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 2026-27)

CHAIRMAN
BOARD OF STUDIES CIVIL ENGINEERING
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SNJB's Late Sau. K. B. Jain College of Engineering, Chandwad

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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.

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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 **Computer 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 Computer 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 V

24-HOC-CE-3-03A: Admixtures and Special Concretes

Teaching Scheme: Theory: 3 Hours/Week	**Credit:** 3	**Examination Scheme:** **SEE** : 100 Marks

Prerequisites Courses: 24-PCC-CE-3- 02: Concrete Technology

Companion Course: —-

Course Objectives:

- To explain the composition, classification, and hydration of cement.
- To learn about the various types and functions of chemical admixtures in concrete
- To introduce mineral admixtures and their role in sustainable concrete.
- To evaluate the sustainability of concrete and its environmental impact through life cycle assessment.
- To study the principles of designing and producing high-strength, ultra-high-performance, and other special concretes.
- To apply knowledge of material science to solve challenges in modern concrete applications.

Course Outcomes:
After completion of the course, learners should be able to

CO No	CO	BL
CO1	**Classify** different types of cement based on composition	2
CO2	**Identify** and describe the use of chemical admixtures to control concrete properties.	2
CO3	**Explain** the role of mineral admixtures.	2
CO4	**Assess** concrete's environmental footprint and sustainability using LCA.	3
CO5	**Apply** the Principles of mix design to high-strength and ultra-high-performance concrete.	3
CO6	**Understand** the properties of various special concrete.	2

Course Contents

Unit I	**Fundamentals of Cement Chemistry and Concrete Performance**	**6 Hours**

Cement history and production, Quality control and composition, Composition of Cement and Classification of Cement, Hydration of Cement, Basics of Hardened Concrete & Curing

#Exemplar/Case Studies: Case Study on Concrete and Material

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

Unit II	**Chemical Admixtures in Concrete**	**6 Hours**

Introduction to chemical admixtures, Water reducers, Set controllers (accelerators and retarders), Standards for admixtures, Air entrainers, Rheology and viscosity modifying agents (VMA)		
#Exemplar/Case Studies: Chemical Admixtures: Mechanism of corrosion		
***Mapping of Course Outcomes**	**CO2**	
Unit III	**Mineral Admixtures and Supplementary Cementitious Materials**	**6 Hours**
Introduction and classification of mineral admixtures, Composition, particle size distribution, and microstructure of SCMs, Flyash: introduction, classification, effects on fresh & hardened concrete, Silica fume: effects on properties, GGBS: properties, hydration, durability, Metakaolin.		
#Exemplar/Case Studies: Mineral Admixtures : Agricultural ashes : Rice husk ash		
***Mapping of Course Outcomes**	**CO3**	
Unit IV	**Life Cycle Assessment and Sustainability of Concrete**	**4 Hours**
Life cycle assessment of concrete, SCMs and sustainability assessment, Environmental impact and carbon footprint reduction		
#Exemplar/Case Studies: Clinker/ Cement Production Nandyal Cement Plant Kurnoor, Andhra Pradesh, India		
***Mapping of Course Outcomes**	**CO4**	
Unit V	**High Strength and Ultra High Performance Concretes**	**6 Hours**
High Strength Concrete (HSC): definition, particle packing, mix design, strength and durability, stress-strain relationships, applications, Ultra High Performance Concrete (UHPC): design principles, strength and durability		
#Exemplar/Case Studies: Case Studies of Systematic Repair & Strengthening Techniques		
***Mapping of Course Outcomes**	**CO5**	
Unit VI	**Special Concretes for Modern Applications**	**8 Hours**
Self Compacting Concrete (SCC): Introduction, design requirements, segregation, workability tests, mix designs, concrete properties, Mass concrete: introduction, materials, thermal cracking, temperature monitoring, Lightweight concrete: classifications, foamed and aerated concretes, lightweight aggregates, High density concrete: heavyweight aggregates, design, 3D Printing Concrete: introduction, process, classification, mix design, critical parameters, failure modes		
#Exemplar/Case Studies: Construction of a 3D printed building in shanghai		
***Mapping of Course Outcomes**	**CO6**	
Learning Resources		
Text Books		
T1. Mehta, P. K., and Monteiro, P. J. M., Concrete: Microstructure, Properties and Materials, Fourth Edition (Indian Edition), McGraw Hill, 2014.		

