VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination – 2020 - 21
M.Tech Programme (CCT-Construction Technology)
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

I semester

No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/Field Work/ Assignment	Duration (Hours)	CIE Marks	SEE Marks	Total Marks	
1	PCC	20CCT11	Mathematics in Construction Technology	4	--	3	40	60	100	4
2	PCC	20CCT12	Construction Project and Management	4	--	3	40	60	100	4
3	PCC	20CCT13	Construction Quality and Safety	4	--	3	40	60	100	4
4	PCC	20CCT14	Advanced Construction Materials and Green Buildings	4	--	3	40	60	100	4
5	PCC	20CCT15	Mechanization in Construction	4	--	3	40	60	100	4
6	PCC	20CCTL16	Advanced Material Testing Lab	--	4 (3 hrs Lab + 1 hr Instruction)	3	40	60	100	2
7	PCC	20RMI17	Research Methodology and IPR	2	--	3	40	60	100	2
Total				**22**	**04**	**21**	**280**	**420**	**700**	**24**

Note: PCC: Professional Core, PEC: Professional Elective

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II semester

No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/Field Work/ Assignment	Duration(Hours)	CIE Marks	SEE Marks	Total Marks	
1	PCC	20CCT21	Construction Economics and Finance	4	--	**3**	40	60	100	4
2	PCC	20CCT22	Pre Engineered Construction Technology	4	--	3	40	60	100	4
3	PCC	20CCT23	Design concepts of sub-structures	4	--	3	40	60	100	4
4	PEC	20CCT24X	Professional elective 1	4	--	3	40	60	100	4
5	PEC	20CCT25X	Professional elective 2	4	--	3	40	60	100	4
6	PCC	20CCTL26	Software Application Lab	--	4 (3 hrs Lab + 1 hr Instruction	3	40	60	100	2
7	PCC	20CCT27	Technical Seminar	--	2	--	100	--	100	2
Total				**20**	**06**	**18**	**340**	**360**	**700**	**24**

Note: PCC: Professional core, PEC: Professional Elective

Professional elective I		Professional elective II	
Course title	**Course Code under 20CCT24X**	**Course title**	**Course Code under 20CCT25X**
1.Building services and Maintenance	20CCT241	1. Building Cost and Quality Management	20CCT251
2. Ground Improvement Techniques	20CCT242	2.Pavement Design and Construction	20CCT252
3. Advanced Reinforced Concrete Design	20CCT243	3. Earthquake Resistant Design of Structures	20CCT253

Note: Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the same and other semesters of the programme shall be mandatory. The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and Question and Answer session in the ratio 50:25:25.

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III semester

No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/Field Work/ Assignment	Duration (Hours)	CIE Marks	SEE Marks	Total Marks	
1	PCC	20CCT31	Construction Contracts, Specifications and Estimation	4	--	**3**	40	60	100	4
2	PEC	20CCT32X	Professional elective III	4	--	3	40	60	100	4
3	PEC	20CCT33X	Professional elective IV	4	--	3	40	60	100	4
4	Project	20CCT34	Project phase I	--	2	--	100	--	100	2
5	INT	20CCTI35	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)		3	40	60	100	6
Total				**12**	**02**	**12**	**260**	**240**	**500**	**20**

Note: PCC: Professional core, PEC: Professional Elective

Professional elective III		**Professional elective IV**	
Course title	**Course Code under 20CCT32X**	**Course title**	**Course Code under 20CCT33X**
1. Restoration and Rehabilitation of Structures	20CCT321	1. Energy and Buildings	20CCT331
2. Construction Demolition and Waste Management	20CCT322	2. Disaster Management Techniques	20CCT332
3. Design of Pre-stressed Concrete Structures	20CCT323	3. Advanced Design of Steel Structures	20CCT333

Note:

1. **Project Phase-1:** Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a seminar. CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25. SEE (University examination) shall be as per the University norms.
2. **Internship:** All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted in the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during the subsequent University examination after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

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IV semester

No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/Field Work/ Assignment	Duration (Hr)	CIE Marks	SEE Marks	Total Marks	
1	Project	20CCT41	Project work phase -2	-	4	3	40	60	100	20
Total				-	**4**	**3**	**40**	**60**	**100**	**20**

Note:

1. Project Work Phase-2:

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

MATHEMATICS IN CONSTRUCTION TECHNOLOGY

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – I

Subject Code	20CCT11	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives:: This course will enable the students:

- To understand the techniques of numerical methods for estimating high accuracy in finding the roots and, in solving differential equations and their applications.
- To introduce matrix algebra in a best suitable approach for solving large number of equations using transformation methods.
- To enable learning integration and solution of ODE‟s numerically.
- To understand the concept of Probability distribution function and their applications in civil engineering.
- To enable learning concepts ofstatistical mathematics and their implication in Construction Engineering.

Modules	**Teaching Hours**	**RBT Level**
Module -1: Solution of System of Linear Equations:		
Rank of the matrix, Echelon form, Linearly dependent and independent equations, Solutions for linear equations, Gauss Seidel method, Partition method, Croute's Triangularisation method. Jacobi method,Eigen Values, Eigen Vectors, Bounds on Eigen Values, Given‟s method for symmetric matrices.	**10 Hours**	**L_2, L_3 L_4**
Module -2: Roots of the equations:		
Simple fixed point iteration methods. Newton Rapson method, Secant Method, Muller‟s method, Graeffe‟s Roots Squaring Method. Aitkin‟s Method, Linear Programming: Simplex method, Sensitivity analysis.	**10 Hours**	**L_2, L_3 L_4**
Module -3: Numerical solution for Differential and Integral Equations		
Solution of Ordinary differential equations: Euler's method, Euler's modified method, and Ranga Kutta 3rd and 4th order method, Taylor‟s series method, Milne‟s Predictor-corrector method. **Solutions for Integral Equations:**, Trapezoidal rule, Simpson‟s 1/3rd and 3/8th rule, and Weddle‟s Rule**.** Least square approximation, Lagrange Interpolations	**10 Hours**	**L_2, L_3 L_4**
Module -4 Probability		
Conditional Probability, Random variables and expectations, Binomial Distributions, Poisson Distribution, Normal Distribution, Uniform distribution, Exponential distribution, Joint distribution. Expectation; Inequalities; Convergence of random variables.	**10 Hours**	**L_2, L_3 L_4**
Module -5 Statistics		
Hypothesis testing and p -values; Bayesian inference; Statistical decision theory, Density curves, ANOVA, Sampling, Designing of Experiments (Inference for the Mean of a Population, Sample Proportions, Inference for a Population, Proportion Comparing, Two	**10 Hours**	**L_2, L_3 L_4**

Means, Comparing Two Proportions, Goodness of Fit Test Two way Tables.		

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

1. Apply the knowledge of direct methods and iterative methods for solving system of linear equations up to required accuracy.
2. Acquire the idea of significant figures, method of approximation of roots of equation.
3. Understand numerical methods/linear programming techniques to various root finding/for differential and integral equations.
4. Interpret the probability concepts in Civil engineering.
5. Learn the applications of statistical methods for the experiments and civil engineering projects.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Erwin Kreyszig ,"Advanced Engineering Mathematics", 10th Edition , Willely India, 2016.
2. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44rd Ed., 2017.
3. C. Ray Wylie and Louis C Barrett, "Advanced Engineering Mathematics", 6th Edition, McGraw- Hill, 2012.
4. M K Jain, S.R.K Iyengar, R K. Jain, Numerical methods for Scientific and Engg.
5. Computation, New Age International, 2003.

Reference Books:-

1. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers," 7th Ed., McGraw-Hill Edition, 2015.
2. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers", 7th Edition, McGraw-Hill Edition, 2015.
3. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers," 7th Ed., McGraw-Hill Edition, 2015.

Web links and Video Lectures:

1. *http://nptel.ac.in/courses.php?disciplineId=111*
2. *http://www.class-central.com/subject/math(MOOCs)*
3. *http://ocw.mit.edu/courses/mathematics/*

CONSTRUCTION PROJECT AND MANAGEMENT

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – I

Subject Code	20CCT12	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives:

This course will enable students to

- Understand the various management techniques for successful completion of construction projects.
- Understand the effect of management for project organization.

