NMAM INSTITUTE OF TECHNOLOGY, NITTE

M.TECH IN CONSTRUCTION TECHNOLOGY

VISION

To uphold the Department as a leader in community development through innovation and excellence in diverse areas of Civil Engineering to meet the global challenges and market demands.

MISSION

- To provide the students a strong theoretical knowledge and practical skills to understand the basic concept and fundamentals of various Civil Engineering subjects.
- To be competent and skilled enough to take the challenges in Research, Consultancy and Entrepreneurship.
- To encourage the students in developing professional ethics through discipline and principles.

PROGRAM EDUCATIONAL OBJECTIVES – M.Tech. CCT

PEO-01	Equipped to pursue professional career in the constantly changing field of construction, Engineering, Technology and Management
PEO-02	Competent enough to contribute knowledge base through Learning and Research
PEO-03	Continue to practice and promote the needs and challenges of real world problems and come up with sustainable solutions for social needs.

PROGRAM OUTCOMES – M.Tech. CCT

PO1: Become Proficient

Acquire in-depth knowledge of the discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and integration of the same for enhancement of knowledge.

PO2: Logical Thinking

Analyze complex Engineering problems logically, reaching substantiated conclusion for evaluating information to make intellectual and/or creative advances for carrying research.

PO3: Problem Solving

Think multi-dimensionally, conceptualize and solve engineering problems, for public health and safety, cultural, societal and environmental factors in the core areas of expertise.

PO4: Pursue an Investigation

Compile information pertinent to real life problems through investigations and experiments, apply appropriate research methodologies, techniques and tools,design of experiments, analysis and interpretation of dataand synthesis of information to provide sustainable solutions.

PO5: Usage of modern Tools& Techniques

Create, select, learn and apply appropriate techniques, resources, and modern engineering tools, including forecasting and modelling, to complex engineering activities considering the limitations.

PO6: Synergetic and Multidisciplinary work

Apply knowledge in understanding the group dynamics, identify opportunities and contribute positively for collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning.

PO7: Environment and Sustainability

Understanding of environmental and social responsibility to contribute to the community for sustainable development of society.

PO8: Professional Ethics

Equip professional and intellectual integrity, professional code of conduct, ethics of research.

PO9: Individual and Team work

Observe and examine critically the outcomes of one's actions and as a member orleader in diverse team of multidisciplinary activities.

PO10: Communication

Communicate with the engineering and social community, and with society at large, regarding complex engineering activities confidently and effectively.

PO11:Project Management and Finance

Illustrateskill in understanding of engineering and management principles and apply to multidisciplinary environments after consideration of economic and financial factors.

PO12: Life-long learning

Identify the need to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PROGRAM SPECIFIC OUTCOMES – M.Tech. CCT

PSO1

Apply knowledge of various domains of Construction Technology; conduct experiments, analyze, interpret data, and design.

PSO2

Competent with skills and knowledge for Research and Innovative practices

PSO3

Illustrateskill in understanding of engineering and management principles in sustainable development in line with social responsibilities.

NMAM INSTITUTE OF TECHNOLOGY, NITTE

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH IN CONSTRUCTION TECHNOLOGY (AUTONOMOUS SCHEME 2017)

I SEMESTER

Sub-Code	Title	TeachingDept	Contact hours/ week	Duration of SEE (Hrs)	Marks		Credits
			L-T-P-S		CIE	SEE	
17CCT101	Construction Planning and Control Management	CV	4-0-2-0	03	50	50	5
17CCT102	Construction Economics & Finance	CV	4-0-2-0	03	50	50	5
17CCT103	Organizational Behavior	CV	4-0-2-0	03	50	50	5
17CCT11X	Elective I	CV	4-0-0-0	03	50	50	4
17CCT12X	Elective II	CV	4-0-0-0	03	50	50	4
17CCT104	Research Experience through Practice-I	CV	0-0-4-0	-	100		2
		TOTAL		**15**	**350**	**250**	**25**

LIST OF ELECTIVE I & II

ELECTIVE I		ELECTIVE II	
17CCT111	Repair and Restoration of Structures	17CCT121	Remedial Engineering
17CCT112	Disaster Management	17CCT122	Pavement Design & Construction
17CCT113	Advanced Design of Foundations	17CCT123	Soil Exploration & Ground Improvement Techniques.
17CCT114	Structural Masonry	17CCT124	Computer Aided Design in Engineering
17CCT115	Re-use & Re-cycle Technology	17CCT125	Advanced Reinforced Concrete Design
17CCT116	Quantitative Methods in Construction	17CCT126	Advanced Concrete Technology

NMAM INSTITUTE OF TECHNOLOGY, NITTE

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH IN CONSTRUCTION TECHNOLOGY (AUTONOMOUS SCHEME 2017)

II SEMESTER

Sub-Code	Title	Teaching Dept	Contact hours/ week	Duration of SEE (Hrs)	Marks		Credits
			L-T-P-S		CIE	SEE	
17CCT201	Mechanization in Construction	CV	4-0-2-0	03	50	50	5
17CCT202	Construction Quality & safety	CV	4-0-2-0	03	50	50	5
17CCT203	Construction & Contract management	CV	4-0-2-0	03	50	50	5
17CCT21X	Elective III	CV	4-0-0-0	03	50	50	4
17CCT22X	Elective IV	CV	4-0-0-0	03	50	50	4
17CCT204	Research Experience through Practice-II	CV	0-0-4-0	-	100		2
		TOTAL		**15**	**350**	**300**	**25**

LIST OF ELECTIVE III & IV

ELECTIVE III	ELECTIVE IV
17CCT211 Design of Earthquake Resistant Structures	17CCT221 Building Services & Maintenance
17CCT212 Human Resource Management	17CCT222 Valuation Techniques in Engineering
17CCT213 Risk Management	17CCT223 Operation Research

LIST OF AUDIT COURSE CURRENTLY OFFERED

Sl. No.	NAME OF THE AUDIT COURSE	AUDIT COURSE CODE	PROGRAMME	DEPT
1	Disaster resistant building design & management	17AP004	1)CONSTRUCTION TECHNOLOGY 2)STRUCTURAL ENGINEERING	CV

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SCHEME OF TEACHING AND EXAMINATION FOR M.TECH IN CONSTRUCTION TECHNOLOGY (AUTONOMOUS SCHEME 2017)

III SEMESTER

Sub. Code	Name of the Subject	Duration	Marks for		Total Credits
		Practical/Field Work/Assignment	CIE	SEE	
17CCT301	Industrial Training/ Mini-Project	Full time 8 weeks	50 (Report) 50(Presentation)		8
17CCT302	Seminar on Special Topics	----	100		2
17CCT303	Project Part-I	Full time 10 weeks	100 (Report) 100(Presentation)		10
TOTAL			400		20

Note:

1. 17CCT 301: Industrial training / Mini Project: Industrial training report and oral presentation are to be evaluated by the department for 50 marks each. If mini project is carried out it is evaluated for 100 marks by the Department Committee.
2. 17CCT 302– Seminar marks are evaluated by the Department Committee**.**

NMAM INSTITUTE OF TECHNOLOGY, NITTE

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH IN CONSTRUCTION TECHNOLOGY (AUTONOMOUS SCHEME 2017)

IV SEMESTER

Sub. Code	Name of the Subject	Duration	Duration of Exam in Hours	Marks for		Total Marks	Credits
		Practical/Field Work		CIE	SEE		
17CCT401	Project Part-II	Full Time 30 Weeks	--	200 [PPE*-I – 100 PPE-II – 100]	200	400	30

* PPE – Project Progress Evaluation

Grand Total from 1st to 4th Semester: 100 credits

Note:

1. 17CCT 401 – Project Phase II: The student should give minimum of three progress seminars and one Pre Synopsis seminar during the semester.
2. 17CCT 401 – Project Phase II: The student should give one Pre Synopsis seminar in front of the Committee consisting of Guide, Chairman BOE (PG) or his nominee and PG Coordinator during the semester. The student should get approval from the Committee to submit the report.
3. 17CCT 401 – Project Phase II: The project report valuation will be carried out separately by the guide and External examiner for 100 marks each. Viva- Voce will carry 200 marks and will be conducted by a Committee consisting of the following.

a) Chairman BOE (PG) or his nominee.
b) PG Coordinator.
c) Guide.
d) External Examiner.

FIRST SEMESTER M.TECH (CONSTRUCTION TECHNOLOGY)

17CCT 101 CONSTRUCTION PLANNING AND CONTROL MANAGEMENT

Sub Code	**: 17CCT101**	**Credits**	**: 05**
Hrs/Week (L:T:P:S)	**: 4:0:2:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52+26**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: During the course students will be enable

1. Understand various organizational forms/structures Bar charts, Milestone charts and Work breakdown structure.
2. Have the knowledge of Activity, Event, Different type of floats, Forward pass, Backward pass, Activity start and finish times.
3. Know three time estimates referring to PERT, Scheduling, Monitoring and Updating. Resource Planning-leveling and allocation.
4. Acquire the knowledge of Cost control in construction, Linear programming, Transportation models.
5. Know about Material Management, Store management, Purchase management and Inventory control management.

UNIT 1

Project Organization, Formal and Informal organization, Organization structures, Bar chart, Milestone chart, Work Breakdown Structure, Cost breakdown structure.

10 Hours

UNIT 2

Network analysis, Activity and event, Fulkerson's rule of numbering events, Activity start and finish times, forward and backward pass, Different types of floats.

10 Hours

UNIT 3

CPM analysis, PERT analysis, Time Estimates-Optimistic time, Pessimistic time, most likely time, Scheduling, Monitoring and Updating. Line of Balance Scheduling. Resource Planning-leveling Allocation, Introduction to Risk Management, Risk Register.

