Maratha Vidya Prasarak Samaj's

Karmaveer Adv. Baburao Ganpatrao Thakare College of Engineering

An Autonomous Institute affiliated to Savitribai Phule Pune University, Pune

Udoji Maratha Boarding Campus, Gangapur Road, Nashik - 422 013, Maharashtra, India

Post-Graduate Program Syllabus

First and Second Year M.Tech. Civil Engineering (Construction Management)

(2024 Pattern) V1.1

As per NEP 2020

Academic Year 2025-26

(Copy for Student Circulation Only)

First Year M.Tech. Civil Engineering (Construction Management)

Curriculum Structure (2024 Pattern) V1.1 Semester - I

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks						Credits			
			TH	PR	TU	CCE	ESE	TW	PR	OR	TOT	TH	PR	TU	TOT
201104	MLC	Research Methodologies and IPR @	4	-	-	50	50	-	-	-	100	4	-	-	4
205102	PCC-1	Management and Project Planning in Construction	3	2	-	50	50	25	-	25	150	3	1	-	4
205103	PCC-2	Construction Technology	3	-	-	50	50	-	-	-	100	3	-	-	3
205104	PCC-3	TQM in Construction	3	-	-	50	50	-	-	-	100	3	-	-	3
205105X	PEC-I	Elective-I*	4	2	-	50	50	25	-	-	125	4	1	-	5
200106	VEC-1	Human Rights - 1 @	-	-	1	-	-	25	-	-	25	-	-	1	1
Total			**17**	**4**	**1**	**250**	**250**	**75**	**-**	**25**	**600**	**17**	**2**	**1**	**20**

Abbreviations: **TH:** Theory **PR:** Practical **TU:** Tutorial **CCE:** Continuous Concrete Evaluation
ESE: End-Semester Examination **TW:** Term Work **OR:** Oral **TOT:** Total

@ common to all branches.

First Year M.Tech. Civil Engineering (Construction Management)

Curriculum Structure (2024 Pattern) V1.1 Semester - II

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks						Credits			
			TH	PR	TU	CCE	ESE	TW	PR	OR	TOT	TH	PR	TU	TOT
205201	**PCC-4**	Sustainability in Construction Projects	3	-	-	50	50	-	-	-	**100**	3	-	-	**3**
205202	**PCC-4**	Construction Contracts Administration and Management	3	2	-	50	50	-	-	25	**125**	3	1	-	**4**
205203	**PCC-6**	Project Economics and Financial Management	3	-	-	50	50	-	-	-	**100**	3	-	-	**3**
205204X	**PEC-II**	Elective-II**	4	2	-	50	50	25	-	-	**125**	4	1	-	**5**
200205	**MLC**	Introduction to Cyber Security @	3	2	-	50	50	25	-	-	**125**	3	1	-	**4**
200206	**VEC-2**	Human Rights – 2 @	-	-	1	-	-	25	-	-	**25**	-	-	1	**1**
Total			**16**	**6**	**1**	**250**	**250**	**75**	**-**	**25**	**600**	**16**	**3**	**1**	**20**

Abbreviations: **TH:** Theory **PR:** Practical **TU:** Tutorial **CCE:** Continuous Concrete Evaluation
ESE: End-Semester Examination **TW:** Term Work **OR:** Oral **TOT:** Total

@ common to all branches.

Second Year M.Tech. Civil Engineering (Construction Management)

Curriculum Structure (2024 Pattern) V1.1 Semester - III

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks						Credits			
			TH	PR	TU	CCE	ESE	TW	PR	OR	TOT	TH	PR	TU	TOT
205301	**SBC-I**	Dissertation Phase - I	-	20	-	-	-	100	-	50	**150**	-	10	-	**10**
205302	**ELC-II**	Research Seminar	-	4	-	-	-	25	-	25	**50**	-	2	-	**2**
205303	**VSEC-I**	Skill Development Laboratory-I	-	4	-	-	-	50	-	-	**50**	-	2	-	**2**
205304	**INT**	Internship	-	8	-	-	-	50	-	50	**100**	-	4	-	**4**
200305	**VEC-3**	Introduction to Constitution @	-	-	2	-	-	50	-	-	**50**	-	-	2	**2**
Total			**-**	**36**	**2**	**-**	**-**	**250**	**-**	**150**	**400**	**-**	**18**	**2**	**20**

Abbreviations: **TH:** Theory **PR:** Practical **TU:** Tutorial **CCE:** Continuous Concrete Evaluation
ESE: End-Semester Examination **TW:** Term Work **OR:** Oral **TOT:** Total

@ common to all branches.

Second Year M.Tech. Civil Engineering (Construction Management)

Curriculum Structure (2024 Pattern) V1.1 Semester - IV

Course Code	Course Type	Course Name	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks						Credits			
			TH	PR	TU	CCE	ESE	TW	PR	OR	TOT	TH	PR	TU	TOT
205401	**SBC-II**	Dissertation Phase - II	-	36	-	-	-	250	-	100	**350**	-	18	-	**18**
205402	**VSEC-II**	Skill Development Laboratory-II	-	4	-	-	-	50	-	-	**50**	-	2	-	**2**
Total			**-**	**40**	**-**	**-**	**-**	**300**	**-**	**100**	**400**	**-**	**20**	**-**	**20**

Abbreviations: **TH:** Theory **PR:** Practical **TU:** Tutorial **CCE:** Continuous Concrete Evaluation
ESE: End-Semester Examination **TW:** Term Work **OR:** Oral **TOT:** Total

@ common to all branches.

Program Elective Course - I and II

Course Code	* Elective -I	Course Code	** Elective -II
205105A	Sustainable Construction Materials	**205204A**	Green Building Design and Construction
205105B	Disaster Management	**205204B**	Infrastructure Development
205105C	Retrofitting of Structures	**205204C**	Material Management
205105D	Construction Safety	**205204D**	Value Engineering and Valuation
205105E	Building Services and Maintenance	**205204E**	Risk Analysis and Mitigation Practice
		205204F	Construction Equipment Management

List of Abbreviations Used with Percentage of Credits

Abbreviations	Course Type	Number of Courses	Credits	% of Credits
PCC	**Program Core Courses**	6	18	**22.5**
PEC	**Program Elective Courses**	2	08	**10.0**
PLC	**Program Laboratory Courses**	4	04	**5.0**
MLC	**Mandatory Learning Courses**	2	08	**10.0**
VEC	**Value Education Courses**	3	04	**5.0**
SBC	**Skill-Based Courses**	2	28	**35.0**
ELC	**Experiential Learning Courses**	1	02	**2.5**
VSEC	**Vocational and Skill Enhancement Courses**	2	04	**5.0**
INT	**Internship**	1	04	**5.0**
Total		**23**	**80**	**100%**

- **Summary of Credits and Total Marks:**

Semester	Credits	Marks
I	20	600
II	20	600
III	20	400
IV	20	400
Total	**80**	**2000**

• Definition of Credit :

The Post Graduate (P.G.) programmes will have credit system. The details of credit will be as follow.
1 Credit = 1 hour/week for lecture
= 2 hours/week for practical
= 1 hour/week for tutorial

Semester - I

Course Code: 201104	Course Name: Research Methodology and IPR	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week	**4**	**CCE : 50 Marks** **ESE : 50 Marks**

Prerequisite Courses:

- Students should complete undergraduate courses in engineering/technology.

Course Objectives:

- To provide an overview of the research problem and describe the functions of literature survey in research.
- To explain the statistical and probability analysis.
- To explain the art of writing research reports and papers.
- To understand the patenting process and its commercial aspects.
- To explain patent rights and new developments in IPR.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Understand research problem formulation, approaches of investigation of solutions for research problems and literature survey.

CO2: Apply the principles of statistics and probability analysis in research.

CO3: Acquire skills in research proposal/paper writing.

CO4: Discover the importance of IPR.

CO5: Understand patent rights and new developments in IPR.

Course Content:

UNIT-I: Research Problem and Literature Survey **11 Hours**

Research Problem: Meaning of research problem, sources of research problem, characteristics of a good research problem, and errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problems, data collection, benchmarking, analysis, interpretation

Literature survey: Effective literature studies approaches, analysis, Plagiarism, its importance and software's, research ethics, research gap, writing objectives of research studies.

UNIT-II: Statistics and Probability Analysis 10 Hours

Statistical Analysis: Introduction, Sources of error and uncertainty, One-Dimensional Statistics: combining errors and uncertainties, t-test, ANOVA statistics.

Probability Analysis: Classical and empirical probability, axioms of probability, conditional probability, Bayes' rule, law of total probability and law of total expectation.

UNIT-III: Technical Writing 11 Hours

Characteristics of effective technical writing, developing a Research proposal, format of the research proposal, financial heads of the research project, research paper writing, abstracting and indexing of journals, impact factor, h index, research paper submission and review process, writing responses to reviewer's comments, Publications.

UNIT-IV: Intellectual Property 10 Hours

Patents, designs, trade and copyright, the process of filing patents, designs, trade and copyright, examination, examination report, writing responses to the examination report, patent grant, commercialization, patenting under PCT and its advantages, case studies.

UNIT-V: Patent Rights and New Developments in IPR 10 Hours

Scope of patent rights, Licensing and transfer of technology, patent information and databases, geographical Indications. Administration of patent system, new developments in IPR, IPR of biological systems, computer software etc.

Learning Resources:

1. Research Methodology: Methods and Trends, by Dr. C. R. Kothari.
2. Research Methodology: An Introduction by Wayne Goddard and Stuart Melville.
3. Research Methodology: A Step by Step Guide for Beginners, by Ranjit Kumar, 2nd Edition.
4. Halbert, Resisting Intellectual Property, Taylor & Francis Ltd.
5. Mayall, Industrial Design, McGraw Hill.
6. Niebel, Product Design, McGraw Hill.
7. T. Ramappa, Intellectual Property Rights under WTO, S. Chand.
8. Paul L. Meyer, Introductory probability and statistical applications, Addison-Wesley Publishing Company, 1970.

Web link for MOOC / NPTEL Links:

1. www.ipindia.gov.in
2. www.nptel.ac.in/courses/121106007

Course Code: 205102	Course Name: Management and Project Planning in Construction	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 3 Hours/Week **Practical :** 2 Hours/Week	**3** **1**	**CCE :** 50 Marks **ESE :** 50 Marks **TW :** 25 Marks **OR :** 25 Marks

Prerequisite Courses:

- Basics of project management.

Course Objectives:

- To acquire knowledge of basic management practices adopted in civil engineering by using various techniques and software's.
- To acquaint knowledge of various aspects relayed work-study.
- To understand aspects of site safety and administration.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Apply knowledge of Management in construction projects.

CO2: Analyze project scheduling using various techniques.

CO3: Evaluate various project monitoring techniques.

CO4: Apply knowledge of work-study on construction sites to improve productivity.

CO5: Evaluate safety norms in the construction site and decide incentive scheme.

Course Contents

UNIT-I: Basics of Management **08 Hours**

Modern scientific management (Contribution by Fayol, F.W. Taylor , Mayo), Management functions, Management styles, SWOT analysis in construction, Basic forms of organization with emphasis on project and matrix structures; project life cycle, qualities, role and responsibilities of project manager, role of project management consultants.

UNIT-II: Project Scheduling **08 Hours**

Work breakdown structure, activity cost and time estimation in CPM, PERT, RPM (Repetitive Project Modeling) techniques. LOB technique, Mass haul diagrams. Precedence Network Analysis.

UNIT-III: Project Monitoring and Software **08 Hours**

Monitoring and control, Crashing, Resource Levelling, Updating, software in Construction scheduling (MSP, primavera, Construction manager), Enterprise Resource Planning (ERP). Introduction to artificial intelligence technique ANN, Fuzzy Logic, Genetic Algorithms.

UNIT-IV: Work Study **08 Hours**

Definition, objectives, basic procedure, method study and work measurement, work study applications in civil engineering. Method study – definition, objective, procedure for selecting the work, recording facts, symbols, flow process charts, multiple activity charts, string diagrams. Work measurement – time and motion studies, concept of standard time and various allowances, time study, equipment performance rating.

UNIT-V: Construction Safety and Administration of Incentive Schemes **08 Hours**

Causes of accidents on various sites, safety measures and safety policies to be adopted, determination of safety parameters, and personal protective equipment. Workmen compensation Act, Minimum Wages Act, Hazard Identifications and Control Techniques - HAZOP, FMEA, and FMECA. Cost of construction injuries - legal implications. Necessity, merit rating, job evaluation, installation, modification and maintenance of incentive schemes based on implementation experience.

Learning Resources:

Text Books:

1. Total Quality Management P. N. Mukharjee
2. Total Quality Management by N.V.R Naidu, G. Rajendra New Age international ,First Edition, Jan 2006
3. Total Quality Management by R.S Naagarazan ,New Age international,3e, 2015.

Reference Books:

1. Construction Planning & management By P S Gahlot & B M Dhir , New Age International Limited Publishers.
2. Construction Management – Roy, Pilcher
3. Construction Management – O'Brien
4. Project Management-Planning and Control---Rory Burkey 4th Ed.—Wiley, India
5. Work study – Currie.
6. Project Management – K Nagrajan – New Age International Ltd.

Web link for MOOC / NPTEL Links:

1. https://archive.nptel.ac.in/courses/105/104/105104161/
2. https://archive.nptel.ac.in/courses/105/103/105103093/

List of Assignments

1. Assignment on Work Breakdown structure.
2. Assignment on PERT.
3. Assignment on CPM and calculation of float.
4. Assignment on using MS Excel, MS Project software.
5. Assignment on ERP software.
6. Assignment on work study.
7. Assignment on safety practices in the construction industry- A case study.
8. Assignment on ANN, Fuzzy Logic, Genetic, Algorithms in the construction industry- A case study.