Modules	Teaching Hours	RBT Level
Module-1		
Introduction: Construction Projects- Concept, Project Categories, Characteristic of projects, project life cycle phase. Project Management- Project Management Function, Role of Project Manager. Organizing For Construction - Principles of organization, type of organization structure.	**10 Hours**	**L1, L2, L3, L4, L5**
Module-2		
Project Feasibility Reports: Introduction, Significance in feasibility report- Technical analysis, Financial analysis, Economic analysis, Ecological analysis, Flow diagram for feasibility study of a project. **Project planning Scope:** Planning Process, Objectives, Types of Project plans, Resource Planning Process.	**10 Hours**	**L1, L2, L3, L4, L5**
Module-3		
Scheduling: Introduction to software's in construction scheduling (MSP, Primavera, Construction manager), Project Monitoring & Controlling Bar Charts, Work Breakdown Structure, Time estimates, Applications of CPM and PERT, A-O-N Network-Logic and Precedence diagrams, advantages, Drawing A-O-N network from A-O-A network and related problems.	**10 Hours**	**L1, L2, L3, L4, L5**
Module-4		
Time Cost relationship: Direct and indirect cost, step in optimization of cost, related problem. Allocation of resources: Histogram, Resource smoothening, Resource leveling and related problem. Project updating using CPM network and related numerical problems.	**10 Hours**	**L1, L2, L4, L5**
Module-5		
Resources: Scheduling, Monitoring and Updating. Line of Balance Scheduling. Resource Planning-Leveling and Allocation. Introduction to Building Information Model (BIM).	**10 Hours**	**L1, L2**

Course outcomes:

On completion of this course, students are able to:

- Allocate the funds for each work and execute thesame.
- Calculate the total time required to complete the job without delay and delay in the project and also estimate the amount of additional funds may require to complete the job.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Chitkara, K.K. **"Construction Project Management: Planning, Scheduling and Control"**, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2. Choudhury S, **"Project Management"**, McGraw-Hill Publishing Company, New Delhi, 1988.
3. Chris Hendrickson and Tung Au, **"Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders"**, Prentice Hall, Pittsburgh, 2000.

Reference Books:

1. Srinath L.S, **"PERT and CPM"**, East West Press Pvt Ltd New Delhi.
2. Frank Harris and Roland McCaffer, **"Modern Construction Management"**- 4th Ed. Blackwell Science Ltd.

CONSTRUCTION QUALITY AND SAFETY

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – I

Subject Code	20CCT13	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives:

This course will enable the students to

- Understand concept of quality management and its implications.
- Understand the importance of quality certifications and application of TQM to the construction projects.
- Understand concept of safety management and its implications
- Study the relationship between quality and safety management.

Modules	Teaching Hours	RBT Level
Module -1		
Construction Quality Management- need and importance, Quality control and methods, Quality Assurance, Quality assurance plan, Inspection and Testing- Process, Inspection test report, concepts of quality policy, Quality standards, Quality manual.	**10 Hours**	**L_1, L_2, L_5**
Module -2		
Quality Certification for companies and laboratories (ISO Certification, NABL certification). Total Quality Management, Features and Elements of TQM, Critical factors of TQM, TQM in construction Projects. Benchmarking, Types of Benchmarking and process, Third Party Certification- Process involved.	**10 Hours**	**L_3, L_4, L_5**
Module -3		
Construction Safety-meaning and scope, Safety in construction- Technological aspects, organizational aspects and behavioral aspects, Safety in Project management, Education and training. Safety legislation and Standards, Contract conditions on safety in Civil Engineering projects.	**10 Hours**	**L_1, L_2, L_4, L_5**
Module -4		
SAFETY IN CONSTRUCTION: Causes, classification, cost and measurement of an accident, accident report. Safety information systems, safety programme for construction, Safety budgeting, Factors affecting safety, Strategic Planning for safety provisions, SOPs, PPE, Inspections.	**10 Hours**	**L_3, L_4, L_5**
Module -5		
Personal & Structural safety and Safety measure: a) For storage and handling of building materials. b) Construction of elements of a building c) During use of equipment d) In demolition of buildings- Safety lacuna in Indian scenario	**10 Hours**	**L_3,L_4, L_5**

Site safety programmes - JSA, JHA, Safety audit, safety policy, manuals, training & orientation.		

Course outcomes:

On completion of this course, students are able to:

- Gain the knowledge, Importance and necessity of quality management in construction.
- Learn and apply the importance of safety management in construction.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Logothetis, N. "Management for total quality." *ed: Prentice-Hall, Upper Saddle River, NJ* (1997).
2. David Gold Smith, **"Safety Management in construction and Industry",**McGrawHill Publishers.
3. K N Vaid, **"Construction Safety Management",** NICMAR, Bombay.
4. D S Rajendra Prasad, **"Quality Management System in Civil Engineering",** Sapna Book House, Bangalore.

References:

1. Robert (QMP) " **Bench Marking**", " The search for industry Best Practices that led to superior performance" American Society of Quality 1995.
2. Break Joseph and Susan Joseph " **Total Quality Management**", Excel Books , New Delhi, 1995.
3. Juran Frank, J.M. and Gryna, F.M. "***Quality Planning and Analysis***", Tata McGraw Hill 2002.

ADVANCED CONSTRUCTION MATERIALS AND GREEN BUILDINGS

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – I

Subject Code	20CCT14	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives:

This course will enable students to

1. Understand the environmental issues due to building materials and the energy consumption in manufacturing building materials
2. Study the various masonry blocks and alternative building materials.
3. Study the properties of concrete making materials, special concretes and various methods for making concrete.
4. Understand the sustainable materials used in construction.
5. Understand the amount of energy required for building and use of Non-renewable sources.

Modules	Teaching Hours	RBT Level
Module -1		
Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings IGBC and LEED manuals – mandatory requirements, Rainwater harvesting &solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions.	**10 Hours**	**L1,L2,L3**
Module -2		
Alternative Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes	**10 Hours**	**L2, L3**
Module -3		
Special Concretes: Definition & Introduction, General properties, Advantages, Disadvantages, Applications, High density concrete, Shrinkage compensating concrete, Mass concrete, Roller compacted concrete. Light weight concrete, High strength concrete, Ultra-high strength concrete (reactive powder concrete), High workability concrete/Self compacting concrete, Fiber reinforced concrete, Polymer-concrete composites.	**10 Hours**	**L2, L3**
Module -4		
Introduction and definition of Sustainability. Carbon cycle and role of construction material such as concrete and steel, etc. CO2 contribution	**10 Hours**	**L1, L2,**

from cement and other construction materials. Control of energy use in building, ECBC code, codes in neighboring tropical countries, features of LEED and TERI Griha ratings, Performance ratings of green buildings.		**L4**
Module -5		
Non-renewable sources of energy and Environmental aspects – energy norm, coal, oil , natural gas, Nuclear energy, Global temperature, Green house effects, global warming. Acid rain - Causes, effects and control methods. Regional impacts of temperature change.	**10 Hours**	**L1, L2, L4**

Course outcomes:

On completion of this course students are able to:

1. Solve the problems of environmental issues concerned to building materials and cost effective building technologies.
2. Analyze different alternative building materials, which will be suitable for specific climate and in sustainable manner.
3. Recommend various types of alternative building materials, technologies and to design a energy efficient building by considering local climatic condition and building materials.
4. Conduct the various tests on fresh and hardened concrete, special concrete and the methods of manufacturing of concrete.

1. 5. Know the idea of utilizing less carbon emission materials.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. K. S. Jagadish, B. V. Venkatarama Reddy and KS Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International Publishers.
2. Gambhir M.L., "Concrete Technology", McGraw Hill Education, 2006.
3. Shetty M.S., "Concrete Technology", S. Chand and Company Ltd. Delhi, 2003.
4. M. L. Gambhir "Building Materials" Neha Jamwal, Tata McGraw Hill Publ.
5. C. J. Kibert (2008) "Sustainable Construction: Green Building Design and delivery", 3rd Ed., John Wiley, Hoboken, New Jersey.

Reference Books:

1. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
2. Mehta. P. K., and Paulo J.M. Monteiro, **"**Concrete- Microstructure, Properties and Materials"- (Indian Ed., Indian Concrete Institute), McGraw Hill.
3. National Building Code 2005, Part 0-10, Bureau of Indian Standards
4. G.T. Miller Jr. (2004) "Living in the Environment: Principles, Connections and Solutions", 14th Ed., Brooks Cole, Pacific Grove, California, Washington DC, April 1989.

MECHANIZATION IN CONSTRUCTION

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – I

Subject Code	20CCT15	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives:

This course will enable students to

- Understand the various types of equipments used forconstruction.
- Understand different construction methods.
- Understand modern techniques used in construction.
- Understand the environmental issues related to construction activities.

