-	1 either or (16) – CO5	-
Unit-V: Multivariate Analysis	2	1 either or	1(2) – CO1	1(2) – CO3	1 either or (16) – CO5	-
Total Qns. Statistical Methods for Construction Engineers	10	5 either or	6(2)	4(2)	5 either or (16)	-
Total Marks	20	80	12	8	80	-
Weightage	20%	80%	12%	8%	80%	-
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	12	4	4	32	48	
Weightage	12%	4%	4%	32%	48%	

CM22102	CONSTRUCTION PLANNING, SCHEDULING AND CONTROL				L	T	P	C
					3	1	0	4
COURSE OBJECTIVE:								
<ul style="list-style-type: none"> To study and understand the concept of construction planning, network representation and analysis, scheduling, monitoring, controlling and organization of information of construction projects 								
UNIT I	CONSTRUCTION PLANNING							12
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							12

Duration Estimation – Gantt / Bar Chart – Types of Network and Techniques – Introduction to Floats, Types of Floats, usage of Floats for Project Decisions - Presenting Project Schedules – Scheduling for Activity-on-Node and with Leads, Lags, and Windows – Critical Path Method (CPM) Network Analysis – PERT Network Modelling and Time Analysis – Precedence Diagramming method (PDM) – PDM network representation, Procedure and Analysis – Case Illustrations.		
UNIT III	SCHEDULING PROJECT WORK AND RESOURCE SCHEDULING	12
Work Scheduling Fundamentals – Bar chart method of Work scheduling – Network Based Project Scheduling – Line of Balance Scheduling for Repetitive Projects – Scheduling with Uncertain Durations – Resource Scheduling Considerations – Crashing and Time/Cost Trade-offs – Case Illustrations – Use of Project management Software for scheduling Process.		
UNIT IV	PROJECT MONITORING AND CONTROLLING	12
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 – Schedule and Budget Updates.		
UNIT V	ORGANIZATION AND USE OF PROJECT INFORMATION	12
Types of Project Information – Accuracy and Use of Information – Computerized Organization and Use of Information – Organizing Information in Databases – Relational Model of Databases – Other Conceptual Models of Databases – Centralized Database Management Systems – Databases and Applications Programmes – Information Transfer and Flow.		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	Define the basic concepts of planning, network representation and analysis, scheduling, monitoring, control and organization of data of construction projects.	
CO2:	Describe the planning concepts, network representation and analysis, scheduling, monitoring, control and data organization in construction.	
CO3:	Develop the coding system, network representation, schedule and estimate the duration of construction projects.	
CO4:	Infer the choice of technology, network analysis, scheduling techniques, monitoring, control and database models of construction projects.	
CO5:	Examine the methods of network representation and analysis, work scheduling, cost control and database models of construction projects.	
REFERENCES:		

1	Albert Lester, Project Management, Planning and Control, 7 th Edition, Butterworth Heinemann, USA, 2018.
2	Chitkara K K., Construction Project Management, Planning, Scheduling and Control, McGraw Hill (INDIA) Publishers, New Delhi, 4 th edition 2014.
3	Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4	Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopaedia of terms and Applications, Wiley, New York, 1995.
5	Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	-	-
CO2	1	1	2	1	-	-
CO3	1	3	3	3	2	3
CO4	1	-	3	3	2	-
CO5	1	-	3	3	2	-
Average	1	2	2	2	2	3

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Construction Planning	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Network Representation and Analysis	2	1 either or	2(2) – CO1	-	1 either or (16) – CO3	-
Unit-III: Scheduling Project Work And Resource Scheduling	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-IV: Project Monitoring And Controlling	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Unit-V: Organization and Use of Project Information	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4

Total Qns. Construction Planning, Scheduling and Control	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22101	MODERN STRUCTURAL MATERIALS AND SYSTEM DESIGN				L	T	P	C	
					3	0	2	4	
COURSE OBJECTIVES:									
<ul style="list-style-type: none"> To study about the modern materials used for construction. 									
<ul style="list-style-type: none"> To study the different loads, its importance for design and the structural systems used for construction. 									
<ul style="list-style-type: none"> To bring an awareness on repair and retrofitting of structures. 									
UNIT I	STRUCTURAL MATERIALS							9	
Materials for structural system – Masonry – materials – masonry units aspects – requirements – concrete infill – reinforcing steel – construction systems. Concrete, Steel – behaviour – tension – compression – Reinforced concrete – characteristics – applications. Fibre reinforced concrete – introduction – properties – factors – requirements – orientation – volume fraction – aspect ratio – applications – experience in use. Composite materials – failure modes – concept – behaviour – applications – advantages.									
UNIT II	STRUCTURAL LOADINGS							9	
Type of loads – static and dynamic loads – terminologies. Dead load – unit weight – materials – building components – store materials. Imposed load – loads on floors –reduction factor – beam – roof – example. Wind load – speed and pressure – forces on structures – dynamic effects – force on circular sections. Special loads – accidental loads. Earthquake and blast loads – general principle – recommendations for planning blast resistance – IS codes.									
UNIT III	STRUCTURAL SYSTEMS							9	
Structural systems – function – understanding – classifications. Floor systems – types – properties – Gravity load transfer systems – lateral load transfer system – cost of system – rigid and braced frames – behaviour – limitations- analysis methods.									
UNIT IV	SYSTEM DESIGN							9	
Introduction – process of design – basic requirements – phases of construction. Design									

parameters – steps in conceptual design – common requirements – data required – stages of design – elements of structural systems – economy in design – structural safety during construction.		
UNIT V	REPAIR AND RETROFITTING	9
Introduction – defect – decay – repair cost – distress in structures – masonry – steel – concrete structures. Quality monitoring – maintenance – preventive measures in new construction. Assessment procedure for damages – flow chart. Materials for repair – techniques of repair – strengthening techniques.		
TOTAL: 45 PERIODS		
LIST OF EXPERIMENTS:		
<ol style="list-style-type: none"> 1. Exercise mix design using IS method 2. Conduct tests on fresh concrete 3. Conduct tests on hardened concrete 4. Measurement of strain in concrete using Demec gauge 5. Quality test on concrete 		
TOTAL: 30 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	State the basics of structural materials, loadings, systems, design, repair and retrofitting.	
CO2:	Describe the concepts of materials, loadings, systems, design, repair and retrofitting of structures.	
CO3:	Apply the design procedure underlying the design of structural systems.	
CO4:	Analyse the structural systems and system design.	
CO5:	Infer the techniques of repair and retrofitting of structures.	
REFERENCES:		
1	Cowan H J, Architectural Structures: An Introduction to Structural Mechanics, American Elsevier, New York, 1980.	
2	Salvadori and Levy, Structural Design in Architecture, Prentice Hall Inc., New Jersey, USA, 1983.	
3	Miha Tomazevic, Earthquake Resistance Design of Masonry Buildings, Series on Innovations in Structures and Construction – Vol. I., Imperial College Press, 1999.	
4	Shetty, M.S., Concrete Technology, S.Chand Publishing., New Delhi, 2018.	
5	Ganesan T.P., Model Analysis of Structures, Universities Press, Hyderabad, 2005.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	-	-
CO2	1	1	2	1	-	-
CO3	1	3	3	3	2	3
CO4	1	-	3	3	2	-
CO5	1	-	3	3	2	-
Average	1	2	2	2	2	3

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Structural Materials	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Structural Loadings	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-III: Structural Systems	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO4
Unit-IV: System Design	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-V: Repair And Retrofitting	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Modern Structural Materials and System Design	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22103	ADVANCED CONSTRUCTION ENGINEERING AND EXPERIMENTAL TECHNIQUES LABORATORY				L	T	P	C
					0	0	4	2

COURSE OBJECTIVES:

<ul style="list-style-type: none"> To provide a thorough knowledge of material selection through the material testing based on specification.
<ul style="list-style-type: none"> To provide a detailed account of modern experimental techniques in construction Engineering research.
<ul style="list-style-type: none"> To introduce the basic working principles, the operational know how, and the strength and limitations of the techniques.
A) ADVANCED CONSTRUCTION ENGINEERING LABORATORY
<ol style="list-style-type: none"> Mix design of concrete as per IS, ACI, BS methods for high performance concrete Flow Characteristics of Self Compacting concrete Effect of minerals and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability NDT on hardened concrete - Rebound hammer and core test
B) EXPERIMENTAL TECHNIQUES LABORATORY
<ol style="list-style-type: none"> Ultrasonic interferometer – ultrasonic velocity in liquids Electrical conductivity of metals and alloys with temperature-four probe method NDT – UPV Calibration of Proving Ring and LVDT.
TOTAL: 60 PERIODS
COURSE OUTCOMES:
Upon completion of the course, the students will.../ will be able to...
CO1: Do the mix proportion using IS, ACI and BS codal provisions.
CO2: Test the properties of fresh and hardened concrete.
CO3: Learn the usage of electrical and optical systems for measurements.
CO4: Apply the analytical techniques and graphical analysis to interpret the experimental data.
CO5: Assess the usage of NDT in structures.
LIST OF EQUIPMENTS:
<ol style="list-style-type: none"> L box apparatus V- apparatus Slump cone Compaction factor apparatus

5. Flow table
6. Compression testing machine
7. Rebound Hammer
8. Ultrasonic Pulse Velocity Tester
9. Four probe apparatus
10. Ultrasonic interferometer
11. Proving Ring
12. LVDT

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	-	2
CO2	3	-	2	-	-	2
CO3	3	-	2	-	2	2
CO4	3	-	2	-	3	2
CO5	3	-	2	-	2	2
Average	3	2	2	-	2	2

RM22101	RESEARCH METHODOLOGY	L	T	P	C	
		2	0	0	2	
COURSE OBJECTIVE:						
<ul style="list-style-type: none"> To give an overview of the research methodology and IPR, and explain the techniques of data collection and analysis 						
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, Licenses, Licensing of related patents, patent agents, Registration of patent agents.		
TOTAL: 30 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	Outline the methodology of research.	
CO2:	Explain the research problem, data collection methods, IPR and patent.	
CO3:	Prepare a well-structured research paper, scientific presentations and patent applications.	
CO4:	Develop awareness on IPR, patent law and procedural mechanism in obtaining a patent.	
CO5:	Compare the methods of measurement scale, questionnaire, sampling and data analysis.	
REFERENCES:		
1	Cooper Donald R, Schindler Pamela S and Sharma J K, “Business Research Methods”, Tata McGraw Hill Education, 2012.	
2	Kothari C R, Gaurav Garg, “Research Methodology - Methods and Techniques” New Age International Publishers, 2019.	
3	Catherine J. Holland, “Intellectual Property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.	
4	David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.	
5	The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	3	-	-	-
CO2	3	-	3	-	-	-
CO3	3	2	3	-	-	-
CO4	3	-	3	-	-	-
CO5	3	-	3	-	-	2
Average	3	2	3	-	-	2