Course Code: 205103	Course Name: Construction Technology	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 3 Hours/Week	**3**	**CCE : 50 Marks** **ESE : 50 Marks**

Prerequisite Courses:

- Building Construction and Materials, Concrete Technology, Geo-technical and foundation Engineering.

Course Objectives:

- To explain different methods and techniques in the construction of deep foundations.
- To illustrate different construction processes with recommended specifications.
- To develop students in the area of construction technology.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Evaluate the appropriate techniques involved in pile construction.

CO2: Explain the type of coffer dam, caissons and diaphragm wall.

CO3: Describe methods of underwater construction and grouting.

CO4: Evaluate high rise construction & Pre-Engineered Building techniques.

CO5: Describe techniques in bridge construction and tunneling.

Course Contents

UNIT-I: Pile Construction Techniques 08 Hours

Introduction, uses, selection of piles, Classification of piles, pile driving techniques and equipment, grouping of piles, efficiency of group of piles, pile cap and pile shoe, loads on piles and pile testing, causes of failures of piles and precautionary measures, Use of NDT in pile construction.

UNIT-II: Coffer Dams, Caissons & Diaphragm Wall Construction 08 Hours

Types and selection of cofferdams, design features and construction of coffer dams, construction of single, double wall, Sheet pile cofferdams, concrete wall movable cofferdam. Types and uses of caissons, construction material, loads on caisson, Construction techniques used in pneumatic and precast caissons, floating, sinking and tilting of caissons, and caisson diseases. Diaphragm wall construction, soldier construction method, Leakage prevention and economic considerations.

UNIT-III: Underwater Excavation, Dewatering Techniques & Grouting 08 Hours

Underwater excavation problems, challenges and solutions, underwater drilling and blasting, grouting methods: jet grouting and chemical grouting, dewatering in shallow and deep

excavations, vacuum dewatering and well point system, electro-osmosis and injection techniques, freezing process and vibro-flotation.

UNIT-IV: High Rise Construction and PEB Techniques 08 Hours

Prefabrication in high-rise construction, shuttering/formwork systems for high-rise buildings, scaffold systems and safety measures, formwork for special structures, ready mix concrete plant erection and concrete pumping, slip forming and aluform techniques, high-rise construction maintenance practices, construction & erection process of pre-engineered buildings.

UNIT-V: Techniques in Bridge Construction and Tunneling 08 Hours

Different methods of bridge construction, launching of bridges by incremental launching, using false work and balanced cantilever construction method. Tunnel alignment, size and shape of a tunnel, tunneling in hard and soft strata, tunnel shaft-sinking and construction, techniques in tunnel lining, ventilation and lighting systems in the tunnel, advance techniques for tunnel maintenance, micro tunneling.

Industrial Visit:

1. Visit the site for pilling work/ High-Rise Building / Pre-Engineered Building site / Bridge Construction sites.

Learning Resources:

Text Books:

1. S.P. Arora and S.P. Bindra, A Text Book of Building Construction, Dhanpat Rai & Sons, New Delhi.
2. S.K. Sarkar and S. Saraswati, Construction Technology, Oxford University Press, New Delhi.
3. B.C. Punmia, Building Construction, Laxmi Publications, New Delhi.
4. S.C. Rangwala, Building Construction, Charotar Publication Pvt Ltd. Anand.
5. Construction Equipment Planning and Applications – Dr. Mahesh Varma
6. Bridge Engineering- S. Ponnuswamy.

Reference Books:

1. Construction Planning, Equipment and Methods – Peurifoy- Tata McGraw Hill Publication
2. Construction Technology by Roy Chudley and Roger Greeno, Prentice Hall, 2005.
3. Journals such as CE & CR. Construction world, International Construction.
4. Dr. Kumar Niraj Jha, — Formwork for Concrete Structures, McGraw Hill Publication.

Weblink for MOOC / NPTEL Links:

1. https://www.coursera.org/specializations/piling-construction-and-practices.

Course Code: 205104	Course Name: TQM in Construction	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 3 Hours/Week	**3**	**CCE : 50 Marks** **ESE : 50 Marks**

Prerequisite Courses:

- Project Management, Construction Management.

Course Objectives:

- To implement TQM and describe role of its techniques for achieving TQM in the construction industry.
- To get acquainted knowledge of ISO 9001 and ISO 9004, training and development of human resources. To describe and discuss the role of techniques used in TQM and TPM in the construction industry.

Course Outcomes:

After successful completion of the course, the learner will be able to:

CO1: To implement the basic concept and framework of Total Quality management in construction.

CO2: To describe and discuss the role of techniques used in TQM.

CO3: To prepare a checklist for RCC Work using training and development of human resources.

CO4: To get acquainted knowledge of ISO 9004 and related quality system standards and application of six sigma.

CO5: To analyze different types of construction defect.

Course Content:

UNIT-I: Concept of Quality **08 Hours**

Definition of quality as given by Deming, Juran, Crosby, and Quality Gurus, difference between Quality control and quality Assurance (QA/QC). Total quality control (TQC) and Total Quality Management (TQM), Need for TQM in the construction industry, Quality Manual, Responsibility matrix, monitoring for quality- PDCA Cycle.

UNIT-II: Quality Control tools and statistical quality Control **08 Hours**

Histogram, Pareto diagram, Fishbone diagram, Quality control chart-Testing required for quality control of construction material used in RCC Work- destructive and Non-Destructive Test (NDT) Statistical Quality Control- Necessity, Benchmarking, and Application of dispersion methods in quality control of construction activity.

Quantitative Techniques: Failure Mode Effect Analysis (FMEA), Kanban, Activity Based Costing (ABC). Taguchi Methods.

UNIT-III: Training and development of Human Resources 08 Hours

Training needs assessment and preparation for training. Training, Project Rework Reduction Tool (PRRT) software, training for preparation of checklist necessary for RCC work for commonly used formats. Development of quality circles, quality inspection team, inspection reports, monitoring and control, 360‘feedback for quality.

UNIT-IV: ISO 9004- Quality System Standards, Six Sigma 08 Hours

Purpose of ISO standards. Difference between ISO 9001 and ISO 9004. Certification process for ISO 9001. Certification bodies involved. Eight principles of ISO. Management support and commitment are necessary for achieving the implementation of quality system standards.

Six Sigma: Definition of six sigma, evolution, historical aspects, six sigma training, application of six sigma tool.

UNIT-V: Achieving TQM in Construction 08 Hours

Advantages, barriers, principles, steps in implementation, seven types of construction defects. Determining cost of poor quality including hidden cost. Quality functions deployment (QFD). Importance of third-party quality audits. CIDC CQRA quality rating systems, customers satisfaction surveys, non-conformity reports (NCR), remedial strategy for reducing NCR‘s. Kizen,5 ‘S.

Learning Resources:

1. Total Quality Management P. N. Mukharjee.
2. Total Quality Management by N.V.R Naidu, G. Rajendra New Age international, First Edition, Jan 2006.
3. Total Quality Management by R.S Naagarazan, New Age international, 3e, 2015.

Text Books:

1. Construction Planning & management By P S Gahlot & B M Dhir , New Age International Limited Publishers.
2. Construction Management – Roy, Pilcher.

Reference Books:

1. International Standards Organization – ISO 9001 and ISO 9004
2. Mantri Handbook – A to Z of Construction – Mantri Publications
3. Juran‘s Quality Handbook – Joseph M. Juran, A. Blanton. Godfrey – McGraw Hill

International Edition (1998)

4. Probability and Statistics for Engineers – Miller, Freund-Hall, Prentice India Ltd.
5. Quality Control and Total Quality Management, P. L. Jain, Tata McGraw Hill Publ.

Web link for MOOC / NPTEL Links:

1. https://onlinecourses.nptel.ac.in/noc21_mg03/preview

Course Code: 205105A	Course Name: Sustainable Construction Materials	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical :** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Basic civil engineering, Concrete technology, Material testing, Building materials.

Course Objectives:

- To analyze the properties of common construction materials and their behavior under various environmental conditions.
- To explore the range of sustainable materials available in the market and assess their applications.
- To understand the properties, mechanical tests, and quality control measures for high-performance concrete.
- To comprehend the principles of sustainability in relation to sustainable building materials and conventional engineered building products.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Analyze the properties and environmental impact of sustainable construction materials.

CO2: Evaluate advanced concrete technologies and their application in sustainable construction.

CO3: Select appropriate recycled and emerging materials for enhancing sustainability in projects.

CO4: Design energy-efficient buildings integrating renewable energy solutions.

CO5: Apply green building standards and energy codes to achieve sustainable construction certifications.

Course Contents

UNIT-I: Fundamentals of Sustainable Construction Materials 11 Hours

Introduction to sustainable construction materials and their role in modern construction. Composition, properties, production methods, storage and distribution of sustainable materials. Economic considerations, testing methods, acceptance criteria and recent developments in sustainable construction materials. Overview of recent market trends in sustainable construction materials and their environmental impacts.

UNIT-II: Advanced and Innovative Concrete Technologies 11 Hours

Role of construction chemicals and admixtures in sustainable construction. Utilization of supplementary cementitious materials like fly ash, silica fume, and self-compacting concrete. Innovative concrete technologies, including fiber-reinforced concrete, lightweight concrete and high-performance concrete. Nanotechnology applications in concrete, ferrocement technology. Aerated Concrete, Hempcrete, Papercrete, Fibre Reinforced Concrete, Permeable Concrete. CO_2 absorbing concrete.

UNIT-III: Recycled and Emerging Materials in Construction 10 Hours

Use of construction and demolition waste in concrete production. Applications of industrial waste materials for construction. Emerging materials in sustainable construction. Carbon Negative **Building Materials:** Traditional Building Materials, Alternate Building Materials, Introduction – environmentally friendly, reliable and durable Building Materials, Nano-cellulose composite brick, Agro bricks (Date Palm Fibres, Rice Husk , Rice Husk Ash), Ecobind tiles. **Smart Building Materials**: Types, Facade systems, smart windows, liquid crystal panels, photochromics, electrochromics, suspended particle panels, thermotropic, thermochromics.

UNIT-IV: Sustainable Building Practices 10 Hours

Integration of Building Integrated Photovoltaics (BIPV) and other renewable energy technologies in buildings. Principles of energy efficiency, including concepts like Overall Thermal Transfer Value (OTTV). Use of renewable energy sources and energy optimization in sustainable construction. Lighting systems - Optimization of lighting systems, Adhesion-changing smart materials - Photo-adhesive smart materials, Titanium Di-oxide Products, Thermochromics, Magnetorheological and electrorheological, Thermotropic, Shape memory Phototropics, Mechanochromics, Chemochromics.

UNIT-V: Green Building Standards and Energy Codes 10 Hours

Operational energy in the building, role of materials and thermal conductivity, Operational energy reduction and net zero building, Optimization for the design of the building for energy efficiency, Overview of energy codes and their requirements including the Energy Conservation Building Code (ECBC).Green building certification systems such as LEED and GRIHA. Criteria for green performance ratings and their application in sustainable construction practices.

Learning Resources:

Text Books:

1. Carole Ryan, 2011, Traditional Construction For A Sustainable Future, Spon Press
   David Rockwood , 2015 Bamboo Gridshells, Routledge Press

2. Erik K. Lauritzen, 2019, Construction, Demolition and Disaster Waste Management-An Integrated and Sustainable Approach, CRC Press
3. Gajanan M. Sabnis, 2016, Green Building With Concrete Sustainable Design and Construction, CRC Press
4. Engineering Materials –Dr. S. V. Deodhar
5. Building Materials by M L Gambhir, Neha Jamwal, Tata McGraw Hill Publ.
6. Concrete Technology by M. S. Shetty, S. Chand Publ.
7. Concrete Technology by Neville.

Reference Books:

1. Newman, J. and Choo, Ban Sang, Advanced Concrete Technology-Processes, 1st Edition, Elsevier, 2003
2. Newman, J. and Choo, Ban Sang, Advanced Concrete Technology-Constituent Materials, 1st Edition, Elsevier, 2003
3. Kubba, S, LEED Practices, Certification, and Accreditation Handbook, 1st ed. Elsevier, 2010.
4. Ministry of Power, Energy Conservation Building Code 2018, Revised Version, Bureau of Energy Efficiency, 2018,
5. Architectural Energy Corporation, Building Envelope Stringency Analysis, International Institute for Energy Conservation, 2004
6. Indian Building Congress, Practical Handbook on Energy Conservation in Buildings, 1 st ed. Nabhi Publication, 2008.
7. McQuiston, F.C., and Parker, J.D. Heating, Ventilating, and Air Conditioning, Analysis and Design, Fourth Ed. John Wiley & Sons, Inc,1994.
8. Clarke, J.A., Energy Simulation in Building Design, Adam Hilger Ltd. 1985.
9. TERI-Griha's Green Design practices (www.teriin.org/bcsd/griha/griha.htm)
10. Leadership in Energy and Environmental Design (www.usgbc.org/LEED)
11. Article on Residential Green Choice(www.austinenergy.com).

Weblink for MOOC / NPTEL Links:

1. https://onlinecourses.nptel.ac.in/noc19_ce40/preview
2. https://onlinecourses.nptel.ac.in/noc24_ar20/preview

List of Assignments:

1. Analyze two sustainable construction materials. Include their properties, production processes, economic considerations, recent market trends, and a comparative analysis of their advantages and limitations.
2. Conduct an experiment comparing conventional and innovative concrete types (e.g., self-

compacting or high-performance concrete). Discuss materials, methods, test results, and sustainability implications.

3. Write a case study on a construction project using recycled or emerging materials. Cover the project's sustainability goals, material selection, implementation, impacts, and lessons learned.
4. Create a conceptual design for an energy-efficient building with integrated renewable energy systems (e.g., BIPV). Include layout, technology used, energy savings, and design justification.
5. Evaluate a certified green building project (e.g., LEED, GRIHA). Discuss the certification criteria, energy codes, benefits, and areas for improvement.