Modules	**Teaching Hours**	**RBT Level**
Module -1		
Introduction to mechanization: Definition, advantages and limitations of mechanization, Indian scenario and Global scenario. Mechanization through construction equipment: Equipment cost, Machine Power, Production cycle - Dozers, scrapers, excavators, Finishing equipment, Trucks and Hauling equipment, Hoisting equipment, Draglines and Clamshells.	**10 Hours**	**L_1, L_2, L_3 L_4, L_5**
Module -2		
Mechanization in aggregate manufacturing: Flow chart of process of manufacturing of coarse aggregates, Different types of crushers used, process of screening and washing. Recycled aggregates: Types of recycled aggregates. Artificial aggregates: Types of artificial aggregates. Mechanization in concrete production (RMC plant):Flow chart of the process of concrete production. Methods of placing and compaction of concrete.	**10 Hours**	**L_1, L_2, L_3**
Module -3		
Mechanization in rebar fabrication Mechanization through construction: formwork and scaffolding types, materials and design principles.	**10 Hours**	**L_1, L_2, L_3 L_4,**
Module -4		
Mechanization through construction methods/technologies: segmental construction of bridges/flyovers, box pushing technology for tunneling, trench-less technology. Pile Driving Equipments. Underground & under water construction (problems encountered, under water drilling, Blasting & grouting)	**10 Hours**	**L_1, L_2, L_3 L_4**
Module -5		
Mechanization through construction methods of Drilling, Blasting and Tunneling Equipment : Definition of terms, bits, Jack hammers, Drifters, wagon drills, chisel drills, piston drills, blast hole drills, shot drills, diamond drills, tunneling equipment, selecting the drilling method equipment; selecting drilling pattern. Safety and Environmental issues in mechanization	**10 Hours**	**L_1, L_2, L_4**

Course outcomes:

On completion of this course, students are able to

- Understand applications of different types of equipments/machineries used in construction industry
- Understand use of modern tools and techniques
- Know the methods of drilling and blasting.
- Impact of different construction activities on environment

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

References :

1. Mahesh Varma, "Construction Equipment and its Planning and Applications", Metropolitan Book Co.(P) Ltd., New Delhi. India.

2. Sharma S.C. "Construction Equipment and Management", Khanna Publishers, Delhi, 1988

3. "Construction Review" Published by Civil Engineering and Construction Review, New Delhi, 1991.

ADVANCED MATERIAL TESTING LABORATORY

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – I

Subject Code	20CCTL16	CIE Marks	40
Number of Lecture Hours/Week	04(3Hours Lab+1Hour Instruction)	SEE Marks	60
Total Number of Lecture Hours	42	Exam Hours	03

CREDITS – 02

Course objectives:

This course will enable students to

- Learn principles and design the experiments.
- Investigate the performance of various concrete.
- Investigate in-situ bearing capacity of soil to decide the size of the foundation.

Modules	Teaching Hours	RBT Level
In situ testing of concrete structures, test methods available, planning of in situ tests, Surface hardness methods- Rebound Hammer equipment, its operation and procedure for testing, factors influencing rebound no., calibration and interpretation of results, applications and limitations,	**9 Hours**	**L2,L3,L4**
Mix design, casting and testing High Performance/Strength concrete cylinders and obtaining the stress-strain behavior (Modulus of Elasticity) under compressive loading.	**9 Hours**	**L3,L4,L5**
Test on soil i) Classification of soil by Hydrometer method ii) Standard penetration test	**6 Hours**	**L3,L4,L5**
i) Effect of Chemical admixtures on fresh & harden properties of concrete ii) Effect of mineral admixtures on fresh & harden properties of concrete Tests on Bitumen materials Tests on Course aggregates for road construction	**12 Hours**	**L3,L4,L5**
Bonding Patterns in Brick work (joints, alignments, level and Plumb maintenance)	**6 Hours**	**L3,L4,L5**

Course outcomes:

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

- Achieve the Knowledge of design and development of experimental skills.
- Understand the properties fresh and hardened concrete.
- Understand the classification of soil and safe bearing capacity of soil in construction industry.

Question paper pattern:

- 15% of total marks for write-up.
- 15% of total marks for viva voce.
- 70% of total marks for conducting experiments followed by the results.

Text Books:

1. Metha P.K and Monteiro. P. J. M. " CONCRETE", Microstructure, Properties and Materials, Third Edition, Tata McGraw-Hill Publishing company Limited, New Delhi,2006
2. Shetty .M.S., "Concrete Technology, Theory and Practice", Revised Edition, S. Chand& company Ltd. ,New Delhi,2006
3. Neville. A.M. , " Properties of Concrete", 4th Edition Longman,1995

4.. Mindass and Young, " Concrete", Prentice Hall.1998

Reference Books

1. JK Ray, “Experimental analysis of stress and strain”, S Chand & Co.
2. J K Bungey, “Testing of concrete in structures”, Surrey University Press.
3. IS codes of 2720 (part 4) and IS: 2131-1981.

RESEARCH METHODOLOGY AND IPR

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – I

Subject Code	20RMI17	CIE Marks	40
Number of Lecture Hours/Week	02	SEE Marks	60
Total Number of Lecture Hours	25	Exam Hours	03

CREDITS – 02

Course Objectives: At the end of this course, students will be able :

- To give an overview of the research methodology and explain the technique of defining a research problem.
- To explain the functions of the literature review in research.
- To carry out a literature review, developing theoretical and conceptual frameworks.
- To explain the details of sampling designs, and also different methods of data collections.
- To explain the art of interpretation and the art of writting research reports.
- To explain various forms of the intellectual property, its relevance and business impact in the changing global business environment.
- To discuss leading International Instruments concerning Intellectual Property Rights

Modules	**Teaching Hours**	**RBT Level**
Module -1		
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.	**5 Hours**	**L_1, L_2**
Module -2		
Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. **Reviewing the literature:** Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.	**5 Hours**	**L_1, L_2**
Module -3		
Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. **Design of Sample Surveys:** Introduction, Sample Design, Sampling and Non- sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.	**5 Hours**	**L_1, L_2**
Module -4		
Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. **Interpretation and Report Writing:** Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing,	**5 Hours**	**L_1, L_2,L_3,L_4**

Different Steps in Writing Report. **Interpretation and Report Writing (continued):** of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.		
Module -5		
Patent Rights: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957, The Protection of Plant Varieties and Farmers" Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property.	**5 Hours**	**L_1, L_2,L_3,L_4**
Graduate Attributes (As per NBA): Problem analysis, Investigation, Design, Individual and teamwork, Communication skills, Professionalism.		
Course outcomes: At the end of the course the student will be able to: • Discuss research methodology and the technique of defining a research problem • Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review. • Explain various research designs and their characteristics. • Explain the art of interpretation and the art of writing research reports • Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR		
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60 • The question paper will have ten questions. • Each full question consists of 20 marks. • There will be 2full questions (with a maximum of four sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • Students will have to answer 5 full questions, selecting one full question from each module.		

Text Books

1. C.R. Kothari, Gaurav Garg "Research Methodology: Methods and Techniques", New Age International 4th Edition, 2018
2. Ranjit Kumar "Research Methodology a step-by step guide for beginners". (For the topic Reviewing the literature under module) SAGE Publications Ltd 3rd Edition, 2011.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" Model Curriculum of Engineering & Technology PG Courses [Volume -II] [15]
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners".
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Asimov , "Introduction to Design", Prentice Hall, 1962.
7. Study Material (For the topic IPR under module 5, Professional Programme IPR, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

CONSTRUCTION ECONOMICS AND FINANCE

Outcome Based Education(OBE) and Choice Based Credit System (CBCS SEMESTER – II

Construction Economics and Finance			
Subject Code	**20CCT21**	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives:

This course will enable students to

- Understand importance of economics
- Understand concept of financial management
- Know the time value money and factors governing it.
- Understand Working Capital Management.
- Understand various risks and Uncertainties involved in construction.

Modules	**Teaching Hours**	**RBT Level**
Module-1		
Economics; Definition and importance and scope Finance: Definition and scope, Sources of finance, Financial Management; Meaning and Scope, Supply and Demand Mechanism, Time value of money, discounted cash flow, NPV, ROR, Problems	**10 Hours**	**L_1, L_2, L_3 L_4,**
Module-2		
Pricing; objectives, determinants, absorption, marginal costing. Financial analysis, Process of Decision making: Capital Budgeting, budgetary control, standard costing and variance, investment appraisal. Practical problems	**10 Hours**	**L_1, L_2, L_3**
Module-3		
Quantifying alternatives for decision making; Bases of comparison, Incremental analysis, Benefit-Cost analysis, Capital budgeting; Profit, loss and Breakeven analysis, Practical Problems	**10 Hours**	**L_2, L_3 L_4, L_5,**
Module-4		
Working capital cycle, Working capital management, Financial statements; Balance sheet and its components, profit & loss account, fund flow statement. Financial ratios and their importance. Project appraisal, project yield, taxation and inflation,	**10 Hours**	**L_2, L_3 L_4, L_5, L_6**
Module-5		
Risk and uncertainty-SWOT analysis, Turnkey activities; cost control, performance budgeting. Equipment economics: Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis, depreciation and amortization.	**10 Hours**	**L_2, L_3 L_4, L_5,**

Course Outcomes:

On completion of this course, students are able :

- To understand the importance of economics and finance in civil engineering projects.
- To understand and analyze financial statements.
- To assess profit, loss and break-even point.
- To develop a budget, manage and regulate it.