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Research Design	2	1 either or	2(2) – CO1	1 either or (16) – CO1	-	-
Unit-II: Data Collection and Sources	2	1 either or	2(2) – CO2	-	1 either or (16) – CO2	-
Unit-III: Data Analysis and Reporting	2	1 either or	1(2) – CO3	1(2) – CO3	-	1 either or (16) – CO3
Unit-IV: Intellectual Property Rights	2	1 either or	2(2) – CO4	-	1 either or (16) – CO4	-
Unit-V: Patents	2	1 either or	1(2) – CO5	1(2) – CO5 1 either or (16) – CO5	-	-
Total Qns. Research Methodology	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	32	16
Weightage	20%	80%	16%	36%	32%	16%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

CM22104	TECHNICAL SEMINAR	L	T	P	C
		0	0	2	1

COURSE 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	
COURSE OUTCOMES:	
Upon completion of the course, the students will.../ will be able to...	
CO1:	Identify latest developments in the field of Construction Engineering and Management.
CO2:	Develop technical writing abilities for seminars, conferences and journal publications.
CO3:	Make use of modern tools to present the technical details.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	3	-	-	3
CO2	-	3	1	-	-	3
CO3	-	-	1	-	-	3
Average	3	3	2	-	-	3

SEMESTER II

CM22202	ECONOMICS AND FINANCE MANAGEMENT IN CONSTRUCTION	L	T	P	C
		3	1	0	4
COURSE OBJECTIVE:					

<ul style="list-style-type: none"> To study the basic concepts of construction economic and finance, evaluating alternative proposals and investments, concepts of funds management and management accounting. 		
UNIT I	BASIC PRINCIPLES	12
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	12
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, Capitalized Cost Analysis.		
UNIT III	EVALUATING ALTERNATIVE INVESTMENTS	12
Real Estate - Investment Property - Equipment Replace Analysis - Buy, Rent and Lease Options - Depreciation – Tax before and after depreciation – Value Added Tax (VAT) – GST – Input Tax Credit (ITC) – Assessment and Administration of GST – Inflation.		
UNIT IV	FUNDS MANAGEMENT	12
Project Finance – Sources of finance - Long-term and short-term finance, Working Capital Management, Inventory valuation, Mortgage Financing - Security and risk aspects - International financial management - foreign currency management.		
UNIT V	FUNDAMENTALS OF MANAGEMENT ACCOUNTING	12
Management accounting, Financial accounting principles - basic concepts, Financial statements – Accounting ratios - Funds flow statement – Cash flow statement.		
TOTAL: 60 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	Define the basics of construction economics and finance including comparing and evaluating alternative proposals, management of funds, and management accounting.	
CO2:	Describe the concepts of construction economics and finance including comparing and evaluating alternative proposals, management of funds, and management accounting.	
CO3:	Develop cash flow diagrams, and cash flow and funds flow statements.	
CO4:	Examine the interest rates, and methods of comparing alternative proposals and investments.	
CO5:	Infer the methods of evaluating alternative proposals and investments, and funds management.	

REFERENCES:	
1	Blank, L.T., and Tarquin, A. J, “Engineering Economy”, 8 th Edn., Mc-Graw Hill Book Co., 2018.
2	Collier C and Gla Gola C, “Engineering Economics and Cost Analysis”, 3 rd Edn., Addison Wesley Education Publishers, 1998.
3	Patel, B M, “Project management - Strategic Financial Planning, Evaluation and Control”, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.
4	Shrivastava, U. K., “Construction Planning and Management”, 2 nd Edn., Galgotia Publications Pvt. Ltd. New Delhi, 2001.
5	Steiner, H.M., “Engineering Economic Principles”, 2 nd Edn., McGraw Hill Book, 1996.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	1	-	-
CO2	1	-	2	1	-	-
CO3	2	3	3	2	2	-
CO4	3	-	3	1	2	-
CO5	3	-	3	1	2	-
Average	2	3	2	1	2	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Basic Principles	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Comparing Alternatives Proposals	2	1 either or	2(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-III: Evaluating Alternative Investments	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO4
Unit-IV: Funds Management	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Unit-V: Fundamentals of	2	1 either or	1(2) – CO1	1 either or (16) – CO2	-	-

Management Accounting						
Total Qns. Economics and Finance Management in Construction	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22203	ADVANCED CONSTRUCTION TECHNIQUES AND EQUIPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure and special structure.
- To study and understand the construction equipment for earthwork, asphalt and concreting.
- To study and understand the equipment used for material handling and miscellaneous equipment used for construction.

UNIT I	SUB STRUCTURE CONSTRUCTION	9
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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
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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
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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	EQUIPMENT FOR EARTHWORK, ASPHALT AND CONCRETING	9
Fundamentals of Earth Work 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. Aggregate Crushers – Feeders - Screening 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 AND MISCELLANEOUS EQUIPMENT	9
Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors and Cranes- Industrial Trucks. Equipment for Dredging, Trenching - Drag line and clamshells, Tunnelling – Equipment for Drilling and Blasting - Pile driving Equipment – Erection Equipment - Crane, Mobile crane - Equipment for Dewatering and Grouting – Equipment for Demolition.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	State the basics of advanced techniques and equipment used in construction.	
CO2:	Demonstrate the principles and concepts relevant to techniques and equipment used in construction of buildings.	
CO3:	Choose the appropriate technique and equipment for construction of structures.	
CO4:	Examine the suitability of construction method and equipment for buildings and special structures.	
CO5:	Infer the methods and equipment available for construction of special structures.	
REFERENCES:		
1	Jerry Irvine, “Advanced Construction Techniques”, California Rocketry 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, 2000.	
5	Sankar, S.K. and Saraswati, S., “Construction Technology”, Oxford University, New Delhi, 2008.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	-	-	-
CO2	2	-	2	-	-	-
CO3	3	-	3	3	-	-
CO4	3	-	3	3	-	-
CO5	3	-	3	3	-	-
Average	2	-	2	3	-	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Sub Structure Construction	2	1 either or	2(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-II: Super Structure Construction for Buildings	2	1 either or	2(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-III: Construction of Special Structures	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO5
Unit-IV: Equipment for Earthwork, Asphalt and Concreting	2	1 either or	1(2) – CO1	1 either or (16) – CO2	-	-
Unit-V: Materials Handling and Miscellaneous Equipment	2	1 either or	1(2) – CO1	1 either or (16) – CO2	-	-
Total Qns. Advanced Construction Techniques and Equipment	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	

Total Marks	16	36	16	16	16
Weightage	16%	36%	16%	16%	16%

CM22204	CONTRACT LAWS AND REGULATIONS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> To study the various types of construction contract and their legal aspects and provisions. 					
<ul style="list-style-type: none"> To learn concepts in Tenders and Arbitration. 					
<ul style="list-style-type: none"> 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 – FIDIC, CPWD, NitiAayog Standard contract conditions - Potential Contractual Problems – World Bank Procedures and Guidelines – Tamil Nadu 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 – Tamil Nadu Factory Act – Child Labour Act - Other Labour Laws – Case studies.					

TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
Upon completion of the course, the students will.../ will be able to...	
CO1:	Define the basic concept and terminology of law of contract & law of labour regulations.
CO2:	Describe the procedure for contract, tender and arbitration.
CO3:	Choose the relevant legal aspects, legal requirements and provision.
CO4:	Distinguish the different processes involved in contract formation.
CO5:	Examine the contract laws and regulations for real time problems in construction industry.
REFERENCES:	
1	Gajaria G.T., “Laws Relating to Building and Engineering Contracts in India”, 2000.
2	Jimmie Hinze, “Construction Contracts”, McGraw Hill, 3 rd 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	Dharmendra Rautray, “Principles of Law of Arbitration in India”, Wolters Kluwer, 2018.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	1	-	-	-	1
CO2	-	1	-	-	-	1
CO3	-	-	2	-	-	2
CO4	-	-	1	-	-	2
CO5	-	-	2	-	-	2
Average	-	1	1	-	-	2

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Construction	2	1 either or	2(2) – CO1	1 either or	-	-

Contracts				(16) – CO2		
Unit-II: Tenders	2	1 either or	2(2) – CO1		-	1 either or (16) – CO4
Unit-III: Arbitration	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	
Unit-IV: Legal Requirements	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-V: Labour Regulations	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Contract Laws and Regulations	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22201	COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING				L	T	P	C
					3	0	2	4
COURSE OBJECTIVE:								
<ul style="list-style-type: none"> To study and understand the hardware and software requirements of computer, programming, optimization techniques, inventory models and scheduling techniques applied to construction engineering and to give knowledge about computer applications in 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 - BIM for construction engineering.								
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 AND RESOURCE ALLOCATION CONCEPTS							9

Deterministic and Probabilistic Inventory Models - Software applications – Resource Allocation – Over Allocation - Resource Levelling and Smoothing.		
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 – Case study – Introduction to ERP systems.		
TOTAL: 45 PERIODS		
LIST OF EXPERIMENTS:		
1. Solving Linear Programming Problems 2. Solving Transportation Models 3. Solving Assignment Models		
TOTAL: 30 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	State the basic concept of computer applications in construction management and planning.	
CO2:	Describe the computer applications in construction management and planning.	
CO3:	Make use of the optimization techniques for problems in construction planning.	
CO4:	Examine the application of software in construction management.	
CO5:	Analyse the inventory models and application of software in construction management.	
REFERENCES:		
1	Billy E. Gillet., “Introduction to Operations Research – A Computer Oriented Algorithmic Approach”, McGraw Hill, 2008.	
2	Feigenbaum, L., “Construction Scheduling with Primavera Project Planner”, Prentice Hall Inc., 2002.	
3	Ming Sun and Rob Howard, “Understanding I.T. in Construction”, Spon Press, Taylor and Francis Group, 2004.	
4	Paulson, B.R., “Computer Applications in Construction”, McGraw Hill, 1995.	
5	Tarek Hegazy, “Computer-Based Construction Project Management”, Pearson New International Edition, 2013.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	-	2
CO2	3	-	2	-	-	2
CO3	3	-	2	-	2	2
CO4	3	-	2	-	3	2
CO5	3	-	2	-	2	2
Average	3	2	2	-	2	2

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Introduction	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Optimization Techniques	2	1 either or	2(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-III: Inventory Models and Resource Allocation Concepts	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO5
Unit-IV: Scheduling Application	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-V: Other Problems	2	1 either or	1(2) – CO1	1 either or (16) – CO5	-	-
Total Qns. Computer Applications in Construction Engineering and Planning	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22205	CONSTRUCTION MANAGEMENT STUDIO LABORATORY	L	T	P	C
		0	0	4	2
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> This course gives an exposure to students in utilizing the sophisticated spread sheets programmes. 					
<ul style="list-style-type: none"> This course gives an exposure to students in utilizing the estimation software. 					
<ul style="list-style-type: none"> This course gives an exposure to students in utilizing the Project management software. 					
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. Model a simple building project using Building information Modelling (BIM).					
TOTAL: 60 PERIODS					
COURSE OUTCOMES:					
Upon completion of the course, the students will.../ will be able to...					
CO1:	Understand the concepts of scheduling, risk analysis and progress tracking of construction projects.				
CO2:	Prepare a proposal for a construction project.				
CO3:	Schedule and track the activities of a construction project.				
CO4:	Develop a simulation model for analysing the project risk.				
CO5:	Create models of buildings using software.				

