BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi)

Avalahalli, Yelahanka, Bengaluru 560064

Bachelor of Engineering

Department of Civil Engineering

VII Semester Scheme and Syllabus
2022 Scheme - Autonomous

Approved in the BoS meeting held on 23/08/2025

Program Educational Objectives (PEOs)

- Lead a successful career by analyzing, designing and solving various problems in the field of Civil Engineering.
- Execute projects through team building, communication and professionalism.
- Excel through higher education and research for endured learning.
- Provide effective solution for sustainable environmental development.

Vision and Mission of the Department

Vision

To be an Exemplary Centre, disseminating quality education and developing technically competent civil engineers with professional integrity for the betterment of society.

Mission

- Impart technical proficiency through quality education.
- Motivate entrepreneurship through enhanced industry - interaction and skill-based training.
- Inculcate human values through outreach activities.

Program Specific Outcomes (PSOs)

- Identify & address the challenges in transportation, sanitation, waste management, and urban flooding in metropolitan cities.
- Provide solutions related to civil engineering built environment through a multidisciplinary approach.

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BMS Institute of Technology and Management
(An Autonomous Institution, Affiliated to VTU Belagavi)
Avalahalli, Doddaballapur Main Road, Bengaluru, Karnataka – 560064

REVISED

Date: 18-12-2024

CONTINUOUS INTERNAL EVALUATION (CIE)
AND
SEMESTER END EXAMINATION (SEE) PATTERN

(Applicable to UG students admitted from the 2022 batch, effective from the Academic year 2024-25 onwards)

The UG students admitted from the 2022 batch onwards are hereby informed to note the following regarding Continuous Internal Evaluation and Semester End Examination pattern:

- The Weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Examination (SEE) is 50%.
- The Minimum passing mark for the CIE is 40% of the Maximum marks (i.e. 20 marks out of 50) and for the SEE minimum passing mark is 35% of the Maximum marks (i.e. 18 out of 50 marks).
- A student will be declared to have passed the course if they secure a minimum of 40% (i.e. 40 marks out of 100) in the combined total of the CIE and SEE.

The following tables summarize the CIE and SEE Patterns for the courses of various credits:

IPCC COURSES: 4 CREDITS OR 3 CREDITS						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	20	-	The sum of the two internal assessment tests will be **80 Marks** and the same will be scaled down to **20 Marks**.
		CIE – Test 2 (1.5 hr)	40			

	CIE – CCA (Comprehensive Continuous Assessment)	CCA	10	05	-	Any one assessment method can be used from the list appended below.
	Total CIE Theory			**25**	**10**	
Practical Component	CIE - Practical		30	15	-	Each laboratory experiment is to be evaluated for **30 Marks** using appropriate rubrics.
	CIE Practical Test		20	10	-	One test after all experiments to be conducted for **20 Marks**
	Total CIE Practical			**25**	**10**	
Total CIE Theory + Practical				**50**	**20**	
SEE			100	50	18	SEE exam is a theory exam, conducted for **100 Marks**, scored marks are scaled down to **50 Marks.**
CIE + SEE				**100**	**40**	
The laboratory component of the IPCC shall be for CIE only.						

Professional Core Courses (PCC) / Engineering Science Courses (ESC): 03 and 02 Credit						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	30	-	The sum of the two internal assessment tests will be **80 Marks** and the same will be scaled down to **30 Marks**.
		CIE – Test 2 (1.5 hr)	40			
	CIE - CCAs	CCA	20	20	-	Any Two assessment methods can be used from the list. If it is project-based, one CCA shall be given.
	Total CIE Theory			**50**	**20**	
SEE			100	50	18	SEE is a theory exam, conducted for **100 Marks**, scored marks are scaled down to **50 Marks.**
CIE + SEE				**100**	**40**	

NON-IPCC COURSES: 01 Credit Course - MCQ						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation Component	CIE – IA Tests (MCQs)	CIE – Test 1 (1 hr)	40	40	-	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on a higher Bloom's level. The sum of the two internal assessment tests will be **80 Marks**, and the same will be scaled down to **40 Marks**.
		CIE – Test 2 (1 hr)	40			
	CIE - CCAs	CCA	10	10	-	Any One Assessment method can be used from the list provided below.
	Total CIE			**50**	**20**	
SEE (MCQ Type)				50	18	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on higher Bloom's level. MCQ-type question papers of 50 questions with each question of a **01 Mark**, examination duration is 01 hour.
CIE + SEE				**100**	**40**	

Professional Core Course Laboratory (PCCL) /Ability Enhancement Course Laboratory (AEC) - 01 Credit					
Evaluation Type	**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation	CIE - Practical	30	30		Each laboratory experiment is to be evaluated for **30 Marks** using appropriate rubrics.
	CIE - Practical Test	50	20		One test after all experiments is to be conducted for **50 Marks** and to be scaled down to **20 Marks**.
	Total CIE	-	**50**	**20**	
Semester End Examination		100	50	18	SEE to be conducted for **100 Marks**.
CIE+SEE		**100**		**40**	

Learning Activities for CCAs:
A faculty member may choose the following CCAs based on the needs of the course:

1. Course project
2. Literature review
3. MOOC
4. Case studies
5. Tool exploration
6. GATE-based aptitude test
7. Open book tests
8. Industry integrated learning
9. Analysis of Industry / Technical / Business reports
10. Programming assignments with higher Bloom level
11. Group discussions
12. Industrial / Social / Rural projects

CoE 18/12/2024

Dean AA 18.12.24

Principal 18/12/24

Copy To:
1. The Vice-Principal, Deans, HoDs, and Associate HoDs
2. All faculty members and students of 2022, 2023, and 2024 batch.
3. Examination Section

Scheme of VII Semester

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institution Affiliated to VTU, Belagavi)