- To analyze different risks and uncertainties.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

References:

1. 1.Peterson, H.C., Lewis, W.C. "Managerial Economics", Prentice Hall of India Pvt. Ltd., 2001
2. Parkin, M. & Bade R., "Modern Macroeconomics" 4th Edition, Prentice Hall, 1996.
3. Werther & Davis, "Human Resources & Personnel Management", McGraw Hill, 1996
4. Edwards, John et.al., 1983 "Manpower planning, John Wiley": New York
5. Anthony, R.N. Govindrajan, V., Irwin, "Management control systems", McGraw Hill Publications, 10th Edition, 2000.

PRE-ENGINEERED CONSTRUCTION TECHNOLOGY

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – II

Subject Code	20CCT22	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course will enable students to

- Understand the type of prefabricated elements.
- Understand the method of hoisting.
- Understand the basic construction of the pre-engineered buildings.

Modules	Teaching Hours	RBT Level
Module-1		
General Principles of Pre Fabrication Comparison with monolithic construction, Types of prefabrication, site and plant prefabrication, Economy of prefabrication, Modular coordination, Standardization, Planning for Components of prefabricated structures, Disuniting of structures, Handling and erection stresses, Elimination of erection stresses (Beams, columns) Symmetrical frames.	**10 Hours**	**L1,L2**
Module-2		
Prefabricated Elements Roof and floor panels, ribbed floor panels, wall panels, footings, Joints for different structural Connections, Effective sealing of joints for water proofing, Provisions for non-structural fastenings, Expansion joints in pre-cast construction. Construction of precast structural components (Purlins, Principal rafters, roof trusses, lattice girders, gable frames, Single span single storeyed frames, Single storeyed buildings – slabs, beams and columns.)	**10 Hours**	**L1,L2**
Module-3		
Production and Hoisting Technology Choice of production setup, Manufacturing methods, Stationary and mobile production, Planning of production setup, Storage of precast elements, Dimensional tolerances, Acceleration of concrete hardening. Equipments for hoisting and erection, Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns, Vacuum lifting pads.	**10 Hours**	**L2,L3**
Module-4		
Precast sandwich Panels ,Pre-stressed concrete solid flat slabs, Hollow core slab/panels, Pre-stressed concrete Double "T", Bridge, Precast segmental Box Girders, Specifications and design considerations.	**10 Hours**	**L2,L3**
Module-5		
Pre-Engineered Buildings Introduction, Advantages, Pre Engineered Buildings Vs. Conventional Steel Buildings, Design Consideration of Pre Engineered Buildings (PEB) – Applications	**10 Hours**	**L3,L4**

Course outcomes:

On completion of this course, students are able :

- To design the pre-engineered structures and execute the same for a given structure.
- To know the different types of stresses acting on the structures while lifting the prefabricated structures and type of equipment required to support such stresses.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. L. Mokk, "**Prefabricated Concrete for Industrial and Public Structures**" Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.

2. T. Koncz, "**Manual of Precast Concrete Construction**", Vol. I, II, III & IV, Berlin,1971.

Reference Books:

1. B. Lewicki, "Building with Large Prefabricates", Elsevier Publishing Company, Amsterdam, London, New York, 1998.
2. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag, 2009.
3. Hass, A.M. Precast concrete design and Applications, Applied Science Publishers,1983.

DESIGN CONCEPTS OF SUB-STRUCTURES

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – II

Subject Code	20CCT23	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:: This course will enable the students:

- To understand the importance of sub-soil exploration, bearing capacity of soil.
- To learn the design of shallow foundation and deep foundations in varies field conditions.
- To understand the importance of soil reinforcement in improving the soil characteristics.

Modules	**Teaching Hours**	**RBT Level**
Module -1: Soil Exploration and Bearing Capacity		
Soil Explorations: Objectives and importance, Disturbed, Undisturbed and representative samples, samplers, Geophysical methods, Geophysical exploration and Bore hole log. **Bearing Capacity:** Safe bearing capacity, Settlement pressure, allowable Bearing Capacity, Types of Foundations soil failure, Terzaghi's and BIS equation for Bearing capacity. Effect of water table and eccentricity. Field methods: Plate load test, standard penetration method, static and dynamics penetration tests. Introduction to bearing capacity of layered soils.	**10 Hours**	**L_1L2,L_3 L_4**
Module -2: Design of Shallow foundation		
Classification of foundation, classification of footing, objectives, importance and field suitability of each. Design of single column footing with and without eccentricity. Design of combined footing. (Using IS: 456-2000)	**10 Hours**	**L_2, L_3 L_4**
Module -3 Raft Foundation		
Design of Raft foundations- types of rafts, Bearing capacity of mat foundations, Mat settlements, Modulus of sub-grade reactions for mats and sub-grades, Numerical problems. Allowable soil pressures for rafts in cohesionless and cohesive soils, Design of raft by rigid beam method and Winkler method, Solution based on elastic half space and based on elastic theory.	**10 Hours**	**L1,L2**
Module -4 Deep foundations		
Deep Foundations: Load Transfer in Deep Foundations, Types of Deep Foundations, Ultimate bearing capacity of different types of piles in different soil conditions, Laterally loaded piles, tension piles & batter piles, Pile groups: Bearing capacity, settlement, uplift capacity, load distribution between piles, Proportioning and design concepts of piles.	**10 Hours**	**L_2, L_3 L_4**
Module -5: Soil Reinforcements		
Geo-synthetics: Classifications, Properties, functions, Laboratory tastings and construction details, metallic strips, metallic grids, geotextiles, geogrids, geomembranes and geocomposites, their functions and design principles. (No problems) Geo-textile: properties, testing	**10 Hours**	**L_1L2,L_3**

methods, functions, design principals. Geo-synthetic clay liners.		

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

1. Understand the importance of soil exploration; determine the Bearing capacity of the soil in various field conditions.
2. Design the shallow foundations and raft foundation.
3. Understand and solve the problems associated with pile foundations.
4. Understand importance of geo-synthetics as soil reinforcement

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students have to answer 5 full questions, selecting one full question from each module.

Reference Books:-

1. Soil Dynamics and Machine Foundation (2010), Swami Saran, Galgotia Publications Pvt. Ltd.
2. Foundation Engineering (2012), JE Bowles. McGraw Hill Book Company
3. Analysis and Design of Foundations and Retaining Structures(1979)–S Prakash, Sarita Prakashana, Meerut
4. Foundation design in practices (2010)-Kaurna Moy Ghosh. PHI
5. Foundation Engineering (1998): Bajara M Das, John Wiley & Sons,
6. Vibration Analysis and Foundation Dynamics(1998)-Kameswara Rao, N. S. V., Wheeler Publication Ltd.,
7. Soil Mechanics and Foundation Engineering – S K Garg, Khanna Publications
8. Geotechnical Engineering – C Venkataramaiah, New Age International Publishers

BUILDING SERVICES AND MAINTENANCE

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – II

Subject Code	20CCT241	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives:

This course will enable the students to

- Understand the importance of ventilation and their different types.
- Understand the difference between electrical and plumbing layout.
- Understand the various types of building services.
- Understand the various methods of maintenance in construction industry.

Modules	Teaching Hours	RBT Level
Module -1		
Introduction to Building Services. Describe basics of building services. Apply various types of services as per needs of building. Classification of building services, Types of services and selection of services. Lighting and Ventilation provisions, Natural and artificial lighting- principles and factors , Necessity of Ventilation, Types – Natural and Mechanical ,Factors to be considered in the design of Ventilation.	**10 Hours**	**L_1, L_2,L_3 L_4, L_5**
Module -2		
Electrical services in the building, Technical terms and symbols for electrical installations and Accessories of wiring, Prepare electrical services requirement and Layout of a given building (Ex residence, small work shop, show room, school building) cold and hot water systems, Type, cold water distribution system as per NBC 2005	**10 Hours**	**L_1, L_2, L_3 L_4, L_5**
Module -3		
Lift Definition, Types of Lifts, Design Considerations, Location, Sizes as per NBC 2005 , Elevators & Escalators, Different types of elevators and Escalators, conveyors Different types of Conveyors, Uses of different types of Conveyors. Standard fire, fire resistance, classification of buildings, means of escape, alarms, etc., provisions of NBC	**10 Hours**	**L_1, L_2, L_3 L_4, L_5**
Module -4		
Building Maintenance, maintenance services, developing a repair plan, conducting the building and apartment condition survey, developing a repair budget, emergency repairs, preventive maintenance, cosmetic repairs, factors affecting maintenance, common building defects and their Symptoms.	**10 Hours**	**L_1, L_2, L_3 L_4, L_5**
Module -5		
Need for maintenance, classification of maintenance, planning of maintenance, scheduling and estimating of maintenance, Preventive and protective maintenance, Scheduled and contingency maintenance planning M.I.S. for building maintenance. Maintenance standards.	**10 Hours**	**L_1, L_2, L_3 L_4, L_5**

Course outcomes:

On completion of this course, students are able to

- Manage the building services provisions in big construction sites.