Course Code: 205105B	Course Name: Disaster Management	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical :** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Construction Management.

Course Objectives:

- To explain various types of natural and manmade disasters and their effects.
- To resolve the challenges in disaster management using technological aids.
- To aware various IT aids, public awareness and their Management.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Apply concepts of disaster to management.

CO2: Explain various aspects of disaster management.

CO3: Organize emergency management programme.

CO4: Organize various public awareness programmes initiated by the government.

CO5: Describe risk identification, risk assessment and disaster mitigation.

Course Contents

UNIT-I: Introduction to Hazard and Disaster 11 Hours

Introduction – hazard and disaster. Concepts of hazard, vulnerability, risks. Different types of disaster: **Natural disasters-** earthquakes, tsunami, floods, drought, landslides, cyclones and volcanic eruptions. Their case studies. Coastal disasters. Coastal regulation zone. **Man-made disaster:** Fire, industrial pollution, nuclear disaster, biological disasters, accidents (road, rail, sea & air) war & terrorism etc. Causes, effects, and practical examples for all disasters.

UNIT-II: Disasters Management 11 Hours

Financing relief expenditure, legal aspects, and rescue operations. Casual management, risk management. Disaster prevention and mitigation. Refugee operations during disasters, human resettlement and rehabilitation issues during and after disasters, role of engineers on disaster management.

UNIT-III: Emergency Management Program 10 Hours

Administrative setup and organization. Hazard analysis, training of personnel, information management, emergency facilities and equipment necessary for public awareness creation, preparation, and execution of the emergency management program Epidemics.

UNIT-IV: Organizations and International Adopted Practices 10 Hours

Organizations: Various organizations registered with the Government and NGOs working for disaster relief-Challenges faced by organizations. International adopted practices, International adopted practices for disaster mitigation. Rules and regulations, monitoring aspects of disaster mitigation programs.

UNIT-V: Methods of Assessment 10 Hours

Methods of assessment of impact of disasters such as an economic impact assessment, social impact assessment, environmental impact assessment, health impact assessment, infrastructure impact assessment, psycho-social impact assessment.

Learning Resources:

Text Books:

1. R. Nishith, Singh AK, Disaster Management in India: Perspectives, issues and strategies New Royal book Company.
2. Sahni, Pardeep et.al. (Eds.), Disaster Mitigation Experiences and Reflections, Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies, Deep &Deep Publication Pvt. Ltd., New Delhi.

Reference Books:

1. Construction Engineering and Management – Seetharaman.
2. Project Management, K Nagarajan (New Age International Ltd.)
3. NICMAR Publications.
4. CECR's Journals.

Weblink for MOOC / NPTEL Links:

1. https://onlinecourses.swayam2.ac.in/cec24_hs83

List of Practicals:

1. Case study on natural Disaster including GI Tag Photo of disaster.
2. Assignment on Disaster Management including Financing relief expenditure, legal aspects, rescue operations.
3. Prepare flow chart on Emergency Management program considering any Real-time example.

4. Assignment on Organizations including in Disaster Management & internationally adopted practices in Disaster Management.

Course Code: 205105C	Course Name: Retrofitting of Structures	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical :** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Building Construction, Concrete Technology, Advanced Concrete Technology.

Course Objectives:

- To impart knowledge about the maintenance and retrofitting of structures
- To acquire knowledge about repairs, rehabilitation and damage assessment
- To enable the students to understand the repair materials and techniques.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Evaluate the cause of deterioration of concrete structures.

CO2: Assess the damage and design the plan to repair.

CO3: Assessment of factor influencing on serviceability and durability of structures.

CO4: Decide the various techniques of retrofitting of structures.

CO5: Recognize good materials for repair and retrofitting technique.

Course Contents

UNIT-I: Introduction to Retrofitting of Structures 11 Hours

Definition for Repair, Retrofitting, Strengthening and rehabilitation. Importance of retrofitting, Physical and Chemical Causes of deterioration of concrete structures. Rehabilitation studies of buildings, underground construction, bridges, highways, sewage treatment plants – masonry work, R.C.C works, and steel structures.

UNIT-II: Damage Assessment 11 Hours

Purpose of assessment, rapid assessment, investigation of damage, evaluation of surface and structural cracks, damage assessment procedure, destructive, non-destructive, and semi-destructive testing systems.

UNIT-III: Influence on Serviceability and Durability 10 Hours

Effects due to climate, temperature, chemicals, wear and erosion, design and construction errors, corrosion mechanism, effects of cover thickness and cracking, methods of corrosion protection,

corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection. Factors influencing serviceability such as material properties, load conditions, design and construction quality, etc. Factors influencing durability such as material selection, environmental exposure, and protective measures etc. Relationship between serviceability and durability.

UNIT-IV: Maintenance and Retrofitting Techniques 10 Hours

Facts of maintenance and importance of maintenance, need for retrofitting, types of retrofitting such as structural retrofitting, energy efficiency retrofitting, seismic retrofitting, retrofitting of various RC structural members, study of different retrofitting techniques like externally bonding technique (ERB), near surface mounted (NSM) technique etc. Guidelines for seismic rehabilitation of the existing building.

UNIT-V: Materials for Repair and Retrofitting of Earthquake Damages Building 10 Hours

Types of FRP like CFRP, GFRP, AFRP, BFRP, and use of natural fibre like Sisal and Jute. Adhesives like Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Gunite and Shot-Crete, epoxy injection, mortar repair for cracks, shoring and underpinning. Construction chemicals based on nano-technology methods of seismic retrofitting, restoration of buildings, effects of earthquakes, response of buildings to earthquake motion, factors related to building damages due to earthquake, maintenance of rehabilitated structures.

Learning Resources:

Text Books:

1. Sidney, M. Johnson, Deterioration, Maintenance and Repair of Structures, McGraw Hill
2. Denison Campbell, Allen & Harold Roper, Concrete Structures Materials, Maintenance and Repair Longman Scientific and Technical.
3. Technology of Building Repairs, Raikar R N, Bombay Technology of Building Repairs 1973.
4. Construction, Maintenance and Restoration and Rehabilitation of Highway Bridges, K. S. Rakshit
5. Modi, P.I., Patel, C.N. (2016). Repair and Rehabilitation of Concrete Structures, PHI India, New Delhi.

Reference Books:

1. IABSE, (2010). Case Studies of Rehabilitation, Repair, Retrofitting, and Strengthening of Structures, Volume 12, Structural Engineering Documents (SED), Switzerland.
2. Varghese, P.C. (2014), Maintenance, Repair & Rehabilitation and Minor Works of Buildings, PHI India, New Delhi.

3. Bhattacharjee, J. (2017), Concrete Structures Repair Rehabilitation and Retrofitting, CBS Publishers & Distributors, New Delhi
4. Maintenance & Repairs of Buildings, P. K. Guha, New Central Book Agency (P) Limited, 2011.
5. R.T. Allen and S.C. Edwards, Repair of Concrete Structures-Blakie and Sons.
6. Raiker R.N., Learning for failure from Deficiencies in Design, Construction and Service- R&D Center (SDCPL).
7. Concrete Structures Protection Repair and Rehabilitation, R. Dodge Woodson, Elsevier Publication.
8. Retrofitting of Concrete Structures by Externally Bonded FRP's-CEB-FIP, Technical report.
9. Handbook on repair and rehabilitation of RC structure by –CPWD.

Weblink for MOOC / NPTEL Links:

1. https://archive.nptel.ac.in/courses/105/105/105105213/
2. https://www.youtube.com/watch?v=WZixd9UhW3w

List of Practicals:

1. Assignment on damage assessment.
2. Assignment on maintenance and retrofitting Techniques.
3. Collection and comparative study of retrofitting materials.
4. Case study presentation by an individual on any topic from the above syllabus.
5. Site visit of the structure under retrofitting details report on causes of distress of structure and type of retrofitting, material used in retrofitting.

Course Code: 205105D	Course Name: Construction Safety	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical :** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Basic civil engineering techniques, materials, plants and equipment.

Course Objectives:

- To acquaint students with industry-specific safety laws, standards and regulations governing construction sites.
- To identify potential hazards in construction projects and develop preventive measures.
- To gain proficiency and to comply with all the statutory requirements of construction safety

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Apply the principles of safety in construction.

CO2: Implement safety management systems that ensure continuous monitoring, evaluation and improvement of safety practices.

CO3: Suggest safety measures for handling of construction material.

CO4: Develop and deliver effective safety programs on construction sites.

CO5: Analyze accident data and trends to identify areas for improvement in safety practices.

Course Contents

UNIT-I: Introduction to Health and Safety in Construction 11 Hours

Basic definitions of health, safety, welfare and environment; need for maintaining good standards of health, safety welfare and environment, human factors contributing to accidents, government's policy in industrial safety; safety & health legislation in India, construction sites (safety) regulations.

UNIT-II: Codes of Practice 11 Hours

Safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety at various stages of construction. Prevention of accidents. Safety measures. Safety in use of construction equipment e.g. vehicles, cranes, hoists and lifts etc. safety of scaffolding and working platforms.

UNIT-III: Construction Materials Handling 10 Hours

Manual handling of materials: Basic principle of correct lifting and handling of materials maximum loads that may be carried; lifting and carrying of objects of different shapes, size and weights, safe use of accessories for manual handling; ergonomics consideration, mechanical. **Handling of materials:** Lifting machinery, lifts and hoists, conveyors; stacking, storage and handling of construction materials: general considerations for stacking and storage-planning for storage layout.

UNIT-IV: Construction Safety Management 10 Hours

Safety organization, site management, role of the safety department, safety officer, safety committee. Introduction to safety checklist, site safety inspection, safety tag system, safety audit report objective of safety audit and training, safety incentives and safety manuals.

UNIT-V: Accident Prevention 10 Hours

Principles of accident prevention, job safety analysis, fault tree analysis, accident management, accident count, hazards of construction and their prevention, fire safety, electrical hazards.

Learning Resources:

Text Books:

1. Construction Project Management: Theory and Practice"* by K. K. Chitkara
2. Construction Safety, by R.K. Mishra, AITBS Publisher
3. Construction Safety Management, 1st Edition, by Kumar Neeraj Jha/ Dilip A Patel/ Amarjit Singh, Pearson Publication.

Reference Books:

1. Construction safety manual published by National Safety Commission of India.
2. Safety Management in Construction Industry – A manual for project managers. NICMAR
3. Construction Safety Handbook – Davies V. S. Thomasin K, Thomas Telford, London.
4. IS Codes for safety in Construction – Bureau of Indian Standards.
5. Construction Safety Management and Engineering, by Darryl C. Hill and David V. McCollum, ASSE
6. Safety and Health for Engineers, by Roger L. Brauer, Wiley.

Weblink for MOOC / NPTEL Links:

1. https://www.edx.org/executive-education/university-of-cape-town-occupational-health-and-safety?index=product&queryID=58b13eff038748a447cfdf04f75f4d31&position=1&results_level=first-level-results&term=safety&objectID=course-cbb17299-3740-4bfe-aa67-3ac8e36ebb9c&campaign=Occupational+Health+and+Safety&source=2u&product_category=executive-education&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch
2. https://onlinecourses.nptel.ac.in/noc21_ce16/preview

3. https://www.edx.org/executive-education/university-of-cape-town-construction-management?index=product&queryID=58b13eff038748a447cfdf04f75f4d31&position=3&results_level=first-level-results&term=safety&objectID=course-1bdbf677-b0c2-44b8-9b75-b8b682616626&campaign=Construction+Management&source=2u&product_category=executive-education&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch

List of Practicals:

1. Report on safety codes available.
2. Accident prevention measures.
3. Laws related to construction safety and compensation act.
4. Report on safety audits.
5. Site visit to understand the implementation of safety measures on site.

Course Code: 205105E	Course Name: Building Services and Maintenance	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical :** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Building Construction, Architectural Planning and drawing, Construction Materials.

Course Objectives:

- To acquaint knowledge in the design, operation, and maintenance of building services systems, including HVAC, plumbing, electrical, fire protection and vertical transportation.
- To enable students to integrate these systems effectively into building designs, ensuring they operate efficiently, safely and sustainably throughout the building's lifecycle.
- To develop and implement maintenance strategies that optimize system performance, reduce operational costs and extend the lifespan of building services.

Course Outcomes:

On completion of the course, learner will be able to:

CO1: Demonstrate comprehensive knowledge of various building services systems, including HVAC, plumbing, electrical, fire protection, and vertical transportation.

CO2: Identify common issues in building services systems, utilizing technical knowledge and problem-solving techniques.

CO3: Design efficient plumbing and firefighting systems in buildings, ensuring the safety, reliability, and sustainability of these critical infrastructure components.

CO4: Explore the role of technology for smart building systems and building management Systems (BMS).

CO5: Implement effective maintenance strategies, including preventive, predictive, and corrective maintenance, to ensure the longevity and efficient operation of building services.

Course Contents

UNIT-I: Introduction to Building Services **11 Hours**

Importance of material management and its role in the construction industry: scope, objectives and functions, integrated approach to materials management, role of materials manager, materials procurement, codification and standardization, vendor development, suppliers evaluation, purchase procedure.

UNIT-II: Mechanical and Electrical Services 11 Hours

HVAC systems, Refrigeration systems, fire protection systems, elevator and escalator systems. Power distribution and electrical systems, lighting systems (natural and artificial lighting, emergency power systems (generators, UPS systems), energy management and conservation techniques.

UNIT-III: Plumbing and Fire Safety Services 10 Hours

Cold and hot water supply systems, drainage and sewage systems, water conservation methods, rainwater harvesting systems, fire detection and alarm systems, firefighting systems (sprinklers, hydrants, security systems (CCTV, access control), building evacuation and safety protocols.