Mapping of Course Outcomes to Programme Outcomes

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

Average	2	2	2	3	3	1
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RM22201	RESEARCH TOOL LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To familiarize the fundamental concepts/techniques for Project Management.
- To familiarize the journal paper formatting using suitable software.
- To familiarize the software for literature review and Bibliography.
- To find the plagiarism percentage of article contents.
- To prepare a quality research report and the presentation.

LIST OF EXPERIMENTS:

1. Use of tools / Techniques for Research - Project management -Microsoft Project / Microsoft OneNote / Asana.
2. Hands on Training related to software for Paper Formatting like LaTeX / MS Office.
3. Design a Layout of a Research Paper - Guidelines for Submitting the Research Paper - Review Process -Addressing Reviewer Comments.
4. Introduction to Data Analysis Software - Origin SPSS, ANOVA etc.
5. Introduction to Software for detection of Plagiarism – Urkund, Turniton.
6. Preparing Bibliography / Different Reference Formats. – EndNote, Mently.
7. Format of Project Report - Use of Quotations - Method of Transcription- Elements: Title Page - Abstract - Table of Contents - Headings and Sub-Headings - Footnotes - Tables and Figures.
8. Introduction to Microsoft Excel –for Research Analysis.
9. Presentation using PPTs.
10. Data analysis using Matlab.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will.../ will be able to...

CO1:	List the various stages in research and develop systematic planning of project stages.
CO2:	Write a journal paper and formulate as per the standard journal format.
CO3:	Develop a literature review and relevant references for a research problem using suitable software.
CO4:	Determine the plagiarism of the article / report content by using the software.

CO5:	Compile a research report and the presentation.
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Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	-	-	2	-
CO2	2	3	-	-	-	-
CO3	-	2	-	-	-	-
CO4	-	2	-	-	-	-
CO5	-	3	-	-	-	2
Average	2	2	-	-	2	2

SEMESTER III

CM22301	PRACTICAL TRAINING				L	T	P	C
					0	0	0	2
COURSE OBJECTIVE:								
<ul style="list-style-type: none"> To train the students in the field work so as to have first-hand knowledge of practical problems related to Construction Engineering and Management in carrying out engineering tasks. 								
SYLLABUS:								
The students individually undertake training in reputed engineering companies doing Construction Engineering and Management 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.								
TOTAL: 120 PERIODS								
COURSE OUTCOMES:								
Upon completion of the course, the students will.../ will be able to...								
CO1:	Describe the Construction Engineering organization.							
CO2:	Realize the various functions of construction activities.							
CO3:	Gain understanding of groups and group dynamics.							

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	3	3	2	-
CO2	2	3	3	3	2	-

CO3	-	-	-	-	-	3
Average	2	3	3	3	2	3

CM22302	PROJECT PHASE I				L	T	P	C
					0	0	6	3

COURSE 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: 90 PERIODS

COURSE OUTCOME:

Upon completion of the course, the students will.../ will be able to...

CO1:	Develop the ability to solve a specific problem right from its identification and literature review till the successful solution and prepare project reports.
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Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	-
Average	3	3	3	3	3	-

CM22401	PROJECT PHASE II				L	T	P	C
					0	0	24	12

COURSE OBJECTIVES:

- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and 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 based on the report and the viva-voce examination by a panel of examiners including one external examiner.	
TOTAL: 360 PERIODS	
COURSE OUTCOME:	
Upon completion of the course, the students will.../ will be able to...	
CO1:	Discover potential research areas in the field of Construction Engineering and Management about the knowledge gained from theoretical and practical courses to be creative, well planned, organized and coordinated, and present the findings of the work conducted by report.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	3
Average	3	3	3	3	3	3

PROFESSIONAL ELECTIVE COURSES

SE22111	ADVANCED CONCRETE TECHNOLOGY	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVE:						
<ul style="list-style-type: none"> To study the properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete. 						
UNIT I	PROPERTIES OF FRESH AND HARDENED CONCRETE					9
Workability - Factors affecting workability - tests to measure workability, Compressive strength, split tensile strength, flexural strength, modulus of elasticity - Test procedures - effect of w/c ratio.						
UNIT II	CREEP AND SHRINKAGE OF CONCRETE					9
Factors affecting creep – effects of concrete, Factors affecting shrinkage – Plastic shrinkage, drying shrinkage, autogenous shrinkage, carbonation shrinkage – effects.						
UNIT III	DURABILITY OF CONCRETE					9

Permeability – Correction – Carbonation - Chloride Penetration - Sulphate attack – acid attack – Fire resistance – Frost damage – alkali silica reaction – Penetration test – Rebound hammer test – Ultra pulse velocity method, Pull out test.	
UNIT IV	STATISTICAL QUALITY CONTROL OF CONCRETE
Mean strength - standard deviation - coefficient of variation – Sampling – testing - acceptance criteria.	
UNIT V	SPECIAL TOPICS IN CONCRETE TECHNOLOGY
Special concrete: Self Compaction concrete - Fibre reinforced concrete - Ready mix concrete - Geo polymer concrete - Green concrete-lightweight concrete. Special Process: Under water concreting - cold weather concrete - hot weather concreting - mass concrete.	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
Upon completion of the course, the students will.../ will be able to...	
CO1:	Define the materials used in construction, test on concrete, special types of concrete and various concreting methods.
CO2:	Describe the materials used in construction, test on concrete and special types of concrete.
CO3:	Apply the rules in the mix proportion of concrete.
CO4:	Identify the special types of concrete and their applications.
CO5:	Examine the properties of concrete, concreting methods.
REFERENCES:	
1	Gambhir. M. L., “Concrete Technology”, Fifth Edition, McGraw Hill Education, 2017.
2	Gupta. B. L., Amit Gupta, “Concrete Technology”, Jain Book Agency, 2010.
3	Neville, A.M., “Properties of Concrete”, Prentice Hall, London, 2012.
4	Shetty M.S., “Concrete Technology”, Revised Edition, S.Chand and Company Ltd. Delhi, 2018.
5	Job Thomas., “Concrete Technology”, Cengage learning India Private Ltd, New Delhi, 2015.

Mapping of Course Outcomes to Programme Outcomes

CO	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	3	-	-
CO2	3	2	3	3	1	-

CO3	3	-	-	3	-	-
CO4	3	-	-	3	-	-
CO5	3	3	1	3	-	3
Average	3	3	2	3	1	3

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Properties of Fresh and Hardened Concrete	2	1 either or	2(2) – CO1	1 either or (16) – CO1	-	-
Unit-II: Creep and Shrinkage of Concrete	2	1 either or	2(2) – CO2	1 either or (16) – CO2	-	-
Unit-III: Durability of Concrete	2	1 either or	1(2) – CO3	1(2) – CO3	1 either or (16) – CO3	-
Unit-IV: Statistical Quality Control of Concrete	2	1 either or	1(2) – CO4	1(2) – CO4	-	1 either or (16) – CO4
Unit-V: Special Topics in Concrete Technology	2	1 either or	1(2) – CO5	1(2) – CO5	1 either or (16) – CO5	-
Total Qns. Advanced Concrete Technology	10	5 either or	7(2)	3(2) 2 either or (16)	2 either or (16)	1 either or (16)
Total Marks	20	80	14	38	32	16
Weightage	20%	80%	14%	38%	32%	16%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

CM22112	CONSTRUCTION PROJECT MANAGEMENT				L	T	P	C
					3	0	0	3
COURSE OBJECTIVE:								
<ul style="list-style-type: none"> 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 – Leadership and Motivation for the Project Team - 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
Labour productivity variations, productivity improvement - work study – Labour Relations in Construction - 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 – Construction Processes Queues and Resource Bottlenecks.		
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		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	State the fundamentals of construction project management.	
CO2:	Explain the stages involved in the planning, organising and design of construction project.	
CO3:	Apply the scheduling techniques for planning construction projects.	
CO4:	Analyse the resources utilization and risk management in project control and management.	
CO5:	Examine the risk and controlling systems using project management information system.	
REFERENCES:		

1	Chitkara, K.K., “Construction Project Management: Planning, Scheduling and Control”, Tata McGraw-Hill Publishing Company, New Delhi, 3rd Edition, 2014.
2	Choudhury S, “Project Management”, McGraw-Hill Publishing Company, New Delhi, 2017.
3	Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall, Pittsburgh, 2 nd edition, 2008.
4	Frederick E. Gould, “Construction Project Management”, Pearson, 4th Edition, 2013.
5	Kumar Neeraj Jha, “Construction Project Management: Theory and Practice”, Pearson, 2015.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	-	-	-	-
CO2	-	-	2	1	-	-
CO3	1	-	3	3	2	-
CO4	3	-	3	3	2	-
CO5	3	-	3	3	1	-
Average	2	-	3	2	2	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Fundamentals of Construction Project Management	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Planning and Organizing Construction Project	2	1 either or	2(2) – CO1	-	1 either or (16) – CO3	-
Unit-III: Design and Construction Process	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-IV: Project Resources Utilization	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-V: Risk Management and Project Controlling	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5

Total Qns.				2(2)	1 either or (16)	2 either or (16)
Construction Project Management	10	5 either or	8(2)	2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22113	DESIGN OF ENERGY EFFICIENT BUILDINGS	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> • 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 Green House Effect – Convection – Measuring latent and sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams – Sun Protection – Types of Shading Devices – 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 odour 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 V	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		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	Define the environmental energy supplies on buildings.	
CO2:	Describe the environmental energy supplies on buildings and the design for different climate zones.	
CO3:	Design a building for climatic zone and apply simulation programmes of buildings to perform energy calculations.	
CO4:	Examine the aspects of energy efficiency in buildings.	
CO5:	Analyse the energy efficiency in buildings for different climate zones.	
REFERENCES:		
1	Brown, G.Z. and DeKay, M., “Sun, Wind and Light - Architectural Design Strategies”, John Wiley and Sons Inc, 2014.	
2	Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, 2007.	
3	Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) 1995.	