B. E. in Civil Engineering

Scheme of Teaching and Examinations – 2022 Scheme

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

VII Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Credits Distribution				Examination				Contact Hours/week
					L	T	P	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (H)	
1	IPCC	BCV701	Design of Steel Structural Elements	TD: CV PSB: CV	3	0	1	4	50	50	100	3	5
2	PCC	BCV702	Design of Pre-Stressed Concrete		3	0	0	3	50	50	100	3	3
3	PEC	BCV703X	Professional Elective Course III		3	0	0	3	50	50	100	3	3
4	OEC	BCV704X	Open Elective Course II		3	0	0	3	50	50	100	3	3
5	PW	BCVP705	Major Project Phase II		0	0	7	7	100	100	200	3	14
6	PCCL	BCVL706	Environmental Engineering Lab		0	0	1	1	50	50	100	3	2
TOTAL								**21**	**350**	**350**	**700**	**-**	**30**

IPCC: Integrated Professional Core Course, **PCC**: Professional Core Courses, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC**: Non Credit Mandatory Course, **ESC**: Engineering Science Course **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course III		Open Elective Course II	
Course Code	**Course Name**	**Course Code**	**Course Name**
BCV703A	Design of Hydraulics Structures	BCV704A	Introduction to Intelligent Transportation Systems
BCV703B	Ground Improvement Techniques	BCV704B	Conservation of Natural Resources
BCV703C	Environmental Impact Assessment	BCV704C	Energy Efficiency, Acoustics and Daylighting In Building
BCV703D	Design of formwork and scaffolding	BCV704D	Environmental Protection and Management
BCV703E	Advanced Design of RCC Structures	BCV704E	Water Resources and International Relations

Integrated Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this condition shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses (OEC): Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the program.
- The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the program.
- The minimum students' strength for offering open electives is 10. However, this condition shall not be applicable to cases where the admission to the program is less than 10.

Major Project Phase II: The objective of the Project work is (i) To encourage independent learning and the innovative attitude of the students. (ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills. (iii) To impart flexibility and adaptability. (iv) To inspire teamwork. (v) To expand intellectual capacity, credibility, judgment and intuition. (vi) To adhere to punctuality, setting and meeting deadlines. (vii) To instill responsibilities to oneself and others. (viii)To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

VII Semester Syllabus

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

Design of Steel Structural Elements (3:0:1) 4

(Effective from the academic year 2024-25)

Course Code	BCV701	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40+10	Exam Hours	03

Course objectives:

1. To understand the fundamentals and design philosophy of steel structures.
2. To learn IS code provisions and section classification.
3. To understand plastic analysis concepts in steel structures
4. To design bolted and welded connections
5. To design tension members, compression members, and bases.

Module-1

Introduction: Advantages and Disadvantages of Steel Structures, Limit state method - Limit State of Strength and Serviceability; Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.

Plastic Analysis: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis.

Module-2

Bolted Connections: Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints) and bracket connections both types.

Module-3

Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Advantages and Disadvantages of Bolted and Welded Connections. Simple welded joints for truss member and Bracket connections both types.

Module-4

Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles.

Design of Column Bases: Design of Simple Slab Base and Gusseted Base.

Module-5

Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened columns

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PRACTICAL COMPONENT OF IPCC

SL NO	Experiments
1	Design a bolted connection using M S Excel
2	Design a welded connection using M S Excel
3	Design of Tension Members using M S Excel
4	Design of Compression Members using MS Excel
5	Design of Simple Slab Base using M S Excel
6	Design of Gusseted Base using M S Excel
7	Draw the following using AutoCAD. Column bases and Gusseted bases with bolted and welded connections
8	Draw the following using AutoCAD. Connections – Beam to beam, Beam to Column by Bolted Connections.
9	Draw the following using AutoCAD. Connections – Beam to beam, Beam to Column by Welded Connections.
10	Draw the following using AutoCAD. Built-up Columns with lacings and battens.

Course outcome

At the end of the course, the student will be able to:

CO 1: Understand the principles of the limit state method and plastic theory
CO 2: Design simple, HSFG and bracket bolted connections.
CO 3: Design welded connections for trusses and bracket connections
CO 4: Design tension members, including lug angles, and column bases
CO 5: Design simple and built-up compression members.

Suggested Learning Resources:

Text Books

1. S K Duggal, "Limit State Design of Steel Structures" McGraw Hill Publications Chennai,2019
2. N Subramanian, "Design of Steel Structures", Oxford University Press, New Delhi, India,2017.

Reference Book

3. Bhavikatti, S.S., *Design of Steel Structures*, 5th Edition, I.K. International Publishing House, 2017
4. Shiyekar, M.R., *Limit State Design in Structural Steel*, 3rd Edition, PHI Learning, 2015.
5. IS 800:2007, *General Construction in Steel – Code of Practice*, Bureau of Indian Standards, New Delhi
6. SP:6(1) – Handbook for Structural Engineers: Structural Steel Sections, Bureau of Indian Standards, New Delhi, 1964 (Reaffirmed 2001)

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/105105162

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Lap Joint, But Joint (bolted and welded)
- Angle connected to Gusset plate
- Plate Connected to gusset plate
- Beam to beam connections
- Beam to Column Connection
- Built up Column with lacings and Battens

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

Design of Pre-Stressed Concrete (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	BCV702	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

1. To understand the materials and Concepts of pre stressing forces
2. To understand losses in Pre stressed concrete technology
3. To design the beams under flexural stress
4. To understand the different modes of shear failure
5. To understand the different anchorage system

Module-1

Introduction and Analysis of Members: Concept of Pre stressing - Types of Pre stressing - Advantages - Limitations –Pre stressing systems - Anchoring devices - Materials – Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete. Comparison between RCC & PSC. Analysis of members at transfer - Stress concept - Force concept - Load balancing concept – Kern point -Pressure line. (Numerical on stress concept)

Module-2

Losses in Pre stress: Loss of Pre stress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.

Deflection: Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio.

Module-3

Design of Sections for Flexure: Analysis of members at ultimate strength - Preliminary Design - Final Design for simply supported beams.

Module-4

Design for Shear: Analysis for shear **-** Components of shear resistance - Modes of Failure – Limit State of collapse for shear - Design of transverse reinforcement.

Module-5

Design of End block: Different anchorage system - Freyssinet, Magnel-Blaton, Gifford Udall, Lee-McCall - Stresses in End Block - Design of end block by latest IS codes.

Course outcome

At the end of the course, the student will be able to:

CO 1: Understand the concepts of prestressing methodologies

CO 2: Determine the losses in prestressing and deflection in prestressed elements.