Reference Books :
R1. Neville, A. M., Properties of Concrete, Pitman Publishing, Inc., MA, 1981. **R2.** Thomas M.D.A., Supplementary Cementing Materials in Concrete, CRC Press, Francis & Taylor Group, Florida, USA, 2013. **R3.** J. Newman and B. S. Choo, Eds., Advanced Concrete Technology, Four Volume Set, Elsevier, 2003
Additional Resources: (Books, e-Resources) https://worksaccounts.com/wp-content/uploads/2020/08/Concrete-Microstructure-Properties-and-Materials.pdf
MOOC Courses links : ● https://nptel.ac.in/courses/105106225

24-HOC-CE-3-04A : Sustainable Engineering Concepts and Life Cycle Analysis

Teaching Scheme: Theory: 3 Hours/Week	**Credit:** 3	**Examination Scheme:** **SEE** : 100 Marks

Prerequisite Course: -NA

Companion Course: - NA

Course Objectives:

- To Understand the principles of sustainability, system thinking, and resource flows, and their relevance in engineering systems.
- To Analyze environmental challenges and risks associated with engineering activities using life-cycle and sustainability perspectives.
- To Apply and analyze Life Cycle Assessment (LCA) methodology, including data collection, inventory, impact assessment, and interpretation as per ISO standards.
- To Apply sustainability indicators to compare engineering alternatives and support environmentally informed decision-making through practical case studies.

Course Outcomes:

After completion of the course, learners should be able to

CO No	CO	BL
1	**Explain** the concepts of sustainability, system thinking, and resource flows in engineering applications.	2
2	**Analyze** environmental challenges and risks associated with engineering and industrial activities.	4
3	**Apply** basic Life Cycle Assessment (LCA) methodology for environmental data collection and inventory analysis.	3
4	**Analyze** the Life Cycle Assessment framework and its implementation as per ISO standards.	4
5	**Analyze** life cycle inventory and impact assessment results for environmental performance evaluation.	4
6	**Apply** sustainability indicators for comparing engineering alternatives through case studies.	3

Course Contents

Unit I	**Sustainability Foundations & System Thinking**	**7 Hours**

Concept of sustainability and sustainable development, Triple Bottom Line: Environmental, Economic, and Social dimensions, Systems thinking in engineering, Material flow analysis and waste management, Water–Energy–Food nexus, Role of engineers in sustainable development

#Exemplar/Case Studies: Case studies on Sustainability initiatives in infrastructure projects, Resource-efficient construction practices