UNIT-IV: Building Management Systems 10 Hours

Introduction to building management systems (BMS), automation in HVAC, lighting and security systems, smart buildings and IoT integration, energy monitoring and control. Role of facility managers in building services. Space management and utilization, health and safety management in buildings, legal and regulatory considerations in building maintenance.

UNIT-V: Maintenance Strategies 10 Hours

Types of maintenance (preventive, predictive, reactive), maintenance planning and scheduling, asset management and lifecycle costing, condition monitoring and diagnostics, sustainable building practices and green technologies, energy-efficient systems and renewable energy integration, waste management and recycling in buildings.

Learning Resources:

Text Books:

1. A textbook on Building Services R. Uday kumar Eswar Press, Chennai.
2. Building Services S. M. Patil, Seema Publication, Mumbai Revised edition.
3. National Building Code of India - 2005 Bureau of Indian Standards BIS, New Delhi.
4. Maintenance of Buildings, by A.C. Panchdhari, New Age International, 2006.

Reference Books:

1. Building Construction Dr. B. C. Punmia Laxmi Publications (P) Ltd., New Delhi.
2. Building Construction P. C. Varghese PHI Learning (P) Ltd., New Delhi
3. Building repair and Maintenance Management P. S. Gahlot CBS Publishers and Distribution(P) Ltd
4. Maintenance of Buildings—A. C. Panchodhari—New Age International Publishers.
5. Building Services Engineering, by David Chadderton, by Routledge, 2012.

Weblink for MOOC / NPTEL Links:

1. https://onlinecourses.swayam2.ac.in/nou21_ce04/preview#:~:text=By%20Dr.%20Munish%20Kumar%20Bhardwaj%20%7C%20Indira%20Gandhi%20National%20Open
2. https://onlinecourses.nptel.ac.in/noc20_ce09/preview#:~:text=Fire%20Protection%20Services%20and%20Maintenance%20Management%20of%20Building.%20By%20Prof.

List of Practicals:

1. Develop a detailed plan that includes HVAC, plumbing, electrical, fire protection, and vertical transportation systems.
2. Perform a cost-benefit analysis to evaluate the financial viability of the potential energy savings, payback period, and impact on building performance.
3. Perform a lifecycle cost analysis (LCCA), including initial installation costs, operational costs, maintenance costs, and eventual replacement or disposal costs.
4. Suggest smart technologies for any selected existing building.
5. Case study on applications of advanced technologies (BIM, IoT, AI) in building projects.

Course Code: 200106	Course Name: Human Rights – 1	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Tutorial : 1 Hours/Week	**1**	**TW :** 25 Marks

Expected Prerequisite Courses: Nil

Course Objectives:

- To familiarize students with the concept, nature, and evolution of human rights and duties.
- To sensitize students, to the interdependence of rights and duties across personal, social, and global contexts.
- To highlight legal instruments, and role of UN agencies in human rights promotion.
- To promote awareness about international human rights instruments such as the Universal Declaration of Human Rights (UDHR) and the role of United Nations.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Explain the concept, nature, and evolution of human rights and duties.

CO2: Discuss the relationship between rights and duties at individual, societal, and global levels.

CO3: Explain legal instruments and their framework.

CO4: Describe International perspectives of human rights, and summarize UN system and human rights bodies.

Course Contents

UNIT-I: Basic Concepts **04 Hours**

Significance of values and their linkage with human rights, human values: dignity, liberty, equality, justice, ethics, morals, unity in diversity. Meaning and significance of human rights education, objectives and models of human rights education.

UNIT-II: Perspective of Rights and Duties **04 Hours**

Concept, meaning, and analysis of rights, types of rights: natural, legal, claim, liberty, positive and negative, individual and group, universal rights, concept and types of duties: moral, legal, positive, negative, perfect, imperfect, relationship between rights and duties, role of national law and responsibilities of individuals and states.

UNIT-III: Legal Instruments and Framework 04 Hours

Introduction of legal instruments and their binding nature. Human rights and Indian Constitution, International legal instruments: charter, conventions covenant, declaration, treaties, protocols, resolutions executive orders, and statutes. Role of UN agencies and international conferences in human rights promotion.

UNIT-IV: United Nations and Human Rights 04 Hours

International and national perspectives of human rights. Overview of the UN system and human rights bodies, Universal Declaration of Human Rights (UDHR): background, significance, and analysis of key articles, human rights and fundamental freedoms: equality, liberty, social justice, and dignity, contemporary challenges and the way forward.

Term Work

Term work shall consist of handwritten a minimum of 08 assignments (Two per unit). The course teacher will decide the assignments based on the content.

Learning Resources:

Text Books:

1. Introduction to Human rights and duties by Dr. T.S.N. Sastry Published by SPPU, Pune.
2. Human rights of vulnerable and disadvantaged groups by Dr. T.S.N. Sastry Published by SPPU, Pune.
3. P.K. Pandey (Ed) Human Rights , APH Publishing Corporation, 2012.

Reference Books:

1. Andrew Clapham : Human Rights Lexion, Oxofrd University Press; 2005.
2. Andrew Clapham:Human Rights A very short Introduction; 2007, Oxford University Press.
3. Magdalena Sepulveda and others: Human Rights : Hand Book, 2004 University for Peace of the United Nations.
4. Human rights and Vulnerable Groups available at http://www.sagepub.com/upmdata/11973_Chapter_5.pdf
5. Vulnerability and Vulnerable Groups; available at http://siteresources.worldbank.org/INTSRM/Publications/20316319/RVA.pdf

Web link for MOOC / NPTEL Links:

1. https://www.youtube.com/watch?v=Y-yBzlNHIyk
2. https://www.youtube.com/watch?v=wDWPiWAJplA

Semester - II

Course Code:205201	Course Name: Sustainability in Construction Projects	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week	**4**	**CCE : 50 Marks** **ESE : 50 Marks**

Prerequisite Courses:

- Basic knowledge about sustainability and environmental impact.

Course Objectives:

- To acquire knowledge of recent innovative approaches and technologies to reduce environmental footprint and improve the sustainability of construction projects.
- To get acquainted with environmental laws.
- To acquire details about the design and delivery of sustainable construction projects.
- To explain efficient energy building services.
- To understand the framework required to assess sustainability in construction projects,

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Understand climate change and the need for environmental management systems.

CO2: Understand the environment and pollution control laws.

CO3: Apply the knowledge of design and delivery of sustainable construction projects.

CO4: Design energy-efficient services in buildings.

CO5: Evaluate the extent of sustainability of built-assets through sustainability rating systems.

Course Content:

UNIT-I: Introduction to Sustainability **11 Hours**

Introduction-Implication of development projects on the climate change, eco- system- land, water and air; environment and ecology. Protocol and Policies in Climate Change Mitigation. Role of Construction industry and built environment in sustainable development.

UNIT-II: Environment and Pollution Control Laws **11 Hours**

Rules and regulations and laws governing energy, conservation in India and developed Nations-Energy Conservation Act 2001, Revisions and present state of implementation standardization and labeling, Electricity Act 2003, Revisions and present status of implementation.

UNIT-III: Designing and Delivering Sustainable Construction Projects 10 Hours

Green Construction: Introduction, Definition, Need, Principles, and Key terminologies, Green buildings and infrastructure, Circular economy principles to design and construct green buildings: materials, energy, water and construction and demolition (C&D) waste perspective, Green building commissioning, High performance, Net Zero and Net positive buildings.

UNIT-IV: Energy Efficient Services 10 Hours

Energy building design-Energy efficient and environmentally friendly building, Thermal phenomena, thermal comfort, indoor air quality, climate, sun and solar radiation, Psychometrics, passive heating and air cooling systems, Energy analysis, active HVAC Systems, preliminary investigation, goals and policies, energy audit, types of wastage, priority of conservative measures, maintenance of energy program.

UNIT-V: Framework for Assessing Sustainability in Construction Projects 10 Hours

Preparation of EIA report for projects; Involuntary dislocation, guidelines of the World Bank and other funding agencies, ISO 14001. Codes, Standards, Rating and Certification Systems for Green Construction: Indian and International Perspective, Green Rating frameworks, for Buildings (IGBC, GRIHA, LEED etc.), Green Rating frameworks for Infrastructure (CEEQUAL, Green roads.

Learning Resources:

Text Books:

1. Environmental Impact Assessment and Audit by Larry W. Canter Environmental, Tata McGraw Hill.
2. Environmental Monitoring and Characterization by Artiola CBS Publishers 2006.
3. Environmental and Pollution Laws in India by Justice T. S. Doabia, I. P. S. Doabia and M. S, S. Doabia, Second Edition 2010.

Reference Books:

1. Environmental Engineering, 4 E by Weiner CBS Publishers 2010
2. Socioeconomic and Environmental Impacts of Biofuels, by Alexandros Gasparatos and per Stromberg, October 2012.
3. Environmental Pollution and Control, 4th Edition, J. Jeffrey Peirce, P Aarne Vesilind and Ruth Weiner, Nov 1997.
4. Financing Energy Efficiency: Forging the Link between Financing and Project Implementation, By Silvia Rezessy and Paolo Bertoldi.
5. Institute Of Energy European Commission, May 2010.

6. Public Procurement Of Energy Efficiency Services Lessons From International Experience by Jas Singh, Dilip R. Limaye, Brian Henderson, And Xiaoyu Shi.
7. Energy Management Handbook By Steve Doty And Wayne C. Turner, 8th Edition
8. Energy Conservation Act 2001, Electricity Act 2003.

Web link for MOOC / NPTEL Links:

1. https://archive.nptel.ac.in/courses/129/106/129106002/
2. https://leap.unep.org/en/countries/in/case-studies/video-lecture-environmental-law-india
3. https://archive.nptel.ac.in/courses/105/102/105102195/

Course Code: 205202	Course Name: Construction Contracts Administration and Management	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 3 Hours/Week **Practical :** 2 Hours/Week	**3** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Project Management and Finance, Tenders and Contracts.

Course Objectives:

- To develop valuable expertise in civil engineers in the construction sector, engineering and analysis are employed.
- To nurture civil engineers with an understanding of Construction Contracts Administration and Management
- To develop civil engineers who are well-versed in the assessment of Construction Contracts Administration and Management.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Infer the construction contracts in projects.

CO2: Explain the contract formation in projects.

CO3: Analyze the contract conditions in projects.

CO4: Analyze the construction claims and understand dispute resolution in projects.

CO5: Explain Conciliation and Arbitration in Projects.

Course Contents

UNIT-I: Construction Contracts **08 Hours**

Indian Contract Act (1872): Definition of the contract as per the ACT. Valid, Voidable, Void contracts, Objectives of the act. **Clauses 1 to 75:** Contract formation, contract performance, valid excuses for nonperformance, Breach of contract, effects of breach- understanding the clauses and applying them to situations/scenarios on construction projects. Importance of the Workmen‘s Compensation Act on construction projects.

UNIT-II: Contract Formation **08 Hours**

Standard Forms of Contracts: methods of inviting tenders, pre-bid meetings, pre-qualification system, scrutiny of tenders, and comparative statements.

Contract Formation: Conditions of contracts, contracts with various stakeholders on major construction projects, contract pricing by the client, project management consultants, and the contractor, contract performance, contract correspondence, and contract closure.

UNIT-III: Contract Conditions and FIDIC **08 Hours**

General conditions and Particular conditions, Conditions of Ministry of Statistics and Program Implementation- Government of India. Model forms of contract. **ICE Conditions**: Introduction, FIDIC conditions - the evolution of FIDIC document, types based on whether the design is of employer or contractor, design and build contract, EPC contract, short forms of contract- colour code. Various conditions of red book.

UNIT-IV: Construction Claims and Dispute Resolution **08 Hours**

Construction Claims: Extra items and causes of claims. Types of construction claims, documentation, settlement of claims.

Dispute Resolution: Causes of disputes and importance of the role of various stakeholders in the prevention of disputes, Alternate dispute resolution methods: mediation, conciliation, arbitration and dispute resolution boards.

UNIT-V: Conciliation & Arbitration **08 Hours**

Indian Arbitration and Conciliation Act 1996: Difference between the 1940 Act and the 1996 Act. Extent of application of 1996 Act. Objectives, general provisions. Composition of the arbitral tribunal, jurisdiction of the arbitral tribunal, duties, power of arbitrators.

Conciliation: Conciliation and its provisions in the Act, Conduct of conciliation and arbitral proceedings, grounds for challenge. Arbitral award and its enforcement. Procedure of appeal against the awards.

Learning Resources:

Text Books:

1. Civil Engineering Contracts and Estimates by B. S. Patil, Universities Press, 2006 Edition reprinted in 2009.
2. Law of contract Part I and Part II, Dr. R.K. Bangia, 2005 Edition, Allahabad Law Agency.
3. Arbitration, Conciliation and Alternative Dispute Resolution Systems, Dr. S. R. Myneni 2004 Edition, reprinted in 2005, Asia Law House Publishers.

Reference Books:

1. The Indian Contract Act (9 of 1872), 1872, Bare Act, 2006 edition, Professional Book Publishers.
2. The Arbitration and Conciliation Act (1996), 1996 (26 of 1996), 2006 Edition, Professional Book Publisher.

3. The Workmen‘s Compensation Act, 1923 (8 of 1923) Bare Act, 2005, Professional Book Publishers.
4. Standard General Conditions for Domestic Contracts - 2001 Edition, Published by Ministry of Statistics and Program Implementation, Government of India.
5. FIDIC Document (1999).
6. Dispute Resolution Board foundation manual, www.drbf.org.

Course Code: 205203	Course Name: Project Economics and Financial Management	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week	**4**	**CCE : 50 Marks** **ESE : 50 Marks**

Prerequisite Courses:

- Project Management and Finance.

Course Objectives:

- Acquire knowledge of economics to facilitate the process of economic decision-making
- Acquire knowledge of basic financial management aspects
- Develop the skills to analyze financial statements.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Acquire knowledge of principles of economics and capital.