CO 3: Design the prestressing elements subjected to flexural loads.

CO 4: Design Prestressed concrete beams to resist shear.

CO 5: Design end block of Prestressed concrete beams as per IS codes.

Suggested Learning Resources:

Text Books

1. Krishna Raju. N., "Pre-stressed Concrete",6th Edition CBS Publishers and Distributors, Pvt. Ltd., New Delhi, 2018.
3. Rajagopalan N, "Pre - stressed Concrete", Narosa Publishing House, New Delhi,2010.

Reference Books:

1. P. Dayaratnam, "Pre stressed Concrete Structures", Scientific International Pvt. Ltd.
2. Lin T Y and Burns N H, 'Design of Pre - stressed Concrete Structures' ,3rd Edition, John Wiley and Sons, New York, 2010.
3. Pundit G S and Gupta S P, "Pre - stressed Concrete", C B S Publishers, New Delhi,2019
4. IS: 1343: Indian Standard code of practice for Pre stressed concrete, BIS, New Delhi.
5. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

Web links and Video Lectures (e-Resources):

- NPTEL video lectures - https://nptel.ac.in/courses/105106117

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to a Pre stressing structural elements manufacturing yard/Case Study and students have to submit a report.

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VII

Design of Hydraulic Structures (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	BCV703A	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Understand the need and functions of hydraulic structures in water resources projects.
2. Explain the design principles and stability aspects of gravity and earth dams.
3. Describe the components and design of spillways, surplus weirs, crest gates, and stilling basins.
4. Recognize the significance of diversion headworks, canal regulators, and canal falls with codal provisions
5. Illustrate the features and maintenance aspects of cross-drainage works and canal networks

Module – 1

Head storage works: Types of hydraulic structures, Storage, diversion, distribution, Control structures, Types of dams- gravity and earth dams.

Gravity dam- forces on a gravity dam, combination of forces for design. Elementary & practical profiles of a gravity dam, stability analysis (without earthquake forces), problems.

Module – 2

Types of Earth dams, construction methods, Design criteria for Earth dams, causes of failure of earth dams, section of dam, preliminary design criteria, problems, Casagrande phreatic line for seepage analysis, Control of seepage through earth dams.

Module – 3

Spillways: Spillway components, location of spillway, types of spillways, design principles of ogee spillway. Energy dissipation and the stilling basin. Crest gates, types, advantages. Design and Drawing of Surplus weir.(only design for SEE)

Module – 4

Diversion Head works: Types of headworks, Components of Diversion Head Works, Weir and Barrages, Theories of Seepage Bligh's theory and Khosla's theory (sample calculations)

Canal Regulators: Types of Canal Regulators – Functions of Regulators, Design of canal regulators. Codal Provisions: IS:6531 (1972) – Criteria for design of canal head regulator (section: 3, 4.1, 4.2, 4.3.1). Canal Falls-Necessity and location of canal fall, Types of falls.

Module – 5

Cross-Drainage Works (CDW): Types of Cross-Drainage Works and features, Classification of Aqueducts, Basic design of aqueduct (sample), types of road culverts, small bridges and necessity. Cost estimation of canal networks and canal maintenance. IS:7784 (1993)- Design of cross drainage works – Code of Practice (section 4,5,6).

Course outcomes:

The students will be able to:

CO1: Illustrate the features of irrigation systems and gravity dam structures.

CO2: Analyze the forces and seepage behavior associated with earth dams.

CO3: Design and draw surplus weir with working principles of stilling basin and crest gates.

CO4: Apply Bligh's and Khosla's seepage theories to diversion headworks and interpret codal provisions for canal regulators.

CO5: Outline the design and maintenance of cross-drainage works and canal networks.

Teaching Practice:

- Classroom teaching (chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools

Alternate Assessment Methods:

→ Seminar
→ Assignment
→ Minor-Project

Text Books

1. Modi, P. N. "Water Resources and Water Power Engineering." Standard book house, Delhi, 10th Edition, 2019.
2. Punmia, B. C., Pande Brij Basi Lal, Ashok Kumar Jain, and Arun Kumar Jain. "Irrigation and water power engineering", Laxmi Publications, Ltd.,17th Edition, 2021.
3. Challa Satya Murthy, "Water Resources Engineering -Principles and Practice", New Age International (P) Limited, 2002

References:

1. Sharma, S. K. "Irrigation Engineering and Hydraulic Structures", S. Chand Publishing, 2017.
2. Arora, K. R. "Irrigation, water power and water resources engineering", Standard Publisher Distributors, 2002.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/126105010

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars
- Self-Study on simple topics
- Case Study Presentation

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

Ground Improvement Techniques (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	BCV703B	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

1. Gain knowledge of the importance of ground improvement and the challenges associated with problematic soils.
2. Learn principles, methods, and equipment used for soil compaction, and understand quality control through testing.
3. Understand the types, properties, and applications of geosynthetics in ground improvement, including reinforcement and drainage.
4. Study advanced ground stabilization methods such as soil nailing, rock anchoring, and reinforced retaining walls, and their design considerations.
5. Understand different grouting and soil stabilization techniques, including their design, applications, and real-world case studies.

Module-1

Fundamentals of Ground Improvement: Importance in modern construction, challenges with problematic soils. Types of Problematic Soils: Clay, silt, and loose sands, Case Studies: Real-world applications and lessons learned. Dewatering: Methods and applications in ground improvement.

Module-2

Soil Compaction Techniques- Principles of Compaction: Soil types, moisture content, and compaction methods. Compaction Equipment: Rollers, compactors, and their uses. Testing and Quality Control: Field and laboratory tests for compaction quality. Case Studies on compaction techniques.

Module-3

Applications of Geosynthetics in Ground Improvement: Introduction to Geosynthetics: Types and properties. Case study and Applications: - Reinforcement, separation, filtration, and drainage. Guidelines for Design and Installation of Geosynthetic materials.

Module-4

Grouting and Soil Stabilization Methods: Grouting Techniques - Types of grouts , injection methods, and applications. Soil Stabilization: Chemical stabilization (lime, cement, and other additives) and mechanical stabilization. Design Considerations: Factors affecting the effectiveness of grouting and stabilization methods. - Case Studies on grouting and soil stabilization techniques.