10 Hours

UNIT 4

Project cost analysis, Time-Cost Trade-off. Cost Control in Construction, Linear programming-Graphical method, Theory of simplex method, Transportation models

12 Hours

UNIT 5

Material Management- Scope, objectives and functions, Store Management-Objectives and functions, Purchase management and inventory control Management-Inventory control techniques, A B C analysis

10 Hours

PRACTICAL COMPONENT

Preparation of Planning and Scheduling by using MS PROJECT/PRIMAVERA

- Planning and Scheduling of a Residential house of 30' x 40' dimension.
- Allocation of Resources and cost estimation
- Leveling of Resources
- Material Management
- Tracking schedule
- Earned Value Management
- Preparation of Reports

Introduction to Mat Lab.

Course Outcomes: At the end of the course the students should be able

1. To prepare bar charts, milestone charts and WBS
2. To analyze and solve problems on activities and events
3. To calculate the project completion period and to estimate the probability of completing the project within the specified period.
4. To minimize the project cost by various techniques
5. To acquire the knowledge of procuring material for the project.

TEXT BOOKS

1. Peurifoy. R L, "**Construction Planning, Equipment and Methods**", Mc Graw Hill.
2. Srinath L.S, "**PERT and CPM**", East West Press Private Ltd New Delhi.

REFERENCE BOOKS

3. Frank Harris and Ronald McCaffer, "**Modern Construction Management**", 6th Ed., Blackwell Science Ltd.
4. B.C Punmia, "*Pert and CPM*", Lakshmi publication.
5. Paul Harris, Planning & Control Using Microsoft Project 2013 & 2016
6. Chatfield, Johnson Microsoft Project 2016 Step By Step - 2016

IS Codes

1. IS 14580-1 (1998): Use of Network Analysis for Project Management, Part 1: Management, Planning, Review, Reporting and Termination Procedures.
2. IS 14580-2 (2006): Use of network analysis for projects management, Part 2: Use of graphic technique.
3. IS 15883-1 (2009): Construction project management - Guidelines, Part 1: General.
4. IS 15883-2 (2013): Construction project management - Guidelines, Part 2: Time Management.
5. SP 7 (2005): NATIONAL BUILDING CODE OF INDIA 2005(GROUP 1 TO 5)

17CCT 102 CONSTRUCTION ECONOMICS AND FINANCE

Sub Code	**: 17CCT102**	**Credits**	**: 05**
Hrs/ Week (L:T:P:S)	**: 4:0:2:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52+26**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: During the course students will enable

1. The scope and relevance of economics to technology driven activities
2. To account and budget the expenditures.
3. To learn the essence of project management
4. Understanding cash flow and fund flow
5. To the learn the accounting for engineers

UNIT I

A Discovery of Economics–The Physical and Economic Environments–The Scope and Relevance of Economics to Technology Driven Activities–Physical and Economic Efficiency–The Engineering Process–Engineering for Economic Competitiveness–The Significance of Economics and Finance for Engineers-Demand and Supply Analysis for Engineers-Elasticity of Demand and Its Measurement-Types of Price Elasticity–Income Elasticity–Cross Elasticity-Advertising Elasticity of Demand–Application of Elasticities in Managerial and Engineering Decision Making.
Cost Concepts in Business–Economic Cost Vs. Accounting Costs–Fixed Costs Vs.Variable Costs – Explicit Costs Vs. Implicit Costs-Sunk Cost–Incremental Cost–Marginal Cost–Law of Variable Proportion.
Break Even Analysis–Theory and Practice **10 Hours**

UNIT II

Capital Budgeting–Phases of Capital Budgeting–Objectives of Capital Budgeting–Planning of Capital Expenditures-Control for Capital Expenditure–Cost of Capital-Measurement of Cost of Capital-Capital Budgeting Process–Capital Rationing–The Evaluation Process-Payback, Accounting Rate of Return-Time–adjusted Rate of Return–Present Value Method–Discounted Cash Flow Method-Index of Profitability Method. **10Hours**

UNIT III

Project Management–Forms of Project Organization–Project Planning–Life Cycle of a Project– Project Control–Pre-Requisites for Successful Project Implementation–Essence of Project Management–Project Risk Analysis– Project Cash Flows-Financial Estimates and Projections–Working Capital Needs-Profitability Projection-Infrastructure Projects for Civil Engineers–Sources of Funds Classification of Assets and Liabilities–The Balance Sheet-Determination of Short term Liquidity and Long term Solvency. **12 Hours**

UNIT IV

Understanding Cash Flows and Fund Flows-Sources of Funds–Term Lending and its Operation– Working Capital Management-Project–Appraiability-Ratio Analysis-Business Plan-Venture Capital – Kinds, Sources and Operation–Venture Capital Industry in India. **10 Hours**

UNIT V

Accounting for Engineers–Meaning and Scope of Book-keeping and Accounting-Accounting Concepts–Accounting Convention-Rules of Credit and Debit–Preparation of Final Accounting-International Financial Reports Standards (IFRS).**10 Hours**

PRACTICAL COMPONENT

- Preparation and analysis of Balance Sheet
- Listing and sequencing of Activities
- Preparation of CPM/Bar chart for the site activities
- Site visits

Course Outcomes: At the end of the course the students should be able

1. To describe the scope and relevance of economics to technology driven activities.
2. To tabulate the account expenditures.
3. To describe the importance of project management.
4. To tabulate the cash flow and fund flow.
5. To account the debit and credit bills.

TEXTBOOKS

1. Courtland A Collies and William B-Ledbetter, "Engineering Economics and Cost Analysis", Horper and Row
2. Kuchhal S.C, "Financial Management–Analytical and Conceptional Approach", Chaitanya Publicity House, Allahabad

REFERENCES

3. Prasanna Chandra, "Projects Planning, Analysis, Selection, Financing, Implementation and Review, "McGraw Hill Education (India) Private Ltd., New Delhi.
4. Gerald J. Thueson and W.J Fabrycky, "Engineering Economy", 9th Edition, Prentice Hall of India, New Delhi.
5. Horne and Wachowicz, "Fundamentals of Financial Management," Prentice Hall of India, New Delhi.

17CCT103 ORGANIZATIONAL BEHAVIOUR

Sub Code	**: 17CCT103**	**Credits**	**: 05**
Hrs/ Week (L:T:P:S)	**: 4:0:2:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52+26**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: During the Course student will learn

1. To distinguish organizational behaviour and management as different yet related disciplines.
2. To know issues related to organizational productivity and employee needs.
3. To know the significance of various psychological traits of employees that systematically influences their behaviour on the job.
4. To know the importance of organizational commitment and job involvement.
5. To understand the effects of leadership in job involvement.

UNIT 1

Approaches to Organizational Behaviour; Overview of the Field of Organization Development; Individuals in Organizations. **10 Hours**

UNIT 2

Motivation and Behaviour; Motivation at work; Designing motivating jobs.

10 Hours

UNIT 3

Creating and individual decision making; Group Dynamics; Group behaviour, Inter-group relation and conflict. **12 Hours**

UNIT 4

Communication; Leadership in Organizations; Characteristics of Organizations: Organization Structure and Design, Organizational Change and Development;

10 Hours

UNIT 5

Organizational Culture and climate. Managing Innovation and Technology in changing environments. **10 Hours**

PRACTICAL COMPONENT

Case studies on organization culture, Case studies of OD interventions in mega-construction projects.

Course Outcomes: At the end of the course student will be able to

1. To describe the various approaches to organizational behavior.
2. To describe the issues related to productivity and needs in an organization.
3. To explain the traits of employees in their behavior on the job.
4. To distinguish the organizational commitment and job involvement.
5. To explain the effects leadership in an organization**.**

TEXT BOOKS

1. Stephen. P. Robbins, “Organizational Behaviour”, 15th edition, Pearson Education Asia, New Delhi 2017
2. Jit. S. Chander, “Organizational Behaviour”, 3rd edition, Vikas Publishing House Pvt. Ltd. New Delhi, 2014

REFERENCE BOOKS

1. Gregery Moorhead and Ricky W. Griffin, **"Organizational Behaviour: Managing People and Organizations"**, 3rd Edition, HoughenMiffin Company, Boston 2000
2. Wendell L French and Cecil H Bell, Jr., **"Organization Development: Behavioural Science Interventions for Organization Improvement"**, 6th edition, Pearson Education Asia, New Delhi 2001

17CCT104 RESEARCH EXPERIENCE THROUGH PRACTICE – I

Sub Code	**: 17CCT104**	**Credits**	**: 02**
Hrs/ Week (L:T:P:S)	**: 0:0:4:0**	**CIE**	**: 100**
Total Contact Hrs	**: 50**	**SEE**	**: -**
		Exam Hrs	**: -**

Course Learning Objectives: During the Course Students will be enable

1. To conduct a literature survey, to identify a research problem, to write a research paper, research report, research proposal, and systematic way of conducting research.

Department specific/PG Programme specific skill sets required for carrying out a research work offered to the students like software tools for system/device simulation and analysis, software/ hardware tools for signal acquisition, data processing, control simulation, Testing/measuring equipment used in research and Testing/measuring procedure.

Course Outcomes

At the end of Research Experience through Practice-I: Students should be able

1. To identify a research problem, with clear objectives and methodologies backed by extensive literature review.

NOTE: All the PG students arerequired to submit a research proposal and a presentation at the end of the first semester.

17CCT111 REPAIR AND RESTORATION OF STRUCTURES

Sub Code	**: 17CCT111**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

COURSE LEARNING OBJECTIVES:

1. Learn the failures of structure due to deterioration of concrete.
2. Gain the knowledge about difference between the repair and restoration of structures.
3. Study about the repair materials and compatibility with the parental structure.
4. Different types of retrofitting to strengthen the existing structures & Types of polymer concrete and epoxy grouting, shotcreting
5. Damage assessment of reinforced concrete structure methodology and approach

UNIT-I

General: Introduction, Cause of deterioration of concrete structures,Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods. Quality assurance for concrete construction as built, concrete properties - strength, permeability, thermal properties and cracking. **12 Hours**

UNIT-II

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels;cathodic protection **10 Hours**

UNIT-III

Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance, Importance of Maintenance, Preventive measures on various aspects of inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration - testing techniques.