CO2: Acquainted with economic analysis and taxation of the corporate sectors.

CO3: Adapt the concept of financial planning and budget.

CO4: Analyze financial statements using ratio analysis, Balance sheet, and profit and loss account statement.

CO5: Apply the concepts of financial management for project appraisal.

Course Content:

UNIT-I: Principles of Economics and Capital 11 Hours

Principles of Economics: Importance of the economic background to measurement, objectives of business firm. Factors bearing on size of firms. Motives to growth. Obstacles to growth of firms, Study of the present economy.

Capital: Analysis of need for working capital, Estimation of requirements of working capital, Credit Management, Cash Management, Corpus Fund.

UNIT-II: Economic Analysis and Corporate Sector 11 Hours

Economic Analysis: Capital investment in project, Cost planning techniques, Cost control during design and construction, depreciation, various appraisal criteria methods. Break-even analysis, Cash flow analysis, Role of Lender‘s Engineer.

Corporate Sector: Corporate tax planning, public policies on ICRA grading of exchange, World financial market, Role of financing institutes in Construction sector, SEBI regulation., GST, CGST, SGST, Direct Tax Court System.

UNIT-III: Financial Planning and Budget **10 Hours**

Financial Planning: Need and sources of Finance, long term finance planning, stock, borrowings, debentures, loan capital, public deposit, dividend policies, bonus shares, market value of shares, and reserves.

Budget: Types of budgets, procedure for master budgets. Budget manual.

UNIT-IV: Construction Accounts **10 Hours**

Accounting process, preparation of profit and loss account and balance sheet as per the Companies Act 2013, Ratio Analysis. Escrow Account for PPP Project.

UNIT-V: Case Studies **10 Hours**

Case studies (any two) for 1) PPP projects, 2) Dams and Canals, 3) Mass Transit System, 5) Government Funded Projects with respect to a) Project Appraisal b) Raising of funds c) Cost to complete analysis.

Learning Resources:

Text Books:

1. Prasanna Chandra, Financial Management‖ (Theory & Practices)
2. Weston & Brigham, Essentials of Managerial Finance.

Reference Books:

1. Construction project scheduling and control, Mubarak, Wiley India.
2. Construction Management & PWD Accounts, D Lal, S. K. Kataria & Sons, 2012
3. Construction Management and Accounts -- Singh H. Tata McGraw Hill, New Delhi, 1988
4. Construction Management: Planning and finance, Cormican D. Construction press, London, Feb 2002.
5. Principles of Corporate Finance, Brealey R.A. Tata McGraw Hill, New Delhi, 2003.
6. Engineering Economics, by Kumar, Wiley, India.
7. Engineering Economy, Leland T. Blank. Anthony Tarquin. McGraw Hill, 2008.
8. Engineering Economics, David Bedworth, Sabah Randhawa. McGraw Hill, 1996.
9. Real Estate, Finance and Investment, Bruggeman. Fishr, McGraw Hill, 2010.
10. Foundations of Financial Management, Block Hirt. McGraw Hill, 2009.
11. Case studies in finance, Burner, McGraw Hill, 2009.

12. Cases in Finance, DeMello McGraw, 2003.
13. The cost management toolbox; A Managers guide to controlling costs and boosting profits. Oliver, Lianabel. Tata McGraw Hill, 1999.
14. Financial Management‖, Indian Institute of Banking and Finance – Macmillan Publications.
15. Projects planning, Analysis Selection, Implementation and Review, Prasanna Chandra, Tata McGraw Hill, New Delhi, 2005
16. Fundamentals of Engineering Economics, by Pravin Kumar, Wiley, India.

Web link for MOOC / NPTEL Links:

1. https://onlinecourses.nptel.ac.in/noc24_mg85/preview

Course Code: 205204A	Course Name: Green Building Design and Construction	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical :** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Building Construction, Sustainable Design Principles, Environmental engineering.

Course Objectives:

- To introduce the fundamental concepts and benefits of green buildings, including key requisites and the role of the Indian Green Building Council.
- To equip students with the skills to design energy-efficient buildings by applying strategies to reduce energy demand and integrate renewable energy sources effectively.
- To introduce various environment-friendly and cost-effective building technologies and materials, enabling students to select and implement innovative construction methods.
- To develop proficiency in material conservation practices, waste management, and indoor air quality improvement, ensuring sustainable and healthy building environments.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Recognize the key requisites for constructing a green building and the essential sustainable features required for effective implementation.

CO2: Apply strategies to reduce energy demand and utilize renewable energy sources in building design.

CO3: Evaluate various eco-friendly building technologies and materials, including alternative construction methods and pre-engineered components.

CO4: Implement waste reduction techniques and select sustainable materials to enhance indoor air quality and overall building performance.

CO5: Assess the application of solar energy and green composites in buildings, focusing on energy efficiency, water management, and waste handling.

Course Contents

UNIT-I: Green Building Concepts and Practices **11 Hours**

Green building, necessity of green building, benefits of green buildings, green building materials

and equipment in India, key requisites for constructing a green building, important sustainable features for green building, Indian green building council, green building moment in India, benefits experienced in green buildings, launch of green building rating systems, residential sector, market transformation; green building opportunities and benefits: opportunities of green building, green building features, material and resources, water efficiency, optimum energy efficiency, typical energy saving approach in buildings, LEED India rating system and energy efficiency.

UNIT-II: Green Building Design 11 Hours

Introduction, reduction in energy demand, onsite sources and sinks, maximize system efficiency, steps to reduce energy demand and use onsite sources and sinks, use of renewable energy sources. Ecofriendly captive power generation for factory and building requirements.

UNIT-III: Environment-Friendly and Cost-effective Building Technologies 10 Hours

Different substitutes for wall construction Flemish Bond , Rat Trap Bond – Arches – Panels , Cavity Wall, Ferro Cement and Ferro Concrete constructions – different pre-cast members using these materials , Wall and Roof Panels – Beams – columns, Door and Window frames, Water tanks, Septic Tanks, Alternate roofing systems, Filler Slab, Composite Beam and Panel Roof, Pre-engineered and ready to use building elements, wood products, steel and plastic, Contributions of agencies – Costford , Nirmithi Kendra , Habitat.

UNIT-IV: Material Conservation 10 Hours

Handling of non-process waste, waste reduction during construction, materials with recycled content, local materials, material reuse, certified wood, rapidly renewable building materials and furniture; indoor environment quality and occupational health: air conditioning, indoor air quality, sick building syndrome, tobacco smoke control, minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, measure of IAQ, reasons for poor IAQ, measures to achieve acceptable IAQ levels.

UNIT-V: Utility of Solar Energy and Green Composites in Buildings 10 Hours

Utility of Solar Energy: Utility of solar energy in buildings concepts of solar passive cooling and heating of buildings. Low energy cooling. Case studies of solar passive cooled and heated buildings.

Green Composites for Buildings: Concepts of green composites. Water utilization in buildings, low energy approaches to water management. Management of solid wastes. Management of sullage water and sewage. Urban environment and green buildings. Green cover and built environment.

Learning Resources:

Text Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air Conditioning Engineers, 2009.
2. Green Building Handbook by Tomwoolley and Samkimings, 2009. Industrial Organization & Engg. Economics, T.R.Banga, S.C.Sharma, Khanna Publ.
3. Green Building Materials: A Guide to Product Selection and Specification, 3rd Edition, Ross Spiegel, Dru Meadows
4. Green Building: Principles & Practices, Dr. Adv. Harshul Savla,
5. Green Building Fundamentals, Notion Press, HarharaIyer G.

Reference Books:

1. Complete Guide to Green Buildings by Trish Riley
2. The standard for the Design for High-Performance Green Buildings by Kent Peterson, 2009
3. C.J. Kibert (2008) ―Sustainable Construction: Green Building Design and Delivery‖, 3rd Ed., John Wiley, Hoboken, New Jersey
4. G.T. Miller Jr. (2004) ―Living in the Environment: Principles, Connections, and Solutions‖, 14th Ed., Brooks Cole, Pacific Grove, California.

IS Codes:

1. Handbook on functional requirements of buildings (SP41), Bureau of Indian Standards, New Delhi, New Delhi, 1987.
2. Energy Conservation Building Code (ECBC), Bureau of Energy Efficiency, 2017
3. Sustainable Building Design Manual- Volume I & II, TERI, 2009.
4. Green Rating for Integrated Habitat Assessment (GRIHA) guidelines.

Web link for MOOC / NPTEL / YouTube Links:

1. https://onlinecourses.nptel.ac.in/noc20_ce09/preview#:~:text=Fire%20Protection%20Services%20and%20Maintenance%20Management%20of%20Building.%20By%20Prof.

List of Assignments:

1. Write a report on the benefits and features of green buildings, comparing them with conventional buildings and analyzing the impact of Indian green building rating systems.
2. Create a proposal for a small green building, focusing on reducing energy demand and integrating renewable energy sources.
3. Compare different eco-friendly wall construction techniques, highlighting their environmental and cost impacts.
4. Develop a plan for managing construction waste, emphasizing recycling and use of materials with recycled content.
5. Solar Energy Case Study: Analyze a building with solar passive cooling and heating, detailing its design and energy savings.
6. Site visit to a green building or construction project consists of sustainable design.

Course Code: 205204B	Course Name: Infrastructure Development	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical:** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Transportation Engineering, Building Planning & Construction.

Course Objectives:

- To know the role of Infrastructure in the Nation's Economy.
- To co-relate Budget provisions and construction sector for infrastructure development.
- To describe the role of Public Private Partnership in Economic development.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Explain the role of Infrastructure in the National Economy.

CO2: Co-relate the Indian budget and its relation with respect to any of the Construction sector.

CO3: Explain Government Schemes and Public Private Partnership (PPP) in Infrastructure.

CO4: Identify issues related to infrastructure development and solutions.

CO5: Explain provisions made for infrastructure development.

Course Content:

UNIT-I: Construction Industry 11 Hours

Nature, characteristics, size and structure. Role of infrastructure development in employment generation and improvement of the national economy. Various agencies associated with infrastructure development in India as regards various sectors.

UNIT-II: Status of Infrastructure in India 11 Hours

Road sector port, Railway, communication, water supply and drainage, power sector, oil and industry, health and educational services. Infrastructure development, Indian budget and its relation with infrastructure development projects in India.

UNIT-III: Government Schemes and Public-Private Partnership (PPP) 10 Hours

Various programs related with infrastructure development in rural and urban sector, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), PMGSY – Pradhan Mantri Gram Sadak Yojana, Sagarmala – Sagartat Samridhi Yojana, Deen Dayal Upadhyaya Gram Jyoti Yojana

(DDUGJY), Ports Connectivity Projects, International airport project, status and infra in nuclear power projects in India: concept, definition, benefits; Processes, modules of PPP, draft concession agreement for PPP projects, Escrow Agreement.

UNIT-IV: Issues related to Infrastructure Development 10 Hours

Pre – requisites necessary to ensure success for switching over from public sector management to private sector management, issues in developing, funding and managing infrastructure projects, roles and responsibilities of project management consultants. FDI in Infrastructure development, problem areas and solutions.

UNIT-V: Provisions made for Infrastructure Development 10 Hours

Five-year plans of the Planning Commission Government of India: Overview, NITI Aayog provisions and objectives, Formation of the Indian Infrastructure Development Corporation. SPV's for Infra projects. Detailed study of 20 years plans by Govt. and provisions made for the development of Infrastructure.

Learning Resources:

Text Books:

1. Construction Engineering & management of Projects (For Infrastructure and Civil Works) by S. C. Sharma, Khanna Publishers, 2 Edition, 2011.
2. India Infrastructure Report – Rakesh Mohan.
3. Infrastructure Development in India by Rajarshi Majumder Rawat Publications – 2010.

Reference Books:

1. Document of five year plans, published by Govt. of India.
2. Public Private Partnership in Infrastructure by R. N. Joshi Vision Publications – 2010
3. Journal of the Indian Roads Congress.
4. Infrastructure Today – Magazine.
5. Indian Highways – Journals.

Web link for MOOC / NPTEL Links:

1. https://www.edx.org/learn/construction/the-university-of-maryland-college-park-the-industry-and-profession-in-construction-management?index=product&queryID=65ac5659ae329f08505215c8a8ab6aaa&position=3&results_level=second-level-results&term=Civil+Engineering&objectID=course-6e6e0f90-67b7-4179-b07b-5f0a69c9060f&campaign=The+Industry+and+Profession+in+Construction+Management&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch
2. https://onlinecourses.nptel.ac.in/noc24_ce81/preview

List of Assignments (Any Five):

1. Presentation on any one of: Atma Nirbhar Bharat, MGNREGA, AMRUT, PMGSY, DDU-GKY, PMAY(G), Shyama Prasad Mukherji Rurban Mission (SPMRM), Saansad Adarsh Gram Yojana SAGY, Jawaharlal Nehru National Urban Renewal Mission (JNNURM),Urban Transport, Swachh Bharat Mission, Sagarmala Programme- Port connectivity projects and its New forms.
2. Case study of any Public Private Partnership scheme.
3. Presentation on Infrastructural activities and its effect on GDP in India.
4. Detailed study with respect to objectives of Five-year plan and its provisions for the development of Infrastructure and role of NITI Aayog.
5. Study on features of PM-Surya Ghar Muft BijliYojana
6. Study on features of Pradhan Mantri Kisan Urja Suraksha evam Utthan Mahabhiyan (PM-KUSUM)
7. Study on features of Mukhyamantri Saur Krushi pump Yojana.

Course Code: 205204C	Course Name: Material Management	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical:** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Basic construction materials and its classification, principles of management.

Course Objectives:

- To acquire the knowledge of principles and practices involved in managing construction materials.
- To mastering techniques for efficient procurement, inventory control, and cost management while ensuring materials meet quality and sustainability standards.
- To understand the concept, principles and strategies of supply chain management.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Discuss the role of material management in construction.