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

Unit II	**Risk Assessment & Environmental Challenges**	**7 Hours**

Environmental challenges in industrial and infrastructure projects, Risk concepts and life-cycle thinking, Environmental Risk Assessment (ERA): sources, pathways, receptors, Health and ecological impacts of pollutants, Uncertainty and risk-based decision making		
#Exemplar/Case Studies: Case studies on Industrial pollution incidents, Risk analysis of construction and material processing activities		
***Mapping of Course Outcomes**	**CO2**	
Unit III	**Environmental Data Collection & LCA Methodology (Basics)**	**7 Hours**
Environmental data collection and data quality issues, Statistical considerations and uncertainty, Analytical instruments used in environmental assessment, Introduction to Life Cycle Assessment (LCA), Goal & scope definition, Life Cycle Inventory (LCI) – basics, Overview of LCA software tools		
#Exemplar/Case Studies: Case studies on Simple LCA example of a construction material		
***Mapping of Course Outcomes**	**CO3**	
Unit IV	**Detailed LCA Methodology & ISO Standards**	**8 Hours**
Historical development of LCA, Detailed LCA framework, Life Cycle Impact Assessment (LCIA) methods, Interpretation of LCA results, Advantages and limitations of LCA, ISO 14040 and ISO 14044 standards for LCA		
#Exemplar/Case Studies: Perform a simplified Life Cycle Assessment (LCA) to compare the environmental impacts of burnt clay bricks and fly ash bricks using the ISO 14040–14044 framework.		
***Mapping of Course Outcomes**	**CO4**	
Unit V	**Life Cycle Inventory, Impact Assessment & Interpretation**	**8 Hours**
Unit processes and system boundaries, Inventory data modeling, Impact categories and characterization, Data quality and sensitivity analysis, Interpretation of LCIA results, Environmental performance indicators		
#Exemplar/Case Studies: Case study on to develop a simplified LCI and LCIA to compare OPC cement and PPC cement and interpret results using environmental performance indicators.		
***Mapping of Course Outcomes**	**CO5**	
Unit VI	**Sustainable Design, Decision Making & Case Studies**	**8 Hours**
Sustainable engineering design principles, Green materials and cleaner technologies, Chemical release, fate, and transport concepts, Environmental cost and benefit analysis, Economic, environmental, and social indicators, Sustainability-based decision making, Comparative case studies (bio-fuels vs fossil fuels, bioplastics vs plastics, conventional vs sustainable technologies)		
#Exemplar/Case Studies:	Case studies on Technology selection using sustainability indicators, Infrastructure sustainability assessment	
***Mapping of Course Outcomes**	**CO6**	

Learning Resources
Text Books
T1. Graedel, T. E., & Allenby, B. R, Industrial Ecology and Sustainable Engineering, Pearson **T2.** Guinée, J. B, Handbook on Life Cycle Assessment, Springer publications
Reference Books :
R1. Environmental Management – Life Cycle Assessment Standards, ISO 14040 & ISO 14044 **R2.**Curran, M. A, Wiley, Life Cycle Assessment Handbook
Additional Resources: (Books, e-Resources)
MOOC Courses links : ● https://nptel.ac.in/courses/105105157 (Web and Video)

Honors Syllabus for SEM VI

24-HOC-CE-3-03B : Smart Cities and Smart Villages

Teaching Scheme: Theory: 3 Hours/Week	**Credit :** 3	**Examination Scheme:** **SEE** : 100 Marks

Prerequisites Courses: -

Companion Course: -

Course Objectives:

- Understand the concept, evolution, and framework of Smart Cities and Smart Villages.
- Learn urban planning methods, governance systems, and development strategies.
- Gain knowledge of infrastructure planning and service delivery systems.
- Understand financing methods and economic aspects of urban and rural development.
- Develop vision-building and leadership skills for sustainable area development.
- Apply smart technologies and sustainability practices in urban and rural contexts.

Course Outcomes:

After completion of the course, learners should be able to

CO No	CO	BL
CO1	Explain the concept, purpose, features, history, funding, and challenges of Smart Cities and Smart Villages.	2
CO2	Analyze modern urban development approaches and public health planning.	3
CO3	Describe government structure, multi-level planning systems, and urban planning documents such as development plans and project reports.	2
CO4	Describe governance structure and urban planning documents.	2
CO5	Evaluate municipal finance sources and funding mechanisms.	3
CO6	Apply smart village models and growth strategies in planning.	3

Course Contents

Unit I	**Framework for Smart City Development**	**7 Hours**

Smart cities concept, purpose, features, Smart cities history, Basic infrastructure, Smart cities procedure, funding and challenges, City development vision, Town planning act 1947, Smart city mission, Leadership in creating the vision, Steps to build up the vision.

#Exemplar/Case Studies - Aurangabad or Nashik smart city.