4	Majumdar, M, “Energy Efficient Buildings in India”, The Energy Resources Institute, 2009.
5	Moore, F., “Environmental Control System”, McGraw Hill Inc. 2002.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	-	-	-	-
CO2	-	-	-	-	-	-
CO3	2	-	3	1	-	-
CO4	3	-	2	1	-	-
CO5	3	-	2	1	-	-
Average	3	-	2	1	-	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Introduction	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Passive Solar Heating and Cooling	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-III: Daylighting and Electrical Lighting	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO4
Unit-IV: Heat Control and Ventilation	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Unit-V: Design for Climatic Zones	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Total Qns. Design of Energy Efficient Buildings	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	

Weightage	16%	36%	16%	16%	16%
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CM22114	SHORING, SCAFFOLDING AND FORMWORK	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To disseminate knowledge about formwork and scaffolding accessories, materials and safety practices.

UNIT I	ELEMENTS FOR FORMWORK	9
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Overall and Detailed Planning - Units - Schedule for column formwork - Formwork elements - Development of basic system - Economical formwork construction.

UNIT II	FORMWORK AND SCAFFOLDING ACCESSORIES	9
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Crane arrangement - Formwork beams - Formwork ties - Wales - Scaffold frames - Form accessories - Vertical transport table form work - Advantages - Functions of various components - Planning of Slip form operations.

UNIT III	SHORING FOR BUILDINGS	9
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Type of shores - Size and spacing - Safety practices - Horizontal shores - Deflection, bending and lateral stability - Shear, Bearing - Examples in wall forms - Slab forms - Beam form - Ties, Anchors and Hangers - Column forms.

UNIT IV	MATERIALS	9
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Materials for Shoring Shuttering and Form Lumber - Types - Finish - Sheathing boards - Plywood - Reconstituted wood - Steel – Aluminium – Form lining materials – Hardware and fasteners – Pressures on Formwork – Temperature – Rates of Placing – Consistency of concrete – Vibration - Advanced Materials used for formworks.

UNIT V	SAFETY PRACTICES	9
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Safety Practices for Forms and its Types, Form for shell structures – Curb and Invert forms – Arch and Wall – Slipforms – Principles – Types of scaffolds – General safety requirements – Precautions against particular hazards – Scaffolding systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will.../ will be able to...

CO1:	State the basics of formwork, scaffolding and safety practices.
CO2:	Explain about formwork and scaffolding accessories, materials and safety practices.
CO3:	Select material and accessories for formwork connections.
CO4:	Analyse the design aspects of formwork under varying requirements.

CO5:	Examine the safety requirements for formwork and scaffolding.
REFERENCES:	
1	Austin, C.K., “Formwork for Concrete”, Cleaver – Hume Press Ltd., London, 1996.
2	Hurd, M.K., “Formwork for Concrete”, 7 th edition, American Concrete Institute, Mich, 2005.
3	Robert L. Peurifoy and Garold D. Oberlender, “Formwork for Concrete Structures”, McGraw – Hill, 2010.
4	Kumar Neeraj Jha, “Formwork for Concrete Structures”, 2017.
5	Formwork: A Guide to Good Practice, Concrete Society, Third edition, 2012.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	-	-	-
CO2	1	-	2	-	-	-
CO3	-	-	3	-	-	-
CO4	-	-	3	-	-	-
CO5	1	-	3	-	-	2
Average	1	-	2	-	-	2

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Elements for Formwork	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Formwork and Scaffolding Accessories	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-III: Shoring for Buildings	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO4
Unit-IV: Materials	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-V: Safety Practices	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Shoring, Scaffolding and	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)

Formwork						
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

SE22221	MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVE:						
<ul style="list-style-type: none"> To study the damages, repair and rehabilitation of structures. 						
UNIT I	INTRODUCTION					9
<p>General Consideration – Distresses monitoring – Causes of distresses – Quality assurance – Defects due to climate, chemicals, wear and erosion – Inspection – Structural appraisal – Economic appraisal- Assessment procedure for evaluating a damaged structure. Building cracks- Causes – diagnosis – Thermal and Shrinkage cracks – unequal loading – Vegetation and trees – Chemical action – Foundation movements – Remedial measures - Techniques for repair – Epoxy injection- grouting, shoring and underpinning.</p>						
UNIT II	MOISTURE PENETRATION					9
<p>Sources of dampness – Moisture movement from ground – Reasons for ineffective DPC – Roof leakage – Pitched roofs – Madras Terrace roofs – Membrane treated roofs - Leakage of Concrete slabs – Dampness in solid walls – condensation – hygroscopic salts – remedial treatments – Ferro cement overlay – Chemical coatings – Flexible and rigid coatings. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels and cathodic protection.</p>						
UNIT III	DISTRESSES AND REMEDIES					9
<p>Concrete Structures: Introduction – Causes of deterioration – Diagnosis of causes – Flow charts for diagnosis – Materials and methods of repair – repairing, spalling and disintegration – Repairing of concrete floors and pavements. Steel Structures : Types and causes for deterioration – preventive measures – Repair procedure – Brittle fracture – Lamellar tearing – Defects in welded joints – Mechanism of corrosion – Design of protect against corrosion – Design and fabrication errors – Distress during erection.</p>						
UNIT IV	MASONRY STRUCTURES AND RETROFITTING					9

Masonry Structures: Discoloration and weakening of stones – Biotical treatments – Preservation – Chemical preservatives – Brick masonry structures – Distresses and remedial measures.	
Repair of structures distressed due to earthquake – Strengthening using FRP – Strengthening and stabilization techniques for repair – Types of demolition techniques – Engineered demolition techniques for structures.	
UNIT V	STRENGTHENING OF EXISTING STRUCTURES
	9
General principle – relieving loads – Strengthening super structures – plating – Conversation to composite construction – post stressing – Jacketing – bonded overlays – Reinforcement addition – strengthening substructures – under pinning – Enhancing the load capacity of footing – Design for rehabilitation.	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
Upon completion of the course, the students will.../ will be able to...	
CO1:	List the importance of maintenance, effects in structures due to climate and temperature variations, techniques for repair and their protection methods.
CO2:	Demonstrate the causes for deterioration and the repairing techniques to improve the service life of the structures elements.
CO3:	Identify the damaged structure and maintain the engineering structures safely and effectively.
CO4:	Discriminate suitable type of strengthening techniques to the structures and the modern techniques for the demolition of large and hazardous structure in safe manner.
CO5:	Survey the quality and durability of concrete and adopt suitable repair techniques and protection methods.
REFERENCES:	
1	Allen R.T and Edwards S.C, “Repair of Concrete Structures”, CRC Press, 2019.
2	Dayaratnam. P and Rao. R, “Maintenance and Durability of Concrete Structures”, Universities Press, India, 1997.
3	Dodge Woodson. R, “Concrete Structures – Protection, Repair and Rehabilitation”, Elsevier Butterworth – Heinmann, UK, 2011.
4	Hand book on seismic retrofit of Building by CPWD and IIT Madras, 2003.
5	Varghese. P.C, “Maintenance Repair and Rehabilitation & Minor works of building”, Prentice Hall India Pvt Ltd, 2014.

Mapping of Course Outcomes to Programme Outcomes

CO	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6

CO1	1	2	1	-	-	1
CO2	2	2	2	-	-	1
CO3	3	2	2	2	2	2
CO4	3	2	2	2	1	2
CO5	3	2	2	2	1	3
Average	2	2	2	2	1	2

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Introduction	2	1 either or	2(2) – CO1	1 either or (16) – CO1	-	-
Unit-II: Moisture Penetration	2	1 either or	2(2) – CO2	1 either or (16) – CO2	-	-
Unit-III: Distresses and Remedies	2	1 either or	1(2) – CO3	1(2) – CO3	1 either or (16) – CO3	-
Unit-IV: Masonry Structures and Retrofitting	2	1 either or	1(2) – CO4	1(2) – CO4	-	1 either or (16) – CO4
Unit-V: Strengthening of Existing Structures	2	1 either or	1(2) – CO5	1(2) – CO5	-	1 either or (16) – CO5
Total Qns. Maintenance and Rehabilitation of Structures	10	5 either or	7(2)	3(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	14	38	16	32
Weightage	20%	80%	14%	38%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

CM22222	PROJECT FORMULATION AND APPRAISAL	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To disseminate knowledge on project formulation, analysis, costing of construction

projects, appraisal, finance and private sector participation.		
UNIT I	PROJECT FORMULATION AND ANALYSIS	9
Project – Capital investments - Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Prefeasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required - Application of MS - Project and Primavera for project planning.		
UNIT II	PROJECT COSTING	9
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	ESTIMATING METHODS AND PROJECT APPRAISAL	9
Cost capacity factor - Cost indices - Detailed estimates - Provision for escalation, inflation and contingencies - Financial appraisal criteria : NPV, BCR, IRR, ARR, Urgency, Payback period – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Selection of a Project and Risk Analysis in Practice.		
UNIT IV	PROJECT FINANCING	9
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	9
Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	Define the basic concepts of construction project formulation, costing, appraisal, finance and private sector participation.	
CO2:	Describe the concepts of the formulation, costing, appraisal, financing and private sector participation of construction projects.	
CO3:	Prepare feasibility reports and estimates of values of projects.	
CO4:	Perform cost, risk and feasibility analyses for construction projects.	
CO5:	Infer costing, financing and private sector participation of construction projects.	
REFERENCES:		
1	Prasanna Chandra, “Projects – Planning, Analysis, Selection, Implementation Review”,	

	McGraw Hill Publishing Company Ltd., New Delhi. 2014.
2	Joy P.K., "Total Project Management - The Indian Context", New Delhi, Macmillan India Ltd., 1994.
3	Barcus, S.W. and Wilkinson. J.W., "Hand Book of Management Consulting Services", McGraw Hill, New York, 1995.
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.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	-	-	-
CO2	1	-	2	-	-	-
CO3	3	3	3	1	2	1
CO4	3	-	3	3	2	-
CO5	2	-	3	3	-	-
Average	2	3	2	2	2	1

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Project Formulation and Analysis	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Project Costing	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO4
Unit-III: Estimating Methods and Project Appraisal	2	1 either or	2(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-IV: Project Financing	2	1 either or	1(2) – CO1	1 either or (16) – CO2	-	-
Unit-V: Private Sector Participation	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Project Formulation and Appraisal	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)

Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22223	MODERN CONSTRUCTION MATERIALS	L	T	P	C
		3	0	0	3

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

UNIT II	NON-STRUCTURAL MATERIALS, ACCESSORIES AND FINISHES	9
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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
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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
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Concretes - Behaviour 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 – Green concrete – Paper Crete - Alternate Materials to concrete on high performance & high Strength concrete, modern water proofing materials.

