Design of Steel Structural Elements		Semester	7
Course Code	**BCV701**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	Theory/practical		

Course objectives:

1. Understand the behaviour of structural elements in steel structures and well versed with Steel design principles according to the guidelines of IS: 800-2007.
2. Apply their knowledge of Structural mechanics to analyse and design the steel structures.
3. Design the steel structural elements of different forms and connections under different stresses.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and Talk
2. Use Power point presentation
3. Visit an Industrial Building Construction site.

MODULE-1

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

Plastic Behavior of Structural Steel: 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, Simple welded joints for truss member and Bracket connections both types. Advantages and Disadvantages of Bolted and Welded Connections.

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 with 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 Systems.

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Design a Bolted Connections using M S Excel
2	Design a welded Connections 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. Roof Truss – Welded and Bolted
9	Draw the following using AutoCAD. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
10	Draw the following using AutoCAD. Built-up Columns with lacings and battens.
11	Drawing of Gantry Girder for the given data using AutoCAD.
12	Drawing of Welded Plate girder for the given data using Auto CAD.

Course outcomes (Course Skill Set):

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

1. Explain: the engineering properties and the behaviour of steel structural elements according to the guidelines. L - 2
2. Analyse and design: Structural connection of Steel Elements. L-4 & L-5
3. Analyse and design: the steel structural elements of different forms under different stresses. L-4 & L-5

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous

evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.

- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Books

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

Web links and Video Lectures (e-Resources):

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

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

Develop a Models of the following connections:

1. Lap Joint, But Joint (bolted and welded)
2. Angle connected to Gusset plate
3. Plate Connected to gusset plate
4. Beam to beam connections
5. Beam to Column Connection
6. Built up Column with lacings and Battens.

ESTIMATION AND CONTRACT MANAGEMENT		Semester	VII
Course Code	BCV702	CIEMarks	50
TeachingHours/Week(L:T:P:S)	3:2:0:0	SEEMarks	50
TotalHoursofPedagogy	40hoursTheory	TotalMarks	100
Credits	04	ExamHours	03
Examinationnature(SEE)	Theory		

Course Learning Objectives: This course will enable students to;

- Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineeringProject
- Understand and apply the concept of Valuation for Properties
- Understand, Apply and Create the Tender and Contract document.

Teaching-Learning Process(General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/power point presentation
2. Regular review of the students by asking questions based on topics covered in the class

MODULE-1

Quantity Estimation for Building: study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates. Estimation of building by Short wall and long wall method - centreline method.

Estimate of R.C.C structures including Slab, beam, column, footings.

MODULE-2

Estimate of Steel truss, manhole and septic tanks and slab culvert.

Quantity Estimation for Roads: Computation of volume of earthwork fully in banking, cutting, partly cuttingand partly Filling by mid-section, trapezoidal and Prismoidal Methods.

MODULE-3

Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings and roads.

Analysis of Rates : Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost

Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.

MODULE-4

. **Contract Management-Tender and its Process:** Invitation to tender, Prequalification, administrative approval& Technical sanction. Bid submission and Evaluation process. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC).

Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture.

Contract Forms: FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC

MODULE-5

Contract Management-Post award : Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach ofcontract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, **Disputes & itsresolution mechanism,** Contract management and administration.

Valuation: Definitions of terms used in valuation process, Purpose of valuation, Cost, Estimate, Value and its relationship, Capitalized value. Freehold and lease hold and easement, Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation, valuation for mortgage, valuation of land.

Course outcomes: After studying this course, students will be able to:

1. Taking out quantities and work out the cost and preparation of abstract for the estimated cost for variouscivil engineering works.
2. Prepare detailed and abstract estimates for various road works, structural works and water supply andsanitary works.
3. Prepare the specifications and analyze the rates for various items of work.
4. Assess contract and tender documents for various construction works.
5. Prepare valuation reports of buildings..

AssessmentDetails(bothCIEandSEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall bedeemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE(Continuous InternalEvaluation)andSEE (SemesterEndExamination)taken together.