Module-5

Advanced Techniques for Ground Stabilization: Soil Nailing - Principles, design considerations, and construction methods. Rock Anchoring - Types of anchors, design, and installation techniques. Reinforced Retaining Walls - Types (e.g., mechanically stabilized earth walls), design principles, applications and Case Studies.

Course outcome

At the end of the course, the student will be able to:

CO1: Understand the need of ground improvement technique.
CO2: Outline the various soil compaction techniques.
CO3: Apply geosynthetics for Ground Improvement.
CO4: Comprehend grouting and soil stabilization methods.
CO5: Implement advanced stabilization techniques for ground improvement.

Suggested Learning Resources:

Textbooks

1. N. P. Singh, Ground Improvement Techniques, 3rd Edition, CBS Publishers & Distributors, 2023.
2. P. Purushothama Raj, Ground Improvement Techniques, 3rd Edition, Pearson Education India, 2022.
3. S. S. Bhardwaj, Ground Improvement Techniques and Design, 2nd Edition, Wiley India Pvt. Ltd., 2021.

Reference Books

1. Jonathan Knappett & R.F. Craig, Craig's Soil Mechanics, 9th Edition, CRC Press, 2019.
2. V.N.S. Murthy, Geotechnical Engineering: Principles and Practices, 2nd Edition, CRC Press, 2020.
3. Braja M. Das, Advanced Soil Mechanics, 5th Edition, Taylor & Francis, 2020.
4. Joseph E. Bowles, Foundation Analysis and Design, 6th Edition, McGraw-Hill Education, 2021.
5. Deepankar Choudhury, Modern Applications of Geotechnical Engineering and Construction, Springer, 2021.

Web links and Video Lectures (e-Resources):

- NPTEL VIDEOS..

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars
- Self-Study on simple topics
- Case Study Presentation

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

Environmental Impact Assessment (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	BCV703C	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course objectives:

This course will enable students to:

1. To explain environmental legislation and policies in India.
2. To understand the different Indian Environment Protection Act
3. Develop a methodical approach on assessment of environmental impacts due to developmental activities.
4. Interpret the role of public participation in the environmental decision-making process.
5. Apply the concept of environmental impact assessment for various types of industries.

Module – 1

Environmental Impact Assessment: Environmental Legislation: Introduction & need, Constitution of India, Environmental Jurisprudence, National Environmental Policy, Environmental Tribunal (Green Tribunal) Legal framework Legislative act, rules, regulations notification and amendment

Module – 2

Indian Environmental Acts: Environment (Protection) Act, 1986, Air & Water Acts. Biomedical Waste (Managing and Handling) Rules, 2011, Recycle Plastics (Manufacturing and Usage) Rules, 1999, Water Act, 1974, Air Act, 1981, Forest Act, 1927, Environmental Tribunal Authority, 1995. Wild Life Protection Act, 1972, Biodiversity Rules, 2004

Module – 3

Environmental Impact Assessment: Definition, Objectives, Types – Rapid and Comprehensive EIA, EIS, FONSI. Step-by step procedure for conducting EIA and Limitations of EIA, Prevention of Significant Deterioration (PSD) Programme. Carrying capacity concept

Module – 4

Attributes, Standards and Value functions: Public participation in EIA. Environmental Management Plan (EMP) and Disaster Management Plan (DMP).

Module – 5

EIA Case Studies: Thermal Power Plant, Mining, Fertilizer, Construction Projects, Airport, Water and Wastewater Treatment Plants

Course outcomes: The students will be able to:

CO 1: Explain the need for environmental legislation and the roles of policy and tribunals.
CO 2: Interpret major Indian environmental acts and their key applications in practice.
CO 3: Describe the process and types of environmental impact assessment and its limitations.
CO 4: Outline the importance of public participation in EIA and the structure of EMP and DMP.
CO 5: Summarize EIA through case studies of key environmental projects.

Text Books

1. Anjaneyulu and Valli Manickam, (2010), "Environmental Impact Assessment Methodologies", BS Publications,
2. Canter L., “Environmental Impact Assessment”, McGraw Hill.

Reference Books

1. Jain R.K., Urban L.V., Stacey G.S., (1977), "Environmental Impact Analysis-A New Dimension in Decision Making", Van Nostrand Reinhold

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

Design of formwork and scaffolding (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	BCV703D	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

1. To select the appropriate formwork system
2. To design the formwork system
3. To compute the bill of quantity for the formwork system
4. To incorporate safer design and construction aspects including assembling and dismantling to prevent formwork failures
5. To comprehend plan, layout and detailed drawing for formwork systems

Module-1

Introduction to Formwork Classification, benefits, objectives, areas of competitiveness, selection of Formwork, formwork materials, accessories and consumables, Various Harare tools. Formwork for Foundation, Wall, Columns, Slab and Beam. Conventional drawings. Vertical Application of Conventional Foundation Formwork, Formwork components, Components, assembly and de-shuttering of formwork System, Flex System, Heavy Duty Tower System, safety of work, Formwork for stairs, Load Bearing Tower.

Module-2

Design of formwork planning and monitoring, basics of formwork design, design assumptions and design methods. Design of wall formwork, slab formwork and checks. Formwork drawing Concept and Preparation Guidelines, BOQ Calculation and Checklist.

Module-3

Formwork cost estimation and optimization - Quantity Calculation Schedule of formwork, Mobilization distribution, BOQ, Quantity Calculation, Cost optimization

Module-4

Modular and Special formwork, scaffolding Modular and Special formwork: Advantages and Limitations, Shuttering and de-shuttering, applications, Aluminium formwork - Drawings & Components, Activities, High rise construction, Table lifting system. Scaffolding: Modular scaffold Installation sequence, Tie and material specification, Ladder safety, Loading Classification, application, Components of L&T Modular Scaffolding system, Access scaffold Do's and Don'ts. Innovation and Global practices.

Module-5

Formwork building and erection Formwork Failures Formwork assembly for Wall & Column Panels, Equipment and Layout, Plant and Machinery, Formwork erection and safety, Inspection and Corrections, Plant and Machinery, Code and Contractual Requirements. Formwork Failures: Causes, design deficiency, safety in formwork, prevention of formwork failures.