UNIT V	SMART AND INTELLIGENT MATERIALS	9
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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

COURSE OUTCOMES:

Upon completion of the course, the students will.../ will be able to...	
CO1:	State the basic properties of modern construction materials.
CO2:	Explain the manufacturing process and applications of modern construction materials.
CO3:	Choose construction materials based on their properties.
CO4:	Compare performances of conventional materials over smart materials.
CO5:	Analyse the case studies showing the applications of smart and intelligent materials.
REFERENCES:	
1	Ganapathy, C. “Modern Construction Materials”, Eswar Press, 2015.
2	Santhakumar A.R. “Concrete Technology”, Oxford University press, New Delhi, 2006.
3	Ashby, M.F. and Jones D.R.H., “Engineering Materials 1: An Introduction to Properties, applications and designs”, Elsevier Publications, 5 th edition, 2019.
4	N. Subramanian, “Building Materials Testing and Sustainability”, Oxford Higher Education, 2019.
5	Shetty M.S, “Concrete Technology: Theory and Practice”, S. Chand Publishing, 2019.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	-	-	-
CO2	1	-	2	-	-	-
CO3	3	-	3	2	-	1
CO4	3	-	3	-	-	-
CO5	3	-	3	2	-	-
Average	2	-	2	2	-	1

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Structural Materials	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Non-Structural Materials,	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-

Accessories and Finishes						
Unit-III: Composites	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO4
Unit-IV: Special Concretes	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-V: Smart and Intelligent Materials	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Modern Construction Materials	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22224	CONSTRUCTION QUALITY CONTROL, ASSURANCE AND SAFETY MANAGEMENT				L	T	P	C
					3	0	0	3
COURSE OBJECTIVE:								
<ul style="list-style-type: none"> To know about the quality control, assurance and safety concerns in construction industry. 								
UNIT I	CONSTRUCTION ORGANIZATION							9
Types of organization - Inspection - Quality Management Systems and method – Responsibilities and authorities in quality assurance and quality control - Quality circle.								
UNIT II	QUALITY PLANNING							9
Quality Policy - Objectives and methods in Construction Industry - Consumers satisfaction - Ergonomics - Time of Completion - Statistical tolerance – Taguchi’s concept of quality - Document - Contract and construction programming - Inspection procedures - Processes and products - Total QA / QC programme and cost implication.								
UNIT III	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 - Quality Control by statistical methods – Sampling by attributes and variables.								
UNIT IV	FACTORS OF CONSTRUCTION QUALITY							9
Appraisals - Critical, Major Failure Aspects and Failure Mode Analysis - Stability methods								

and tools, optimum design – Reliability testing, reliability coefficient and reliability prediction.		
UNIT V	QUALITY IMPROVEMENT TECHNIQUES AND SAFETY MANAGEMENT	9
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 – Safety in construction - Introduction to OSHA regulations - Safe Operating Procedures.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	State the basic concepts of quality control, assurance and safety in construction.	
CO2:	Explain the skills of preparing inspection procedures for quality planning, assurance and control.	
CO3:	Apply the quality and safety standards for preparing quality environment.	
CO4:	Compare the techniques and tools for quality assurance and control in construction industry.	
CO5:	Examine the quality and safety practices to achieve quality and safety construction environment.	
REFERENCES:		
1	Hutchins. G, “ISO 9000: A Comprehensive Guide to Registration, Audit Guidelines and Successful Certification”, John Wiley & Sons, 1997.	
2	James J. O’Brian, “Construction Inspection Handbook – Total Quality Management”, Springer, 2012.	
3	KB Rajoria, Deepak Naryan, Deepak Gupta, “Practices in construction”, CBS Publishers & Distributors Pvt. Ltd., ISBN:978-93-90709-33-5, 2021.	
4	Juran Frank, J.M. and Gryna, F.M., “Quality Planning and Analysis”, McGraw Hill, 2001.	
5	Steven McCabe, “Quality Improvement Techniques in Construction”, Routledge, Oxon, 2016.	

Mapping of Course Outcomes to Programme Outcomes

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

CO4	3	-	3	3	3	-
CO5	3	-	3	3	-	-
Average	3	-	2	3	3	1

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Construction Organization	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Quality Planning	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-III: Quality Assurance and Control	2	1 either or	2(2) – CO1	-	1 either or (16) – CO3	-
Unit-IV: Factors of Construction Quality	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-V: Quality Improvement Techniques and Safety Management	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Construction Quality Control, Assurance and Safety Management	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22231	CONSTRUCTION PERSONNEL MANAGEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVE:					
<ul style="list-style-type: none"> To study the various aspects of leadership, human behaviour, human resources, communication and manpower in construction. 					

UNIT I	LEADERSHIP	9
Definition – leaders vs. managers – styles of leadership - Theories of leadership, Personality theories- behavioral theories – situational theories – Organization - Span of control - Organization charts -Staffing plan - job descriptions and organization structure and Human relations.		
UNIT II	HUMAN BEHAVIOUR	9
Introduction to the Field of Management-basic individual psychology-motivation-Motivation of individuals – theories of motivation - Maslow’s theory – Herzberg’s model – McClelland’s three need model – Vroom’s expectancy theory – McGregor’s theory.		
UNIT III	PRODUCTIVITY OF HUMAN RESOURCES	9
Compensation-Wages and Salary, Employee Benefits, employee appraisal and assessment-Employee services- Safety and Health-Discipline and Discharge-Special human resource problems, Performance appraisal.		
UNIT IV	COMMUNICATION	9
Importance and process – directions of communication – media and types of communication – factors affecting communication – barriers to communication – improving interpersonal and organizational communication – Transactional analysis.		
UNIT V	MANPOWER	9
Manpower Planning, Organizing, Staffing Recruitment-Selection, directing and Controlling-Personnel Principles.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	State the fundamentals of construction personnel management.	
CO2:	Explain the concepts of leadership, human behaviour, human resources, communication and manpower in construction.	
CO3:	Make use of communication and leadership qualities for personnel management in construction.	
CO4:	Examine the theories of leadership and human behavior.	
CO5:	Analyse the different aspects of construction personnel management.	
REFERENCES:		
1	Charles D Pringle, Justin Gooderi Longenecter, “Management”, CE Merril Publishing Co. 1981.	
2	Dwivedi R.S, “Human Relations and Organisational Behaviour”, Macmillian India Ltd., 2005.	

3	Josy.J. Familiaro, “Handbook of Human Resources Administration”, McGraw-Hill International Edition, 1987.
4	Memoria, C.B., “Personnel Management”, Himalaya Publishing Co., 1997.
5	Carleton Counter II and Jill Justice Coutler, “The Complete Standard Handbook of Construction Personnel Management”, Prentice-Hall, Inc., 1989.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	-	-	-	-
CO2	-	-	2	1	-	-
CO3	1	-	3	3	2	-
CO4	3	-	3	3	2	-
CO5	3	-	3	3	1	-
Average	2	-	3	2	2	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Leadership	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Human Behaviour	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO4
Unit-III: Productivity of Human Resources	2	1 either or	2(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Unit-IV: Communication	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-V: Manpower	2	1 either or	1(2) – CO1	1 either or (16) – CO2	-	-
Total Qns. Construction Personnel Management	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	

Total Marks	16	36	16	16	16
Weightage	16%	36%	16%	16%	16%

CM22232	SAFETY IN CONSTRUCTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge on safety aspects in construction.
- To have the knowledge in hazards of construction and their prevention methods.
- To gain knowledge in health hazards and safety in demolition work.

UNIT I	ACCIDENTS CAUSES AND MANAGEMENT SYSTEMS	9
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Problems impeding safety in construction industry - causes of fatal accidents, types and causes of accidents related to various construction activities, human factors associated with these accident – construction regulations, contractual clauses – Pre contract activities, preconstruction meeting - design aids for safe construction – permits to work – quality assurance in construction - compensation – Recording of accidents and safety measures – Education and training.

UNIT II	HAZARDS OF CONSTRUCTION AND PREVENTION	9
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Excavations, basement and wide excavation, trenches, shafts – scaffolding , types, causes of accidents, scaffold inspection checklist – false work – erection of structural frame work, dismantling – tunnelling – blasting, pre blast and post blast inspection – confined spaces – working on contaminated sites – work over water - road works – power plant constructions – construction of high rise buildings.

UNIT III	WORKING AT HEIGHTS	9
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Fall protection in construction OSHA 3146 – OSHA requirement for working at heights, Safe access and egress – safe use of ladders- Scaffoldings , requirement for safe work platforms, stairways, gangways and ramps – fall prevention and fall protection , safety belts, safety nets, fall arrestors, controlled access zones, safety monitoring systems – working on fragile roofs, work permit systems, height pass – accident case studies.

UNIT IV	CONSTRUCTION MACHINERY	9
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Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist - builder’s hoist, winches, chain pulley blocks – use of conveyors - concrete mixers, concrete vibrators – safety in earth moving equipment, excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, drills, grinding tools, manual handling scaffolding, hoisting cranes – use of conveyors and mobile cranes – manual handling.

UNIT V	SAFETY IN DEMOLITION WORK	9
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Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition - Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods – interesting experiences at the construction site against the fire accidents.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will.../ will be able to...

CO1:	State the basic concepts of safety in construction.
CO2:	Explain the equipment, hazards, safe operations and inspections in construction work.
CO3:	Identify the problems, types and causes of accidents in construction industries.
CO4:	Examine the safety procedures for working to prevent accidents during construction.
CO5:	Infer the construction regulations and Indian standards for construction and demolition work.