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

Unit II	**Contemporary Trends in Urban Planning**	**7 Hours**

Modernism to neoliberalism, New approach to urban planning- Knowledge economy, financial cities, creative cities, green city, transit oriented development, use of technology, New urbanism, Sustainability goals, Covid 19 Pandemic and health.		
#Exemplar/Case Studies - Mumbai Metropolitan Region (MMR).		
***Mapping of Course Outcomes**	**CO2**	
Unit III	**Urban Planning Systems and Governance Framework**	**7 Hours**
Three tiers of government, Multi level planning and finance, urban plan - perspective plan, development plan, zonal plan, annual plan and project report, Planning process, Basic parameters for development, Planning control tools.		
#Exemplar/Case Studies - Pune Smart City Mission.		
***Mapping of Course Outcomes**	**CO3**	
Unit IV	**Urban infrastructures and services**	**7 Hours**
Infrastructure, Classification of urban infrastructure, Road and transportation, Major physical infrastructure - Water supply, Sewage and sanitation, Drainage, Social infrastructure.		
#Exemplar/Case Studies - Navi Mumbai – Planned Urban Infrastructure Development, Services used for sustainable cities in Japan		
***Mapping of Course Outcomes**	**CO4**	
Unit V	**Municipal Finance and alternate finance source**	**7 Hours**
Sources of municipal finance, Finance resource management, Issues and roles, alternate sources of municipal finance, bonds, borrowing, example of financing public infrastructure.		
#Exemplar/Case Studies - Municipal Finance and Infrastructure Funding – Nashik Municipal Corporation (NMC).		
***Mapping of Course Outcomes**	**CO5**	
Unit VI	**Smart Village**	**7 Hours**
Motivation and approaches, Government programs for villages, The five STERM [Science, Technology, Engineering, Regulation, Management] forces, Smart Village ecosystem, Service chain and resources, Delivery services, Growth strategies for villages, GRIP framework, Future growth for villages.		
#Exemplar/Case Studies - Pochampally Village, Hivare Bajar.		
***Mapping of Course Outcomes**	**CO6**	
Learning Resources		
Text Books		
T1. Houbing Song, Ravi Srinivasan, Smart Cities: Foundations, Principles, and Applications, Wiley & Sons, Edition - 1. **T2.** Schahram Dustdar, Stefan Nastić, Smart Cities: The Internet of Things, People and Systems, Springer International Publishing, Edition - 1.		

Reference Books :
R1. Arpan Kumar Kar, M. P. Gupta, Advances in Smart Cities: Smarter People, Governance, and Solutions, Taylor & Francis, Edition-1. **R2.** V. I. Lakshmanan, Arun Chockalingam, Smart Villages: Bridging the Global Urban-Rural Divide, Springer, Edition - 1.
Additional Resources: (Books, e-Resources) ● https://drive.google.com/file/d/12YT7fS7sOMitoJF_IJ28WoRDMwPl3gys/view?usp=sharing
MOOC Courses links : ● http://kcl.digimat.in/nptel/courses/video/124107158/L22.html ● https://www.youtube.com/watch?v=SfQtybyBwFk&t=172s ● https://www.youtube.com/watch?v=1AT2jjPVKvM - Unit-VI

24-HOC-CE-3-04B: Flood Mitigation and Hazard Management

Teaching Scheme: Theory: 3 Hours/Week	**Credit:** 3	**Examination Scheme:** **SEE** : 100 Marks

Prerequisites Courses: 24-PEC-CE-3-03A: Solid and Hazardous Waste Management

Companion Course: –

Course Objectives:

- Introduce students to the causes and impacts of floods as a natural hazard.
- Familiarize students with hydrological, hydraulic, and geomorphological aspects of flood generation.
- Understanding of flood forecasting, warning, and risk assessment methods.
- Study structural and non-structural flood mitigation measures and integrated flood management strategies.
- Train students in disaster preparedness, emergency planning, and post-flood rehabilitation techniques.
- Enable students to use modern tools and techniques (GIS, Remote Sensing, Modeling) for flood hazard management.