CO2: Apply techniques for efficient inventory management.

CO3: Develop strategies for organizing and managing construction material stores, inventory tracking, optimal storage conditions, and the efficient flow of materials.

CO4: Implement quality control procedures for materials, ensuring that all materials meet project specifications and industry standards.

CO5: Implement strategies to optimize the supply chain in construction projects, ensuring the coordination and integration of suppliers, manufacturers and logistics.

Course Content:

UNIT-I: Introduction to Material Management **11 Hours**

Importance of material management and its role in the construction industry: scope, objectives and functions, integrated approach to materials management, role of materials manager, materials procurement, codification and standardization, vendor development, suppliers evaluation, purchase procedure.

UNIT-II: Inventory Management **11 Hours**

Inventory classification, selective inventory control techniques: ABC, XYZ, VED, etc, inventory models: EOQ Analysis, Q and P models, two bin technique, safety stock, reorder level, lead time,

concept of JIT: Just in time management.

UNIT-III: Store Management **10 Hours**

Storing of materials, management of stores, receipt and inspection, location: site layout and site organization, different types of stores, methods of storing, store accounts, stock verification, care, safety and security of materials, losses on storage, wastage, stores equipment, materials handling equipment, factors affecting materials handling.

UNIT-IV: Quality Control **10 Hours**

Quality control: conventional methods of quality control of Construction materials. Statistical method of quality control, sampling techniques quality control in process. Quality management and its economics or techniques in material management.

UNIT-V: Supply Chain Management **10 Hours**

Introduction to supply chain management; Process view of supply chain; Supply chain performance measures; Supply chain performance measures; Make or buy decisions; Supply Chain Strategy: competitive and supply chain strategies, achieving a strategic fit, expanding strategic scope; SCM: drivers; Design supply chain network; Supply chain planning and analysis: Supply chain operations.

Learning Resources:

Text Books:

1. Materials Management: An Integrated Approach, P. Gopal Krishnan and M. Sundaresan, Prentice Hall India
2. Jhamb, L. C. (2014). Materials-and-Logistics-Management, Everest Publishing House
3. Materials Management a Supply Chain Perspective: Text and Cases, 3rd Edition, Kindle Edition, by A. K. Chitale, R. C. Gupta.

Reference Books:

1. Purchasing and Inventory Control- by K. S. Menon, Wheeler Publication.
2. Datta, A. K. (1998). Materials Management: Procedures, Text and Cases, New Delhi, Prentice Hall of India.
3. Dam Jespersen, B., and Skjøtt-Larsen, T. (2005). Supply Chain Management: In Theory and Practice. Copenhagen Business School Press.
4. Pagh, J. D. and Cooper, M. C. (1998). Supply chain postponement and speculation strategies: how to choose the right strategy. Journal of Business Logistics, 19(2), 13

Web link for MOOC / NPTEL Links:

1. https://archive.nptel.ac.in/courses/110/105/110105095/

2. https://www.edx.org/learn/supply-chain-design/massachusetts-institute-of-technology-supply-chain-fundamentals
3. https://www.edx.org/learn/supply-chain-management

List of Practicals:

1. Prepare vendor selection criteria for construction material.
2. Selection of inventory control techniques on construction sites.
3. Case study analysis for material management in Mega Projects.
4. Use of advanced technologies of AI, IoT, and Blockchain to optimize the supply chain for construction materials.
5. Site visit to understand material procurement, storage, handling, inventory management, and waste reduction practices.

Course Code: 205204D		Course Name: Value Engineering and Valuation
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical:** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Project Management and Finance.

Course Objectives:

- To create valuable expertise in civil engineers in the construction sector, engineering and analysis are employed.
- To acquaint with value engineering and life cycle costing analysis.
- To build civil engineers who are well-versed in the assessment of different types of assets.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Assess the engineering value of the product.

CO2: Execute a number of steps for the development of the product.

CO3: Identify the methodology for assessing value.

CO4: Examine the lifecycle cost.

CO5: Write a report that applies value engineering to a construction project.

Course Content:

UNIT-I: Value Engineering **11 Hours**

Definition, importance to contractors, potential. VE applications value: basic and secondary functions, factors contributing to value such as aesthetic, ergonomic, technical, economic: identifying reasons or unnecessary costs.

UNIT-II: Value Analysis **11 Hours**

Ten Commandments of value analysis; value analysis team; principles of value analysis, elements of a job plan viz. orientation, information, presentation. Implementation, follow-up action, benefits of value analysis, various applications, assessing the effectiveness of value analysis.

UNIT-III: Value Engineering Techniques **10 Hours**

Orientation phase, information phase, function analysis phase, creative phase, evaluation phase, development phase, presentation phase, implementation phase.

UNIT-IV: Life Cycle Costing 10 Hours

Forecasting of capital as well as operating and maintenance costs, time value, present worth analysis, DCF methods, ROR analysis and sensitivity analysis.

UNIT-V: Valuation of Construction Project 10 Hours

VE during the planning phase of a construction project, VE during the design phase of a construction project, VE during the construction phase of a construction project, valuation report, contents, standard formats, case study of any one report.

Learning Resources:

Text Books:

1. Value Engineering: Analysis And Methodology By Del Younke, CRC Press Inc
2. Industrial Organization & Engineering. Economics, T. R. Banga, S. C. Sharma, Khanna Publication
3. Estimating and Costing in Civil Engineering: Theory and Practice B.N Dutta Published S. Dutta & Company, Lucknow.

Reference Books:

1. Industrial Engineering & Mgt., O. P. Khanna, Dhanpat Rai Publication,
2. Estimating and Costing By: G. S. Birdie, Dhanpat Rai Publication.
3. Estimating and Costing By: Rangwala Published By: Charotar Publishing House
4. Practical Information for Quantity Surveyors, Property Valuers, Architects Engineers and Builders. P. T. Joglekar, Pune Vidyarthi Griha Prakashan, 2008 reprint.

e-Books:

1. https://www.routledge.com/Value-Engineering-Analysis-And-Methodology/Younker/p/book/9780824706968?srsltid=AfmBOooHa5sxuo3fMNy5RFzog_fkRJlLT4sdoUo3yGCAKuP92y22KegT.

Web link for MOOC / NPTEL Links:

1. Product design and value engineering, https://archive.nptel.ac.in/courses/112/107/112107282/

List of Practicals:

1. A case study on the application of Value Engineering in large scale construction projects.
2. Evaluate the cost-benefit analysis of implementing sustainable practices of VE.
3. Detail step-by-step application of the value engineering process in real-world construction projects.

4. A case study to compare the LCCA of a green-certified building versus a traditional building.
5. Detailed value analysis report for any one infrastructure and real estate project analysis.

Course Code: 205204E	Course Name: Risk Analysis & Mitigation Practice	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical:** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Project management and finance, tenders and contracts

Course Objectives:

- To identify the various types of risks associated with construction projects.
- To analyze the identified risk in the construction industry.
- To apply the risk mitigation techniques.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Understand the risk in projects.

CO2: Analyze the risk management in projects.

CO3: Evaluate the risk assessment using different techniques.

CO4: Apply the risk evaluation using different techniques.

CO5: Apply the risk mitigation in projects.

Course Content:

UNIT-I: Introduction to Risk **11 Hours**

Definitions, life cycle of project, stakeholders in project, classification of risks, components of risk, quantifiable and un-quantified (qualitative) risks.

UNIT-II: Risk Management **11 Hours**

Risk management, ISO 31000, principle of risk management, key areas in risk management, framework of risk management, processes of risk management.

UNIT-III: Risk Assessment **10 Hours**

Risk identification and techniques, risk assessment tools and techniques - systems approach, taxonomy based, risk breakdown structure, HHM, SWOT, root cause analysis, influence diagram, PHA, HAZOP, JSA, risk matrix, risk index and risk ranking, FMEA, FTA, CCA, ALARP.

UNIT-IV: Risk Evaluation 10 Hours

Qualitative and quantitative risk analysis, risk prioritization, objectivity in risk rating, likelihood, impact, risk appetite and tolerance, basic accounting, application of risk assessment tools and techniques, risk treatment process, fundamental risk treatment strategies, performance monitoring and review, decision making under uncertainty, decision trees, Monte Carlo simulation, application of risk treatment strategies, performance monitoring and review.

UNIT-V: Risk Mitigation 10 Hours

Necessity risk mitigation, importance of risk mitigation, process of risk mitigation, risk mitigation strategies, risk mitigation practices, risk mitigation tools.

Learning Resources:

Reference Books:

1. Engineering Risk Management By Thierry Meyer, De Gruyter Publishing.
2. Risk Management and Assessment, By John Fraser, Intech Open Publishing.
3. Risk Management and Governance Concepts, Guidelines and Applications By Terje Aven, Ortwin Renn, Springer Berlin Heidelberg.
4. Corporate Financial Risk Management A Computer-based Guide for Non-specialists By Roy Nersesian, Bloomsbury Publishing.
5. Enterprise Risk Management Today's Leading Research and Best Practices for Tomorrow's Executives By John Fraser, John R. S. Fraser, Betty J. Simkins, Wiley Publishing.
6. Financial Risk Management, By Bradstreet, Tata McGraw-Hill Publishing Comp Ltd.
7. Mastering Risk Modeling By Day A.L., Pearson Publishing.
8. Principles of Risk Management By Keller K.L., Pearson Publishing.
9. Risk Management and Insurance By Harrington S.E., Niehaus G.R., Tata McGraw-Hill Publishing Comp Ltd.

Web link for MOOC / NPTEL Links:

1. https://www.youtube.com/watch?v=wW1kjrnktDU&pp=ygUnUmlzayBtYW5hZ2VtZW50IGJ5IERyLiBBLiBUaGlsbGFpIFJhamFu
2. https://www.youtube.com/watch?v=ZGjXFkdGeNU
3. https://www.youtube.com/watch?v=6FLA8WpqJDc
4. https://www.youtube.com/watch?v=ZIHXB0bF7jI
5. https://www.youtube.com/watch?v=gOi0SL2sqtA
6. https://www.youtube.com/watch?v=YsqU2gk4SxI
7. https://www.youtube.com/watch?v=_ByfzB_6x8g

8. https://www.youtube.com/watch?v=82OUSjOM2bg

List of Practicals:

1. Assignment on finding out different risks and stakeholders in any construction project.
2. Assignment on study of ISO 31000.
3. Assignment on application of risk assessment technique for the identified risks in assignment 1.
4. Assignment on application of risk evaluation technique for the identified risks in assignment 1.
5. Assignment on application of risk mitigation for the identified risks in assignment for the identified risks in assignment 1.

Course Code: 205204F	Course Name: Construction Equipment Management	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 4 Hours/Week **Practical :** 2 Hours/Week	**4** **1**	**CCE : 50 Marks** **ESE : 50 Marks** **TW : 25 Marks**

Prerequisite Courses:

- Construction techniques, plants and machineries

Course Objectives:

- To acquaint with selection criteria of construction equipment.
- To apply principles of equipment management, including optimization of equipment utilization, maintenance strategies, cost analysis, and the integration of technology to enhance productivity and safety on construction sites.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Discuss the selection criteria of construction equipment.

CO2: Identify and categorize various types of construction equipment and machinery based on their functions and applications in different phases of construction projects.

CO3: Calculate and analyze the total costs associated with construction equipment, including initial investment, operating costs, maintenance, and depreciation.

CO4: Implement strategies to optimize the use of equipment, reducing idle time, enhancing operational efficiency and record keeping of equipment.

CO5: Develop maintenance plans for various types of equipment ensuring their reliability, longevity, and safety.

Course Contents

UNIT-I: Introduction to Construction Equipment **11 Hours**

Overview of construction equipment types and their roles in construction projects, the importance of equipment management in construction productivity and cost control, Factors influencing equipment selection.

UNIT-II: Construction Equipment and Machinery **11 Hours**

Operation and applications of earthmoving equipment, concrete production and placement

equipment, material handling equipment, pile driving equipment, concrete/bitumen road construction equipment, tunneling equipment, aggregate production equipment, compressors.

UNIT-III: Equipment Economics 10 Hours

Cost components of construction equipment: initial cost, operating cost, maintenance cost, and depreciation, economic life and replacement analysis, equipment cost estimation and budgeting, financing options for equipment procurement.

UNIT-IV: Equipment Management 10 Hours

Costing, optimum utilization and equipment selection, depreciation, interest on capital, manpower, spare parts etc., documentation, logbooks, history books, periodical MIS report.

UNIT-V: Equipment Maintenance 10 Hours

Types of maintenance: preventive, predictive, corrective, and condition-based, Maintenance scheduling and planning, common issues and troubleshooting in construction equipment, Equipment repair processes and decision-making for repair or replacement.

Learning Resources:

Text Books:

1. Construction Planning, Equipment and Methods – Peurifoy-Tata McGraw Hill Publication.
2. Construction Technology: Analysis, and Choice, Bryan, Wiley India.
3. Construction Planning, Equipment and Methods – Peurifoy-Tata McGraw Hill Publication.
4. Construction Equipment Planning and Applications – Dr. Mahesh Varma.

Reference Books:

1. Journals such as CE and CR. Construction World, International Construction.
2. Construction Technology by Roy Chudley and Roger Greeno, Prentice Hall, 2005.
3. Dr. Kumar Niraj Jha, Formwork for Concrete Structures, McGraw Hill Publication

MOOC / NPTEL / YouTube Links:

1. https://onlinecourses.nptel.ac.in/noc21_ce21/preview

List of Practicals:

1. Site visit for fleet management on any construction project and submission of a report.
2. Cost comparison of various construction equipment's for any construction activity cost-effective analysis of equipment used for a construction activity.
3. Determination of work cycle time for any Equipment for its use.
4. Prepare the checklist of maintenance for any equipment and its analysis of maintenance cost.
5. Case study/Literature review on implementation of advanced technologies such as IoT, AI, etc. in monitoring performance of construction equipment.