REFERENCES:

1	Davies V.J and Thomasin K, “Construction Safety Hand Book” Thomas Telford Ltd., London, 1996.
2	David L. Goetsch, “Construction Safety and the OSHA Standards”, Prentice Hall, 2009.
3	Hudson, R. “Construction hazard and Safety Hand book”, Butter Worth’s, 1985.
4	R. K. Mishra, “Construction Safety”, AITBS Publishers, 2011.
5	Charles D. Reese and James V. Edison “Handbook of OSHA Construction safety and health” CRC Press, 2 nd edition, 2012.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	1	3	-	-
CO2	-	-	2	3	-	-
CO3	-	-	3	3	-	1
CO4	3	-	3	3	3	-
CO5	3	-	3	3	-	-
Average	3	-	2	3	3	1

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Accidents Causes and Management Systems	2	1 either or	2(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-II: Hazards of Construction And Prevention	2	1 either or	2(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-III: Working at Heights	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO5
Unit-IV: Construction Machinery	2	1 either or	1(2) – CO1	1 either or (16) – CO2	-	-
Unit-V: Safety in Demolition Work	2	1 either or	1(2) – CO1	1 either or (16) – CO2	-	-
Total Qns. Safety in Construction	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22233	HUMAN RESOURCES MANAGEMENT IN CONSTRUCTION				L	T	P	C
					3	0	0	3
COURSE OBJECTIVE:								
<ul style="list-style-type: none"> To know about 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 organization - Management process in organisations – Planning – Organising – Staffing – Directing- Controlling – Delegation of authority – responsibility – accountability – lines and staff organization - Workforce diversity- international dimensions of Organisation- Organisational structure- determinants of organisational design.		
UNIT III	HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR	9
Basic individual psychology – Approaches to job design and job redesign – Self managing work teams – Intergroup – Conflict in organizations - Conflict Resolution – 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 - Trade Union Act, 1926, Workers and employers organizations in India.		
UNIT V	MANAGEMENT AND DEVELOPMENT METHODS	9
Management Development - On-the-job and off-the-job- Management Developments - Performance appraisal in practice. Managing careers: Career planning and development - Managing promotions and transfers. of operations – Developing policies, practices and establishing process pattern – Competency upgradation and their assessment – New methods of training and development – Performance Management.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	State the fundamentals of human resource management in construction.	
CO2:	Explain the management of the human resources in construction.	
CO3:	Experiment with the behaviour of human resources in organization.	
CO4:	Examine the planning, organisation, welfare and management of human resources.	
CO5:	Analyse the practices and techniques for evaluating performance, structuring teams, coaching and mentoring people.	
REFERENCES:		
1	Charles D Pringle, Justin Gooderi Longenecter, “Management”, CE Merrill Publishing Co. 2001.	
2	Dwivedi R.S, “Human Relations and Organisational Behaviour”, Macmillian India Ltd., 2005.	

3	Josy .J, Familaro, “Handbook of Human Resources Administration”, McGraw-Hill International Edition, 2007.
4	D. Longford M.R. Hancock, R. Rellows & A. W. Gale, “Human Recourse Management In Construction”, Longman Group Limited, Fourth impression, 2000.
5	Carleton Counter II and Jill Justice Coulter, “The Complete Standard Hand Book of Construction Personnel Management ”, Prentice Hall, Inc., New Jersey, 1989.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	1	-	-	-
CO2	-	-	2	-	-	-
CO3	3	-	3	-	-	1
CO4	3	-	3	2	-	-
CO5	3	-	3	-	-	-
Average	3	-	2	2	-	1

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Manpower Planning	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Organisation	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-III: Human Relations and Organisational Behaviour	2	1 either or	2(2) – CO1	-	1 either or (16) – CO3	-
Unit-IV: Welfare Measures	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-V: Management and Development Methods	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Human Resource Management in Construction	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						

	CO1	CO2	CO3	CO4	CO5
Total Marks	16	36	16	16	16
Weightage	16%	36%	16%	16%	16%

CM22234	COST MANAGEMENT OF ENGINEERING PROJECTS				L	T	P	C
					3	0	0	3
COURSE OBJECTIVE:								
<ul style="list-style-type: none"> To give an overview of cost management concepts of construction engineering projects. 								
UNIT I	INTRODUCTION							9
Project costs – Costs involved in construction projects - Cost control and management - Introduction to Strategic Cost Management Process - Overview of the Strategic Cost Management Process.								
UNIT II	COST CONCEPTS							9
Cost concepts in decision-making - Relevant cost, Differential cost, Incremental cost and Opportunity cost - Objectives of a Costing System - Inventory valuation - Creation of a Database for operational control - Provision of data for Decision Making.								
UNIT III	PROJECT MANAGEMENT							9
Project: meaning - Different types, why to manage, cost overruns - Various stages of project execution: conception to commissioning - Project execution as conglomeration of technical and nontechnical activities - Pre project execution main clearances and documents - Project team: Role of each member - Project contracts - Types and contents - Project execution Project cost control - Bar charts and Network diagram - Project commissioning process.								
UNIT IV	COST BEHAVIOR AND PROFIT PLANNING							9
Cost Behaviour and Profit Planning Marginal Costing - Distinction between Marginal Costing and Absorption Costing - Break-even Analysis - Cost-Volume-Profit Analysis - Various decision-making problems - Standard Costing and Variance Analysis - Pricing strategies: Pareto Analysis - Target costing - Life Cycle Costing - Costing of service sector - Just-in-time approach - Activity-Based Cost Management - Bench Marking - Balanced Score Card and Value-Chain Analysis - Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.								
UNIT V	QUANTITATIVE TECHNIQUES							9
Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation Problems, Assignment problems, Simulation, Learning Curve Theory.								
TOTAL: 45 PERIODS								

COURSE OUTCOMES:	
Upon completion of the course, the students will.../ will be able to...	
CO1:	State the fundamentals of cost management in construction.
CO2:	Explain cost concepts, behaviour and profit planning in construction.
CO3:	Identify the suitable analysis technique for project cost.
CO4:	Examine the planning and management techniques of construction project costs.
CO5:	Infer the analysis and quantitative techniques of construction costs.
REFERENCES:	
1	Robert S Kaplan Anthony A. Alkinson, “Management & Cost Accounting”, Prentice Hall of India Pvt. Ltd., 2003.
2	N.D. Vohra, “Quantitative Techniques in Management”, Tata McGraw Hill Book Co. Ltd., 2007.
3	Charles T. Horngren, “Cost Accounting A Managerial Emphasis”, Prentice Hall of India, New Delhi, 2011.
4	Charles T. Horngren and George Foster, “Advanced Management Accounting”, Pearson Education, 2017.
5	Ashish K. Bhattacharya, “Principles & Practices of Cost Accounting”, A. H. Wheeler publisher, 2000.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	1	1	-	-
CO2	-	-	2	2	-	-
CO3	3	-	3	3	-	-
CO4	-	-	3	3	2	-
CO5	3	-	3	3	2	-
Average	3	-	2	2	2	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Introduction	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-

Unit-II: Cost Concepts	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-III: Project Management	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO4
Unit-IV: Cost Behavior and Profit Planning	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-V: Quantitative Techniques	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Cost Management of Engineering Projects	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22341	PROJECT SAFETY MANAGEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVE:					
<ul style="list-style-type: none"> To impart the importance of safety and safety practices in construction. 					
UNIT I	CONSTRUCTION SAFETY MANAGEMENT	9			
Safety in construction operations - Safety in use of construction equipment - General trades and their occupational hazards – Fire safety in buildings - Causes of fire hazards - fire control devices - Technologies and equipment.					
UNIT II	DESIGN FOR SAFETY	9			
Safety Culture - Safe Workers - Safety and First Line Supervisors - Safety and Middle Managers - Top Management Practices, Company activities in Safety - Safety Personnel – Sub contractual Obligation – Project Coordination and Safety Procedures – Workers Compensation.					
UNIT III	SAFETY POLICIES AND CONTRACTUAL OBLIGATIONS	9			
Study of safety policies - Study of various IS codes - Operations of construction and OSHA guidelines - Safety in Construction Contracts – Substance Abuse – Safety Record Keeping - Workmen Compensation Act.					
UNIT IV	SAFETY PROGRAMME	9			

Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-site Safety Assessment – Safety Meetings – Safety Incentives.		
UNIT V	OWNERS’ AND DESIGNERS’ OUTLOOK	9
Owners and Designers – Roles and responsibility in ensuring safety – Preparedness – Role of the designer in ensuring safety – Safety clause in the design document.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	Define the fundamentals of construction safety management.	
CO2:	Illustrate the constructions safety concepts.	
CO3:	Identify the construction activities prone to accidents and their safety measures.	
CO4:	Examine the safety practices, policies and programmes for construction safety.	
CO5:	Infer the safety policies, programmes, and owners’ and designers’ responsibilities for safety in construction.	
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.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	1	-	-	-
CO2	-	-	2	-	-	-
CO3	1	-	2	-	-	-
CO4	1	-	2	-	-	-
CO5	1	-	2	-	-	-
Average	1	-	2	-	-	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Construction Safety Management	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Design for Safety	2	1 either or	2(2) – CO1	-	1 either or (16) – CO3	-
Unit-III: Safety Policies and Contractual Obligations	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-IV: Safety Programme	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-V: Owners' and Designers' Outlook	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Project Safety Management	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22342	RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES:								
<ul style="list-style-type: none"> To study the management and control of various resources involved in construction. To study the effect of resource planning, labour management, material and equipment, time management, and resource allocation and resource leveling in construction. 								
UNIT I	RESOURCE PLANNING							9
Resource Planning - Stages of Planning - Procurement - Identification - Planning for material - Labour - Time schedule and cost control - Types of resources.								
UNIT II	RESOURCE MANAGEMENT							9
Systems approach in resource management-Characteristics of resources- Resources Utilization - Measurement of actual resources required - Tools for measurement of resources - Classes of Labour- Labour Productivity - Cost of Labour- Labour Schedule.								
UNIT III	TIME AND COST MANAGEMENT							9

Time and quality - Management and Planning - Managing Time on project-forecasting the future - Critical path measuring the changes and their effects - Cash flow and Cost Control - Objectives of Cost Control.		
UNIT IV	MATERIALS AND EQUIPMENT	9
Time of Purchase - Quantity of Material – Sources – Transportation - Delivery and Distribution. Equipment: Planning and Selecting by Optimistic Choice With Respect to Cost and Time - Source and Handling - Depreciation of Construction Equipment.		
UNIT V	RESOURCE ALLOCATION	9
Time-Cost Trade Off - Resource List - Resource Allocation - Resource Smoothing - Resource Loading - Computer Application in Resource levelling – Calculation of EAC and ETC – Value Management.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	State the resource management and control in construction.	
CO2:	Illustrate the management of resources in construction.	
CO3:	Identify the types of resources and their management in a construction industry.	
CO4:	Examine the equipment output and its operation condition.	
CO5:	Infer the time and cost related information in a construction sector.	
REFERENCES:		
1.	Sharma, S C., “Construction Equipment Management”, Khanna publishers, Delhi, 2016.	
2.	Kumar Neerajha, “Construction Project Management”, Pearson publishers, 2015.	
3.	Andrew. D., Szilagg, “Hand Book of Engineering Management”, 1982.	
4.	Oxley R and Poslcit, “Management Techniques applied to the Construction Industry”, Granda Publishing Ltd., 1980.	
5.	Paul Netscher, “Construction Project Management: Tips and Insights”, Panet Publications, 2017.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	1	1	-	-
CO2	-	-	2	1	-	-
CO3	1	-	2	1	2	-
CO4	1	-	2	1	-	-
CO5	1	-	2	1	-	-

