SNJB's

Late Sau. Kantabai Bhavarlalji Jain

College of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

Shri Neminath Jain Brahmacharyashram (SNJB) (Jain Gurukul)

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ESTD - 1928

Curriculum and Evaluation Scheme for Second Year B. Tech. in Civil Engineering with Multidisciplinary Minor and Honor

To be implemented for 2024-28 Batch

(With Effect from Academic Year 2025-26)

CHAIRMAN
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Chandwad (Nashik)

Vision of the Institute

Transform young aspirant learners towards creativity and professionalism for societal growth through quality technical education.

Mission of the Institute

1. To transfer the suitable technology, particularly for rural development.
2. To enhance diverse career opportunities among students for building a nation.
3. To acquire the environment of learning to bridge the gap between industry and academics.
4. To share values, ideas, and beliefs by encouraging faculties and students for the welfare of society.

Vision of the Civil Engineering Department

To empower students to get knowledge and excellence in civil engineering and to cultivate a sense of commitment to society.

Mission of the Civil Engineering Department

1. To develop outstanding Civil Engineering graduates with Highest ethics.
2. To provide advanced skills of learning which helps to travel the journey from academics to industry.
3. To impart basic knowledge to serve the society.

Program Outcomes (POs) for an engineering graduate:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes

1. To offer engineering services with professional and ethical responsibility.
2. To demonstrate knowledge in analysis, design, laboratory investigation with high proficiency in mathematics,science.
3. Interact with stakeholders effectively and execute quality construction work applying necessary tools.

GENERAL COURSE STRUCTURE

A. Definition of Credit:

Table 1: Credit Definition

1 Hour Lecture (L) per week	1 Credit
1 Hour Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: (B.Tech. or Equivalent) in Tech. with Multidisciplinary Minor:

In the light of the fact that a typical NEP Compliant Model Four-year Undergraduate degree program in Technology has about 176 credits, the total number of credits proposed for the four-year B.Tech. in **Civil Engineering** with Multidisciplinary minor degree is kept as **172.**

Table 2: Range of Credits

Course Category		Credits As PER NEP Guidelines	Proposed Credits
Basic Science Course	BSC/ESC	14-18	15
Engineering Science Course		16-12	14
Programme Core Course (PCC)	Program Courses	44-56	47
Programme Elective Course (PEC)		20	20
Multidisciplinary Minor (MD M)	Multidisciplinary Courses	14	17
Open Elective (OE) Other than a particular program		8	8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	8	8
Ability Enhancement Course (AEC)	Humanities Social Science and Management (HSSM)	4	6
Entrepreneurship/Economics/ Management Courses		2	4
Indian Knowledge System (IKS)		2	2
Value Education Course (VEC)		4	5
Research Methodology(RM)	Experiential Learning Courses	4	4
Community Engagement Project (CEP)/ Field Project (FP)		2	2
Project		4	5
Internship/ OJT		12	12
Co-curricular Courses (CC)	Liberal Learning Courses	4	3
Total Credits		**160-176**	**172**

C. Semester wise Credit Distribution Structure for Four Year B. Tech in Civil Engineering with Multidisciplinary Minor:

Table3: Semester-wise Credit Distribution Structure

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course	BSC/ESC	8	7	-	-	-	-	-	-	15
Engineering Science Course		7	7	-	-	-	-	-	-	14
Programme Core Course (PCC)	Program Courses	-	3	11	8	9	4	9	3	47
Programme Elective Course (PEC)		-	-	-	-	6	5	6	3	20
Multidisciplinary Minor (MD M)	Multidisciplinary Courses	-	-	3	3	3	2	3	3	17
Open Elective (OE) Other than a particular program		-	-	-	3	2	3	-	-	8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	2	2	-	2	-	2	-	-	8
Ability Enhancement Course (AEC)	Humanities Social Science and Management (HSSM)	1	-	1	2	2	-	-	-	6
Entrepreneurship/Economics/ Management Courses		-	-	2	2	-	-	-	-	4
Indian Knowledge System (IKS)		2	-	-	-	-	-	-	-	2
Value Education Course (VEC)		-	-	3	2	-	-	-	-	5
Research Methodology	Experiential Learning Courses	-	-	-	-	-	4	-	-	4
Community Engagement Project (CEP)/ Field Project (FP)		-	-	2	-	-	-	-	-	2
Project		-	-	-	-	-	2	3	-	5
Internship / OJT		-	-	-	-	-	-	-	12	12
Co-curricular Courses (CC)	Liberal Learning Courses	1	2	-	-	-	-	-	-	3
Total Credits (Major)		**21**	**21**	**22**	**22**	**22**	**22**	**21**	**21**	**172**