- Synchronize the construction activities with installation of building services.
- Select the suitable electrical as well mechanical services for particular requirements of buildings.
- Select the appropriate type of maintenance depending upon necessity and requisite budget.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. R. Udaykumar **"A text book on Building Services ",** Eswar Press, ISBN-13,9788178740638, Chennai.

2. S.M.Patil"**BuildingServices**",SeemaPublication,ISBN-13,1234567121246,MumbaiRevised edition.

3. Dr. B. C. Punmia "**Building Construction** ",Laxmi Publications (P) Ltd., Edition11-2017, New Delhi.

4. P. S. Gahlot "**Building repair and Maintenance Management ",** CBS Publishers & Distribution(P) Ltd, DEC-2010.

Reference Book.

1. "**National Building Code of India - 2005** ", Bureau of Indian Standards, BIS, New Delhi.

GROUND IMPROVEMENT TECHNIQUES

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – II

Subject Code	20CCT242	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives:

This course will enable students to

- Understand the fundamental concepts of ground improvement techniques
- Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
- Understand the concepts of grouting and other miscellaneous methods.

1. Impart the knowledge of geosynthetics, vibration, grouting and Injection

Modules	Teaching Hours	RBT Level
Module -1		
Compaction: Theory of compaction, Shallow Surface Compaction - Equipment, Placement water content, factors affecting shallow compaction; Deep compaction: Methods - Vibrofloatation, Terra probe method, Pounding, Blasting, Compaction piles; Compaction Control	**10 Hours**	**L_1, L_2, L_3 L_4**
Module -2		
Vertical Drains: Sand drains, Sand wicks, Rope drains, Design of vertical drains, Stone columns, application of the techniques to Marine clays.	**10 Hours**	**L_1, L_2, L_3, L_4, L_5**
Module -3		
Stabilization: Introduction, objectives, Methods of stabilization – Mechanical, Cement, Lime, Bituminous, Calcium chloride; construction methods, factors affecting stabilization of soils; Deep Mixing methods – Soil lime Columns and Cement Lime Columns, applications	**10 Hours**	**L_1, L_2, L_3 L_4**
Module -4		
Dewatering: Definition, necessity, Methods of dewatering – Interceptor ditch, Single, Multistage and Vacuum well points, Horizontal wells, Electro-osmosis. Permanent drainage by Foundation drains and Blanket drains. Geosynthetics: Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of Geosynthetics	**10 Hours**	**L_1, L_2, L_3 L_4**
Module -5		
Grouting: Definition, Objectives of grouting, Grouts and their properties, Categories of Grouting, Grouting methods: Asending, Descending and Stage Grouting in Soils, Hydrofracture, Grouting Equipment, Post grouting tests. In-situ Reinforcement: Ground Anchors, Tiebacks and Soil Nailing, Micropiles.	**10 Hours**	**L_1, L_2, L_4**

Course outcomes:

On completion of this course, students are able to

- Give solutions to solve various problems associated with soil formations having less strength.
- Use effectively the various methods of ground improvement techniques depending upon the requirements.
- utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures Program

1.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

1. Ground Improvement Techniques by P. Purushothama Raj, Laksmi Publications, New Delhi.
2. R. M. Korner, Design with Geosynthetics, Prentice Hall, New Jersy, 3rd Edn. 2002
3. P. Purushothama Raj, Ground Improvement Techniques, Tata McGrawHill, New Delhi, 1995.
4. Dr. B.C.Chattopadhyay and J.Maity, Ground Control and Improvement Techniques, PEEDOT, Howrah, 2011.
5. G. V. Rao and G. V. S. Rao, Text Book On Engineering with Geotextiles, Tata McGraw Hill

Reference Books:

1. Engineering Principles of Ground Modification by Monfred R Hausmann, Mc Graw Hill Publishing Co.
1. 2. Reinforced Soil and Its Engineering Applications by Swami Saran, I.K. International Pvt. Ltd

ADVANCED REINFORCED CONCRETE DESIGN

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – II

Subject Code	20CCT243	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course will enable the students to:

- Learn the principles of Structural Design.
- Design and detail the different types of structures.
- Understand the ductile detailing (Seismic Detailing) of RC Structures.

Modules	Teaching Hours	RBT Level
Module-1		
Yield line method of design of slabs: Assumptions, Characteristic features, yield line patterns Derivation and Examples for different shapes of Slab.	**10 Hours**	**L2,L3,L4**
Module-2		
Design of grid floors: Concept, Importance and Design Examples.	**10 Hours**	**L2,L3,L4**
Module-3		
Design of continuous beams Concept of Moment Redistribution, Design Examples.	**10 Hours**	**L2,L3,L4**
Module-4		
Design of flat slabs, Importance of flat slabs, Flat slab with and without Column Head, Drops, Design Examples.	**10 Hours**	**L1,L2,L4**
Module-5		
Art of detailing earthquake resistant construction –Ductile detailing (Seismic Detailing) considerations As Per IS 13920:Expansion and Construction joints.	**10 Hours**	**L1,L2,L3**

Course outcomes:

On completion of this course, students are able to:

- Achieve Knowledge of design and development of problem solving skills.
- Understand the industrial building and the components.
- Design and develop analytical skills.
- Summarize the principles of Structural Design and detailing
- Summarize the concepts of Ductile detailing (Seismic Detailing) of RC Structures

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to

answer 5 full questions, selecting one full question from each module.

Text Books:

1. S.S. Bhavikatti, "Advanced R C C Design (R C C Vol. 2)"-New Age International Private Limited Publishers, 3rd Edition: 2016.
2. P.C.Varghese, "Advanced Reinforced Concrete Design"- Prentice-Hall of India, New Delhi, 2005.
3. Punmia, B. C., Jain, A. K., & Jain, A. K. (1998). *Comprehensive Rcc. Designs*. Laxmi Publications.
4. Advanced Reinforced Concrete Design - N. Krishnaraju, CBS Publishers.
5. IITK-BMTPC Earthquake Tips https://www.nicee.org/EQTips.php
6. IS 13920 (1993): Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of practice.
7. "Current Literature".

BUILDING COST AND QUALITY MANAGEMENT

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)] SEMESTER – II

Subject Code	20CCT251	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course will enable the students to:

- Prepare the Bill of Quantities (BOQ) of a given project.
- Understand the qualities of materials used in the construction work.

Modules	Teaching Hours	RBT Level
Module-1		
Estimation of quantities for R.C.C. multi storeyed complex viz. earthwork, concrete in foundation, D.P.C., R.C.C. work, flooring and roofing, plastering and pointing etc., wood work, white washing.	**10 Hours**	**L1,L2,L3**
Module-2		
Analysis of rates for multi storeyed building works – Brick work in foundations and Superstructure, cement concrete, R.C. C., Plastering, Flooring, Timber work etc. Checking of construction quality – various tests for bricks, cement, concrete, aggregates, and steel as per IS codes.	**10 Hours**	**L1,L2,L4**
Module-3		
Preparation of bills for payment, measurement book, mode of payment, running account bill. Ledger and Cash book details, Arbitration.	**10 Hours**	**L1,L2,L3,L4**
Module-4		
Estimation of building services viz. water supply works, electrification, sanitary fitting etc, and their cost analysis.	**10 Hours**	**L1,L2,L3,L4**
Module-5		
Elements of Valuation: methods, techniques and examples Completion report of the project; Checking of Plan, Details of various works, and issue of completion report of the project.	**10 Hours**	**L1,L2,L3,L4**

Course outcomes:

On completion of this course, students are able :

- To prepare the quantities of work for a multi storeyed building.
- To certify the valuation report on existing structures.
- To prepare the detailed bills for the on-going projects.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. B.N. Dutta "Estimating and Costing" UBS Publishers' Distributors Pvt Ltd,28th Revised Edition edition (2016).