CIE(maximummarks50)

- 50 marks for CIE are split into **30marks** for three Internal Assessment Tests and 2**0marks** for other assessment methods mentioned in 22OB4.2.
- The first test at the end of 30-35% coverage of the syllabus, the second test after covering 65-70%of the syllabus and the third test for 95-100% coverage of syllabus
- The student must secure 40% of 50marks to qualify in the CIE

SEE (Max 100 Marks scaled downed to 50 Marks)

Theory SEE will be conducted by University as per the scheduled timetable, with common questionpapersfor thecourse (**duration03hours**)

1. The question paper will have ten questions. Each question is set for 20marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3sub-questions), **should have a mix of topics** under that module.
3. The students must answer 5 full questions, selecting one full question from each module. Marks scored by the student shall be proportionally scaled down to 50Marks

Suggested Learning Resources:

Recommended Reading:

1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi.
2. B.S. Patil, "Civil Engineering Contracts and Estimates", Universities Press.
3. M. Chakraborthi; "Estimation, Costing and Specifications", Laxmi Publications.
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi
5. Kohli D.D and Kohli R.C, "Estimating and Costing", 12 th Edition, S.Chand Publishers, 2014.
6. Vazirani V.N and Chandola S.P, "Estimating and costing", Khanna Publishers, 2015.
7. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
8. Duncan Cartlidge , "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
9. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
10. Robert L Peurifoy , Garold D. Oberlender , " Estimating Construction Costs" – 5ed , Tata McGraw-Hill , New Delhi.
11. David Pratt, "Fundamentals of Construction Estimating" – 3ed, Edition.
12. PWD Data Book, CPWD Schedule of Rates (SoR). and NH SoR – Karnataka FIDIC Contract forms.
13. B.S. Ramaswamy "Contracts and their Management" 3ed, Lexis Nexis(a division of Reed Elsevier IndiaPvt Ltd).

WeblinksandVideoLectures(e-Resources):

https://youtu.be/ofkpm4lhJcg
https://youtu.be/GGikveOcaJw

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

- Conduction of technical seminars on recent research activities
- Group Discussion

- Site visits

Prestressed Concrete		Semester	7
Course Code	**BCV703**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	04	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

- To explain the necessity of prestressed concrete
- To understand the principles and methods of design according to IS 1343 and IRC 112
- To estimate losses due to prestressing
- To design pre-stressed concrete pipes, tanks, beams or I-girder for bridge, one-way and two-way slabs
- To illustrate the concept of special bridge like cable stayed bridges and balanced cantilever bridges

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.
5. Adopt problem-based learning (PBL) to develop analytical and thinking skills.

Module-1

Introduction to pre-stressed concrete structures: Concepts of Prestressing- Historical development of prestressing-Design Codes for PreStressed Structures- Advantages & Limitations of Pre-stressed Concrete Material - Need for High Strength Concrete- High Tension Steel- Types of Prestressing Steel

Module-2

Losses of Prestressing and Prestressing Systems: Losses– Immediate losses due to Friction and wobble, Elastic shortening Anchorage Slip - Time dependent losses due to Creep, Shrinkage and Relaxation losses - Introduction to Pre-stressing systems – Pre -Tensioning Devices – Post -Tensioning Devices - Anchorage Devices - Mechanical pre-stressing - Chemical Pre-stressing - Electrical Pre-stressing

Module-3

Principle and Methods of design: Combined Load Approach - Internal Couple Approach - Load Balancing Approach - Steel Stress in Bonded and Un-bonded tendons – Flexure and Shear – Crack and Deflection - Design as per IS 1343 - Design of Anchorage zone – End block- Cable Profiling for different beams - Mechanism of Transfer of Prestress in Pre-Tensioning System and Post Tensioned system

Module-4

Applications of Pre-stressing: Circular Prestressing – Introduction - Types and Design of Prestressed Concrete Pipes Pre-stressing in Buildings – Beams – One-way Slabs – Two-way Slabs – Flat slabs Structures – Tanks, Poles & Piles - Partial Prestress - behavior, advantages and disadvantagesRemember the concepts of Prestressing

Module-5

Pre-stressing in Bridges: Composite Construction – Introduction - Analysis-IRC 112 Codal provisions for ULS and SLS – Design of a I-girder with cast in situ slab -Viaducts – Balanced cantilever bridges – Railway sleepers

Course outcome (Course Skill Set)

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

1. Remember the concepts of Prestressing
2. Understand the concept of pre-tensioning and posttensioning
3. Carry out the Analysis and Design of composite I girder
4. Perform the design of anchorage zones, composite pipes, sleepers and tanks

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Prestressed Concrete Structure by T.Y. Lin, Ned H. Burns
2. Prestressed Concrete by N. Krishna Raju
3. Prestressed Concrete by G.S.Pandit and S.P.Gupta
4. IRC 112 and IS 1343 codes

Web links and Video Lectures (e-Resources):

- E-learning content on L&T EduTech Platform.