Course outcome

At the end of the course, the student will be able to:

CO 1: Identify the appropriate formwork materials and suitable formwork system

CO 2: Design formwork systems as per Industrial requirement

CO 3: Estimate the bill of quantity for the formwork

CO 4: Comprehend the modular and special formwork features

CO 5: Understand the erection and safety aspects of the formwork

Suggested Learning Resources:

Books

1. Kumar Neeraj Jha., Formwork for Concrete Structures, McGraw Hill Education (1 July 2017)
2. Formwork for Concrete Structures" by Robert L. Peurifoy and Garold D. Oberlender is the Fourth Edition, published by McGraw Hill in 2010.

Reference Books and Code Books

1. IS 14687 - Guidelines for falsework for concrete structures.
2. Concrete pressure on formwork (R108D) – CIRIA.
3. IS 456:2000 (Reaffirmed 2021, including Amendment 6: June 2024)

Web links and Video Lectures (e-Resources):

- NPTEL and YouTube Videos.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to construction sites to understand form work

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

Advanced Design of RCC Structures (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	BCV703E	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the usage of codes for strength, serviceability and durability.
4. To give an exposure to the various structural systems like flat slab, Deep beam, corbels, Bunkers, Silos and water tank.

Module-1

Design of Beams (Limit state method): Basic Design Concept - Short-term and long-term deflection of reinforced concrete beams and slab- Estimation of crack width in reinforced concrete members.

Module-2

Deep Beam and Corbels (Limit state method): Introduction - Strut and tie method of analysis for corbels and deep beams, Design of corbels, Design of deep beams.

Module-3

Analysis and Design of Flat Slabs (Limit state method): Introduction, Proportioning of flat slabs, Determination of bending moment by direct design method, slab reinforcement details. Design for punching shear.

Module-4

Retaining wall: Design of cantilever Retaining wall. Design concept of counter fort retaining wall.

Module-5

Portal frames: Design of portal frames with fixed and hinged based supports.

Course outcome

At the end of the course, the student will be able to:

CO 1: Analyse the beam for deflection and estimate the crack width

CO 2: Design deep beam and corbels

CO 3: Design flat slabs

CO 4: Analyse and design retaining walls

CO 5: Analyse and design different kinds of R.C.C. portal frames

Suggested Learning Resources:

Books

1. Krishnam Raju, N. "Design of Reinforced Concrete Structures", 2nd Edition, CBS Publishers and Distributors, New Delhi, 2007.
2. Unnikrishnan Pillai and Devdas Menon, "Reinforced Concrete Design" ,4th Edition, McGraw Hill, New Delhi,2021.
3. Subramanian. N., (2013), Design of Reinforced Concrete Structures, Oxford University Press, New Delhi.

Reference Books:

1. P C Varghese, "Limit State design of reinforced concrete",2nd Edition, PHI, New Delhi.2008.
2. W H Mosley, R Husle, J H Bungey, "Reinforced Concrete Design",5th Edition, MacMillan Education, Palgrave publishers,1999.
3. Kong and Evans, "Reinforced and Pre-Stressed Concrete", Springer Publications,1987.
4. A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press,2000
5. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", Wiley India Pvt Ltd, Inc,2009
4. Bhavikatti S. S. "Advance RCC Design", 3rd Edition, New Age International Private Limited, 2008

Code Books:

1. IS 456 Plain and Reinforced Concrete - Code of Practice.
2. SP 16- Design Aids for Reinforced Concrete.
3. SP:34: handbook on detailing of RC reinforcement.
4. IS 875 (part 1) - 1987: Indian Standard Codes provides design dead loads (Unit weights of building material and stored materials) for buildings and structures.
5. IS 875 (part 3) - 1987: Indian Standard Codes provides design wind loads for buildings and structures.
6. IS 3370-(part 1.2 & 4): Code of practice for concrete structures for the storage of liquid.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/105105105

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Students to prepare the models showing the reinforcement details in singly reinforced, doubly reinforced beams, Columns, Staircases and footings.

B.E. CIVIL ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER - VII

Introduction to Intelligent Transportation Systems (3:0:0) 3
(Effective from the academic year 2024-2025)

Course Code	BCV704A	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

1. Understand the fundamental concepts and components of Intelligent Transportation Systems (ITS).
2. Explore the technological, systems, and institutional aspects of ITS.
3. Analyze the benefits of ITS in enhancing transportation efficiency, safety, and sustainability.
4. Examine various ITS data collection techniques and their applications.
5. Discuss real-world ITS implementations and case studies.

Module-1

Introduction to Intelligent Transportation Systems (ITS): Definition and overview of ITS, Importance and need for ITS in modern transportation, Basic elements of ITS: technological, systems, and institutional aspects. **Advanced Traveller Information Systems (ATIS):** Principles and functionalities of ATIS, Real-time information dissemination, Traveler behaviour and decision-making.

Module-2

Technological Aspects of ITS: Overview of ITS technologies, Communication systems and data processing, Sensor technologies and their applications.
Advanced Transportation Management Systems (ATMS): Components and operations of ATMS, Traffic monitoring and control systems, Incident management and response.

Module-3

Benefits of ITS: Enhanced traffic management, Reduced congestion, Improved safety and emergency response, Environmental sustainability. Advanced Public Transportation Systems (APTS) and Commercial Vehicle Operations (CVO), Electronic Toll Collection (ETC) and New Technologies

Module-4

ITS Data Collection Techniques: Overview of data collection methods, Detectors: inductive loops, infrared sensors, microwave radar, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), Video data collection and analytics.

Module-5

Regional Architecture and Infrastructure Integration: Development of regional ITS architecture, Integration of infrastructure, ITS Issues and Emerging Trends: Technical, economic, and policy challenges in ITS, Future directions and emerging trends in ITS, Impact of autonomous vehicles and smart cities on ITS.

Course outcome

At the end of the course, the student will be able to:

CO 1: Comprehend on Intelligent Transportation Systems and Advanced Traveller Information Systems.
CO 2: Compare Advanced Transportation Management Systems.
CO 3: Summarize Advanced Public Transportation Systems (APTS), Commercial Vehicle Operations (CVO), and Electronic Toll Collection (ETC).
CO 4: Classify various data collection techniques used in ITS and apply this knowledge to real-world transportation challenges.
CO 5: Discuss regional architecture, infrastructure integration, and outline ITS issues and Emerging trends considering various factors.