2. G.S. Birdie "Estimating and Costing" Dhanpat Rai Publishing Company.

Reference Book:

1. Roshan N Namavati "Professional Practice", Lakahni Book Depot, Mumbai.

PAVEMENT DESIGN AND CONSTRUCTION

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – II

Subject Code	20CCT252	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

The students will be able to

- Discuss the factors influencing design of pavements and compute stresses and deflections induced in flexible pavement under various design loads.
- Understand the material specification and construction of different layers.
- Understand the various types of equipments used for road construction and pre construction methods.
- Design the thickness of flexible pavements by different methods and as per IRC guidelines.
- Design the thickness of concrete pavements and joints associated with CC pavements in addition to the computation of stresses in CC pavements.

Modules	Teaching Hours	RBT Level
Module-1		
Pavement and its composition – Types of pavement, functions of various layers, choice of pavement type, Factors affecting design and performance of flexible and rigid pavements , Desirable characteristics of pavements. Design wheel loads – axle load distribution, ESWL, EWL, and VDF due to varying loads and CSA. **Stresses and Deflections in Flexible Pavements**: Application of elastic theory, stresses, deflections in single, and two layer system, Applications in pavement design. Problems.	**10 Hours**	**L1,L2,L3,L4**
Module-2		
Pavement construction- Different types of granular base course– WMM, CRM, WBM, specifications, construction method and quality control tests. Different types of bituminous layers for binder and surface courses, their Specifications (as per IRC and MORTH), construction method and quality control tests. Different types of sub-base and base course for cement concrete pavement, construction of paving quality concrete and joints, quality control tests during construction.	**10 Hours**	**L1,L4,L5**
Module-3		
Plants and equipments for road construction- Bituminous mixing plants, cement concrete mixers – various types, advantages and choice. Road construction equipment – different types of excavators, graders, soil compactors / rollers, pavers and other equipment for construction of different pavement layers – their uses and choice. Construction of embankments and cuts for roads, preparation of subgrade and quality control tests.	**10 Hours**	**L2,L3,L4,**

Module-4		
Design of Flexible Pavements: Factors effecting Design. Deflection studies in Flexible Pavements. Present Serviceability Index. IRC guidelines for Flexible Pavements. Pavement Performance and methods- AASHTO and Asphalt Institute Method. Need for Overlays, Overlays design methods for Flexible and Rigid pavements.	**10 Hours**	**L3,L4,L5**
Module-5		
Design of rigid pavement -General design principle, stresses in rigid pavements (due to wheel loads and temperature variations), design of cement concrete pavements (joints and slab thickness) as per IRC guidelines. Design features of CRCP, SFRC and ICBP, Problems.	**10 Hours**	**L2,L4, L5,**

Course outcomes:

After completion of the course the student will be able to

- Explain the various factors affecting design and performance of pavements.
- Calculate the stresses and deflection in flexible and rigid pavements.
- Select suitable equipment for preparation of sub grade and preparation stages for base and sub base layers.
- Design the thickness of flexible pavements by different methods under different exposure conditions and materials.
- Design the thickness of concrete pavements and joints associated with CC pavements in addition to the computation of stresses in CC pavements.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Yoder and Witczak, "Principles of Pavement Design"- John Wiley and sons Inc(second edition) 1975
2. Yang, "Design of functional pavements"- McGraw Hill BookCo.

Reference Books:

1. Huang, "Pavement Analysis"- Elsevier Publications
2. David Croney, Paul Croney, "Design & Performance of Road Pavements"- McGraw hill Book Co.
3. W.Ronald Hudson, Ralph Haas and Zeniswki "Modern Pavement Management"-McGraw Hill and Co
4. IRC 37-2001, IRC 81-1997, IRC 58 – 2002, IRC 59 – 1976, IRC 101-1988, Indian Roads Congress
5. Khanna and Justo "Highway Engineering"- Nemchand& Bros, Roorkee

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – II

Subject Code	20CCT253	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Prerequisites: Structural Dynamics

Course objectives: The students will be able to

1. Learn the principles of engineering seismology.
2. Design the reinforced concrete buildings for earthquake resistance structures.
3. Evaluate the seismic response of the structures.

Modules	Teaching Hours	RBT Level
Module-1		
Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments. Earthquake Hazards in India, Earthquake Risk Evaluation and Mitigation. Structural behavior under gravity and seismic loads, Lateral load resisting structural systems, Requirements of efficient earthquake resistant structural system, damping devises, base isolation systems.	**10 Hours**	**L1,L2**
Module-2		
The Response history and strong motion characteristics. Response Spectrum – elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multi-storied buildings –using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893.	**10 Hours**	**L2, L3, L4, L5**
Module-3		
Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modeling concepts of infill masonry walls. Behavior of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – codal provisions.	**10 Hours**	**L2, L4, L5**
Module-4		
Design of Reinforced concrete buildings for earthquake resistance-Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS1893. Structural behavior, design and ductile detailing of shear walls.	**10 Hours**	**L2, L4, L5**
Module-5		
Seismic response control concepts – Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures	**10 Hours**	**L2, L5, L6**

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

· Achieve Knowledge of design and development of problem solving skills.

· Understand the principles of engineering seismology

· Design and develop analytical skills.
· Summarize the Seismic evaluation and retrofitting of structures.
· Understand the concepts of earthquake resistance of reinforced concrete buildings.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Reference Books:

1. Dynamics of Structures – Theory and Application to Earthquake Engineering 2nd ed. – Anil K. Chopra, Pearson Education.
2. Earthquake Resistant Design of Building Structures, Vinod Hosur, WILEY (india) India.
5. IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993
6. Design of Earthquake Resistant Buildings, Minoru Wakabayashi, McGraw Hill Publishers.

SOFTWARE APPLICATION LABORATORY

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – II

Subject Code	20CCTL26	CIE Marks	40
Number of Lecture Hours/Week	04(3 hours lab +1 hour instruction)	SEE Marks	60
Total Number of Lecture Hours	42	Exam Hours	03

CREDITS – 02

Course objectives:

This course will enable students to

- Plan and schedule multi storeyed building with various constraints.
- Carry out estimation of buildings using softwares
- Understand and apply project management techniques.

Modules	Teaching Hours	RBT Level
Software Application 1. Preparation of estimation of a structure using excel (6 hours). 2. Construction management software (MS-PROJECTS /PRIMAVERA) i. Understanding basic features (3 hours). ii. Create WBS, activities, and tasks and computation time using Excel spread sheet and transferring the same to MS project management software (6 hours). iii. Identification of Predecessor and Successor activities with constraints (6 hours). iv. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and other non-Critical paths, Project duration, Floats (6 hours). v. Study on various view options available (3hours). vi. Basic understanding about resource creation and allocation, resolving over allocation of activities (6hours). vii. Splitting the activities, linking multiple activities, assigning constrains, merging multiple projects, creating baseline project and updating the project (6 hours).	**42 Hours**	**L1,L2,L3**

Course outcomes:

On completion of this course, students are able to:

- Achieve Knowledge of Design and development of soft skills.
- Understand the application of planning and scheduling techniques to construction project.
- Optimize time and cost for the construction project.

Question paper pattern:

- 15% of the total marks for write-up
- 15% of the total marks for viva voce
- 70% of the total marks for conducting experiments followed by the results

References:

1. Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", Tata McGraw- Hill Publishing Company, New Delhi, 1998.
2. Choudhury S, "Project Management", McGraw-Hill Publishing Company, New Delhi, 1988.

CONSTRUCTION CONTRACTS, SPECIFICATIONS AND ESTIMATION

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – III

Subject Code	20CCT31	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course will enable students to

- Summarize, analyze and evaluate the estimates, rate analysis and specifications.
- Analyze, evaluate and design construction contract documents, tendering procedure.
- Summarize and analyze the, claims and dispute mechanisms.
- Summarize and analyze the BOT, PPP, Concession contracts.
- Recognize and summarize the laws affecting engineers, relational contracts.