Average	1	-	2	1	2	-
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Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Resource Planning	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Resource Management	2	1 either or	2(2) – CO1	-	1 either or (16) – CO3	-
Unit-III: Time and Cost Management	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Unit-IV: Materials and Equipment	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-V: Resource Allocation and Levelling	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Total Qns. Resource Management and Control in Construction	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22343	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3
COURSE OBJECTIVE:					
<ul style="list-style-type: none"> To study the various quantitative methods applied to the elements of management, inventory control, queuing theory, decision theory and simulation of management systems. 					
UNIT I	INTRODUCTION TO OPERATIONS RESEARCH				9
Linear programming - Graphical and Simplex Methods, Duality and Post- Optimality Analysis-Transportation and Assignment Problems.					
UNIT II	INVENTORY CONTROL				9
EOQ, Quantity Discounts, Safety Stock - Replacement Theory - PERT and CPM Simulation Models. Working Capital Management: Compound Interest and Present Value methods -					

Discounted Cash Flow Techniques - Capital Budgeting.	
UNIT III	DECISION THEORY 9
Decision Rules - Decision making under conditions of certainty, risk and uncertainty - Decision trees - Utility Break-even -Analysis-Pricing techniques- Game Theory application	
UNIT IV	QUEUING THEORY 9
Single server infinite queue length model - Single server finite queue length model - multiple server infinite queue length model - multiple serve infinite queue length model.	
UNIT V	SIMULATION OF MANAGEMENT SYSTEMS 9
Terminology, Process of Simulation, Monte Carlo Method, Waiting Line Simulation Method, Inventory Management Simulation, Marketing Management Simulation, Financial Management Simulation.	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
Upon completion of the course, the students will.../ will be able to...	
CO1:	State the quantitative techniques in construction management.
CO2:	Illustrate the operations research, simulation and inventory control in construction.
CO3:	Apply the required man, material, equipment, cost and time as per needs by proper decision rules.
CO4:	Examine the application of operations research in construction management.
CO5:	Analyse the simulation of management systems.
REFERENCES:	
1.	Frank Harrison, E., "The Managerial Decision-Making Process", Houghton Mifflin Co., Boston, 1999.
2.	Hamdy A. Taha, "Operations Research: An Introduction", Prentice Hall, 2010.
3.	Levin, R.I, Rubin, D.S., and Stinson J., "Quantitative Approaches to Management", McGraw Hill College, 1993.
4.	Tang S.L., Irtishad U. Ahmad, Syed M. Ahmed, Ming Lu, "Quantitative Technique for Decision making in Construction", Hongkong University Press, HKU, 2004.
5.	Vohra, Nd., "Quantitative Techniques in Management", Fifth Edition, Tata McGraw-Hill Company Ltd, 2017.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	-	-	-
CO2	1	-	2	-	-	-

CO3	3	-	3	3	2	-
CO4	3	-	3	-	3	-
CO5	3	-	3	-	3	-
Average	2	-	2	3	3	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Introduction to Operations Research	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Inventory Control	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-III: Decision Theory	2	1 either or	2(2) – CO1	-	1 either or (16) – CO3	-
Unit-IV: Queuing Theory	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-V: Simulation of Management Systems	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Quantitative Techniques in Management	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22344	ORGANIZATIONAL BEHAVIOUR				L	T	P	C
					3	0	0	3

COURSE OBJECTIVES:

- To learn the basic concepts of organizational behaviour.
- To gain a solid understanding of human behaviour in the workplace as an individual and in group.
- To learn the dynamics of organizational behaviour.

UNIT I	INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR	9
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Definition - Need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models - Challenges and Opportunities for Organisational Behaviour - Organisational Behaviour and Emotional Intelligence.		
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 behaviour.		
UNIT III	GROUP BEHAVIOUR	9
Groups: Concept and Classification; Stages of Group Development – Groups in organizations –Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques – Team building - Interpersonal relations: Understanding Self and Others; Developing Interpersonal Relationships – Communication – Control - Management of Conflicts.		
UNIT IV	LEADERSHIP AND POWER	9
Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centres – Power and Politics - Organisational Culture: Concept; Dominant Culture; Strong Vs Weak Cultures ; Creating and Sustaining Culture; Employees Learning of The Culture; Creating a Customer - Responsive Culture.		
UNIT V	DYNAMICS OF ORGANIZATIONAL BEHAVIOUR	9
Organizational culture and climate – Factors affecting organizational climate – Importance of Job satisfaction – Determinants–Measurements – Influence on behaviour - 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		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	State the basic concepts of organizational behaviour.	
CO2:	Illustrate the human behaviour in the organisations.	
CO3:	Apply the dynamics of human behaviour in the varied cultures of the organisation.	
CO4:	Analyse the complexities associated with management of the group behaviour in the organization.	

CO5:	Infer the dynamics of organization behaviour with balance of work life.
REFERENCES:	
1.	Stephen P. Robins, “Organisational Behaviour”, PHI Learning / Pearson Education, 15 th edition, 2012.
2.	Fred Luthans, “Organisational Behaviour”, McGraw Hill, 12th Edition, 2005.
3.	Schermerhorn, Hunt and Osborn, “Organisational Behaviour”, John Wiley, 12th Edition, 2011.
4.	Udai Pareek, “Understanding Organisational Behaviour”, 2nd Edition, Oxford Higher Education, 2008.
5.	Mc Shane & Von Glinov, “Organisational Behaviour”, 6th Edition, Tata McGraw Hill, 2012.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	-	-	3
CO2	1	-	2	-	-	3
CO3	3	-	3	-	-	3
CO4	3	-	3	-	-	3
CO5	3	-	3	-	-	3
Average	2	-	2	-	-	3

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Introduction to Organizational Behaviour	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Individual Behaviour	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-III: Group Behaviour	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO4
Unit-IV: Leadership and Power	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO3	-
Unit-V: Dynamics of Organizational Behaviour	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5

Total Qns. Organizational Behaviour	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

SE22351	STRUCTURAL HEALTH MONITORING	L	T	P	C
		3	0	0	3
COURSE OBJECTIVE:					
<ul style="list-style-type: none"> To make the students familiar with various structural health monitoring tools and techniques 					
UNIT I	INTRODUCTION TO STRUCTURAL HEALTH MONITORING	9			
Need for SHM, Structural Health Monitoring versus Non-Destructive Evaluation, Methods of SHM Local & Global Techniques for SHM, Short & Long-Term Monitoring, Active & Passive Monitoring, Remote Structural Health Monitoring- Advantages of SHM - Challenges in SHM.					
UNIT II	SENSORS AND INSTRUMENTATION FOR SHM	9			
Sensors for measurements: Electrical Resistance Strain Gages, Vibrating Wire Strain Gauges, Fiber Optic Sensors, Temperature Sensors, Accelerometers, Displacement Transducers, Load Cells, Humidity Sensors, Crack Propagation Measuring Sensors, Corrosion Monitoring Sensors, Pressure Sensors, Data Acquisition – Data Transmission - Data Processing – Storage of processed data - Knowledgeable information processing.					
UNIT III	STATIC AND DYNAMIC MEASUREMENT TECHNIQUES FOR SHM	9			
Static measurement - Load test, Concrete core trepanning, Flat jack techniques, Static response measurement, Dynamic measurement - Vibration based testing - Ambient Excitation methods, Measured forced Vibration - Impact excitation, step relaxation test, shaker excitation method.					
UNIT IV	DAMAGE DETECTION	9			
Damage Diagnostic methods based on vibrational response- Method based on modal frequency/shape/damping, Curvature and flexibility method, Modal strain energy method, Sensitivity method, Baseline-free method, Cross-correlation method, Damage Diagnostic methods based on wave propagation Methods-Bulk waves/Lamb waves, Reflection and transmission, Wave tuning/mode selectivity, Migration imaging, Phased array imaging, Focusing array/SAFT imaging.					
UNIT V	DATA PROCESSING AND CASE STUDIES	9			

Advanced signal processing methods -Wavelet, Hilbert-Huang transform, Neural networks, Support Vector Machine Principal component analysis, Outlier analysis. Applications of SHM on bridges and buildings, case studies of SHM in Civil/ Structural engineering.	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
Upon completion of the course, the students will.../ will be able to...	
CO1:	State the different types of structural health inspection.
CO2:	Explain the need, importance and instrumentation of structural health monitoring.
CO3:	Identify the health of the Structure using the advanced techniques.
CO4:	Apply the process and methods of health monitoring techniques.
CO5:	Analyse the accuracy of various health monitoring techniques.
REFERENCES:	
1.	Daniel Balageas, Peter Fritzen, Alfredo Guemes, Structural Health Monitoring, John Wiley & Sons, 2006.
2.	Douglas E Adams, Health Monitoring of Structural Materials and Components Methods with Applications, Wiley Publishers, 2007.
3.	Hua-Peng Chen, Structural Health Monitoring of Large Civil Engineering Structures, Wiley Publishers, 2018.
4.	Ansari, F Karbhari, Structural health monitoring of civil infrastructure systems, V.M, Woodhead Publishing, 2009.
5.	J. P. Ou, H. Li and Z. D, “Duan Structural Health Monitoring and Intelligent Infrastructure”, Vol. 1, Taylor and Francis Group, London, UK, 2006.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	1	1
CO2	1	-	-	-	1	-
CO3	2	2	2	2	1	1
CO4	2	3	2	2	1	1
CO5	2	3	3	2	1	1
Average	1	2	2	1	1	1

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Introduction to Structural Health Monitoring	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Sensors and Instrumentation For SHM	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-III: Static and Dynamic Measurement Techniques For SHM	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Unit-IV: Damage Detection	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-V: Data Processing and Case Studies	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO3	
Total Qns. Structural Health Monitoring	10	5 either or	7(2)	3(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	14	38	16	32
Weightage	20%	80%	14%	38%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	14%	38%	16%	16%	16%	

CM22352	MANAGEMENT INFORMATION SYSTEMS				L	T	P	C
					3	0	0	3
COURSE OBJECTIVES:								
<ul style="list-style-type: none"> To study the concepts of information systems and their applications, support systems, implementation and control and system audit. 								
UNIT I	INTRODUCTION TO INFORMATION SYSTEM							9
Introduction to Information System: System Concepts - Trends - Types of Information System - Operations Support Systems - Transaction processing systems - Management information systems - Management Support Systems - Strategic Information system and other classifications - Success and Failure with IT.								
UNIT II	STRATEGIC USES OF INFORMATION TECHNOLOGY							9
Business level Strategy - Firm level Strategy - Role of IT in Re-engineering – Functional Business Systems – Marketing – Manufacturing – Human Resource – Accounting – Financial								