10 Hours

UNIT-IV

Materials for Repair: Special concretes and mortar, concrete chemicals, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete.

Techniques for Repair: Rust eliminators and polymers coating for rebar during repair, foamed concrete, Mortar and Dry pack, Vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, Shoring and Underpinning. **10 Hours**

UNIT-V

Strengthening of structures: Techniques, designconsideration, flexural strengthening,Shear Strengthening,
Strengthening of columns-Guide lines for retrofit of concrete structures, Jacketing of Columns – strengthening by interior and external reinforcing, Steel Plate jacketing, External Pre-stressing, Fiber wrapping, **10 Hours**

COURSE OUTCOME:

On completion of this course, students will be able to:

1 Explain the failure and Experimental investigations to be carried out on structures.
2 Outline the difference between repair and restoration of structures.
3 Explain the Repair materials compatibility with the Parent structures
4 Suggest different retrofitting techniques for existing damaged structures.
5 Explain the damage assessment technique to be followed for RC structures

REFERENCE BOOKS:

1 Sidney., M. Johnson "**Deterioration Maintenance and Repair of Structures**"
2 R.N. Raikar "**Rehabilitation of Structures**"- Edited by, Vol. 1, 2 and 3, Proc., Int. Symposium, Maharashtra Indian Chapter of ACI, Bombay
3 Denison Campbell, Allen & Harold Roper, "**Concrete Structures – Materials, Maintenance and Repair**", Longman Scientific and Technical
4 R.T.Allen and S.C. Edwards, "**Repair of Concrete Structures**", Blakie and Sons
5 Raiker R.N. "**Learning for failure from Deficiencies in Design, Construction and Service**"- R&D Center (SDCPL)
6 Santhakumar A.R. "**Training Course notes on Damage Assessment and Repair in Low Cost Housing**", Anna University
7 Key, T. **"Assessment and renovation of concrete structures"**
8 B.S. Nayak **"Maintenance Engineering" PublishingCompanyPvt.Ltd.,NewDelhi**

17CCT112DISASTER MANAGEMENT

Sub Code	**: 17CCT112**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

COURSE LEARNING OBJECTIVES:

1 Describe the basic types of hazards and their potential consequences to India
2 Understand the planning and assessment of Hazard, Risk, Vulnerability and disaster
3 Describe the basic concepts of the emergency management cycle (mitigation, preparedness, response, and recovery)
4 Critically understand the various disaster management acts and policies and approaches in both national and state level scenario.
5 To build skills to respond to disasters in an effective, humane and sustainable manner

UNIT-I

Hazard, Risk, Vulnerability, Disaster and Disaster Management. Types of Disasters: Hazard and vulnerability profile of India. **12 Hours**

UNIT-II

Relevance of Disaster Risk, Vulnerability & Capacity Assessment in Planning, Concepts of Hazard Assessment, Vulnerability Assessment, Risk Assessment and Capacity Assessment, Hazard Identification and analysis. **10 Hours**

UNIT-III

Four elements of comprehensive disaster management (Preparedness, Response, Recovery and Mitigation), Concept of Mitigation and its importance (Structural and Non Structural mitigation measures, identification of mitigation measures relating to different types of hazards and implementing strategies). Land use Management tools for disaster risk reduction. (building codes, GDCR, zoning ordinances, land acquisition, transfer of development rights, Recovery and reconstruction plan). **10 Hours**

UNIT-IV

National Disaster Management Act, Various State Disaster Management Acts (Gujarat, Uttar Pradesh, Uttaranchal, Bihar, Karnataka) and State disaster management policies (e.g. Orissa, Gujarat, Uttaranchal, Karnataka, Tamil Nadu, Delhi, Uttar Pradesh). Relevance of Rehabilitation and Resettlement Policy in Recovery and reconstruction phase of disaster management. Coastal zoning regulation for construction and reconstruction phase in the coastal areas.

10 Hours

UNIT-V

Role of Government/Civil Society/International Organizations/Communities and Approaches to Community Based Disaster Risk Management and Planning. (Local coping mechanisms, Importance of Mock Drills and On site volunteer management in Community level disaster preparedness activities).

Projects implemented general description of projects carried out in India following natural disasters. Disaster resistant buildings & measures. Recent developments. Case studies

10 Hours

COURSE OUTCOME:

On completion of this course, students will be able to:

1	Develop an understanding of the key concepts, definitions a key perspectives of All Hazards, Disasters, Risk and Vulnerability
2	Develop a deep understanding of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe
3	Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery
4	Understand the various acts and policies related to Indian disaster management
5	Explain the role of public and private partnerships

REFERENCE BOOKS:

1. Emergency Management: A Reference Handbook by Jeffrey B. BumgarnerABC-Clio, 2008
2. Lessons of Disaster: Policy Change after Catastrophic Events by Thomas A. BirklandGeorgetown University Press, 2006
3. The Indian Ocean Tsunami: The Global Response to a Natural Disaster by Pradyumna P. Karan; Shanmugam P. SubbiahUniversity Press of Kentucky, 2011.
4. Chaos Organization and Disaster Management by Alan KrischenbaumMarcel Dekker, 2004.
5. Emergency Relief Operations by Kevin M. CahillFordham University Press, 2003
6. A Comprehensive Approach to Emergency Planning By Worsely, Tracy L.; Beckering, DonCollege and University, Vol. 82, No. 4, January 1, 2007.

17CCT113ADVANCED FOUNDATION DESIGN

Sub Code	**: 17CCT113**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

COURSE LEARNING OBJECTIVES:

1. Understand the concept of soil exploration and analysis.
2. Understand the concept of evaluating safe bearing capacity and design of foundation.
3. Understand the method to evaluate load bearing capacity of pile and pile groups and design.
4. Understand different components of well foundation and stability analysis.
5. Study the concept of soil structure interaction.

UNIT-I

Introduction, soil exploration, analysis and interpretation of soil exploration data, estimation of soil parameters for foundation design. **12 Hours**

UNIT-II

Shallow Foundations: Methods for bearing capacity estimation, total and differential settlements of footing and raft, code provisions.Design of individual footings, strip footing, combined footing, rigid and flexible mat, buoyancy raft, basement raft, underpinning.

10 Hours

UNIT-III

Pile Foundations: Estimation load carrying capacity of single and pile group under various loading conditions. Pile load testing (static, dynamic methods and data interpretation), settlement of pile foundation, code provisions, design of single pile and pile groups, and pile caps.

10 Hours

UNIT-IV

Well Foundations: Types, components, construction methods, design methods(Terzaghi, IS and IRC approaches), check for stability, base pressure, side pressure and deflection.
Reinforced Earth: Geotechnical properties of reinforced soil, shallow foundation on soil with reinforcement, retaining walls with reinforcements, design considerations.

10 Hours

UNIT-V

Soil-Foundation Interaction: Idealized soil, foundation and interface behavior.Elastic models of soil behavior; Elastic-plastic and time dependent behavior of soil.Beams and plates on elastic foundation; numerical analysis of beams and plates resting on elastic foundation. **10 Hours**

COURSE OUTCOME:

On completion of this course, students will be able to:

1. Conduct soil exploration and evaluate index properties of soil.
2. Design suitable foundation for the given soil condition.
3. Design and conduct load bearing tests for pile and pile groups.

4 Design well foundation and suitable soil reinforcement.
5 Analyze beams and plates resting on elastic foundation.

TEXT BOOKS

1. Joseph Bowles, "Foundation Analysis and Design", McGraw-Hill Book Company.
2. V.N.S. Murthy, "Advanced Foundation Engineering", CBS Publishers and Distributors.

REFERENCE BOOKS:

1. A.P.S. Selvadurai, "Elastic Analysis of Soil-Foundation Interaction", Elsevier Scientific Publishing Company.
2. Braja M. Das, "Principles of Foundation Engineering", PWS Publishing Company.
3. Literature on Advanced foundations Bureau of Indian Standard codes on foundations.

17CCT114STRUCTURAL MASONRY

Sub Code	**: 17CCT114**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

COURSE LEARNING OBJECTIVES: The objectives of this course is to make students

1 To learn performance of masonry structures
2 To learn masonry structural design.
3 To evaluate the strength and stability of the masonry structures
4 To learn the load bearing masonry design
5 To study the design procedure for earthquake resistant masonry

UNIT-I

Introduction, Masonry units, materials and types: History of masonry Characteristics of Brick, stone, clay block, concrete block, stabilized mud block masonry units – strength, modulus of elasticity and water absorption. Masonry materials – Classification and properties of mortars, selection of mortars. **12 Hours**

UNIT-II

Strength of Masonry in Compression: Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, Failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength. **10 Hours**

UNIT-III

Flexural and shear bond, flexural strength and shear strength: Bond between masonry unitand mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength. **10 Hours**

UNIT-IV

Design of load bearing masonry buildings: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall; Design of load bearing masonry for buildings up to 3 to 8 storeys using BIS codal provisions.

10 Hours

UNIT-V

Earthquake resistant masonry buildings: Behaviour of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions. Masonry arches, domes and vaults: Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure. **10 Hours**

COURSE OUTCOME:

On completion of this course, students will be able to:

1 Achieve Knowledge of design and development of problem solving skills.
2 Understand the principles of design and construction of masonry structures
3 Design and develop analytical skills.
4 Summarize the masonry Characteristics.
5 Evaluate the strength and stability of the masonry structures.