Course Code: 200205		Course Name: Introduction to Cyber Security
Teaching Scheme	**Credit**	**Evaluation Scheme**
Theory : 3 Hours/Week **Practical** : 2 Hours/Week	**3** **1**	**CCE** : 50 Marks **ESE** : 50 Marks **TW** : 25 Marks

Expected Prerequisite Courses:

- Computer Networks & Security.

Course Objectives:

- To understand the fundamental concepts, terminologies, and increasing threat landscape in cyber security.
- To identify and analyze different forms of cybercrimes, attacks, and malicious activities across digital platforms.
- To explore the legal framework, national and international cyber laws, and regulations governing cyber security.
- To understand and evaluate data privacy, data security principles, and compliance mechanisms.
- To develop skills to manage organizational cyber security through policies, risk assessment, audit, incident response, and governance strategies.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Explain the core concepts and terminology of cyber security and modern cyber threat landscape.

CO2: Identify and classify various cybercrimes, social engineering attacks, and reporting procedures.

CO3: Examine cyber laws, legal provisions, and ethical considerations related to emerging technologies.

CO4: Analyze data privacy, data protection laws, and big data security concerns at national and international levels.

CO5: Develop cyber security plans, policies, and apply risk management and governance principles in organizations.

Course Contents

UNIT-I: Overview of Cyber Security **08 Hours**

Cyber security increasing threat landscape, cyber security terminologies - cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker, non-state actors, cyber terrorism, critical IT and national critical infrastructure, cyberwarfare.

UNIT-II: Cyber Crimes **08 Hours**

Types of cyber crime, cyber crimes targeting computer systems and mobiles, online scams and frauds, darknet - illegal trades, drug trafficking, human trafficking, social media scams and frauds, crime against persons, social engineering attacks, cyber police stations, crime reporting procedure, hacking and cracking, types of hackers.

UNIT-III: Cyber Laws **08 Hours**

Cyber-crime and legal landscape around the world, IT Act, 2000 and its amendments. Limitations of IT Act, 2000. Cyber crime and punishments, Cyber laws, legal and ethical aspects related to new technologies - AI/ML, IoT, blockchain, darknet and social media, cyber laws of other countries, case studies.

UNIT-IV: Data Privacy and Data Security **08 Hours**

Defining data, meta-data, big data, non-personal data. Data protection, data privacy and data security, personal data protection bill and its compliance, data protection principles, big data security issues and challenges, data protection regulations of other countries- General Data Protection Regulations (GDPR), 2016 Personal Information Protection and Electronic Documents Act (PIPEDA), social media- data privacy and security issues.

UNIT-V: Cyber Security Management, Compliance and Governance **08 Hours**

Cyber security plan - cyber security policy, cyber crises management plan, business continuity, risk assessment, types of security controls and their goals, cyber security audit and compliance, national cyber security policy and strategy.

Learning Resources:

Text Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
2. Information Warfare and Security by Dorothy F. Denning, Addison Wesley.

Reference Books:

1. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.
2. Data Privacy Principles and Practice by Natraj V. & Ashwin Shriram, CRC Press.
3. Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, 1st Edition, Wiley Publication.
4. Auditing IT Infrastructures for Compliance by Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning.

Web link for MOOC / NPTEL Links:

1. SWAYAM Course: "Introduction to Cyber Security" by Dr. Jeetendra Pande https://onlinecourses.swayam2.ac.in/nou25_cs18/preview
2. NPTEL Course: "Cyber Security and Privacy", IIT Madras by Prof. Saji K Mathew https://nptel.ac.in/courses/106106248
3. Coursera Course "Introduction to Cyber Security" https://www.coursera.org/specializations/intro-cyber-security
4. SWAYAM Course: "Cyber Laws" by Dr Vishal Goyal, Punjabi University, Patiala https://onlinecourses.swayam2.ac.in/cec25_cs04/preview

Activity based Learning (Suggested Activities in Class)

1. Flipped Classroom
2. Role Play on Cyber Crime Trials
3. Case Study Analysis
4. Group Discussions on Global Cyber Law Trends
5. Quizzes/Assignment.

List of Practicals

1. Identify the platforms for reporting cyber-crimes.
2. Registering complaints on a social media platform.
3. Prepare password policy for computer and mobile device.
4. List out security controls for computer and implement technical security controls in the personal computer.
5. List out security controls for mobile phone and implement technical security controls in the personal mobile phone.
6. Log into computer system as an administrator and check the security policies in the system.

Course Code: 200206	Course Name: Human Rights – 2	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Tutorial : 1 Hours/Week	**1**	**TW :** 25 Marks

Expected Prerequisite Courses:

- Human Rights – 1.

Course Objectives:

- To develop the concept of vulnerability and its relationship with human rights, including dimensions of social exclusion and discrimination.
- To foster the knowledge of human rights related to indigenous peoples and vulnerable groups.
- To cultivate the knowledge of human rights pertaining to socially and economically disadvantaged groups.
- To explore the existing challenges, issues regarding human rights, and strengthen the knowledge of domain-specific human rights.

Course Outcomes:

After successful completion of the course, the learner will be able to:

CO1: Explain the concept of vulnerability, including dimensions of social exclusion and discrimination.

CO2: Describe the human rights of indigenous people and vulnerable groups.

CO3: Discuss the human rights of Socially and Economically Disadvantaged Groups.

CO4: Apply the domain-specific human rights in their professional field.

Course Contents

UNIT-I: Foundations **04 Hours**

Human rights and vulnerability: Meaning, causes of social exclusion, discrimination, and intersectionality. **Legal frameworks:** Universal Declaration of Human Rights (UDHR), International Covenant on Civil and Political Rights (ICCPR), International Covenant on Economic, Social and Cultural Rights (ICESCR), Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), Convention on the Rights of the Child (CRC),

Convention on the Rights of Persons with Disabilities (CRPD); **Constitutional rights:** Role of judiciary and human rights commissions. Role of advocacy groups.

UNIT-II: Rights of Vulnerable Groups 04 Hours

Concepts of vulnerable groups, including women and **Gender minorities:** Gender equality, violence, and children's rights. Child protection laws, child labor, and abuse. **Persons with Disabilities:** Definition, barriers, inclusive development, and indigenous and ethnic minorities: cultural identity, land/resource rights, and constitutional safeguards. **Human rights of vulnerable groups:** Stateless persons, sex workers, migrant workers, refugees, HIV/AIDS victims, and migration rights.

UNIT-III: Socially and Economically Disadvantaged Groups 04 Hours

Concept of disadvantaged groups. **Older persons:** neglect, health, social security measures, other groups: people with chronic illness, victims of conflict/terrorism, other indigenous, backwards groups, and minorities in India, labor protection.

UNIT-IV: Challenges, Way Forward and Domain Specific Human Rights 04 Hours

Existing challenges: Poverty, inequality, marginalization and weak enforcement. **Emerging issues:** Globalization, climate change, digital divide and surveillance. **Towards inclusion:** Community participation, policy reform, education, empowerment and civil society role.

Domain Specific Human Rights

Civil Engineering: Right to life and safety, right to water and sanitation, right to a clean, healthy, and sustainable environment, ethical and sustainable development, minimize risk of legal disputes, project delays, and community resistance.

Computer Engineering: Science, technology and human rights. Data privacy and surveillance ethics. Real-world human rights challenges in Tech industries, digital sovereignty and cyber security. AI governance and ethical regulation.

Mechanical Engineering: Right to safety and protection: safe design of machines, tools, and systems. Right to health and workplace environments. Minimizes health risks and promotes comfortable, accessible, human-friendly systems. Right to human dignity over commercial profit.

E&TC Engineering: Technology and online expression, website blocking and content filtering. Balancing national security, public order, and freedom of expression, privacy rights and data protection, digital inclusion and the digital divide, emerging technologies and future challenges.

Business Administration: Right to equality, dignity, and non-discrimination; fair wages and decent working conditions; protection against harassment. Rights to privacy, safe workplaces,

social security, and freedom of association. Managerial responsibilities and ethical leadership. An inclusive and productive workplace.

Term Work

Term work shall consist of handwritten a minimum of 08 assignments (Two per unit). The course teacher will decide the assignments based on the content.

Learning Resources:

Text Books:

1. Introduction to Human rights and duties by Dr. T.S.N. Sastry Published by SPPU, Pune.
2. Human rights of vulnerable and disadvantaged groups by Dr. T.S.N. Sastry Published by SPPU, Pune.
3. P.K. Pandey (Ed) Human Rights, APH Publishing Corporation, 2012.

Reference Books:

1. Andrew Clapham: Human Rights Lexion, Oxofrd University Press; 2005.
2. Andrew Clapham: Human Rights A very short Introduction; 2007, Oxford University Press.
3. Magdalena Sepulveda and others: Human Rights : Hand Book, 2004 University for Peace of the United Nations.
4. Human rights and Vulnerable Groups available at http://www.sagepub.com/upmdata/11973_Chapter_5.pdf
5. Vulnerability and Vulnerable Groups; available at http://siteresources.worldbank.org/INTSRM/Publications/20316319/RVA.pdf

Web link for MOOC / NPTEL Links:

1. https://www.youtube.com/watch?v=Y-yBzlNHIyk
2. https://www.youtube.com/watch?v=wDWPiWAJplA

Semester - III

Course Code: 205301	Course Name: Dissertation Phase - I	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical : 20 Hours/Week	**10**	**TW :** 100 Marks **OR :** 50 Marks

Prerequisite Courses:

- Seminar, Research Proposal Writing.

Course Objectives:

- Identify gaps in existing literature or technologies and propose innovative solutions.
- Apply theoretical knowledge to practical scenarios to design, implement, and test solutions.
- Develop project planning, time management, and organizational skills.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Review relevant literature, including books and national/international peer-reviewed journals, and consult experts on the chosen research topic.

CO2: Use various software, computational, and analytical tools effectively.

CO3: Design and develop an experimental set up/ equipment/test rig.

Course Contents:

Project Work Stage - I is an essential part of the overall project. In this stage, the student is expected to complete a portion of the project, which includes defining the problem statement, reviewing related literature, providing a project overview, outlining the implementation plan (using tools like UML diagrams, ER diagrams, block diagrams, PERT charts, etc.), and designing the layout or setup.

Guidelines for Conduction:

Coordinator needs to assign a domain specific guide / mentor to every student. The finalization of project topic will be considered with the concern of the mentor only. The dissertation stage - I work will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on literature study, work undergone, Algorithm / method understanding, content delivery, presentation skills, documentation and report. The continuous assessment of the progress needs to be documented unambiguously. For standardization and

documentation, it is recommended to follow the formats and guidelines in the dissertation workbook approved by the department. All the mentors must encourage their students to initiate the process of copyright registration for their dissertation work as part of academic compliance and intellectual property protection.

Instructions for Students:

The students are expected to validate their study undertaken by publishing it at standard platforms. The investigations and findings need to be validated appropriately at standard platforms-conference and/or peer reviewed journals. The student has to exhibit the continuous progress through regular reporting and presentations and proper documentation of the frequency of the activities in the sole discretion of the PG coordination.

- Identify the Problem statement of recent trends in Mechanical Engineering.
- Study of Literature and previous work related to the problem identified.
- Analysis and study of design, flowchart and other diagrams which are related to the solution.
- Representation and study of Methods / Algorithms to solve the problem.
- 30% or Partial implementation of the solution to the identified problem.
- Every student is required to present and publish a Review paper at International Journal (International Peer Review)
- All M.Tech students are required to initiate the process of copyright registration for their dissertation work as part of academic compliance and intellectual property protection.
- Students can present their work through PPTs and any supporting documents.
- At the end of semester, every student must submit THREE copies of the manuscript of their work by following the instructions and specified format given by the coordinator

Learning Resources:

Text Books:

1. Research Methodology: A Step-by-Step Guide for Beginners, Ranjit Kumar
2. Design Thinking: Understanding How Designers Think and Work : Nigel Cross

Reference Books:

1. The Craft of Research, Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams
2. Project Management for Engineering and Technology, John M. Nicholas, Herman Steyn.

Web link for MOOC / NPTEL Links:

1. NPTEL – Research Methodology
   https://nptel.ac.in/courses/121/107/121107007/
2. Coursera – Academic Research and Writing (University of California)
   https://www.coursera.org/learn/academic-research-writing
3. edX – Research Methods (University of London)
   https://www.edx.org/course/research-methods
4. Future Learn – Project Management for Research
   https://www.futurelearn.com/courses/project-management-for-research

Course Code: 205302.	Course Name: Research Seminar	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical : 4 Hours/Week	**2**	**TW : 25 Marks** **OR : 25 Marks**

Prerequisite Courses:

- Research Methodology Concepts.

Course Objectives:

- To identify the latest topic in the field of civil engineering.
- To carry out literature surveys and problem identification.
- Enhance presentation and report writing skills

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Identify the research seminar topic in the field of civil engineering by literature survey.

CO2: Understand how research papers are written and understand modeling, theory, concept, and simulation related to the topic of interest.

CO3: Effectively communicate the research seminar topic through oral presentation.

CO4: Prepare a detailed seminar report.

Course Contents:

Research seminar topic will be based on dissertation phase-I, considering recent trends in the field of civil engineering – construction management. This seminar will be mainly focuses on domain introduction, Study of literature related to the topic and study of methodology or techniques which are going to get implemented in the project. The student shall submit the duly certified seminar report in standard format, also students will have to present their work in any International Conference for satisfactory completion of the work by the concerned guide and head of the department.

Guidelines for Topic Selection:

1. Individual students need to study recent topics in the field of civil engineering under the guidance of an allocated guide.
2. Students can choose a topic related to civil-structural engineering, considering recent trends and their societal importance.