Students can opt for any of the following as per the rules and regulations given by the institute:

1. B. Tech with Multidisciplinary Minor = Total 172 Credits
2. B. Tech with Multidisciplinary Minor and Honor = Total 190 Credits

HONORS

- In addition to 172 credits of B. Tech Programmes (Bachelor of Technology) i.e. Major in which the student has taken admission, a student may opt for Honors in the same Tech. discipline/branch / Emerging Areas.
- A student is required to earn an additional 18 credits in the same Tech. discipline/ branch / Emerging Areas for Honors distributed over semesters III to VIII.
- The total number of credits required to complete the Honors in the same Tech. discipline/ Emerging Areas is 18 credits, in addition to 172 credits in Major.
- Students will have to compulsorily choose Honors from the same Tech. discipline/branch.
- Honors Degree in the Bachelor of Engineering programme shall be awarded to students earning additional total credits of all six semesters from the second year to final year, i.e., 18 Credits, in addition to 172 credits or 130 credits respectively. The student admitted in the first year must earn 172 credits and 130 credits admitted in lateral entry (admitted after Diploma or B.Sc.) in the second year.
- Minor Courses can be completed through an online platform.

The student has to choose One Honor out of the Two Honor groups provided below

Honors offered by Civil Engineering are as follows:

Table 4: Honors

Sr No	Name of Honors Offered by Department
A.	Construction Management
B.	Sustainability Engineering

The detailed syllabus structure for the same is as follows:

Table 5A: Specialization Honors in Construction Management

Sr. No	Category	SEM	Course Code	Course Name	Teaching Scheme				
					Hours				Credits
					L	T	P	Total Hours	
01	HOC	III	24-HOC-CE-2-01A	Project Planning and Control	3	-	-	3	3
02	HOC	IV	24-HOC-CE-2-02A	Principles of Construction Management	3	-	-	3	3
03	HOC	V	24-HOC-CE-3-03A	Admixtures and Special Concretes	3	-	-	3	3
04	HOC	VI	24-HOC-CE-3-04A	Sustainable Engineering Concepts and life Cycle Analysis	3	-	-	3	3
05	HOC	VII	24-HOC-CE-4-05A	Safety in Construction	3	-	-	3	3
06	HOC	VIII	24-HOC-CE-4-06A	Bridge Engineering	3	-	-	3	3
Total					**18**	-	-	**18**	**18**

Table 5B: Specialization Honors in Sustainability Engineering

Sr. No	Category	SEM	Course Code	Course Name	Teaching Scheme				
					Hours				Credits
					L	T	P	Total Hours	
01	HOC	III	24-HOC-CE-2-01B	Environmental legislation in India	3	-	-	3	3
02	HOC	IV	24-HOC-CE-2-02B	Sustainable Construction Materials	3	-	-	3	3
03	HOC	V	24-HOC-CE-3-03B	Smart Cities and Smart Villages	3	-	-	3	3
04	HOC	VI	24-HOC-CE-3-04B	Flood Mitigation and Hazard Management	3	-	-	3	3
05	HOC	VII	24-HOC-CE-4-05B	Green Buildings	3	-	-	3	3
06	HOC	VIII	24-HOC-CE-4-06B	Environment Sustainability and Climate Change	3	-	-	3	3
Total					**18**	-	-	**18**	**18**