TEXTBOOKS

1. Hendry A.W., "Structural masonry"- Macmillan Education Ltd., 2nd edition
2. Sinha B.P & Davis S.R., "Design of Masonry structures"- E & FN Spon
3. Dayaratnam P, "Brick and Reinforced Brick Structures"- Oxford & IBH

REFERENCE BOOKS:

1. Curtin, "Design of Reinforced and Prestressed Masonry"- Thomas Telford
2. Sven Sahlin, "Structural Masonry"-Prentice Hall
3. Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, "Alternative Building Materials and Technologies"- New Age International, New Delhi & Bangalore
4. IS 1905, BIS, New Delhi.
5. SP20(S&T),New Delhi

17CCT 115 REUSE AND RECYCLE TECHNOLOGY

Sub Code	**: 17CCT115**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

COURSE LEARNING OBJECTIVES: The objectives of this course is to make students

1. To learn the waste as a resource and govt. role in waste management.
2. To learn the system designing of waste resource.
3. To learn the energy recovery methods.
4. To study the analysis of waste.
5. To learn different categories of demolition waste.

UNIT I

Waste as a Resource: Resource Economics, Disposable Materials, Classification of wastes Recycling Collection, Processing, Governmental Role in Waste Management, Potential for Reuse

10 Hours

UNIT II

System Design: Design of Recycling Systems, Collection System, Process Train Design and Complexity, Product Design of Recycling, Conveyance, Transport Safety, Efficiency of Operation Systems. **12 hours**

UNIT III

Energy Recovery: Combustion, Energy Losses, Energy Recovery Analysis Emission Control, Residue Control, In-Plant Operations, Refuse Derived Fuel **12 hours**

UNIT IV

Waste Analysis: waste sampling, sampling mechanics, waste composition, waste properties, hazardous waste aspects. **10 hours**

UNIT V

Construction Demolition Wastes: Classifications, Reuse as fine aggregate, coarse aggregate, Properties of Construction Demolition Wastes, Properties of concrete products, Specifications, Standards, National Policy etc. **08 hours**

COURSE OUTCOME: On completion of this course, students will be able to

1. Describe the govt. role in waste management and using waste as a resource.
2. Design a system for using waste resource.
3. Describe the energy recovery methods.
4. Analyze the waste for utilization in construction.
5. Segregate the different kinds of demolition waste.

REFERENCE BOOKS

1. Springer, "**Recycling and Resource Recovery Engineering"**, Springer-Verlag Berlin Heidelberg (1996).
2. Kut, and Hase C, "**Waste Recycling for Energy conservation",** John Wiley and Sons Inc.
3. **Current Literature**

17CCT116 QUANTITATIVE METHODS IN CONSTRUCTION

Sub Code	**: 17CCT116**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

COURSE LEARNING OBJECTIVES: The objectives of this course is to make students

1. To study the average and dispersion techniques.
2. To study the correlation, regression and sampling techniques.
3. To study the probability distribution.
4. To study the linear programming techniques.
5. To study dynamic programming techniques.

UNIT-I

Averages and Dispersion: Data collection, presentation of data, measures of central tendencies, measures of dispersion and coefficient of variation**.** **10 Hours**.

UNIT-II

Probability Distributions and Sampling: Definition of probability, axioms of probability, conditional probability, Baye's theorem, one dimensional random variable, expectation and variance, curve fitting-linear, non-linear and exponential, correlation and regression.

08 Hours.

UNIT-III

Probability Distributions: Normal and exponential distributions, two dimensional random variables, marginal distributions, conditional distributions, expectation, covariance and correlation, moments, relation between raw and central moments, skewness, kurtosis and central limit theorem.

10 Hours.

UNIT-IV

Linear Programming: Introduction to linear programming, formulation of LPP, solution of LPP-Graphical method, Simplex method, big-M method, two-phase method, transportation problem and assignment problem**.** **12 Hours**

UNIT-V

Markov Chains: Probability vectors, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probabilities, stationery distribution of regular Markov chains and absorbing states.

Dynamic Programming: Introduction to dynamic programming, traveling salesman problem and simulation applied to construction**.** **12 Hours**

COURSE OUTCOME: On completion of this course, students will be able to

1. Derive the average and dispersion techniques.
2. Solve the correlation, regression and sampling techniques.
3. Calculate the probability distribution.
4. Represents the linear programming techniques.
5. Describe dynamic programming techniques.

TEXT BOOKS

1. Dr.B.S.Grewal, *Higher Engineering Mathematics*, 36th Edition.
2. Hamdy A. Taha, *Operations Research*, 5th Edition, PHI.
3. William Feller, *An Introduction to Probability Theory and its Applications*, Vol.1, 3rd Edition.

REFERENCE BOOKS

1. James J. Adrian,P.E. "Quantitative methods in construction management", American Elsevier.
2. AlfredoH.S. and WilsonH.Tang,"Probability concepts in Engineering, Planning and Design", Vol.1, John Willy& sons.
3. Rao S.S., *Engineering Optimization*, New Age International.
4. R.E.Walpole and R.H. Myers, *Probability and Statistics for Engineers and Scientists*, 8th Edition, Pearson Education.

17CCT 121REMEDIAL ENGINEERING

Sub Code	**: 17CCT121**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: This Course will enable students to

1. Know about causes of deteriorations of concrete and various NDT methods for investigations.
2. Have vast information about the design and construction errors, corrosion mechanism and corrosion protection.
3. Know about different types of concrete for repairing of damaged building.
4. Know about crack pattern, different techniques of crack repairing of damaged structures.
5. Demonstrate various methods of retrofitting of RC members and demolition technique.

UNIT-I

Introduction, Cause of deterioration of concrete structures, Diagnostic methods &Analysis, preliminary investigations, experimental investigations using NDT **08 Hours**

UNIT- II

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection. **12 Hours**

UNIT-III

Materials for Repair:Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforcedconcrete. **12 Hours**

UNIT-IV

Techniques for Repair: Rust eliminators and polymers coating for rebar during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. **10 Hours**

UNIT -V

Examples of Repair: To Structures Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures - case studies **10 Hours**

Course Outcomes: At the end of the course the student will be able to

1. Identify the defects in concrete by using various NDT methods and propose proper remedial measures.
2. Identify the design and construction errors and suggest appropriate solution to repair.
3. Idea of using appropriate materials for repair and restoration of damaged structure.

4. Identification of crack pattern and suggest various techniques of crack repairing for damaged structures.
5. Suggest suitable methods of retrofitting of damaged RC members and safe demolition technique for severely damaged buildings.

REFERENCE BOOKS

1. Sidney., M. Johnson “Deterioration Maintenance and Repair of Structures”
2. R.N. Raikar “Rehabilitation of Structures”- Edited by, Vol. 1, 2 and 3, Proc., Int. Symposium, Maharashtra Indian Chapter of ACI, Bombay
3. Denison Campbell, Allen & Harold Roper,“ Concrete Structures– Materials, Maintenance and Repair”- Longman Scientific and Technical
4. CPWD Hand book on Repair and Rehabilitation of RCC Buildings, DG(W), Central Public Works Department, New Delhi, 2002.

17CCT 122 PAVEMENT DESIGN AND CONSTRUCTION

Sub Code	**: 17CCT122**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: This Course will enable students to

1. Know the factors to be considered in designing a good highway and airfield pavement, and their requirements.
2. Understand the analysis of various types of stresses in flexible pavements and to design the thickness of various layers as per IRC:37-2001.Also, to know the guidelines in design of the flexible pavement as per some famous standard International methods.
3. Attain the knowledge on analyzing various types of stresses in rigid pavements and to design the pavement slab thickness as per IRC:58-2002.
4. Get the knowledge in designing the various elements of rigid pavements like spacing of expansion and contraction joints, dowel bars and tie bars as per IRC:58-2002.
5. Understand the working principle of various equipments used for highway construction and also to describe the different steps involved in preparing sub-grade, embankment, and tests used to check its quality.
6. Study the specifications, construction methods and quality control checks used for different layers of flexible pavements, and various components of rigid pavements.

UNIT-I

INTRODUCTION: Highway and airport pavements, objects of pavement design, Desirable characteristics and requirements of a well-designed Pavement. Types and component parts of pavements, their differences - Factors affecting design and performance of flexible and rigid pavements. Significance and determination of CBR value and modulus of sub-grade reaction value in pavement design. **08 Hours**

UNIT- II

ANALYSIS OF FLEXIBLE PAVEMENTS: Stresses and deflections in homogeneous single layer and two-layer masses. ESWL concept for dual and tandem wheel load assembly, Effect of wheel-load repetitions-EWLF and its applications.

FLEXIBLE PAVEMENT DESIGN METHODS: General approach, Vehicle damage factor- significance and its determination from axle-load distribution data. CBR method of pavement design-Principle – Design steps and Problems on ***IRC: 37-2001***,
Pavement design guidelines from AASHTO method, Asphalt Institute method, and Shell Method. **12 Hours**

UNIT-III

ANALYSIS OF RIGID PAVEMENTS: Basic principle and concepts. Effect of wheel load and its repetitions, Westergaard's analysis of stresses, Modified Westergaard's (IRC) equations- Concept of Wheel load stresses-Warping stresses-Frictional stresses-Combined stresses.

RIGID PAVEMENT DESIGN: Introduction, Types of joints and their functions, joint spacing; Design of joint details for longitudinal joints, contraction joints, expansion joints and load transfer joints. IRC method of design by stress ratio method (***IRC: 58-2002)***.

12 Hours

UNIT-IV

EQUIPMENT IN HIGHWAY CONSTRUCTION: Various types of equipment for excavation, grading and compaction - their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement construction.

SUBGRADE: Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests. **10 Hours**

UNIT -V

FLEXIBLE PAVEMENTS: Introduction, Interface treatment-Prime coat and tack coat; Specifications of materials, construction method and field control checks for the following flexible pavement layers – GSB, WBM, WMM, BM, DBM, SDBC and BC as per IRC (MORT&H) guidelines.