Suggested Learning Resources:

Books

1. A. J. Khattak and B. N. Janson, Intelligent Transportation Systems: Smart and Green Infrastructure Design. McGraw-Hill, 2010.
2. R. E. Brydia, Introduction to Intelligent Transportation Systems. Artech House, 2013.

Reference Books

1. Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning" Artech House, 2025.
2. Pradip Kumar Sarkar, Amit Kumar Jain, "Intelligent Transport Systems", PHI Learning Publisher, 2018.
3. Kan Paul Chen, John Miles, "Recommendations for World Road Association (PIARC)" ITS Hand Book 2000.
4. Sussman, J. M., "Perspective on ITS", Artech House Publishers, 2005.
5. US Department of Transportation, "National ITS Architecture Documentation", 2007 (CDROM).
6. Turban. E and Aronson. J. E, "Decision Support Systems and Intelligent Systems", 7th Edition, Pearson Publisher, 2004.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/105107210
- https://www.civil.iitb.ac.in/tvm/nptel/591_ITS_1/web/web.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quiz (To assist in GATE Preparations)
- Self-Study on simple topics
- Simple problems solving using Excel
- Discussion of case studies
- Virtual Lab experiments

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

Conservation of Natural Resources (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	BCV704B	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

1. Understand the classification of natural resources, causes of their depletion, and the ecological footprint of engineering activities.
2. Learn the importance of land resources, soil health, sustainable land use planning, and major biogeochemical cycles.
3. Gain knowledge of water resources, water scarcity, and conservation through harvesting, reuse, recycling, and smart technologies.
4. Explain air pollution sources, standards, health and economic effects, and methods of monitoring and control.
5. Recognize the importance of biodiversity and ecosystems, their threats, and conservation

Module-1

Introduction to Natural Resources: Classification of natural resources, Importance of resource conservation, Types of resources - Renewable vs. Non-renewable; Causes for Resource depletion and its ecological footprint, ecological Footprint of engineering projects

Environmental limits - Carrying Capacity, Planetary Boundaries, Thresholds and Relevant SDG's

Module-2

Land Conservation: Land as a resource, types of lands, conservation of land forms, deforestation, effect of land use changes. Soil health, ecological and economic importance of soil, impact of soil degradation on agriculture and food security, need for soil conservation, sustainable land use planning. Biogeochemical cycles - C,O,N,P,S,

Module-3

Water Conservation: Water as a resource, global water scarcity, need for conservation of water, water conservation in Daily Use, Agriculture, Commercial and Industry, Conservation strategies**:** Demand reduction, reuse and recycling, efficiency improvement, and pollution prevention. Water harvesting: Need & principles, general water harvesting methods, roof top rainwater harvesting with groundwater recharge, Desalination plants, smart technologies for water conservation.

Module-4

Air Conservation: Introduction, composition, sources and classification of air pollutants, National Ambient Air quality standards (NAAQS), Air quality index, effects of air pollution on human health. Economic effects of air pollution. Control of air pollution by equipment, measurement of smoke and its control.

Module-5

Biodiversity: Introduction, Flora and Fauna, Importance of biodiversity, threat to biodiversity - natural & anthropogenic disturbance, habitat loss. Conservation of biodiversity - National parks, wild life sanctuaries, zoological gardens, gene banks, pollen culture, ecological restoration, social forestry.

Ecosystem: Definition, Types - forest, grass land, marine, desert, wetlands, estuarine, lotic, lentic. Abiotic & biotic components of ecosystem.

Course outcome

At the end of the course, the student will be able to :

CO 1: Classify natural resources and assess their ecological footprint.

CO 2: Describe land resources and soil health with reference to biogeochemical cycles.

CO 3: Explain water conservation methods including harvesting, recharge, and smart technologies.

CO 4: Interpret sources and effects of air pollution in relation to air quality standards.

CO 5: Summarize the importance of biodiversity and ecosystems with conservation measures.

Suggested Learning Resources:

Text Books

1. Erach Bharucha, *Textbook of Environmental Studies for Undergraduate Courses*, University Grants Commission (UGC), New Delhi, 2005.
2. S.N. Chatterjee, *Water Resources, Conservation and Management*, Atlantic Publishers, New Delhi, 2008.
3. P. Jayarami Reddy, *A Textbook of Environmental Science and Technology*, BS Publications, Hyderabad, 2011.
4. Krishnamurthy K.V., *An Advanced Textbook on Biodiversity – Principles and Practice*, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2004.

Reference Books

1. Odum, E.P., "Fundamentals of Ecology", W.B Sounders, Philadelphia, USA, 1971
2. R.K. Trivedi and P.K. Goel, *An Introduction to Air Pollution*, Techno Science Publications, Jaipur, 2003

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/126103022

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to forest department, KSNDMC, KSRSAC to understand Natural resources data and Management

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

Energy Efficiency, Acoustics and Daylighting in Building (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	BCV704C	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

1. To facilitate learners to understand climatology, heating ressin building and energy
2. To expose the learners to building acoustics, indoor air quality and day lighting.
3. To impart fundamental knowledge on Life cycle assessment and Energy efficiency in buildings.

Module-1

Introduction to Climatology and heating of building: Basics of climatology, Earth– Sun relationship, Solar angles and sun path diagram, Design of shading systems. Basics of Thermodynamics, Convection/ radiation heat transfer, Heat gain through various elements of a building, Thermal comfort models and case studies.

Module-2

Building acoustics, Indoor air quality and Lighting in buildings: Basics of sound and Building acoustics– Acoustic defects, prevention of sound transmission and acoustic measure for office building. Indoor Air Quality– Effects, control of contaminants and moisture in indoor environment, Integrated approach for IAQ management. Fundamentals of lighting – Day lighting and its metrics– Strategies for day lighting and its control. Artificial lighting – Design and control strategies – Visual comfort enhancement.