#Note for NPTEL/SYAYAM: Approved courses and platforms will be enlisted timely by authorities along with rules and regulations

Honors Syllabus for SEM III and SEM IV

24-HOC-CE-2-01A: Project Planning and Control

Teaching Scheme:	**Credit:** 3	**Examination Scheme:**
Theory: 3 Hours/Week		**CIE** : 20 Marks **MSE :** 20 Marks **SEE** : 60 Marks

Prerequisite Course: -

Companion Course: -

Course Objectives:

- Recognize different types of projects and understand their scope, complexity, and industry-specific needs.
- Grasp the significance of time management in projects, and become familiar with tools like Gantt charts, Work Breakdown Structure (WBS), and other time management techniques.
- Learn the different types of floats (total float, free float, independent float) and their significance in project scheduling and decision-making.
- Apply emerging trends and tools for project scheduling, and gain proficiency in applying these tools to projects.

Course Outcomes:

After completion of the course, learners should be able to

CONo	CO	BL
1	**Articulate** the key functions of management (planning, organizing, leading, controlling) and apply them in project scenarios.	2
2	**Apply** time management tools, including WBS, Gantt charts to plan and monitor project progress.	3
3	**Create** AON (Activity on Node) diagrams, **analyze** project dependencies, and optimize project scheduling based on critical path analysis.	3
4	**Calculate** and interpret different types of float (total, free, independent) and use float management to optimize project timelines.	3
5	**Apply** PERT (Program Evaluation and Review Technique) for uncertainty management in project schedules.	3

Course Contents

Unit I	**Introduction to Construction Project Management**	**7 Hours**

Importance, Objectives & Functions of Management, Principles of Management, Categories of Project , Project Failure, Project---Life Cycle Concept and Cost Components, Importance of Organizational Structure in Management- Authority / Responsibility Relation, Management By Objectives (MBO)

#Exemplar/Case Studies : Case study on site layout design

***Mapping of Course Outcomes**	**CO1**

Unit II	**Time Management, Work Breakdown Structure (WBS), Gantt Charts**	**7 Hours**
Time Management –overview, Basics of Work Breakdown Structure(WBS), Tools for time management, Gantt/Bar Chart –History, Representation, Progress Monitoring, Uses, Steps to draw a Bar Chart, Develop a Bar Chart, Pros and cons.		
#Exemplar/Case Studies: Case study on any one construction site showing WBS		
***Mapping of Course Outcomes**	**CO2**	
Unit III	**Duration Estimation, Network Representation and analysis**	**7 Hours**
Duration Estimation – Types, Inputs, Methods, Parametric Estimation, Factors influencing productivity, example of ideal productivity, Factored productivity and working time factor, Methods to estimate activity duration, Types of networks –Introduction, techniques and examples on Bar Chart or AON		
#Exemplar/Case Studies : Case study on any one construction site showing Bar Chart or AON.		
***Mapping of Course Outcomes**	**CO3**	
Unit IV	**Network representation and analysis**	**8 Hours**
Introduction to floats, Types of floats, examples, Uses of floats for project decision, Two span bridge - activity identification and duration estimation, Apply network analysis to two span bridge, Two span bridge- resource constraint in network logic		
#Exemplar/Case Studies : Do the activity identification and duration estimation of bridge construction.		
***Mapping of Course Outcomes**	**CO4**	
Unit V	**Time cost trade off (crashing) and Resource scheduling**	**8 Hours**
Fast tracking Vs crashing, relationship between activity direct cost and activity duration - assumptions, time cost trade off - example, Steps for crashing, Incorporating factors such as bonus and penalty. Influence of resources on schedule -example , Resource decision, Resource over allocation - examples, Resource profile requirements, Resource levelling - example		
#Exemplar/Case Studies: Do the time cost trade off or resource scheduling of any one construction site.		
***Mapping of Course Outcomes**	**CO5**	
Unit VI	**Project monitoring and control**	**8 Hours**
Review of key issue in project monitoring, earn value concept- examples, Basic earn value -definition and terminology, Uncertainty in project schedule, PERT background and assumption stepwise procedure, PERT example, Emerging trends /tools in project planning		
#Exemplar/Case Studies: Implementation of PERT or Emerging Tools in a Real Project.		
***Mapping of Course Outcomes**	**CO2,CO5**	
Learning Resources		