CEMENT CONCRETE PAVEMENTS:

Introduction, Specifications of materials and method of cement concrete pavement construction as per IRC (MORT&H) guidelines; Quality control tests; Construction of various types of joints in CC pavement. **10 Hours**

Course Outcomes: At the end of the course the student will be able to

1. Understand the requirements and the factors to be considered in designing a good highway and airfield pavements.
2. Analyze the stresses in various layers of flexible pavements and to design the pavement as per IRC:37-2001.
3. Analyze the various types of stresses in rigid pavements and to design the pavement thickness and components as per IRC:58-2002.
4. Select the suitable equipment for the construction of pavement based on necessity and their working principle, and also to narrate the different steps involved in preparing sub-grade embankment, and tests used to check its quality.
5. Apply the specifications, construction methods and quality control checks used for different layers of flexible and jointed cement concrete pavement.

TEXT BOOKS:

1. Khanna. S. K, Justo. C.E.G, Veeraragavan. A, “Highway Engineering”, Revised 10th edition, Nem Chand and Bros, (2014).
2. Kadiyali L. R., Lal. N.B, “Principles and Practices in Highway Engineering”, Khanna Publishers, New Delhi. 7th Revised Edition. (2013).

REFERENCE BOOKS:

1. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 3rd Revised Edition. (2015).
2. Peurifoy R. L, Schexnayder, C. J., AviadShapira., “Construction Planning, Equipment and Methods”, TMH, New-Delhi, 7th Revised Edition. (2010).
3. Yoder E.J. and Witczak M.W., “Principle of pavement design”, 2nd edition, John Wiley and Sons, 1975.
4. Handbook for Roads and bridges – MORT&H, New Delhi.(2001)
5. Yang H. Huang, “Pavement Analysis and Design”, Pearson Prentice Hall, 2nd Revised Edition 2004.

17CCT 123SOIL EXPLORATION & GROUND IMPROVEMENT TECHNIQUES

Sub Code	**: 17CCT123**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: This Course will enable students to

1. Understand the underlying concepts of type of soil and its suitability for construction work.
2. Understand various field tests and their suitability to field conditions.
3. Develop ability to analyze weak and compressible soil and provide proper treatment to improve its characteristics.
4. Understand the underlying principle in dynamic consolidation. Select proper method for anchors, grouting and vacuum consolidation.

UNIT-I

Principles of exploration:Geophysical and sounding methods, Modern methods of boring and sampling; Preservation and transportation of samples; Sampling records, Soil profiles. **08 Hours**

UNIT- II

Various types of field tests; Instrumentation; Investigation below sea/river bed;offshore investigation; investigation; interpretation of exploration data and report preparation; economics of field testing & lab testing. **12 Hours**

UNIT-III

Engineering properties of soft & weak and compressible deposits; principles of treatment; Methods of soil improvement-lime stabilization and injection; thermal, electrical and chemical methods. **12 Hours**

UNIT-IV

Dynamic consolidation; vibroflotation; compaction by blasting; pre-consolidation with vertical drains; Granular piles; soil nailing. **10 Hours**

UNIT -V

Anchors; Grouting; Electro-osmosis; Soil freezing; Vacuum consolidation; Case histories Soilconfinement **10 Hours**

Course Outcomes: At the end of the course the student will be able to

1. Plan the method of soil exploration for a given site and structure.
2. Analyzing soil strata below river/sea bed by planning proper field tests.
3. Propose proper treatment method for soft, weak and compressible soil strata.
4. Planning and design of suitable method of dynamic consolidation for a site.
5. Planning and design of suitable techniques of grouting, anchors and vacuum consolidation.

TEXT BOOKS

1. Manfredd RH, “Engineering Principles of Ground Modification”, Mc Graw Hill

REFERENCE BOOKS

1. Hvorslev MJ, “Subsurface Exploration and Sampling of Soils for Civil Engg. Purposes” Elsevier Pub. Co
2. Head KH, “Manual of Soil Laboratory Testing”.
3. Purushotham Raj, “Ground Improvement Techniques”.
4. “Current Literature”, LaxmiPub.

17CCT 125ADVANCED REINFORCED CONCRETE DESIGN

Sub Code	**: 17CCT125**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: This Course will enable students to

1. Understand the underlying concepts for the design of elements subjected to shear and Torsion
2. Use the concept of redistribution of moments in design
3. Develop equations for the design of compression members of arbitrary sections subjected to general loading
4. Compute effective length of columns based on structural framing, instead of simplified values.
5. Select proper method for Design of Flat slab systems

UNIT-I

Behaviour of RC Beams in Shear and Torsion: Modes of Cracking, Shear Transfer Mechanisms, Shear Failure Modes, Critical Sections for Shear Design, Influence of Axial Force on Design Shear Strength, Shear Resistance of Web Reinforcement, Compression Field Theory, Strut-and-Tie Model. Equilibrium Torsion and Compatibility Torsion, Design Strength in Torsion, Design Torsional Strength with Torsional Reinforcement-Space Truss Analogy and Skew Bending Theory **08 Hours**

UNIT- II

Redistribution of Moments in RC Beams: Conditions for Moment Redistribution – Final shape of redistributed bending moment diagram – Moment redistribution for a two-span continuous beam – Advantages and disadvantages of Moment redistribution – Modification of clear distance between bars in beams (for limiting crack width) with redistribution – Moment – curvature Relations of Reinforced Concrete sections. Curtailment of tension Reinforcement - code procedure – Numerical Example.

12 Hours

UNIT-III

Design of Reinforced Concrete Deep Beams: Introduction – Minimum thickness -Steps of Designing Deep beams – design by IS 456 - Detailing of Deep beams. **12 Hours**

UNIT-IV

Behaviour and Analysis of Compression Members: Effective Length Ratios of Columns in Frames, Code Charts – Numerical Examples, Short Columns - Modes of Failure in Eccentric Compression, Axial Load - Moment Interaction equation, Interaction Surface for a Bi-axially Loaded Column, Concept of Equilibrium approach and application to Non rectangular columns. Slender Column: Braced and Unbraced, Design Methods as per IS 456 – Strength Reduction and Additional Moment Method **10 Hours**

UNIT -V

Flat Slab Design: Behaviour of Slab supported on Stiff, Flexible and no beams, Equivalent Frame Concept, Proportioning of Slab Thickness, Drop Panel and Column Head, Transfer of Shear from Slab to column, Direct Design Method, Equivalent Frame Method – Design Examples. FE analysis and design of Slab Panels based on Wood-

Armer equations.

10 Hours

Course Outcomes: At the end of the course the student will be able to

1. Design R C beams subjected to critical shear and torsional moment.
2. Analysing continuous R C beams using moment redistribution concepts.
3. Design of reinforced concrete R C deep beams.
4. Design of compression members.
5. Design of flat slabs.

TEXT BOOKS

1. S. Pillai, DevdasMenon- REINFORCED CONCRETE DESIGN 3/ED 3rd Edition
2. Varghese. P.C., Advanced Reinforced Concrete design, prentice, Hall of India, Neevpeth.

REFERENCE BOOKS

1. Srinath. L.S., Advanced Mechanics of Solids, Tata McGraw-Hill Publishing Co ltd., New Delhi
2. Krishna Raju – "Advanced R.C. Design", CBSRD,1986,
3. Park R. and Paulay, T., Reinforced Concrete Structures, John Wiley and Sons.
4. N. Subramanian , Design of Reinforced Concrete Structures, Oxford IBH

17CCT 126Advanced Concrete Technology

Sub Code	**: 17CCT126**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

COURSE LEARNING OBJECTIVES:

1. To understand and know the microstructure of concrete, three phases ofConcrete and their contributions, rheology and mechanical behaviour of concrete.
2. To know principles and concepts of dimensional stability and proportioning of concrete Mixes.
3. To know and discuss High Strength/Performance Concrete in terms of properties, uses and proportioning.
4. To describe the different types of polymer composites and properties, uses and Proportioning.
5. To understand importance of corrosion of steel, adhesives and sealants.

UNIT 1

Microstructure of concrete, Fresh concrete and its rheology, Mechanical, deformational behaviour of hardened concrete. **10 Hours**

UNIT 2

Creep and Shrinkage of Concrete. Proportioning of Mixes-Normal concrete. Problems on Concrete mix proportioning. **10 Hours**

UNIT 3

High Strength/Performance Concrete, Roller Compacted Concrete, Self Compacting Concrete and Reactive Powder Concrete – properties and applications **12 Hours**.

UNIT 4

Polymer-concrete composites, Slurry infiltrated fibrous concrete (SIFCON), Slurry infiltrated mat concrete (SIMCON) – properties and applications **10 Hours**

UNIT 5

Corrosion of Reinforcing Steel- Electro-chemical process, measures of protection. Adhesives and sealants- properties, types and their uses. **10 Hours**

COURSE OUTCOME:

On completion of this course, students will be able to:

1) Know and apply concept microstructure of concrete and their contributions, rheology and mechanical behavior of concrete in practice.
2) Practice proportioning of concrete mixes in sites.
3) Know and discuss high strength/performance concrete in terms of properties, uses and proportioning of mixes.
4) Use different types of polymer composites and perform proportioning of mixes.

5) Understand importance and remedies of corrosion of steel, applications of adhesives and sealants.

TEXTBOOKS

1. Neville A.M. "**Properties of Concrete**", 4th Ed., Longman.
2. Mehta .P.K., and Paulo J.M. Monteiro, "**Concrete: Microstructure, Properties and Materials**", (Indian Ed., Indian Concrete Institute), McGraw Hill.