Module-3

Energy efficient buildings, Water and Waste management in buildings: Energy efficiency: Energy efficiency in building envelope, lighting as per Energy conservation building code (ECBC) 2017, Water Efficiency– Planning and design of water management system, Rain water harvesting, Water efficient design and fixtures, Treatment and reuse, Waste management in residential, commercial buildings, health care facilities.

Module-4

Life Cycle Assessment of Buildings and Green project management: Materials – Green product certifications, features of sustainable building materials and sustainable alternatives for structural, envelope and finishing materials. Low carbon cement, Zero emission bricks and lean construction practices. Life cycle assessment and its types.

Module-5

Energy efficiency in HVAC system: Variable Frequency Drive (VFD), Air volume drive. Roof top solar installations and solar water heaters, Heat recovery system in buildings, Building Management System (BMS) – Occupancy sensors and energy efficient lighting controls, Smart Buildings.

Course outcome

At the end of the course, the student will be able to:

CO 1: Comprehend climatology, shading system and analyze heat transfer mechanism in buildings.

CO 2: Assess the design considerations and parameters for lighting, acoustics and indoor air quality.

CO 3: Develop solutions for energy efficiency, water efficiency and waste management in buildings.

CO 4: Calculate energy savings and CO2 mitigation using web tools such as ECONIWA Sand Solar roof top calculator.

CO 5: Adopt green project management methodology and evaluate building life cycle assessment.

CO 6: Understand energy efficiency measures in a building.

Suggested Learning Resources:

Books

1.HarharaIyer G, Green Building Fundamentals, Notion Press

2.Dr. Adv.HarshulSavla, Green Building: Principles & Practices

Reference Books:

1. The Sustainable Habitat Handbook (6VolumeSet), GRIHAVersion2019
2. National Building Code–2016,Volume1&2, Bureau of Indian Standards
3. Energy Conservation Building Code – 2017(with amendments upto 2020), Bureau of Energy Efficiency.

Web links and Video Lectures (e-Resources):

- Online study material
- NPTEL video lectures.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

Environmental Protection and Management (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	BCV704D	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

1. Appreciate the need for Environmental protection.
2. Explore pollution prevention assessment team and implement waste minimization options.
3. Describe and interpret methods of the Environmental Management Systems according to ISO 14001 standards.
4. Audit Environmental Management systems for Organizations.
5. Critically evaluate tools and possibilities for Environmental Protection for various industries.

Module-1

Environmental Quality: Unique Characteristics of Environmental Issues (Types and Examples), Environmental Stewardship (Evolution and Types), Environmental Management Principles (Types and Significance), Environmental standards – Rationale, Types (NAAQS, Freshwater Classification, Drinking Water Standard, Noise standards, Effluent Standards and Emission Standards), Classification of Environmental Impact and Reduction Efforts.

Module-2

Environmental Management Objectives: ICC Business Charter for Sustainable Development (2015), India's National Policy Statement for Abatement of Pollution (1992)- Evolution and Salient features; Charter on Corporate responsibility for Environmental protection (2003), Environmental Protection Act (1986), Hazardous Waste Management (Introduction, Types, Impacts, Treatment and Disposal), SAARA III, Basel Convention (Importance of Trans-Boundary Movement, Conditions and Procedural Flow scheme)

Module-3

Environmental Management System: EMS as per ISO 14001 (Flow chart and explanation of each component), Environmental Aspect and Impact Analysis (Experiential Learning), Environmental Policy, Environmental Statement (Form V), Environmental performance indicators (OPI, MPI, ECI), Environmental performance Evaluation and Benchmarking, Non-conformance (Significance, Corrective and preventive actions)

Module-4

Environmental Audit: EIA (Types, Flow chart and explanation of each component), Types of Environmental Audits (incl. Waste audit, due-diligence audit, compliance audit), Environmental management system audits as per ISO 19011 (pre-EMS and EMS audit), Procedures and Guidelines to conduct Environmental Audit, Roles and qualifications of Auditors

Module-5

EMS in Industries: Process, Pollution sources and Control measures (Volume reduction and strength reduction) - Cotton Textile Industries, Pulp and Paper Industries and Tanneries.

Course outcome

At the end of the course, the student will be able to:

CO 1: Compare Rationale for existing Objectives, Standards, Policies, Principles and Opportunities for Environmental Management and Protection.

CO 2: Comprehend the existing policies complying with international environmental management.

CO 3: Discuss the framework and relevance of Environmental Management Systems in accordance with to ISO 14001.

CO 4: Audit pollution prevention assessment measures and recommend waste minimization options.

CO 5: Review Environmental Management systems for various Industries and Organizations.

Suggested Learning Resources:

Text Books

1. Christopher Sheldon and Mark Yoxon, "Installing Environmental Management Systems – a step by step guide", Earthscan Publications Ltd, London, 1999.
2. Paul L. Bishop, "Pollution Prevention: Fundamentals and Practice", McGraw- Hill International, Boston, 2000.
3. Ann Arbor, "Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations", NSF International, Michigan, Second Edition, 2001.

References Books:

1. Bureau of Indian Standards, ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System Auditing", Bureau of Indian Standards, New Delhi, 2002.
2. Bureau of Indian Standards, ISO 14001 Certification - Environmental Management Systems: A Practical Guide for Preparing Effective Environmental Management Systems, Bureau of Indian Standards, New Delhi.
3. Peavy, H.S, D.R. Rowe and T.George, "Environmental Engineering", New York: McGraw Hill, 1987.
4. Rajesh Gopinath and N. Balasubramanya, "Environmental science and Engineering", 1st Edition, Cengage Learning India Private Limited, 2018.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Peer learning: Cleaner Technology-Cleaner Production, Zero Discharge Technology (Closing the Loop) followed by Group Discussion upon Case Study-based interaction and PPT presentation for various industries.
- Industrial Visit – Visit to STPs.
- Self-study: MOOC - https://unccelearn.org/course/view.php?id=131&page=overview.

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VII

Water Resources and International Relations (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	BCV704E	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Appreciate the significance of water resources, water balance and socio-economic factors in water management
2. Gain knowledge on water resources planning and conservation techniques.
3. Recognize various methods of integrates watershed management.
4. Realize the importance of water governance and water policies
5. Apply United Nation's international water relations and dispute management.

Module – 1

Introduction Global water resources, Objectives of Water Resources Planning and Development, Socio Economic Characteristics.