Text Books
T1. "Project Planning and control" by Prof. D. Koshy Varghese **T2.** "Project Planning and Control: A Managerial Approach" by Peter W. G. Morris
Reference Books :
R1. "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" by Harold Kerzner **R2.** "Project Management: A Managerial Approach" by Jack R. Meredith & Samuel J. Mantel
Additional Resources: (Books, e-Resources) http://library.atu.kz/files/128706.pdf
MOOC Courses links : ● https://nptel.ac.in/courses/105106149 ● https://www.coursera.org/specializations/project-management

24-HOC-CE-2-02A: Principles of Construction Management

Teaching Scheme:	**Credit:** 3	**Examination Scheme:**
Theory: 3 Hours/Week		**CIE** : 20 Marks **MSE : -** 20 Marks **SEE** :- 60 Marks

Prerequisites Courses: - 24-HOC-CE-2-01A Project Planning and Control

Companion Course: -

Course Objectives:

- To provide a comprehensive understanding of construction project execution, including resource management, planning, scheduling, and safety management practices.
- To equip students with the knowledge and skills to implement quality control measures and ensure compliance with industry standards in construction processes.
- To familiarize students with the legal and financial frameworks in construction management, focusing on contracts, dispute resolution, and financial planning strategies.

Course Outcomes:

After completion of the course, learners should be able to

CONo	CO	BL
1	Demonstrate an understanding of construction project execution, resource management, and the application of planning and scheduling techniques such as PERT and CPM.	2
2	Apply safety management principles to identify and mitigate risks in construction projects, ensuring compliance with safety standards and practices.	3
3	Implement quality management and control techniques to maintain high standards in construction materials and processes.	3
4	Analyze legal and financial aspects of construction projects, including contract management, dispute resolution, and long-term financial planning.	3

Course Contents

Unit I	**General Overview and Project Organization**	**7 Hours**

Nature of modern construction projects, Overview of steps in execution of a project, Resource management in construction projects, Illustrative examples for evaluation of bids based on different schemes, Types of organization structure.

#Exemplar/Case Studies: High-Rise Commercial Tower Project

***Mapping of Course Outcomes**	**CO1**

Unit II	**Planning & Scheduling**	**7 Hours**
Repayment of a loan, Introduction to planning and scheduling, Project scheduling, PERT, CPM, Project monitoring and control systems, Resource leveling and allocation, crashing of networks,Work Breakdown Structure, Bar chart Techniques.		
#Exemplar/Case Studies: Planning & Scheduling in a Hospital Construction Project		
***Mapping of Course Outcomes**	**CO1**	
Unit III	**Construction Safety Management**	**7 Hours**
Introduction to construction safety, Accidents in construction industry, Personal protective equipment, Implications of construction accidents, Safety organization and safety officer: Roles and Responsibilities, Project safety for High rise Structures and Special Structures in seismic sensitive zones		
#Exemplar/Case Studies: Safety Management in a Large-Scale Infrastructure Project		
***Mapping of Course Outcomes**	**CO2**	
Unit IV	**Quality Management in Construction**	**8 Hours**
Quality control in construction, Total Quality Management, Quality in construction – welding, Epoxy coated bars, Quality control (QC) issues in concrete, Contribution of Quality Gurus, Defects & it's classification in construction, Study of ISO 9001:2015 principles.		
#Exemplar/Case Studies: Quality Management in a Commercial Skyscraper Project		
***Mapping of Course Outcomes**	**CO3**	
Unit V	**Legal Aspects of Construction Projects**	**8 Hours**
Legal issues in construction management - An introduction, Essentials of a good contract, Dispute resolution in construction projects, Types of construction contracts – Definitions, Closing the discussion on legal aspects, Quality control - concrete sewer pipeline, Roles and responsibilities Petty Contractor and Technical Contractor, Role of Advocate in the Construction Projects. Labor Laws : Compensation and Insurances.		
#Exemplar/Case Studies: Contract Dispute – Delays and Cost Overruns		
***Mapping of Course Outcomes**	**CO4**	
Unit VI	**Financial Planning**	**8 Hours**
Long term finance planning, Stock, Borrowings, Debentures, Loan Capital, Public Deposit, Dividend Policies, Bonus Shares, Market value of shares, Reserves. Over and under capitalization, Introduction to Micro financing.		
#Exemplar/Case Studies: Budgeting and Debt Management		
***Mapping of Course Outcomes**	**CO4**	