Modules	Teaching Hours	RBT Level
Module-1 Estimation and Rate Analysis		
Estimation: Estimate, Data required to prepare estimate, Types of estimate, Report for estimate, Factors affecting estimation of major construction project. **Analysis of Rates:** Purpose of rate analysis, Procedure for rate analysis, Factors affecting rate analysis. Rate analysis for Lime concreting in foundation or floor, Cement concreting in foundation or floor, RCC work in beams, slabs & column, Reinforced brick work in slabs, First class brick work in foundation & superstructure, Coursed Rubble stone masonry in superstructure, Ashlar stone masonry in superstructure, Cement plastering & Pointing, Cement Concrete Floor, Mosaic or terrazzo Tile floor, white washing & distempering, Damp proof course, Painting, Varnishing , Earth work in excavation, Centering, Shuttering, formwork for RCC beam, slab, Galvanized corrugated iron sheet roofing.	**10 Hours**	**L2,L3,L4**
Module-2 Construction Specifications		
General/brief specifications of a first class building, Second class building, Third class building, fourth class building. **Detailed specifications** for Earth work in excavation in foundation, Lime concrete in foundation, Cement concrete, Reinforced cement concrete, Damp proof course, Brick work first class, Reinforced brick work, Plastering, pointing, Cement concrete floor, Mosaic or terrazzo floor, White washing, Colour washing, Distempering, Painting, Varnishing, Wood work (carpenter's work), Doors and windows, Glazing, Centering and shuttering, Ashlar stone masonry, Coursed Rubble masonry, Galvanized corrugated iron sheet roofing.	**10 Hours**	**L2,L3,L4**
Module-3 Contracts, Tendering, Bidding & Contracting		
Introduction to Contracts: Agreement, Contract, Essentials conditions of a Valid Contract, Terminologies of Contract, Distinction between Agreement and Contract, Types of Contracts, Indian Contract Act 1872.	**10 Hours**	**L1,L2,L3**

Tendering, Bidding & Contracting: Tender and Tender Documents, Tendering procedure, Tender Notice, Methods Of Bidding/Tendering, Conditions of Contract, Securities/Guarantees in contract.		
Module-4 Construction Claims and Dispute Resolution		
Construction Claims: Reasons for Claims in Construction Contracts, Types of Claims, Causes of claims, effects of claims Preparation And Presentation of Claims, Deviations/ Variations: Extra item, Excess quantity, Deficit quantity, Price Escalation. **Dispute Resolution:** Dispute Resolution Mechanism, Types of Dispute Resolution: Arbitration, Mediation, Conciliation, Litigation, Dispute Resolution Board [DRB].	**10 Hours**	**L1,L2,L3**
Module-5 BOT Contract, Relational Contracts, **Laws affecting Engineers**		
BOT Contract: Types of contract, PPP framework, types of risk, concession agreement. **Relational Contracts**: Partnering, Alliancing. **Laws affecting Engineers:** Labour Law, Sales Tax, VAT, Service Tax, Excise Duty.	**10 Hours**	**L1,L2,L3**

Course outcomes:

On completion of this course, students are able to:

- Attain the knowledge on estimates, Develop and present rate analysis and specifications.
- Develop and present the tender documents for the project
- Attain the knowledge on tendering procedure, claims and dispute mechanisms.
- Attain the knowledge on BOT, PPP, Concession contracts.
- Attain the knowledge on laws affecting engineers, relational contracts.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. B.N.Dutta, "Estimation and Costing in Civil Engineering", 28th revised edition, UBS Publishers Distributors Pvt. Ltd., 2016.
2. Collier, K. (1982). "*Managing Construction Contracts",* Reston Publishing Company.
3. S. Ranaga Rao Contract Management and Dispute Resolutions Engineering staffCollege of India January 2008.
4. C. J. Schexnayder and R. E. Mayo, "Construction Management Fundamentals", McGraw Hill, New Delhi. 2003
5. General Conditions of Contract, Central Public Works Department, New Delhi,2010

6.D.S. Berrie and B.c. Paulson, Professional construction management including C.M., Design construct and general contracting, McGraw Hill InternationaL, Third Edition1992.

7.V. K. Raina, Construction & Contract Management Practices, SPD, New Delhi

RESTORATION AND REHABILITATION OF STRUCTURES

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – III

Subject Code	20CCT321	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course will enable the students to:

- Learn the structural properties of different members.
- Identify the failure phenomenon of structures.
- Understand the new approaches in the design aspects.
- Understand the concepts of serviceability and durability of structures.

Modules	Teaching Hours	RBT Level
Module-1		
Restoration & Rehabilitation; Definition and importance components in services and testing of existing structures both destructive and non-destructive; Causes of deterioration; preventive measures and maintenance.	**10 Hours**	**L_1, L_2 L_3**
Module-2		
Principles of assessment of weathering and durability; Performance of construction materials and their Characteristics. Diagnosis of construction failures; Dealing with cracks; Methods of repair in concrete, Steel and timber structural components.	**10 Hours**	**L_1, L_2,L_3, L_4**
Module-3		
Corrosion of reinforcement in concrete; Process of corrosion, Causes, Effects, repair and preventive measures. Deterioration of Concrete; Causes of Efflorescence, Effects, Repair and Preventive measures. Grouting and shotcrete techniques. Surface coatings used in repair of structures. Leakage in slabs; Causes and Preventive measures to be taken to prevent during and after construction. Water proofing; Different techniques of water proofing.	**10 Hours**	**L_1, L_2,L_3,**
Module-4		
Strengthening of existing structures; Different methods of strengthening the existing structural elements. Maintenance Inspection; Steps involved in Maintenance Inspection. Maintenance Budget and its importance.	**10 Hours**	**L_1, L_2,L_3, L_4, L_5**
Module-5		
Remedial measures and techniques for failures due to strength, deflection, cracking, chemical attack, weathering, fire, leakage, marine conditions. Demolition methods.	**10 Hours**	**L_1, L_2,L_3,**

Course outcomes:

On completion of this course, students are able to:

- Predict the failure modes in structures.
- Design the structures to overcome the failure in construction activities.
- Understand the deterioration of structures.
- Suggest remedial measures for different types of failures.
- Understand different methods of demolition.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

References:

1. J. Bhattacharjee, Concrete structures Repair, Rehabilitation and Retrofitting, CBS Publishers,2017.

2. B. Vidivelli, Rehabilitation of concrete Structures, standard Publishers and distributors, 2007.

3. R T Allen, S C Edwards and D.N. Shaw, Repair of Concrete Structures, CRC press,1992.

4. A Technical Report on Learning of failures from Deficiencies in design, construction and Service, Raikar R. N., R & D Centre (SDCPL).

CONSTRUCTION DEMOLITION AND WASTE MANAGEMENT

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – III

Subject Code	20CCT322	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course Objectives:

This course will enable students to

- Focus on the principles of sustainable construction and demolition waste management and resource efficiency.
- Examine the environmental impact of building materials, formulating and designing pre–construction and site waste management plans.

Modules	Teaching Hours	RBT Level
Module-1		
Environmental Impact of Building Materials, Embodied energy of materials; impact on the local environment; toxicity of the material; lifecycle assessment-examples. Nature and Source of Direct and indirect waste; site types and origins; composition; quantity; current recycling/reuse potential of building materials.	**10 Hours**	**L1,L2**
Module-2		
Construction and Demolition Waste Management Plans, International good practice; planning requirements; demolition plans; site implementation; supplier agreements; sub–contractor management; role of waste management contractor; training; auditing; current disposal options; health and safety; reporting to local authorities. Treatment of Construction and Demolition Waste, waste permits; waste licenses; waste transfer facilities; landfills; treatment technologies; hazardous waste facilities; reporting to EPA	**10 Hours**	**L2,L3,L4**
Module-3		
Designing for Waste Prevention and Minimization. Client, contractor and designer attitudes; proper maintenance of existing buildings; reuse of existing building structure; design flexibility; design for reuse and recycling; dimensional co–ordination and standardization; material selection and control.	**10 Hours**	**L3,L4,L5**
Module-4		
Waste Forecasting Tools, Application of WRAP's, Procedure for designing out waste tool for buildings and civil engineering projects; WRAP net waste tool; BRE SMART Waste; WRAP Site Waste Management Plan Tracker	**10 Hours**	**L1 TO L5**
Module-5		
Future developments and potential future markets; Production of precast elements using demolished wastes. Significance of partial replacement or substitution of construction materials Smart materials; Properties, components, classification, advantages and applications. Use of eco–materials; Properties and types.	**10 Hours**	**L1,L2**

Course outcomes:

On completion of this course, students are able to:

- Formulate, design, evaluate and review pre−construction and construction phase resource efficient waste management plans.
- Evaluate, assess and recommend potential reuse/recycling/disposal options considering existing and potential future markets/uses.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions and each full question consists of 20 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Stessel, R. I. Recycling and resource recovery engineering: principles of waste processing. Springer Science & Business Media, (2012).

2. Greg Winkler, "Recycling Construction and Demolition waste: A LEED-Based Toolkit (Green Source) McGraw Hill Publishers

3. V M Tam, Chi Ming Tam, "Reuse of Construction and Demolition Waste in Housing Development", Nova Science Publishers, 2008.

References

1. Nováková, I., & Mikulica, K. (2016). Properties of concrete with partial replacement of natural aggregate by recycled concrete aggregates from precast production. *Procedia Engineering*, *151*, 360-367.

2. Xiao, J. (2018). Reclaim of Waste Concrete. In *Recycled Aggregate Concrete Structures* (pp. 15-37). Springer, Berlin, Heidelberg.

DESIGN OF PRESTRESSED CONCRETE STRUCTURES

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – III

Subject Code	20CCT323	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course will enable students to

- Learn the concepts of prestress in Civil Engineering projects.
- Learn the concepts of prestressing in mass housing projects, railway sleepers, flyovers etc.