3. The extensive literature survey, mathematical modeling of particular methods, experimentation and valuable conclusion is expected from seminar study.
4. Seminar report should be submitted as a compliance of term work.
5. Technical paper presentation in any International Conference is MANDATORY as the outcome of the seminar.
6. Total Duration: 48 Contact hours and additional 48 hours should be spent by students on completion of related activities and requirements.

Suggested Rubrics for TW / PR:

Assessment Parameter	Criterion	Review Assessment Weightage
AP 1	**Preparation of PPTs** ● Organization of contents ● Visual Aids	**20 M**
AP 2	**Presentation Skills** ● Subject Knowledge ● Communication skills ● Gesture & Postures	**30 M**
AP 3	**Viva Voce**	**10 M**
AP 4	**Report/s** ● Organization of contents ● Visual Aids and Conclusion	**20 M**
AP 5	**Technical Presentation at international Conference**	**20 M**
	Total Weightage (TW and OR)	**100 M**
Note: All the above parameters are mandatory for granting the TW / OR.		

Course Code: 205303	Course Name: Skill Development Laboratory – I (Software Skills)	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical : 4 Hours/Week	**2**	**TW : 50 Marks**

Prerequisite Courses:

- Project management, Basic operating systems, MS Office, Estimation and costing, Construction methods.

Course Objectives:

- To acquire basic software skills and competency skills.
- To learn planning, and scheduling using software.
- To learn resource management using the software.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Prepare a detailed cost estimate for the project.

CO2: Apply project planning, scheduling and monitoring techniques.

CO3: Organize resources for a project using software.

Course Contents

ASSIGNMENT-I: 08 Hours

Prepare detailed cost estimates for any selected construction project by using MS Excel.

ASSIGNMENT-II 08 Hours

Defining and creating the WBS hierarchy for any project.

ASSIGNMENT-III 06 Hours

Application of MS Project/ Primavera software for project planning, scheduling and control.

ASSIGNMENT-III 06 Hours

Manage resources such as labour, materials, equipment, finance, suppliers, and contractors by using (Enterprise Resource Planning) ERP Software.

Learning Resources:

Text Books:

1. Construction Management and Planning by Sengupta and Guha-Tata McGraw Hill publication.
2. Construction Project Management Planning, Scheduling and Controlling-Chitakara- Tata McGraw Hill, New Delhi.
3. Estimating, Costing, Specification & Valuation In Civil Engineering by M Chakrabort

Reference Books:

1. Learning Microsoft Project 2019 by Srikanth Shirodkar
2. Planning and Managing Projects with PRIMAVERA (P6) Project Planner by P. Vinayagam ,A. Vimala

Course Code: 205304	Course Name: Internship	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical : 8 Hours/Week	**4**	**TW : 50 Marks** **OR : 50 Marks**

Course Objectives:

- To develop industry-relevant skills, professional ethics, and workplace etiquette through experiential learning.
- To promote exposure to current industry practices, tools, and trends, facilitating a bridge between academic learning and industrial applications.
- To develop interpersonal, communication, and collaborative skills by working in diverse professional environments.
- To prepare students for future employment through firsthand experience, understanding of industry expectations, and professional networking.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Apply theoretical knowledge and engineering principles to real-world industry problems and professional practices.

CO2: Demonstrate proficiency in tools, techniques, and methodologies relevant to the internship domain.

CO3: Exhibit professional behavior, including teamwork, time management, ethics, and communication skills in a workplace environment.

CO4: Effectively communicate findings and insights through well-structured reports and professional presentations.

Guidelines for Topic Selection:

1. Individual student needs to attempt for OJT/ Internship in an industry in the field of civil engineering – construction management.
2. If not received any OJT/ Internship, student can choose in-house mini project related to civil engineering – construction management.
3. Students need to submit a detailed report and present their work to an evaluation committee

appointed by the Head of the Department.

Evaluation Criteria:

The student will be evaluated by the panel based on the below criteria. Weightage for each criterion will be determined by the evaluation committee and will be informed to the students. The following is the suggested marks allocation.

Criteria	Description	Weightage (Term Work Out of 100)	Weightage (Term Work Out of 50)	Marks Allotted
1.	Relevance of the area of work.	**20**	**--**	**20 M**
2.	Performance of the task/s.	**20**	**--**	**20 M**
3.	Crucial learning's from the work and maintaining daily workbook.	**30**	**--**	**30 M**
4.	Report Preparation.	**30**	**--**	**30 M**
5.	Clarity and structure of presentation.	**--**	**15**	**15 M**
6.	Articulation of key learnings.	**--**	**15**	**15 M**
7.	Response to questions.	**--**	**20**	**20 M**
	Grand Total	**100**	**50**	**150**

Course Code: 200305	Course Name: Introduction to Constitution	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Tutorial : 2 Hours/Week	**2**	**TW :** 50 Marks

Course Objectives:

- To provide an understanding of the historical foundations and evolution of the Indian Constitution.
- To help students appreciate the structure, philosophy, and key principles of the Constitution.
- To create awareness about rights, duties, governance mechanisms, and federal structure in India.
- To enable future managers/engineers to understand the legal environment affecting business, technology, and society.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Explain the historical background and development of the Indian Constitution.

CO2: Interpret the core constitutional philosophy of justice, liberty, equality and fraternity.

CO3: Analyze the structure and functions of major constitutional bodies.

CO4: Understand citizens' fundamental rights, duties, and responsibilities.

CO5: Evaluate the role of constitutional provisions in business, technology, and society.

Course Contents

UNIT-I: Philosophy of the Indian Constitution 08 Hours

Constitutional History of India, Features of Indian Constitution, Preamble - Source and Objects, Sovereign and Republic, Socialist and Secular, Democratic - Social and Economic Democracy, Justice - Social, Economic and Political, Liberty - Thought, Expression, Belief, Faith and Worship, Equality - Status and Opportunity, Fraternity, Human Dignity, Unity and Integrity of the Nation.

UNIT-II: Fundamental Rights 07 Hours

Right to equality, Right to freedoms, Right against exploitation, Right to freedom of religion, Cultural and educational rights, Right to property Right to constitutional remedies.

UNIT-III: Directive Principles of State Policy 07 Hours

Equal Justice and free legal aid, Right to work and provisions for just and humane conditions of work, Provision for early childhood, Right to education and SC, ST, weaker section, Uniform Civil Code, Standard of Living, nutrition and public health, Protection and improvement of environment, Protection and improvement of environment, Separation of Judiciary from executive, Promotion of International peace and security.

UNIT-IV: Fundamental Duties 08 Hours

Duty to abide by the Constitution, Duty to cherish and follow the noble ideals, Duty to defend the country and render national service, Duty to value and preserve the rich heritage of our composite culture, Duty to develop scientific temper, humanism, the spirit of inquiry & reform, Duty to safeguard public property and abjure violence, Duty to strive towards excellence.

Learning Resources:

Text Books:

1. D.D. Basu – Introduction to the Constitution of India (LexisNexis Publications).
2. M. Laxmikanth – Indian Polity (McGraw Hill Education).
3. J.N. Pandey – Constitutional Law of India (Central Law Agency).

Reference Books:

1. Subhash Kashyap – Our Constitution National Book Trust
2. P.M. Bakshi – The Constitution of India Universal Law Publishing
3. M. V. Pylee – India's Constitution S. Chand Publishing
4. B.K. Sharma – Introduction to the Constitution of India Pearson.

Web link for MOOC / NPTEL Links:

1. NPTEL – Constitutional Government & Democracy in India
   https://nptel.ac.in/courses/117104055

Assignments

Term work shall consist of handwritten a minimum of 08 assignments (Two per unit). The course teacher will decide the assignments based on the above contents.

Semester - IV

Course Code: 205401.	Course Name: Dissertation Phase - II	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical : 36 Hours/Week	**18**	**TW :** 250 Marks **OR :** 100 Marks

Prerequisite Courses:

- Research Methodology Concepts.

Course Objectives:

- Identify gaps in existing literature or technologies and propose innovative solutions.
- Apply theoretical knowledge to practical scenarios to design, implement and test solutions.
- Develop project planning, time management and organizational skills.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Review relevant literature, including books and national/international peer-reviewed journals, and consult experts on the chosen research topic.

CO2: Use various software, computational, and analytical tools effectively.

CO3: Design and develop an experimental set up/ equipment/test rig.

Course Contents:

In Dissertation Stage–II, the student shall consolidate and complete the remaining part of the dissertation which will consist of selection of technology, installations, implementations, testing, results, measuring performance, discussions using data tables as per parameter considered for the improvement with existing/known algorithms/systems, comparative analysis, validation of results and conclusions.

Guidelines for Conduction:

The student has to exhibit the continuous progress through regular reporting, presentations, and proper documentation of the frequency of the activities in the sole discretion of the PG coordination. The continuous assessment of the progress needs to be documented unambiguously. It is recommended to continue with guidelines and formats as mentioned in the Dissertation Workbook approved by the department. The dissertation stage - II work will be assessed by a panel

of examiners of which one is necessarily an external examiner. The assessment will be broadly based on results, comparisons and implementation of Algorithm / method. The continuous assessment of the progress needs to be documented unambiguously. For standardization and documentation, it is recommended to follow the formats and guidelines in the dissertation workbook approved by the department.

Instructions for Students:

The students are expected to validate their study undertaken by publishing it at standard platforms. The investigations and findings need to be validated appropriately at standard platforms – peer reviewed journals.

- Implementation and Representation of Methods / Algorithms to solve the problem.
- 100% implementation of the solution to the identified problem.
- Every student is required to publish a final paper at the International Journal (International Peer Review) by maintaining the standards of IPR.
- Students can present their work through PPTs and any supporting documents.
- At the end of semester, every student must submit THREE copies of the manuscript of their work by following the instructions and specified format given by the coordinator.

Learning Resources:

Text Books:

1. Research Methodology: A Step-by-Step Guide for Beginners, Ranjit Kumar
2. Design Thinking: Understanding How Designers Think and Work: Nigel Cross.

Reference Books:

1. The Craft of Research, Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams
2. Project Management for Engineering and Technology, John M. Nicholas, Herman Steyn.

Web link for MOOC / NPTEL Links:

1. NPTEL – Research Methodology
   https://nptel.ac.in/courses/121/107/121107007/
2. Coursera – Academic Research and Writing (University of California)
   https://www.coursera.org/learn/academic-research-writing
3. edX – Research Methods (University of London)
   https://www.edx.org/course/research-methods
4. Future Learn – Project Management for Research
   https://www.futurelearn.com/courses/project-management-for-research

Course Code: 205402	Course Name: Skill Development Laboratory – II (Oral and Written Communication)	
Teaching Scheme	**Credit**	**Evaluation Scheme**
Practical : 4 Hours/Week	**2**	**TW : 50 Marks**

Prerequisite Courses:

- Basic communication skills and English language.

Course Objectives:

- To facilitate holistic growth among students.
- To aware the significance of soft skills and English aptitude.
- To develop the ability to effectively communicate through individual and group activities.
- To expose to right attitude and behavioral aspects and build the same through various activities.

Course Outcomes:

After successful completion of the course, learner will be able to:

CO1: Express effectively through verbal/oral communication skills.

CO2: Prepare for group discussions/meetings/interviews and presentations.

CO3: Operate effectively in diverse, multidisciplinary teams through interpersonal relationships, conflict management, and leadership.

Guidelines:

1. Total activities to be conducted are four out of five.
2. Total: five activities in 15-20 hours.

Course Contents

UNIT I: Group Discussion and Debate **10 Hours**

Group Discussion: Make students aware of proper and globally accepted ethical ways to handle work, colleagues and clients. Develop group communication skills. Learn to speak-up one's opinion in a forum. Cultivate the habit of presenting solution-driven analytical arguments making them contributors in any team. **Debate on current affairs/ Social relevance topics:** Cultivate the habit of presenting forceful arguments while respecting the opponent's perspective and enhancing verbal skills.

UNIT-II: Public Speaking **10 Hours**

Any one of the following activities may be conducted: **Prepared speech:** Topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver. **Extempore speech**: Students deliver speeches spontaneously for 5 minutes each on a given topic.

UNIT-III: Writing an Article and Email Etiquettes **10 Hours**

Build writing skills, improve language and gain knowledge about how to write an article/ report. Provide students with an in-depth understanding of writing formal emails.

UNIT-IV: Reading and Listening Skills **10 Hours**

The batch can be divided into pairs. Each pair will be given an article by the facilitator. Each pair would come on the stage and read aloud the article one by one. After reading by each pair, the other students would be asked questions and needful corrections in the article. The facilitator can evaluate the students for reading and listening skills.

UNIT-V: Telephonic Etiquettes and Mock Interviews **10 Hours**

Telephonic etiquettes: To teach students the skills to communicate effectively over the phone. Students will be divided into pairs. Each pair will be given different situations, such as phone call to enquire about job vacancy, scheduling a meeting with team members, phone call for requesting of urgent leave from higher authorities. Students will be given 10 min to prepare. Assessment will be done on the basis of performance during the telephone call. **Mock interviews:** Guide students and conduct mock interviews.

Learning Resources:

Text Books:

1. Barrun Mitra, Personality Development and Soft Skills, Oxford Higher Education
2. Stephen Lucas, the Art of Public Speaking, McGraw-Hill Education.

Reference Books:

1. Marica weaver, empowering employees through basic skills, Quality Resources, 1996.
2. Gerald Ratiga, Aced: Superior interview skills to gain an unfair advantages to land Your DREAM JOB!, Gerald Ratigan, CMA, CPA Publisher.

Web Link for MOOC / NPTEL / YouTube Links:

1. https://onlinecourses.nptel.ac.in/noc22_hs77/preview

List of Practicals:

Term work is based on above activity report with all necessary documents and photographs.