Learning Resources
Text Books
T1. Construction Management and Accounts -- Singh H. Tata McGraw Hill, New Delhi, 1988 **T2.** Construction Management and Planning by Sengupta and Guha-Tata McGraw Hill publication. **T3.** Quality Control and Total Quality Management P. L. Jain- Tata McGraw Hill Publ. Company **T4.** Construction Safety Management by Raymond E. Levitt and Nancy M. Samelson
Reference Books :
R1. Engineering Economy, Leland T. Blank. Anthony Tarquin. McGraw Hill, 2008 **R2.** Safety Management in Construction Industry – A manual for project managers. NICMAR Mumbai. **R3:** Relevant BIS standards.
Additional Resources: (Books, e-Resources)
MOOC Courses links : ● https://nptel.ac.in/courses/105104161 ● https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-ce10/ ● https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-ce16/

24-HOC-CE-2-01B- Environmental Legislation in India		
Teaching Scheme: Theory: 3 Hours/Week	**Credit:** 3	**Examination Scheme:** **CIE** : 20 Marks **MSE :** 20 Marks **SEE** : 60 Marks
Prerequisite Courses:		
Companion Course:		

Course Objectives:

- To consider the importance of environment and awareness related to its current issues
- To preserve and protect nature's gifts from pollution by implementation of environmental laws and policies.
- To understand environmental public policy strategies in pollution control.

Course Outcomes:

After completion of the course, learners should be able to

CONo	CO	BL
1	Get the importance of environment protection and the role of international laws.	2
2	Understand and apply the acts related to water pollution.	2
3	Understand and apply the acts related to air pollution.	3
4	Understand and apply the acts related to industrial waste	3
5	Understand and apply the acts related to wildlife protection.	3
6	Understand and apply the related to international issues like armed conflict, nuclear, Antarctica and the Arctic	3

Course Contents		
Unit I	**Environmental Laws**	**7 Hours**
Introduction of international environmental law, Principles of environmental law, Human rights to environment and constitution of the world, Sources of environmental law		
#Exemplar/Case Studies: The Bhopal Gas Tragedy and Its Impact on International Environmental Law		
***Mapping of Course Outcomes**	**CO1**	
Unit II	**Water pollution Laws**	**7 Hours**
Law relating to Water pollution, Regulation of wetlands, Dams and the environment, Coastal regulation laws in India, High seas and outer space.		