Modules	Teaching Hours	RBT Level
Module-1		
Design of high strength concrete mixes. Loss of prestress in single span and continuous beams. Use of IS 1343-1980, Analysis Limit State Design of beams for Tension Type II and III problems, Cracking moment, untensioned reinforcement, Partial prestressing, Stress Corrosion. Transfer of prestress by bond, Transverse tensile stresses, End zone reinforcement. Behaviour of Bonded and unbounded prestress concrete beams	**10 Hours**	**L1,L2,L3**
Module-2		
Deflection of Prestressed concrete members, short and long term, control of deflections. Crack width considerations. Flexural strength of prestressed concrete sections: Types of flexural failures, Limit state concept.	**10 Hours**	**L1,L2,L3**
Module-3		
Shear resistance of prestressed concrete members: Principal stresses and ultimate shear Resistance, Design of shear reinforcement, prestressed concrete, members in Torsion, Design of reinforcement in torsion shear and bending.	**10 Hours**	**L1,L2,L3**
Module-4		
Stress distribution in end block, Analysis and Anchorage Zone reinforcement. Composite Construction of prestressed precast and cast in situ concrete. Statically Indeterminate structures: Continuous beams, primary and secondary moments, Continuity, concordant cable profile, Analysis and Design of continuous beams	**10 Hours**	**L1,L2,L3**
Module-5		
Pre-stressed concrete pipes and poles. Design of Pre-stressed concrete tanks. **Pre-stressing of dams and bridges**: Method of construction. Stage pre-stressing, Dynamic and Fatigue behavior of pre-stressed concrete	**10 Hours**	**L1,L2,L3**

Course outcomes:

On completion of this course, students are able :

- To take the appropriate decision in respect of choice of Pre-stressed section over R.C.C.
- To design the structures with various methods of pre-stressing.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.

- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Nigel R Hewon Prestressed Concrete Bridge, Design and construction Thomas Telford London 2003.

2. Devid A. Sheppard& William R. Phillps Plan Cast Precast and Prestressed concrete (A Design Guide) Mcgraw Hill Publication Co. 1989.

3. N.Krishnaraju Prestressed Concrete Tata McGraw Hill (Third Edition) 1981**. Reference Books:**

1. Lin T.Y,Burns N.H. Design of Prestressed Concrete Structures. John Wiley & sons (Third Edition).1982. ,

ENERGY AND BUILDINGS

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – III

Subject Code	20CCT331	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course will enable the students

- To understand the importance of energy conservation.
- To understand importance of non-renewable resources.
- To design energy efficient buildings.

Modules	Teaching Hours	RBT Level
Module-1		
Conservation & energy efficiency concepts-overview of significance of energy use- RenewableandNon-Renewable, energy and their significance, Global energy and environmental resources, Impact of temperature change, Energy crises Energy processes in buildings	**10 Hours**	**L1,L2**
Module-2		
Solar energy fundamentals & practices in building design- solar astronomical relations and radiation physics and measurements, design decision for optimal orientation of building, shadow analysis.	**10 Hours**	**L1,L2**
Module-3		
Heating and ventilation design- Human thermal comfort, climatological factors, material specifications and heat transfer principles, thermal performance evaluation, Heat loss from buildings, design of artificial ventilation system, design of insulators	**10 Hours**	**L1,L2**
Module-4		
Design audits & economic optimization- Concept of cost/benefit of energy conservation & carbon footprint estimation. Energy efficient lighting system design: Basic terminologies and standards, daylighting and artificial lighting design, auditing.	**10 Hours**	**L1,L2**
Module-5		
Computerenergysimulationprograms-Needforenergysimulationprogramsand its working, Energy simulation tools, Implementation of computer simulation programs.	**10 Hours**	**L1,L2**

Course outcomes:

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

- Understand the importance of energy resources
- Design energy efficient buildings.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks. There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

References

1. Mili Majumdar, "Energy Efficient Buildings In India", The Energy Research Institute.
2. LalJayamaha Energy-EfficientBuildingSystems,McGrawHillPublication.
3. J A Duffie & W A Beckman Solar Energy and thermal processes, John Wiley
4. Energy Conservation Building Code, 2007.
5. Handbook of functional requirement of buildings, SP: 41:1987

DISASTER MANAGEMENT TECHNIQUES

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – III

Subject Code	20CCT332	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course will enable the students to

- Adopt various numerical methods and mathematical tools for analysis of research data.
- Learn about the natural disasters.
- Learn the risk reduction methods of disasters
- Understand the application of GIS in disaster managementtechniques.

Modules	Teaching Hours	RBT Level
Module-1		
Introduction: Disaster preparedness, Goals and objectives of ISDR Programme, Risk identification, Risk sharing Disaster and development: Development plans and disaster management, alternative to dominant approach, Disaster development linkages, Principle of risk partnership	**10 Hours**	**L1,L2,L3,L4**
Module-2		
Application of Technology in disaster risk reduction: Application of various technologies: Data bases RDBMS Management information systems-Decision support system and other systems- Geographic information systems-Intranets and extranets video teleconferencing-Trigger mechanism-Remote sensing-an insight contribution of remote sensing and GIS	**10 Hours**	**L1,L2,L3,L4**
Module-3		
Awareness of Risk reduction: Trigger mechanism constitution of trigger mechanism- risk reduction by education-disaster information network risk reduction by public awareness Development of planning on disaster: Implication of development planning- financial arrangements- areas of improvement-disaster preparedness-community based disaster management-emergency response.	**10 Hours**	**L1,L2,L3,L4**
Module-4		
Seismicity: seismic waves-Earthquakes and faults measures of earthquake, magnitude and intensity-ground damage-Tsunamis and earthquakes. The design and management of Disaster Information Resource Network, Asian Disaster Preparedness Centre, Regional data base, Contacts and Sources.	**10 Hours**	**L1,L2,L3,L4**
Module-5		
Causes, effects (damages) and Preventive measures of ground failures, Landslides, rockslides, liquefaction, fire, floods, tsunamis, release of hazardous material like poisonous gas, nuclear radiation.	**10 Hours**	**L1,L2,L3**

Course outcomes:

On completion of this course, students are able to:

- Analyze the existing data of the natural calamities and prediction of the disaster
- Develop an appropriate methods to identify and rectify the disaster

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Pardeep Sahni, Madhavi Malalgoda and Ariya bandu, "Disaster risk reduction in south Asia", PHI Learning.
2. Amitasinvhal, "Understanding earthquake disasters", TMH publishers, 2010.
3. Pardeep sahni, Alka Dhameja and Uma Medury, "Disaster Mitigation: Experiences and reflections", PHI Learning.

ADVANCED DESIGN OF STEEL STRUCTURES

[Outcome Based Education(OBE) and Choice Based Credit System (CBCS)]

SEMESTER – III

Subject Code	20CCT333	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives:

This course will enable the students

- To learn principles of design of industrial buildings.
- To design different components of industrial structures and to detail the structures.

Modules	Teaching Hours	RBT Level
Module-1		
Laterally Unrestrained Beams: Lateral Buckling of Beams, Factors affecting lateral stability, IS 800 code provisions, Design Approach. Lateral buckling strength of beams – Design Examples.	**10 Hours**	**L1,L2**
Module-2		
Design of tension members and Design of compression members, built up compression members.	**10 Hours**	**L1,L2**
Module-3		
Connections bearing type joints – un stiffened and stiffened seat connections, moment resisting connection of brackets - bolted and welded.	**10 Hours**	**L2,L3**
Module-4		
Steel beams with web openings: Shape of the web openings, practical guide lines, and Force distribution and failure patterns, Design of castellated beams.	**10 Hours**	**L3,L4**
Module-5		
Forms of light gauge sections, Effective width computation of unstiffened, stiffened compression elements of cold formed light gauge sections. Concept of local buckling of thin elements. Limiting width to thickness ratio.	**10 Hours**	**L2,L3,L4**

Course outcomes:

On completion of this course, students are able to:

- Achieve Knowledge of design and development of problem solving skills.
- Design and develop analytical skills.
- Summarize the principles of Structural Design and detailing.

Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Bureau of Indian Standards, IS800-2007, IS875-1987, IS-801-1975. Steel Tables, SP 6 (1) – 1984.
2. N Subramanian- "Design of Steel Structure" oxford University Press.
3. Duggal "Limit State Design of Steel Structures" TMH publishers.
4. B.C. Punmia, A.K. Jain "Design of Steel Structures", Laxmi Publications, New Delhi.
5. Ramchandra and Virendra Gehlot "Design of Steel Structures " Vol 1 and Vol.2, Scientific Publishers, Jodhpur.