Management Systems.		
UNIT III	SUPPORT SYSTEMS	9
Decision Support Systems: Group decision support system – What if Analysis – Sensitivity Analysis – Goal seeking Analysis – Optimization Analysis - Knowledge management system - Artificial Intelligence technologies in Business - Expert Systems.		
UNIT IV	IMPLEMENTATION AND CONTROL	9
Control – Testing Security – Coding Techniques – Defection of Error – Validating – Cost Benefit Analysis – Assessing the value and risk of Information System.		
UNIT V	SYSTEM AUDIT	9
Software Engineering qualities – Design, Production, Service, Software specification, Software Metrics, Software quality assurance – Systems Methodology – Objectives – Time and Logic, Knowledge and Human Dimension – Software life cycle models – Verification and Validation.		
TOTAL: 45 PERIODS		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	State the basic concepts and technologies used in the field of management information systems.	
CO2:	Illustrate the role of the ethical, social, and security issues of information systems.	
CO3:	Identify how the information systems work together to accomplish the information objectives of an organization.	
CO4:	Examine the support systems of the management information systems.	
CO5:	Analyse the role of information systems in system audits for strategic management.	
REFERENCES:		
1.	Gordon B. Davis, Management Information System: Conceptual Foundations, Structure and Development, McGraw Hill, 1974.	
2.	Joyce J Elam, Case series for Management Information Systems , Simon and Schuster, Custom Publishing, 1996.	
3.	Kenneth C Laudon and Jane Price Laudon, Management Information Systems - Organisation and Technology, Prentice Hall, 1996.	
4.	Michael W. Evans and John J Marciniah, Software Quality assurance and Management, John Wiley and Sons, 1987.	
5.	Ralph H Sprague and Huge J Watson, Decision Support for Managers, Prentice Hall, 1996.	

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	1	-	-	-
CO2	-	-	2	-	-	-
CO3	3	-	3	-	1	-
CO4	3	-	3	2	3	-
CO5	2	-	3	2	3	-
Average	3	-	2	2	2	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Introduction to Information System	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Strategic Uses of Information Technology	2	1 either or	2(2) – CO1	-	1 either or (16) – CO3	
Unit-III: Support Systems	2	1 either or	1(2) – CO1	1(2) – CO2		1 either or (16) – CO4
Unit-IV: Implementation and Control	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	
Unit-V: System Audit	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. Management Information Systems	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	14%	38%	16%	16%	16%	

CM22353	FUNDAMENTALS OF ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C	
		3	0	0	3	
COURSE OBJECTIVES:						
<ul style="list-style-type: none"> 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. 						
UNIT I	INTRODUCTION					9
Sustainable Development challenges and need - Key approaches for Impact Assessment – EIA Approach: historical development - Legal and Regulatory aspects in India - Impact of development projects under Civil Engineering on environment.						
UNIT II	PREDICTION AND ASSESSMENT					9
Prediction and Assessment tools - Assessment of Impact of construction projects on land, water (surface water and groundwater) and air, noise - Mathematical models - Public participation – Rapid EIA - EIA Report Preparation - Environmental impact statement.						
UNIT III	ENVIRONMENTAL MANAGEMENT PLAN					9
Plan for mitigation of adverse impact on environment – Options for mitigation and rehabilitation of impacts of construction projects on water, air and land - Addressing the issues related to the construction project affected people – ISO 14000.						
UNIT IV	EIA METHODOLOGIES					9
Environmental attributes related to construction - Criteria for the selection of EIA methodology, Methods of EIA - Checklists - Matrices – Networks - Cost-benefit analysis. EIA review - Baseline Conditions - Construction Stage Impacts - Post project impacts.						
UNIT V	IMPACT OF INFRASTRUCTURE AND ENVIRONMENTAL SERVICES					9
EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storied Buildings – Water Supply and Drainage Projects - Case Studies.						
TOTAL: 45 PERIODS						
COURSE OUTCOMES:						
Upon completion of the course, the students will.../ will be able to...						
CO1:	State the basic concepts of Environmental Impact Assessment.					
CO2:	Explain the identification, prediction, evaluation and the legal aspects of impacts caused by infrastructure projects on environment.					
CO3:	Identify appropriate methods for environmental impact assessment for infrastructure and environmental service.					
CO4:	Examine the environmental attributes to be considered for the EIA study and management.					
CO5:	Infer the impacts of infrastructure projects on environmental services.					

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

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	1	-	-	-
CO2	-	-	2	-	-	-
CO3	3	-	3	2	3	-
CO4	1	-	3	2	-	3
CO5	2	-	3	2	3	-
Average	2	-	2	2	3	3

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Introduction	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Prediction and Assessment	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-III: Environmental Management Plan	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-IV: EIA Methodologies	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) – CO3	
Unit-V: Impact of Infrastructure and Environmental Services	2	1 either or	2(2) – CO1	-	-	1 either or (16) – CO5

Total Qns.						
Fundamentals of Environmental Impact Assessment	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

CM22354	SYSTEM INTEGRATION IN CONSTRUCTION	L	T	P	C
		3	0	0	3
COURSE OBJECTIVE:					
<ul style="list-style-type: none"> To study and understand the construction system integration, environmental factors, services, maintenance and safety systems. 					
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 (HVAC) systems in buildings and implementation techniques in high rise buildings.					
UNIT IV	MAINTENANCE	9			
Component longevity in terms of operation performance and resistance to deleterious forces - Planning systems for least maintenance materials and construction – Access for maintenance – Feasibility for replacement of damaged components – Equal life elemental design – Maintenance free exposed and finished surfaces.					
UNIT V	SAFETY	9			
Ability of systems to protect fire – Preventive systems – Fire escape system design – Planning for pollution-free construction environment – Hazard free construction execution.					
TOTAL: 45 PERIODS					
COURSE OUTCOMES:					
Upon completion of the course, the students will.../ will be able to...					

CO1:	State the construction system integration, environmental factors, services, maintenance and safety systems.
CO2:	Illustrate the structural integration, environmental factors, services, maintenance and safety in construction.
CO3:	Apply the systems and services in high rise buildings.
CO4:	Infer the intricacies of physical installation of services and their critical sequence in the construction process.
CO5:	Analyse the requirements and elements of services, maintenance and safety systems in buildings.
REFERENCES:	
1.	David V. Chadderton, “Building Services Engineering”, Taylor and Francis, 2013.
2.	A.J. Elder and Martiz Vinden Barg, “Handbook of Building Enclosure”, McGraw-Hill Book Company, 1983.
3.	Jane Taylor and Gordon Cooke, “The Fire Precautions Act in Practices”, 1987.
4.	Peter R. Smith and Warren G. Julian, “Building Services”, Applied Science Publishers Ltd., London, 1993.
5.	William T. Mayer, “Energy Economics and Building Design”, McGraw-Hill Book Company, 1983.

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Programme Outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	1	1	1	-
CO2	1	-	1	1	1	-
CO3	3	-	3	1	2	-
CO4	3	-	2	1	2	-
CO5	2	-	2	1	2	-
Average	2	-	2	1	2	-

Table of specification for end semester question paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Cognitive Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)
			No. of Qns. (marks) and CO			
Unit-I: Structural Integration	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-
Unit-II: Environmental Factors	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-

Unit-III: Services	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO4
Unit-IV: Maintenance	2	1 either or	2(2) – CO1	-	1 either or (16) – CO3	-
Unit-V: Safety	2	1 either or	1(2) – CO1	1(2) – CO2	-	1 either or (16) – CO5
Total Qns. System Integration in Construction	10	5 either or	8(2)	2(2) 2 either or (16)	1 either or (16)	2 either or (16)
Total Marks	20	80	16	36	16	32
Weightage	20%	80%	16%	36%	16%	32%
Weightage for COs						
	CO1	CO2	CO3	CO4	CO5	
Total Marks	16	36	16	16	16	
Weightage	16%	36%	16%	16%	16%	

AUDIT COURSES

AC22101	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • 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	
COURSE OUTCOMES:	
Upon completion of the course, the students will.../ will be able to...	
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	Goldbort R, “Writing for Science”, Yale University Press (available on Google Books) 2006.
3	Highman N, “Handbook of Writing for the Mathematical Sciences”, SIAM. Highman’s book 1998.

AC22102	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> • 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	5			
History, Drafting Committee, (Composition & Working).					

UNIT II	PHILOSOPHY OF THE INDIAN CONSTITUTION	5
Preamble, Salient Features		
UNIT III	CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	5
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	5
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	5
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	5
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		
COURSE OUTCOMES:		
Upon completion of the course, the students will.../ will be able to...		
CO1:	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	
CO2:	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	
CO3:	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.	
CO4:	Discuss the passage of the Hindu Code Bill of 1956.	
REFERENCES:		
1	The Constitution of India, 1950 (Bare Act), Government Publication.	
2	Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1st Edition, 2015.	

3	M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AC22201	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	0
COURSE OBJECTIVES:					
<ul style="list-style-type: none"> 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					
COURSE OUTCOMES:					
Upon completion of the course, the students will.../ will be able to...					

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.

AX4094	நற்றமிழ் இலக்கியம்	L	T	P	C
		2	0	0	0
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) - போரை நிறுத்திய ஒளவையா					
UNIT II	அறநெறித் தமிழ்				6
1. அறநெறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன்புமை, ஒப்பறவு அறிதல், ஈகை, புகழ் 2. பிற அறநூல்கள் - இலக்கிய மருந்து - ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)					
UNIT III	இரட்டைக் காப்பியங்கள்				6
1. கண்ணகி புரட்சி - சிலப்பதிகார வழக்குரை காதை 2. சமூக சேவை இலக்கியம் மணிமேகலை - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை					
UNIT IV	அருள்நெறித் தமிழ்				6
1. சிறுபாணாற்றுப் படை - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஒளவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள். 2. நற்றிணை					

<ul style="list-style-type: none"> - அன்னைக்குரிய புன்னை சிறப்பு 3. திருமந்திரம் (617, 618) <ul style="list-style-type: none"> - இயமம் நியமம் விதிகள் 4. தர்மச்சாலையை நிறுவிய வள்ளலார் 5. புறநானூறு <ul style="list-style-type: none"> - சிறுவனே வள்ளலானான் 6. அகநானூறு (4) - வண்டு நற்றிணை (11) - நண்டு கலித்தொகை (11) - யானை, புறா ஐந்திணை 50 (27) - மான் <p style="text-align: center;">ஆகியவை பற்றிய செய்திகள்</p>		
UNIT V	நவீன தமிழ் இலக்கியம்	6
<ol style="list-style-type: none"> 1. உரைநடைத் தமிழ் <ul style="list-style-type: none"> - 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	

HOD

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