#Exemplar/Case Studies: The Narmada Dam Project and Its Environmental Legal Challenges		
***Mapping of Course Outcomes**	**CO1, CO2**	
Unit III	**Air Pollution Laws**	**7 Hours**
Law relating to Air pollution, Ozone depletion, Climate change law, Financial mechanisms and technology transfer, Energy laws.		
#Exemplar/Case Studies: The Paris Agreement and India's Climate Change Commitments		
***Mapping of Course Outcomes**	**CO1, CO3**	
Unit IV	**Laws related to industry waste**	**7 Hours**
Law relating to Waste management, Law relating to Plastic and bio- medical waste management, Industrial disasters and the environment, Disaster management and environment, Chemicals and impact on environment		
#Exemplar/Case Studies	The Union Carbide Bhopal Gas Tragedy and Its Impact on Environmental Laws in India	
***Mapping of Course Outcomes**	**CO1, CO4**	
Unit V	**Wildlife Protection Laws**	**7 Hours**
Regulation of Mining sector in India,Forest conservation laws in India, Wildlife protection, Environment crimes		
#Exemplar/Case Studies	Illegal Sand Mining in India and Its Environmental Impact	
***Mapping of Course Outcomes**	**CO1, CO5**	
Unit VI	**International Laws**	**7 Hours**
Nuclear energy and law, Armed conflict and the environment, International law and the Protection of the Antarctica and the Arctic, Regional environmental co-operative framework, International environment institutions		
#Exemplar/Case Studies: The Chernobyl Nuclear Disaster and Its Impact on International Nuclear Laws		
***Mapping of Course Outcomes**	**CO1, CO6**	
Learning Resources		
Text Books		
• Leelakrishnan P. (2008) Environmental Law in India, 3rd ed., Lexis Nexis, India. • Divan S. and Rosencranz A. (2005) Environmental Law and Policy in India, 2 nd ed., Oxford, New Delhi • Newson M.M., Managing the Human Impact on the Natural Environment: Patterns and Processes, International Book Distributor, Dehradun (1993). • M N Rao, Air Pollution Tata McGraw-Hill, 1989		
Reference Books:		

- CPCB, "Pollution Control acts, Rules and Notifications issued thereunder "Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi, 1997
- Trivedi R.K., Handbook of Environmental Laws, Guidelines, Compliances and Standards, Vol I and II, B.S. Publications
- The ISO 14000 Handbook: Joseph Cascio

Additional Resources: (Books, e-Resources)

http://acl.digimat.in/nptel/courses/video/129106002/L57.html

MOOC Courses links :

- https://onlinecourses.swayam2.ac.in/cec20_ge12/preview (Environmental Law By Dr. Bharti Kumar | National Law University, Delhi)

24-HOC-CE-2-02B : Sustainable Construction Materials		
Teaching Scheme: Theory**: 3** Hours/Week	**Credit:** 3	**Examination Scheme:** **CIE** : 20 Marks **MSE :** 20 Marks **SEE** : 60 Marks
Prerequisites Courses: –		
Companion Course: -		

Course Objectives: -

- To Provide a comprehensive knowledge about concept of sustainability and sustainable and contemporary building materials.
- To give adequate knowledge about sustainable methods and technology
- To empower students with brief knowledge of Green Building rating system and different codes and ICT for sustainable constructions

Course Outcomes:

After completion of the course, learners should be able to

CO NO	CO	B.L.
1	To Understand the fundamental concepts of sustainability , the features of sustainability and to apply knowledge regarding sustainability in upcoming construction projects	3
2	To Understand the key concept of sustainability and their application in construction materials	3
3	Identify suitable construction techniques and practices for sustainable buildings and to apply knowledge whenever necessary	3
4	To Analyse and apply recycled material in construction in civil engineering projects.	3
5	To gain practical knowledge of certifications, standards, and innovative trends in sustainable construction.	3
6	To Evaluate the environmental impact of various construction materials using life cycle assessment (LCA).	3

Course Contents		
Unit I	**Introduction to Concept of Sustainability**	**7 Hours**