Course Outcomes:

After completion of the course, learners should be able to

CO No	CO	BL
CO1	**Explain** the causes, types, and impacts of floods on communities and ecosystems.	2
CO2	**Analyze** flood hydrology and perform basic flood frequency analysis.	2
CO3	**Design** and evaluate structural flood mitigation measures like levees, embankments, detention basins, and channel improvements.	2
CO4	**Recommend** non-structural measures such as zoning, flood forecasting, early warning systems, and insurance.	2
CO5	**Apply** GIS and remote sensing techniques for flood hazard mapping and risk assessment.	2
CO6	**Formulate** flood management plans and disaster mitigation strategies for real-life scenarios.	2

Course Contents

Unit I	**Introduction to Floods and Hazards**	**8 Hours**

Definition of floods, flash floods, urban floods, riverine floods, coastal floods; Causes of floods – natural and anthropogenic; Impacts of floods on life, economy, infrastructure, and environment; Flood hazard, vulnerability, and risk concepts; Flood disaster case studies (national & international).

#Exemplar/Case Studies: 2013 Uttarakhand Floods

***Mapping of Course Outcomes**	CO1

Unit II	**Flood Hydrology and Analysis**	**8 Hours**
Hydrological cycle and its link to floods; Rainfall-runoff relationship, infiltration, and hydrograph concepts; Estimation of design flood: empirical, rational, and unit hydrograph methods; Flood frequency analysis using statistical methods (Gumbel, Log-Pearson Type III); Probable Maximum Flood (PMF) and Standard Project Flood (SPF).		
#Exemplar/Case Studies: 2018 Kerala Floods		
***Mapping of Course Outcomes**	CO2	
Unit III	**Flood Routing and Modeling**	**7 Hours**
Hydraulic flood routing: Muskingum method, reservoir routing; Flood wave propagation and attenuation; Basics of 1D/2D hydrodynamic models (HEC-RAS, MIKE FLOOD); Application of numerical modeling in flood forecasting.		
#Exemplar/Case Studies: 2013 Uttarakhand Floods (Tehri Dam and Bhagirathi–Ganga Basin)		
***Mapping of Course Outcomes**	CO3	
Unit IV	**Structural Flood Mitigation Measures**	**7 Hours**
Levees, dikes, flood walls, embankments – design considerations; Flood storage reservoirs, detention basins, channel improvements; Diversion channels, spillways, and flood bypasses; Urban stormwater drainage systems and sustainable urban drainage (SUDS); Limitations and failures of structural measures.		
#Exemplar/Case Studies: Kosi River Embankment System, Bihar		
***Mapping of Course Outcomes**	CO4	
Unit V	**Non-Structural Measures and Integrated Flood Management**	**8 Hours**
Floodplain zoning and land-use planning; Flood forecasting and early warning systems; Community participation and awareness programs; Flood insurance and financial risk transfer mechanisms; Role of NDMA, CWC, IMD, and local authorities in flood management; Integrated flood management (IFM) principles.		
#Exemplar/Case Studies: Flood Management in Brahmaputra Basin, Assam		
***Mapping of Course Outcomes**	CO5	
Unit VI	**Flood Disaster Preparedness and Rehabilitation**	**7 Hours**
Disaster preparedness and emergency response plans; Evacuation strategies, rescue operations, and relief distribution; Post-flood damage assessment and rehabilitation of affected areas; Resilient infrastructure design and climate change adaptation; Best practices in flood mitigation (Indian & international).		
#Exemplar/Case Studies: 2008 Bihar Kosi Flood – Disaster Preparedness and Rehabilitation		
***Mapping of Course Outcomes**	**CO6**	
Learning Resources		
Text Books		

T1. S.C. Rangwala, Flood Control and River Training Works, Charotar Publishing House T2 O.P. Sharma, Disaster Management Handbook, IK International Publishing House
Reference Books :
R1 Gareth Pender, Hazel Faulkner, Flood Risk Science and Management, Wiley-Blackwell Publication R2 P.N. Modi, Irrigation, Water Resources and Water Power Engineering, Standard Book House R3 K. Subramanya, Engineering Hydrology, Tata McGraw-Hill R4 S.K. Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers R5 R.K. Sharma, T.K. Sharma, Hydrology and Water Resources Engineering, Dhanpat Rai Publications
Additional Resources: (Books, e-Resources)
MOOC Courses links : ● https://nptel.ac.in/courses/105105214 ● .https://nptel.ac.in/courses/126105334