REFERENCE BOOKS

1. Shetty M.S. **"Theory and Practice of Concrete Technology"**, S.Chand & Co.
2. Gambhir M.L "**Concrete Technology**".
3. IS 13311-1: Method of Non-destructive testing of concrete, Part 1: Ultrasonic pulse velocity
4. IS 13311-2: Method of Non-destructive testing of concrete - methods of test, Part 2: Rebound hammer

SECOND SEMESTER M.TECH (CONSTRUCTION TECHNOLOGY)

17CCT201 MECHANIZATION IN CONSTRUCTION

Sub Code	**: 17CCT201**	**Credits**	**: 05**
Hrs/ Week (L:T:P:S)	**: 4:0:2:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52+26**	**SEE**	**: 50**
		Exam Hrs	**: 03**

COURSE LEARNING OBJECTIVES:

1. To understand the importance of mechanization in construction projects, study the different classification of the equipments in construction projects, calculating costs related to the equipments in construction.
2. To understand how to reduce to costs related to the equipments in the construction projects, estimating the productivity of the equipments.
3. To understand the different types of aggregate production, types of bar bending techniques, workability and its assessment of concrete in fresh state and during its production, and costs related to the concrete productions.
4. To know the different types of constriction of bridges, understand different types of tunnelling methods.
5. To know and understand the types of form work, design of form work for the construction projects, difference between prefab/prefab construction, and safety related to the construction.

UNIT I

Introduction to mechanization, need for mechanization, standard and special equipments. Ownership cost and operating cost. Depreciation and methods of assessing depreciation costs. **12Hours**

UNIT II

Mechanization through construction equipments: earth excavation, moving and hauling. Productivity estimation and problems on same. **10Hours**

UNIT III

Aggregate manufacturing, Rebar fabrication, Concrete production and placement- types of equipment, process, production outputs and costs.

10Hours

UNIT IV

Mechanization through construction methods/technologies: segmental construction of bridges, box pushing technology for tunneling, trench-less technology. **10Hours**

UNIT V

Formwork and scaffolding- types, materials and design principles.

Precast/Prefab construction. Safety and Environmental issues in different equipment usages. **10Hours**

PRACTICAL COMPONENT

1. Quantity takeoff by using MS EXCEL
2. Productivity estimation of equipments using MS EXCEL
3. Problems on production outputs and costs

COURSE OUTCOME: On completion of this course, students will be able to

1. Apply the importance of mechanization in construction projects, classify the equipment's in construction projects and calculate equipment costs.
2. Understand and practice how to reduce to costs related to the equipments and estimatethe productivity of the equipments.
3. Understand and implement the different types of aggregate production, bar bendingtechniques, and improvise costs related to the concrete productions.
4. Know the different types in constriction of bridges, understand different types of tunnelingmethods.
5. know and understand the types of form work, design of form work for the construction projects, difference between prefab/prefab construction, and safety aspects.

REFERENCE BOOKS:

1. Peurifoy R L, "**Construction Planning, Equipment and Methods**",Mc Graw Hill
2. James F. Russell, "**Construction Equipment**", Prentice Hall.
3. Chithkara K.K "Construction Project Management.

17CCT202 CONSTRUCTION QUALITY & SAFETY

Sub Code	**: 17CCT202**	**Credits**	**: 05**
Hrs/ Week (L:T:P:S)	**: 4:0:2:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52+26**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: During the course students will learn

1. To provide an insight into the basic concepts of Quality Management
2. To help students understand the tools and techniques to achieve quality.
3. An insight into the importance of TQM and its advantage for the organization
4. The need for safety in construction industry and hazards due to equipments.
5. To study the reliability of equipments.

UNIT 1

Foundations of Total Quality Management: Understanding quality, TQM philosophy: Concept of Deming, Juran, Crosby, Imai, Ishikawa, Taguchi, Shingo philosophies. Models and frame works. **07 Hours**

UNIT 2

Construction Quality, Inspection and Testing, Quality Control, Quality Assurance. Benchmarking, concepts of quality policy, standards, manual, third party certification. Total Quality Management, Critical Factors of TQM; TQM in Projects. **09 Hours**

UNIT 3

Planning and implementation of TQM, Sustained improvement, TQM models in practice. **ISO 9000** quality systems, Six sigma practice. Customer-Supplier Chain, Continuous improvement. **ISO 14001** quality systems.

12 Hours

UNIT 4

Safety laws and standards. Safety Hazards and cost effectiveness. Safety Management in Construction Industry- Safety rules in construction.

Planning for safety in construction projects: Legal requirements, Reporting occurrence of accidents and hazards, Action to be taken by site engineer in case of accidents, First aid/ Ambulance room/ dispensary **12 Hours**

UNIT 5

Safety remedies for common hazards: Dust, Vibration, Lead poisoning, Noise, Movement, Material, Lighting. Safety in Use of Construction equipments**.** Equipment Reliability considerations. Safety Budgeting. **12 Hours**

PRACTICAL COMPONENT

- Case studies on QualityCompliance Requirements
- Preparation of Quality Checklist
- Preparation of Quality Manuals.
- Preparation of Safety Manuals.

Course Outcomes: At the end of the course students should know to

1. Describe the importance of Quality Management.
2. Discuss the various tools and techniques used for quality.
3. Explain the importance of Total Quality Management.

4. Describe the importance of safety and precautions at construction site.
5. Describe the reliability of equipments in construction industry.

TEXT BOOKS

1. N. Logothetis, "**Managing for Total Quality**", Prentice Hall.
2. David Gold Smith, "**Safety Management in Construction and Industry**", Mc Graw Hill.
3. K.N.Vaid, "**Construction Safety Management**"- NICMAR, Bombay.

REFERENCE BOOKS

1. K. ShridharBhat "Total Quality Management",Himalaya Publishing House, revised edition 2010.
2. Oakland John S (2006) "TQM", Text with cases, Butterworth- Heinemann, Oxford.
3. Vaid K.N. (1988) "Construction Safety Management" National Institute of Construction management, Mumbai.
4. Krishna, N.V., (1983) "An Introduction to Safety Engineering and Management" OPS Publishers Limited 14, Hare street, Calcutta, first Edition.
5. David Goldsmith (1987) "Safety Management in Construction and Industry" McGraw Hill book company.

17CCT 203 CONSTRUCTION AND CONTRACT MANAGEMENT

Sub Code	**: 17CCT203**	**Credits**	**: 05**
Hrs/ Week (L:T:P:S)	**: 4:0:2:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52+26**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: This Course will enable students to

1. To understand ethics, preliminary cost estimation and concept of building cost index in construction project.
2. To know concept of detailed estimation, different cost involved in construction project.
3. To understand bidding strategies.to develop bidding model and know law of contract.
4. To understand different types of contract and FIDIC contract forms.
5. To understand concept involved in contract administration and management and also to resolve disputes in contract.

UNIT I

Ethics: definition of ethics, ethical principles, Ethics in Construction, unethical practices in construction, Professional and Engineering Ethics.

Concept of Cost and Cost engineering, Lifecycle cost, Different stages for Evolution of Project and its associated Costing method, Types of Estimates: Design Estimate, Bid Estimate and Control Estimate.

Understanding the meaning of Estimation, budgeting and Budget control

Preliminary Cost Estimation or Rough estimation: various methods like Area method, Volume Method, Cost indices method, power sizing method, production function: Typical problems.

Concept of Building Cost Index number and how it is used in Rough or Preliminary Estimation **10 Hours**

UNIT II

Detailed Estimation: Quantity Takeoff, BOQ

Detailed Estimation:Costing: Broad Costing Philosophy: Direct cost, Indirect Cost and Other Cost parameters.

Direct Cost: Components of Direct Cost:Labour, Materials, Plant and Machinery, other costs including all subcontracting items.

Indirect Cost:Preliminaries, enabling works, Manpower Cost, Office establishment and running cost,Taxes,Risks,Escalation, other costs including Profit. Top Sheet

Direct Cost:Labour: Estimation of LabourCost,Labour Production rate or Productivity,Labour Emolument estimation and Direct Unit Cost of Labour for an activity or BOQ.

Direct Cost:Materials: Estimation of Material Unit Basic Cost for a BOQ Element.

Plant and Machinery: Estimation of Plant and Machinery Unit Basic Cost for a BOQ Element – P&M Productivity based on Time Cycle & Production rate analysis, Ownership charges / Rental Charges.

Understanding how indirect costs are computed: Building Project, Road Project or any Infrastructure Projects

Developing Top Sheet & getting Unit Total cost by Balanced Bid **12 hours**

UNIT III

Bidding Models: Concept of unbalanced bid using Front end loading, back end loading and quantity error exploitation methods. Merits and demerits of each method with applicability. Problems based on GATES model.
Bidding strategies: Detailed concept about bidding strategies followed in a Contracting company,Principles of Competitive Bidding & Factors impacting bidding competition
Types of Tender: Open competitive Bidding, Serial Tendering, selective tendering and negotiated tendering
Tender or Bidding: general understanding about the meaning and process of tendering or bidding, different stages of Bidding, Prequalification and its Process, prequalification requirement, Bid Capacity – International competitive Bidding
Bidding or Tender document or Form: understanding various elements of entire Tender document for an Item Rate Tender under International Competitive bidding format. Other types of Tender forms followed in India: Government and Private.
Complete process adopted in a contracting company for preparation and submission of tender. Item rate tender, EPC Tender, BOT Tender.
Law of Contract: Indian Contract Act 1872:Contract,offer,acceptance,promise,agreement, essentials of valid contract + Valid, void, Voidable and Unenforceable Contracts, Contingent Contracts, Performance of Contract, delay or non-performance of contract, breach of contract, Damages-Liquidated and Un-liquidated, Termination of Agreements

12 hours

UNIT IV

Types of Contract: All in contract or entire contract, Lump sum contract or Fixed Price Contract, Item rate or unit price contract, Percentage rate contract, Cost Plus Contract,cost plus percentage rate contract, cost plus fixed fee contract, cost plus fluctuating fee contract, Target contract, The Schedule Contracts, TermsContracts, Specialvariants EPC /BOT –Toll / Annuity/DBOT / DBFOT
Problems on: Percentage rate contract, Cost plus Contract, cost plus percentage rate contract, cost plus fixed fee contract, cost plus fluctuating fee contract, Target contract.
Contract Form or Conditions of Contract: detailed discussion on various elements of Contract which needs to be included in contract form (based on FIDIC Red Book 1999 – Item rate tender only)
Understanding about FIDIC &its Contract forms used for different types, nature of work / contract.
Brief Discussion about FIDIC Sliver Book: EPC Contracting: Various Contract Clauses Provision in Silver Book **10 hours**

UNIT V

Contract Management & Contract administration: Detailed discussion about Process of Contract management and administration
Extra work and Change order
Claims and Claim management
Disputes and Dispute resolution mechanism including Arbitration and reconciliationbased onArbitration and Conciliation Act 1996 **08 hours**

PRACTICAL COMPONENT

1. Carryout the Rate analysis and costing of work.
2. Preparation and delivery of the bid or proposal of an Engineering Construction project.
3. Case studies on legal aspects, Arbitration

Course Outcomes: At the end of the course the student will be able to

1. To inculcate ethics, and apply concept of preliminary cost estimation and building cost index in construction project.
2. To conduct detailed estimation, and identify different cost involved in construction project.
3. To apply law of contract and bidding strategies.to develop bidding model.
4. To identify and apply different types of contract and FIDIC contract forms.
5. To use concept involved in contract administration and management and also use techniques to resolve disputes in contract.