Water resources – Global water resources and Indian Water resources, Surface and Ground water Resources, Horton's Hydrologic Cycle, Water budget equation (sample calculation), Effect of human interference in global water balance

Module – 2

Water resources planning: Necessity, System components, Planning scales, Approaches to planning and management aspects, Water-data management Models for impact prediction and evaluation, Adaptive Integrated Policies, Post Planning and management Issues.

Water Harvesting and Conservation: Water Harvesting Techniques –Surface runoff, Farm Ponds, Percolation Tanks, Yield from a Catchment, Rainwater Harvesting-various techniques related to Rural and Urban area.

Module – 3

Integrated Water Resources Management (IWRM): Watershed and types, Need for watershed management, Objectives and principles of IWRM, Conjunctive use, Implementation of IWRM, Legislative and Organizational Framework, Types and forms of Private Sector Involvement, Community involvement, IWRM watershed case studies.

Module – 4

Water Governance and Water Policy: Legal framework of water resources management, National water laws – key provisions and scope, National Water Policy – objectives and guiding principles, Regulatory tools and incentive mechanisms for water management, Role and functions of national-level water commissions and agencies, Legal recognition and role of Water User Associations (WUAs) and community-based/local organizations.

Module – 5

International Waters: United Nations Convention on the Law of the Sea (UNCLOS), Objectives and frameworks of UNCLOS III, Classification of sea waters and areas, Transboundary water regulations, Impact of human rights and the law of climate change on global water management, Global water stress and water scarcity, Case studies on resolution of international water disputes.

Course outcomes:

The students will be able to:

CO 1: Apply fundamentals of basic science in water resources planning and management.

CO 2: Design framework for water resources planning, water harvesting techniques and watershed models.

CO 3: Assess issues in water management at individual, community and national levels through water governance and policies

CO 4: Address the implication of transboundary water regulations on International Waters.

CO 5: Summarize case studies on water security, water scarcity and climate change frameworks.

Teaching Practice:

- Classroom teaching (chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools

Alternate Assessment Methods:

→ Seminar
→ Assignment
→ Minor-Project

Text Books

1. Loucks, Daniel P., and Eelco Van Beek. "Water resource systems planning and management: An introduction to methods, models, and applications". Springer, 2017.
2. Mollinga, Peter P., Ajaya Dixit, and Kusum Athukorala, "Integrated water resources management: Global theory, emerging practice and local needs", Sage Publications India, 2006.

References:

1. Vedula, S., and P. P. Mujumdar., "Water resources systems: modelling techniques and analysis", Tata McGraw-Hill, 2005.
2. Jain, Sharad K., and Vijay P. Singh. "Water resources systems planning and management", Elsevier, 2003.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/109104035
- https://nptel.ac.in/courses/109106200

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Case studies
- Self learning

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

Environmental Engineering Laboratory (0:0:1) 1

(Effective from the academic year 2024-25)

Course Code	BCVL706	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	03

Course objectives:

1. Identify the environmental significance of various parameters and application in environmental engineering practice.
2. Demonstrate the process of water & wastewater quality testing.
3. Compare the concentrations various parameters of water and wastewater.
4. Propose the degree and type of treatment to be given to a water or wastewater before disposal.

List of Regular Experiments

Introduction to the course: Relevance in the Global scenario. Financial bearing on the World Economy. Role in Environmental and Societal concerns. Job opportunities as consultant or engineer.

1.	Determination of pH.
2.	Determination of Turbidity using Nepheloturbiditymeter.
3.	Determination of Electrical Conductivity.
4.	Comparison of Total, Permanent and Temporary hardness for different water sources.
5.	Estimation of Alkalinity for different water samples.
6.	Comparison of Total, Calcium & Magnesium Hardness for different water sources.
7.	Estimation of Acidity for different water samples.
8.	Estimation of Chloride Concentration to predict probable contamination of a given water source.
9	Determination of Dissolved Oxygen and Estimation of BoD.
10	Estimation of Percentage of available chlorine in bleaching powder
11	Determination of Residual Chlorine and Estimation of Chlorine Demand for given water sample.
12	Determination of Optimum Dosage of Alum using Jar Test Apparatus

Open Ended Experiments

1.	Determination of suitability of near-by surface water source for various uses.
2.	Determination of reliability of house/hostel water for drinking purposes.

Course outcome

At the end of the course, the student will be able to:

CO 1: Work as an individual and in a Team to Plan and safely accomplish the objectives of the experiment.

CO 2: Interpret the experimental outcome with respect to environmental standards, health aspects, ethical facets and feasibility

CO 3: Draft holistic structured report with inference-based rationale for absence or presence of pollutants in tested samples.

CO 4: Formulate Experiments for a given real-time scenario.

References:

1. Howard S. Peavy, Donald R. Rowe, George T., Environmental Engineering, McGraw Hill, International Edition, New York, 2000.
2. Rajesh Gopinath and N. Balasubramanya, “Environmental science and Engineering”, 1st Edition, Cengage Learning India Private Limited, 2018.

3. Metcalf & Eddy, Wastewater Engineering: Treatment & Reuse, 4th Edition, McGraw Hill Education, 2003.
4. CPHEEO, Manual on Water Supply and Treatment", Ministry of Urban Development, New Delhi, 1999.
5. APHA, Standard Methods for the Examination of Water and Wastewater, 21st Edn. American Public Health Association, Washington DC, 2005.
6. CPHEEO, Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Ministry of Urban Development, GOI, 2016.
7. http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental_Engineering_1/index.html
8. CPCB (2011), Guidelines for the Measurement of Ambient Air Pollutants, Volume-1,Delhi.
9. Rao, M.N., and Rao, H.V.N., Air pollution. Tata McGraw-Hill Publishing Co. Ltd., New Delhi 1989.
10. IS 5182 (part 23), 2006, Indian standards – Methods for measurement of air pollution, Part-23 – Respirable suspended particulate matter (PM10), cyclonic technique.
11. GRIMM, environmental dust monitor (model 1.107) manual.
12. IS 5182 (Part 14)-2000 (reaffirmed 2005) : Indian standards, Method of measurement of air pollution: Guidelines for planning the sampling for atmosphere.