Introduction and Planet Equivalent, Basics of carbon cycle, Factors affecting carbon cycle , Fundamental of Sustainability, Roles of Materials and embodied energy, Calculations of ecological footprints, Role of Cement in Sustainability and Calculation of chemical energy, Definition and Principles - Environmental, Social, and Economic Pillars , Sustainability in the Built Environment, Benefits and Challenges in Construction Sector.		
#Exemplar/Case Studies:- The Green Building Project – The Edge, Amsterdam		
***Mapping of Course Outcomes**	**CO1**	
Unit II	**Sustainable Construction Materials, Testing and Certifications of Materials**	**8 Hours**
Definition and Classification of Sustainable Materials - Natural vs. Engineered Sustainable Materials – Eco efficient Materials - Bamboo, Recycled Concrete, Fly Ash, etc, Fuel for Cement, Cementitious/supplementary cementitious materials and their characterization, Strength of concrete with supplementary cementitious materials and composite cements, Types of composite cements, Alternative fuel for cement and embodied energy, Life cycle Embodied Energy and Concrete Sustainability, Strength of Concrete and use of admixtures, Curing Methods and use of waste water for mixing and curing, Modern Composite Concrete. Material Testing Standards for Sustainability - Certifications: LEED, BREEAM, IGBC, GRIHA - Importance of Material Transparency and Compliance		
#Exemplar/Case Studies:- Sustainable Building and Material Use in the Construction of Burj Khalifa		
***Mapping of Course Outcomes**	**CO2**	
Unit III	**Recycled and Reused Materials, Alternative Building Materials**	**8 Hours**
Recycled aggregate – ITZ and Processing, Classification of Recycled aggregate : Crushing and Grinding of Aggregate, Crushing and Grinding : Bond's Law + Operational energy : U Value, Operational Energy : Thermal Conductivity Models, Estimation of thermal conductivity, Thermal diffusivity and clay bricks, Types of bricks Kilns and Carbon balance, Comparison of various types of bricks, Kilns and Sealants, Paints and Adhesives, Health hazards of building materials and Emission models, emission models and testing		
#Exemplar/Case Studies:- Sustainable Use of Recycled Aggregates and Thermal Performance in the construction of Bosco Verticale (Vertical Forest), Milan		
***Mapping of Course Outcomes**	**CO3**	
Unit IV	**Life Cycle analysis of Sustainable Materials and Sustainable Construction Techniques**	**8 Hours**
Introduction to Life Cycle Thinking , Phases of LCA , Tools and Software for LCA, Energy-Efficient Construction Practices- MIVAN and Tunnel Forming Techniques - Prefabrication and Modular Construction , Low Carbon Concrete and Alternative Construction Methods, Waste Management during Construction		
#Exemplar/Case Studies:- Sustainable construction practices in the green building of the Crystal, London		
***Mapping of Course Outcomes**	**CO4**	

Unit V	**Green Building Rating System, Certifications and Standards**	**7 Hours**
Introduction to Green building, Introduction to LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method), Green Globes and other sustainability certification programs, How material selection contributes to certification, Green Building Rating systems : Guidelines from IGBC, LEED Rating system, TERI-GRIHA rating systems. Codes :- Energy conservation building code (BEE), National Building Code. Concept of Net zero buildings :- Use of BIPV, and other renewable energy in building.		
#Exemplar/Case Studies:- Sustainable Design and Certification of the Edge, Amsterdam		
***Mapping of Course Outcomes**	**CO5**	
Unit VI	**Economics of Sustainability and Sustainable Design in Practice**	**7 Hours**
Cost vs. Benefit Analysis of Sustainable Construction, Return on Investment (ROI) in Green Construction, Incentives and Policies for Sustainable Construction, Principles of Passive Design and Energy Efficiency - Integrating Smart Technologies with Sustainability		
#Exemplar/Case Studies:- Cost Vs Benefit analysis and ROI in green Construction		
***Mapping of Course Outcomes**	**CO6**	
Learning Resources		
Text Books		
T1. Sustainable Construction Materials by R. S. M. Ganjian and R. H. S. Kian **T2.** Introduction to Sustainable Engineering by Michael L. G. H. Shaw **T3**. Automation Systems in Smart and Green Buildings (Modern Building Technology), Er. V. K. Jain Khanna Publishers **T4.** P. K. Singh, rainwater harvesting : Low Cost indigenous and innovative technologies, Macmillan Publishers, India		
Reference Books :		
R1. BIS National Building code, New Delhi **R2.** Energy Conservation Building code of India		
Additional Resources: (Books, e-Resources) **1.**Online materials on current trends in sustainable construction **2.**Research papers on emerging materials **3.**Sustainable construction conferences and workshops		
NPTEL/Swayam Courses links :https://archive.nptel.ac.in/courses/105/102/105102195/ **https://onlinecourses.swayam2.ac.in/ntr25_ed36/preview**		