TEXTBOOKS

1. Civil engineering contracts and estimates 3rd edition B. SPatil
2. Rains's construction & contract management practices - 2ed Dr.V.K.Raina

REFERENCE BOOKS

1 Contracts and their Management 3rd edition , BS Ramaswamy
2 Estimating Construction Costs 5th edition , R.L.Peurifoy , Garold D oberlender
3 Construction and contract management practies 2nd edition , Dr V.K.Raina
4 Construction project management :2nd edition , K.K. Chitkara
5 Roshan Namavathi, “Professional Practice”
6 Gajaria GT, “Law Relating to Building & Civil Engg. Contracts in India”
7 Collier, Kieth, “Managing Construction Contracts”
8 Construction Equipment and its Management S.C Sharma
9 Construction Planning and management P.S GAHLOT and B.M. DHIR
10 Handbook of Construction Management 2nd edition by PK Joy
11 FIDIC Contract Red Book 2004& Silver Book , Indian Contract Act 1872, Indian arbitration act 1996
12 Any other books , reference manual , articles related to above topic

17CCT204 RESEARCH EXPERIENCE THROUGH PRACTICE-II

Sub Code	**: 17CCT204**	**Credits**	**: 02**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 100**
Total Contact Hrs	**: 39**	**SEE**	**: -**
		Exam Hrs	**: -**

Course Learning Objectives: During the course students will be enable to learn

1. Mathematical modelling/Design calculations/computer simulations/Preliminary experimentation/testing of the research problems identified during Research Experience through Practice-I

Course Outcomes: At the end of the course should will be able

1. To write a full research paper based on the Mathematical modelling/ Design calculations/computer simulations/Preliminary experimentation/testing carried out during second semester.

17CCT211DESIGN OF EARHQUAKE RESISTANT STRUCTURES

Sub Code	**: 17CCT211**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: This Course will enable students to

1. To give preliminary exposure to design of earthquake engineering
2. To improve analytical skill and problem solving abilities
3. To study the design methods of earthquake resistant structures
4. To study Structural configuration for earthquake resistant design frames, shear walls and dual systems
5. To study the concepts for Earthquake resistant masonry

UNIT I

Introduction to engineering seismology, Seismic Waves, Characteristics of Earthquake and its quantification, Magnitude and Intensity, Seismic Instruments, Strong Ground Motions, Characteristics of Earthquakes, Attenuation of the Ground motion, History of Major Earthquakes in India **10 Hours**

UNIT II

Seismic response of buildings,Study of response of buildings and structures due to past earthquakes, Complexity of Earthquake Ground Motion, introduction to structural dynamics-Damping in the dynamic system, concept of dynamic equilibrium, vibration of multi degree of freedom system, orthogonality of modes

Response Spectrum- elastic and elasto-plastic spectra, tripartite plot, use of response spectrum in earthquake resistant design **12 Hours**

UNIT III

Earthquake analysis of multi-storied RC structure, discussion of IS code provisions of Earthquake resistant design of buildings. Analysis and design of RCC multistoried buildings by limit state method using static and dynamic method **10 Hours**

UNIT IV

Structural configuration for earthquake resistant design frames, shear walls and dual systems, Seismic Resistant Structural Systems

Ductility and energy absorption in buildings, details of providing ductility in structures, lessons from structural damage during past earthquakes. 1**0Hours**

UNIT V

Concepts for Earthquake resistant masonry: lateral load analysis of masonry building, basis of flexibility of diaphragm, strength and material properties of masonry, Causes to failure of masonry structures and remedial measures taken to retrofit the structures, causes of damage in masonry building, poor performance of masonry building, Behavior of unreinforced and reinforced masonry wall, preparation of earthquake resistance of earthen building, in plane stiffness of wall with openings, Seismic behavior of masonry buildings during past earthquake, earthquake resistant design of masonry building- IS codal provisions.

10Hours

Course Outcomes: At the end of the course the student will be able to

1. Understand the basic principle of earthquake engineering
2. Ability to deal with practical problems in earthquake engineering
3. Design the earthquake resistant structures.
4. Describe the Structural configuration for earthquake resistant design frames, shear walls and dual systems
5. Describe the concepts for Earthquake resistant masonry

TEXT BOOKS

1. Minoru Wakabayashi, "**Design of Earthquake Resistant Buildings**", McGraw Hill Pub.
2. Minoru Wakabayashi, "**Design of Earthquake Resistant Buildings**", McGraw Hill Pub.
3. Anil K Chopra, "**Dynamics of Structures – Theory and Application to Earthquake Engineering**", 2nd ed., Pearson Education pub.

REFERENCE BOOKS

1. Anderson, R .A., "**Fundamentals of Vibrations**", Mc Millan
2. IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993
3. Timoshenkeo, S., "**Vibration and Structural Dynamics**", Van Nostrand Co.
4. Clough and Penzien, "**Dynamics of Structures"**. McGraw Hill
5. Mukyopadhyaya, "**Vibration and Structural Dynamics**", Oxford & IBH
6. James Ambrose and DimitryVergun, **"Design for Earthquakes".**
7. David Key, "**Earthquake Design Practice for Buildings**", Thomas Telford.

17CCT212HUMAN RESOURCE MANAGEMENT

Sub Code	**: 17CCT212**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: During the course students will learn

1. To introduce the basic concepts, functions and processes of human resource management
2. To create an awareness of the role, functions and functioning of human resource department of the organizations
3. To familiarize the students with the basic concepts, tools and techniques of qualitative measurement of human resources requirements.
4. To enable the students to acquire the knowledge necessary for preparing the manpower plan of a business enterprise and subsequent plans of actions.
5. To train them in application of human resource planning techniques.

UNIT I

Human Resource Management: Concept and Challenges, Scope, Objectives' HR Planning Job Analysis and Design. Recruitment, Selection, Placement, Training Performance appraisal, Employee remuneration and Benefits. Industrial relations: Trade unions, Disputes and their resolution. **10 Hours**

UNIT II

HR Profession, and HR Department Line Management Responsibility in HRM HR Philosophy, Policies, Procedures and Practices Designing HR systems Functional Areas of HRM Human Resource Development: Values and Tools HR as a Factor of Competitive Advantage Accountability in HR

12 Hours

UNIT III

Productivity Management Quantitative determination of Human Resource requirements: Work Study. The Human Factor in the Application of Work Study. Working Conditions and the Working Environment. Methods Study; the Approach to Methods Study.

10 Hours

UNIT IV

Work Measurement; the Purpose and the Basic Procedure. The Techniques of Work Measurement; Work Sampling, Structured Estimating, Time Study and Pre-determined Time Standards. Strategic Planning and Human Resource Planning. Human Resource Planning in Changing Context 1**0Hours**

UNIT V

Qualitative determination of human resource requirements: Job Analysis. Human Resource Demand Forecasting. Human Resource Supply Estimates. Action Plans – Separation. Action Plans – Retention, Training, Redeployment & Staffing **10Hours**

Course Outcomes: At the end of the course students should know to

1. Describe the basic concepts, functions and process in human resource management.
2. Explain the functioning of human resource.

3. Describe the qualitative measurement of human resources.
4. Prepare the manpower plan of a business enterprise and plan of action.
5. To execute the application of human resource planning technique.

TEXTBOOKS

1. Mirza S. Sayadin, (1988) "Human Resource Management", Tata McGraw Hill Book Company, New Delhi.
2. Suri S.K. (1988) "Human Resource Development and Productivity: New Perspective", National Productivity Council, Delhi.

REFERENCE BOOKS

1. Rao Subba P, (1999) Essential of HRM and Industrial Relations, "Text cases and Games", Himalaya Publishing house, II Edition.
2. Gupta C.B., (2003) "Human Resource Management", Sultan Chand and Sons, New Delhi.

17CCT213RISK MANAGEMENT

Sub Code	**: 17CCT213**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: During the course students will learn

1. The importance of risk, quantifiable and unquantifiable risks.
2. Risk analysis methodology, applications and extensions.
3. The method of risk register and importance of risk communication.
4. The method of risk assessment and risk mitigation.
5. Management of risk in AEC industry

UNIT I

General – Importance of Risk, types of risks, quantifiable and un-quantified risks. Micro, market, project level risk analysis approach. Risk analysis and Management for projects (RAMP) – Identifying risk events. Probability distribution. Stages in Investment, life-cycle; determination of NPV and its standard deviation for perfectly co-related, moderately co-related and un-correlated cash flows.

10 Hours

UNIT II

Probability and decision-analysis basics. Risk analysis methodologyconcepts and application. Risk analysis methodologyapplication and extensions. Other modeling approaches (including fault trees and fishbone diagrams) **12 Hours**

UNIT III

Risk communication, Forensic risk management and expert witness role, Risk registers, risk charters and risk management plans, Engineering contracts and project execution strategies **10 Hours**

UNIT IV

Use of risk prompts, use of Risk Assessment tables, details of RAMP process, utility of Grading of construction entities for reliable risk assessment. Risk Mitigation – by elimination, reducing, transferring, avoiding, absorbing or pooling. Residual risk, mitigation of un-quantified risk. 1**0Hours**

UNIT V

Risk planning and management case studies, Management of risk in the AEC industry – extensions of the risk concepts, Management of risk in the AEC industry **10Hours**

Course Outcomes: At the end of the course students should know to

1. Quantify the risk of the given projects.
2. Analyse the risk and apply in the projects.
3. Describe the risk register methods and communication.
4. Derive a solution through risk assessment and mitigation.
5. Manage the risk in AEC industry.

TEXTBOOKS

1. Project Risk Analysis and Management Guide by John Bartlett APM Publishing Limited, 2004 2nd Edition.
2. Construction Project Management, K. K. Chitkara, Tata Mcgraw Hill Publ.

REFERENCE BOOKS

1. Industrial Engineering and Management of Manufacturing Systems. - Dr.Surendra Kumar SatyaPrakashan
2. RAMP Handbook by Institution of Civil Engineers and The Faculty and Institute of Actuaries Thomas Telford Publishing, London.
3. Construction Engineering and Management – Seetharaman.
4. Projects Planning Analysis Selection Implementation and Review – Prasanna Chandra.
5. Construction Management Practice, Dr.V.K.Raina, Shroff Publ.
6. Projects, Prasanna Chandra, Tata Mcgraw Hill Publ.

17CCT 221BUILDING SERVICES AND MAINTENANCE

Sub Code	**: 17CCT221**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

COURSE LEARNING OBJECTIVES: During the course students will learn

1. To understand the terms related to Fire and Life Safety.
2. To know the classification of buildings based on occupancy, various fire alarm systems.
3. To understand the installations of various services to the buildings such as lifts, Escalators, Fire extinguishers.
4. To acquire knowledge about water supply services to buildings such as cold and hot water systems, Waste water systems, Solid waste disposal, Energy supply – Gas and Renewable sources.
5. To understand the importance of building maintenance, Deterioration aspects, Investigation of defects in buildings, Maintenance problems and Route causes.

UNIT I

Fire resistance, Classification of buildings based on occupancy, Means of escape, Fire alarm systems, Provisions of NBC. **10 Hours**

UNIT II

Classification of building according to fire load, Engineering services in a building as a system, Lifts, Escalators, Fire Extinguishers - Portable Fire extinguishers, Automatic carbon dioxide fire extinguishing system, Halon or B T M system. **12 Hours**

UNIT III

Water supply services to buildings - Cold and Hot water systems, Waste water systems, Solid waste disposal, Energy supply - Gas and Renewable sources. **10 Hours**

UNIT IV

Building Maintenance: Importance of building maintenance, Principles of maintenance management and quality assurance, Agencies causing deterioration, Investigation of defects in buildings, Maintenance problems and Route causes. **10 Hours**

UNIT V

Materials for repair, Maintenance and protection. Preventive maintenance and Special precautions,Common techniques of building repair. **10 Hours**

COURSE OUTCOME: On completion of this course, students will be able to

1. To describe the terms related to Fire and Life Safety.
2. To explain the classification of buildings based on occupancy, various fire alarm systems.
3. To describe how to provide essential installations of various services to the buildings including legal aspects.

4. To execute installations of services to buildings such as cold and hot water systems, Waste water systems, Solid waste disposal, Energy supply – Gas and Renewable sources.
5. To undertake repair and maintenance works of buildings in order to protect themfrom deterioration.

TEXTBOOKS

1. P.S Gahlot, Sanjay Sharma **"Building repair and Maintenance Management"**
2. Jain V K, "**Services in Building Complex and HighRiseBuildings**", Khanna Pub.

REFERENCE BOOKS:

1. NBC-2016, Relevant Parts, **BIS New Delhi**
2. Pchelinstev V. A., "**Fire Resistance of Buildings**."

17CCT 222 VALUATION TECHNIQUES IN ENGINEERING

Sub Code	**: 17CCT222**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

COURSE LEARNING OBJECTIVES:

1. To understand and know the necessity of valuation, types of value anddetermine depreciation by various methods.
2. To know and decide suitability of different methods of valuing open urbanlands.
3. To know the different types of outgoings, understand standard rent determination.
4. To describe the different methods of valuation of land with buildings and toKnow valuation of hotel and cinema.
5. To understand concepts of market values, easements and valuation of land acquisition.

UNIT I

Purpose of valuation, different forms of values, obsolescence, amortization, depreciation and its methods of determination using straight line, constant percentage, declining balance, sinking fund and sum of years method. Problems on valuation using Year's Purchase, Capitalized value. **09 Hours**

UNIT II

Methods of valuation of open urban land, factors affecting intrinsic values of land, Comparative method, Abstractive method, belting method. Problems on above methods.
. **10 Hours**

UNIT III

Outgoings- Municipal & Govt Taxes, insurance, Loss of rent, collection charges, annual repairs & maintenance. Problems on outgoings. Rent: definition, types of rent, problems on standard rent of buildings. Cost of structure-BIS rules for measuring plinth area and cubical contents**.** **10 Hours**

UNIT IV

Valuation of land with buildings-Rental method, Valuation by reference to profit, Direct comparisons of capital value, Residual or developmental method, valuation based on cost or contractor's method. Leasehold properties and freehold Properties. Rights and Liabilities of Lessor & Lessee. Valuation of licensed premises. Problems on valuation of cinema and hotel.

11 Hours

UNIT V

Easements- self-imposed, legally created, Dominant and servient heritage- effect of easements on valuation. Market- Real Estate market and market value-fair market value, open market value- parameters affecting Investments- Bonds, debentures, capital gains, wealth Tax and Income Tax. Valuation on land acquisition. **12 Hours**

COURSE OUTCOME: On completion of this course, students will be able to

1. Understand and know the necessity of valuation, types of value and determine Depreciation by various methods.
2. Know and decide suitability of methods in valuation of open urban lands.
3. Know the outgoings, determine standard rent of premises.
4. Describe the different methods of valuation of land with buildings and to know valuation of hotel and cinema.
5. Understand market values, easements and valuation of land acquisitions.

TEXTBOOKS

1. S.C. Rangwala “Valuation of Real Properties” (2011) Charotar Publishing private limited, Anand India.
2. Rao Gopinath C.H., “Valuation Practice of Immovable Properties”.

REFERENCE BOOKS:

1. Banerjee “Principles and Practice of valuation”.
2. Mitra A.K., “Theory and Practice of valuation”.
3. Shah N.A., “Quality surveying and valuation”.

17CCT223OPERATION RESEARCH

Sub Code	**: 17CCT223**	**Credits**	**: 04**
Hrs/ Week (L:T:P:S)	**: 4:0:0:0**	**CIE**	**: 50**
Total Contact Hrs	**: 52**	**SEE**	**: 50**
		Exam Hrs	**: 03**

Course Learning Objectives: During the course students will learn

1. The use of operation research in civil engineering.
2. The linear programming methods in solving engineering problems.
3. The non-linear programming methods in solving engineering problems.
4. The dynamic programming methods in solving engineering problems.
5. The network analysis and post optimality analysis.

UNIT I

Use of Operations Research in Civil Engineering and Managerial Decision making process. Introduction to Optimization Techniques and their application in Engineering Planning, Design and Construction. Various models; Objective function and constraints, convex and concave functions, regions and sets. **10 Hours**

UNIT II

Linear programming: Formulation of Linear optimization models, Civil engineering applications. Simplex method, special cases in simplex method, Method of Big M, Two phase method, duality, sensitivity analysis. Transportation Model and its variants, Assignment Model and its variants. Games Theory. **12 Hours**

UNIT III

Non-Linear programming: Single variable unconstrained optimization –Local & Global optima, Uni-modal Function- Sequential Search Techniques: Dichotomous, Fibonacci, Golden Section methods.

Multivariable optimization without constraints-The gradient vector and Hessian Matrix, Gradient techniques, steepest ascent/decent technique, Newton's Method. Multivariable optimization with equality Constraints-Lagrange Multiplier Technique. **10 Hours**

UNIT IV

Dynamic Programming: Introduction – Recursive equation approach, solution of Discrete DPP, Solution of LPP by Dynamic Programming

Waiting line models: Poisson - Exponential single server model – infinite and finite population, Poisson - Exponential multiple server model – infinite population. **10Hours**

UNIT V

Network Analysis: Introduction- Minimum Span Problems, Shortest- Route problems, Maximal- Flow Problems. **Post optimality analysis:** Monte - Carlo system simulation **10Hours**

Course Outcomes: At the end of the course students should know to

1. Describe the importance of operation research in civil engineering.
2. Integrate the linear programming methods in solving engineering problems.
3. Involve the non-linear programming methods in solving engineering problems.
4. Integrate the dynamic programming methods in solving engineering problems.
5. Design a network and analyzethe post optimality.

TEXTBOOKS

1. Operations Research by J.K.Sharma
2. Quantitative Techniques in Management by N. D. Vohra

REFERENCE BOOKS

1. N.D. Vohra., (2001) Quantitative Techniques in Management – Tata McGraw Hill Book Co.
2. Gupta R.C. (1986) Quantitative methods and operations Research – CBS Management Series
3. Operations Research by Hamdy A.Taha
4. Engineering Optimization Theory & Practice – S.S. Rao., Wiley.
5. Engineering Optimization—Methods and Applications—Ravindran,Wiley
6. Principles of Construction Management by R. Pilcher
7. Operations Management by E.S.Buffa
8. Principles of Operations Management by H. M. Wangner
9. Principles of Operation Research – Wagner, Prentice Hall.
10. Operation Research – Hira and Gupta, S. Chand
11. Operations Research: Principles and Practice-Ravindra v,Philip & Solberg, Wiley, India