Mid Semester Examination (MSE: March 2025)

Programme: AIDS/Civil/Computer/E&TC/Mechanical/MBA-I	
Class	**Pattern:**
Course Name:	**Course Code:**
AY:	**Semester:**
Time:	**Maximum Marks:** 20

Instructions to the candidates:

1. *Solve Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6*
2. *Bold-faced figures to the right indicate full marks.*
3. *Assume the suitable data if necessary*
4. *Any other instruction required for particular course may be added by subject/course chairman*

QN	Question	Mark
1a)	Q 1 can be bifurcated to maximum two sub questions	07
1b)		
	OR	
2	Q 2 can be bifurcated to maximum two sub questions	07
3	Q 3 can be bifurcated to maximum two sub questions	07
	OR	
4	Q 4 can be bifurcated to maximum two sub questions	07
5	Q 5 can be bifurcated to maximum two sub questions	06
	OR	
6	Q 6 can be bifurcated to maximum two sub questions	06

Shree Neminath Jain Brahmacharyashram's
Late Sau. Kantabai Bhavarlalji Jain College of Engineering
Neminagar, Chandwad -423 101 Dist. Nashik.
An Autonomous Institute, Affiliated to Savitribai Phule Pune University, Pune

Semester End Examination (Regular) <<Month Year>>

Programme: Class:

Course and Code: Semester

Academic Year: Pattern:

Time: 2Hr 30 Min Examination: SEE (Month Year) Max. Marks: 60

Instructions to the candidates:

1. *Solve Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6, Q.7 OR Q.8*
2. *Bold-faced figures to the right indicate full marks.*
3. *Assume the suitable data if necessary, but Justify it.*
4. *Draw the neat labelled diagrams, wherever necessary.*

QN	Question	Marks
1 a)	Unit I	6
1 b)	Unit II	7
1 c)	Unit III	7
	OR	
2 a)	Unit I	6
2 b)	Unit II	7
2 c)	Unit III	7
3 a)	Unit IV	7
3 b)	Unit IV	7
	OR	
4 a)	Unit IV	7
4 b)	Unit IV	7
5 a)	Unit V	7
5 b)	Unit V	6
	OR	
6 a)	Unit V	7
6 b)	Unit V	6
7 a)	Unit VI	7
7 b)	Unit VI	6
	OR	
8 a)	Unit VI	7
8 b)	Unit VI	6

Supporting Document

Sr. No.	Syllabus Contains	Short Answer	Yes / No	Page No. (In Syllabus)
1	अभ्यासक्रम	Enclosed in Syllabus	Yes	1
2	पात्रता	(As per the Rules and Regulations mentioned in MoM)	Yes	22
3	अभ्यासक्रमाची उद्दिष्टे	Enclosed in Syllabus	Yes	9
4	विषयाचे नाव	Enclosed in Syllabus	Yes	6
5	घटकांचा तपशील	Enclosed in Syllabus	Yes	6
6	तासिका	Enclosed in Syllabus	Yes	6
7	श्रेयांक पद्धत	Enclosed in Syllabus	Yes	6
8	संदर्भ साहित्य	Enclosed in Syllabus	Yes	11
9	संदर्भ ग्रंथ	Enclosed in Syllabus	Yes	11
10	प्रश्नपत्रिकेचे स्वरूप	Enclosed in Syllabus	Yes	21
11	अंतर्गत मूल्यमापनाचे स्वरूप	Enclosed in Syllabus	Yes	6
12	सत्र परीक्षेचे स्वरूप	Enclosed in Syllabus	Yes	22
13	गुणांकन	Enclosed in Syllabus	Yes	6