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

- Visit to Site to understand prestressing

VII Semester

INTELLIGENT TRANSPORTATION SYSTEMS			
Course Code	BCV714A	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

This course will enable students

- To learn the fundamentals of ITS.
- To study the ITS functional areas
- To have an overview of ITS implementation in developing countries

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1 Introduction to Intelligent Transport System

Introduction to Intelligent Transportation Systems (ITS) -Definition – Role and Responsibilities – Advanced Traveller Information System – Fleet Oriented ITS Services – Electronic Toll Collection – Critical issues – Security – Safety

Module-2 ITS Architecture and Hardware

Architecture – ITS Architecture Framework – Hardware Sensors – Vehicle Detection – Techniques – Dynamic Message Sign – GPRS – GPS – Toll Collection

Module-3 Advanced Transport Management System

Video Detection – Virtual Loop - Cameras - ANPR – IR Lighting – Integrated Traffic Management – Control Centre – Junction Management Strategies- ATMS – Advanced Traveler Information Systems (ATIS)- Route Guidance – Issues - Historical – Current – Predictive Guidance – Data Collection – Analysis – Dynamic Traffic Assignment (DTA) – Components – Algorithm.

Module-4 Advanced Traveller and Information System

Travel Information – Pre Trip and Enroute Methods- Basic ATIS Concepts – Smart Route System – Data Collection – Process – Dissemination to Travelers – Evaluation of Information – Value of Information – Business Opportunities

Module-5 Case Studies

Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.

Course outcome (Course Skill Set)

On completion of the course the students should be able to

- Understand the sensor and communication technologies.
- Apply the various ITS methodologies
- Define the significance of ITS under Indian conditions

Assessment Details (both CIE and SEE)

CIE for the theory component of the PEC (maximum marks 50)

CIE for the practical component of the PEC

SEE for PEC

Suggested Learning Resources:

Books

1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2001.
2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill, 1992.
3. Turban E.,"Decision Support and Export Systems Management Support Systems", Maxwell Macmillan, 1998.
4. Sitausu S. Mittra, "Decision Support Systems – Tools and Techniques", John Wiley, New York, 1986.
5. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems – Theory and Application", Springer Verlog, New York, 1987
6. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

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

Earthquake Resistant structures		Semester	VII
Course Code		CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory	Total Marks	100
Credits	03	Exam Hours	
Examination nature (SEE)	Theory/practical/Viva-Voce /Term-work/Others		

Course objectives: The Course will enable students

- Fundamentals of structural dynamics
- Fundamentals of engineering seismology
- Irregularities in building which are detrimental to its earthquake performance
- Different methods of computation seismic lateral forces for framed and masonry structures
- Earthquake resistant design requirements for RCC and Masonry structures and Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Black board teaching/power point presentation
2. Regular review of the students by asking questions based on topics covered in the class

MODULE-1

Introduction to structural dynamics: Basic Definitions, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles, Types of Vibrations, Damping and its types, Analytical Model of dynamic system, Free vibration of damped and undamped system having single degree of freedom. Concept of equivalent spring, Numerical problems on determining natural period, natural frequency, mass, stiffness, amplitude, and acceleration for undamped free vibration systems.

MODULE-2

Engineering Seismology: Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India, Earthquake measuring instruments-Seismoscope, Seismograph and accelerograph.

MODULE-3

Seismic Performance of Buildings and Over View of IS-1893 (Part-1): Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.

MODULE-4

Determination of Design Lateral Forces: Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls). Numerical problems.

MODULE-5

Ductility considerations: Factor affecting ductility, ductile detailing of flexural members, columns and frame members as per IS13920. Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column

Earthquake Resistant Design of Masonry Buildings: Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

PRACTICAL COMPONENT OF IPCC*(May cover all / major modules)*

Sl.NO	Experiments

Course outcomes (Course Skill Set):

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

- To formulate the solution for damped and undamped SDOF systems.
- To describe basic principles of engineering seismology
- To describe various irregularities and their limits for earthquake resistant structure as per Indian standard code books.
- Analyze the structure for seismic forces using Equivalent static lateral force method and response spectrum method
- To perform ductile Design of RC members and to describe behavior of masonry under seismic loads.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other

assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scoredby the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Books

1. Pankaj Agarwal and Manish Shrikande, "Earthquake resistant design of structures", PHI India.
2. S.K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press
3. Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson
4. Education, Inc.
5. T. K. Datta, "Seismic Analysis of Structures", John Wiley & Sons (Asia) Ltd.
6. David Dowrick, "Earthquake resistant design and risk reduction", John Wiley and Sons Ltd.
7. C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, "Some Concepts in Earthquake
8. Behaviour of Buildings", Published by Gujarat State Disaster Management Authority, Government of Gujarat.

9. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi.

10. IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi.

11. IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.

12. IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.

13. IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

Web links and Video Lectures (e-Resources):

1. https://www.steel-insdag.org/assets/frontend/trmpdf/Chapter41.pdf
2. https://www.steel-insdag.org/assets/frontend/trmpdf/Chapter6.pdf
3. https://www.steel-insdag.org/assets/frontend/trmpdf/Chapter42.pdf
4. https://nptel.ac.in/courses/105105162

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

Design And Execution of Pile Foundations		Semester	7
Course Code	**BCV714D**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

- Introduce the concept of Piling works and design requirements for a pile
- Elaborate the construction procedures which are involved in different pile foundations
- Explain the different load test which need to be conducted on the piles.
- Understand the Environmental, Health and Safety standards which need to be in place for the handling of the pile works
- Elaborate on the bill of quantities of various Pile foundations

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.
5. Adopt problem-based learning (PBL) to develop analytical and thinking skills.

Module-1

Introduction to piles, Design and construction of Bored Cast insitu piles and Driven Cast insitu piles: Overview of Pile foundations, Selection Criteria, Common Design considerations, General Terminologies and Indian standard codes. Materials and Equipment, Construction procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests, Case Studies of Bored cast insitu piles and Driven cast insitu piles

Module-2

Introduction, design and construction of precast driven and under reamed piles: Materials and Equipment, Construction procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests, Case Studies of precast driven piles, precast driven piles in pre-bored holes and Under reamed piles

Module-3

Grouping and settlement of piles and testing: Introduction to Grouping and Settlement of piles, Pile Group efficiency and Spacing, Capacity of Pile group, Settlement of Pile group, Case studies Introduction & Types of testing on piles and General requirements for testing, Pile Integrity tests - introduction & Equipment Types of Pile Integrity test, Data Recording & Interpretation of results, Introduction to quality assurance of piles, General requirement

Module-4

Quality control and Special Types of piles: Quality Control of BCIS, DCIS piles, Quality records and checklists. Materials, Equipment, manufacturing procedure, Design and installation, suitability and application and failure modes of spun piles and helical piles

Module-5

Software and Bill of quantities, Construction challenges: Introduction to Bill of quantities for Bored cast insitu, Driven Cast insitu, Precast driven and Precast driven piles in pre-bored holes and undreamed piles. Challenges in bored and driven piles, Introduction to types of piling

software, Software demonstrations (e.g., PLAXIS) and step-by-step design techniques for deep foundations. Modelling in Plaxis 2D

Course outcome (Course Skill Set)

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

1. Comprehend Basic design concepts, of pile foundations
2. Compute capacity of piles and select suitable type of pile foundation based on soil conditions
3. Apply different construction procedures of pile foundation
4. Design and execute different load testing on piles
5. Compute bill of quantities for pile foundations

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. IS 2911- Indian standard code driven cast insitu, bored cast insitu, Driven precast piles
2. IS 14593-Indian standard code for bored cast insitu piles founded on rocks – Guidelines
3. Michel Tomilson and John Woodward, "Pile design and construction practice", CRC Press

Web links and Video Lectures (e-Resources):

- E-learning content on L&T EduTech Platform.

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

- Visit to a nearby site if available to pile foundation

VIISemester

BUILDING SERVICES-HVAC,ACOUSTICS AND FIRE SAFETY			
CourseCode	**BCV755D**	CIEMarks	50
TeachingHours/Week(L:T:P:S)	3+0+0	SEEMarks	50
TotalHoursofPedagogy	40	TotalMarks	100
Credits	3	ExamHours	3

CourseLearningObjectives: Thiscoursewillenablestudentsto;

1. TolearnthebasicsofMEPsystems.(Mechanical,Electricalandplumbing)
2. Toexposethelearnerstobuildingacoustics
3. ToimpartknowledgeonHVACandfireprotectionsystemsinbuilding

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk, PPT presentations,
2. You tube videos,
3. visit to nearby sites
4. NDT EQUIPMENTS AWARENESS

Module-1

AdvancedElectricalSystemDesignforBuildings :Basics of Electrical System, Electrical terminologies, Major Electrical equipment, Buildingpower distribution and its schemes, Fundamentals of Power& distribution transformers, HT,LT, DG Sets, Cables & Wires, UPS and its importance, Introduction of HT, LT switchgearssystems,ImportanceofLightingdesign&differentLightfixturesusedinbuildings–Interior,external, street & offices,RMU, HT consumer, Substation Building in Master plan - SpaceplanningforRMU,HT,DGset,HSDyard,SpaceprovisionforElectricalEquipmentincludingSubstation,Variousequipmentclearancerequirements,HVAC,PHE,FPSservice-electricalloadinputfordesigningelectricalpowerdistribution,Pedestals&ceilingsupportrequirementforallElectricalequipment.

Teaching-LearningProcess	Chalk&Talk,PPTpresentation,Youtubevideos,Nearbysitevisits

Module-2

ExtraLowVoltageSystemforInfrastructureandBuildingAcoustics: Introduction & Brief of ELV Systems, Concept of Building Management System (BMS) &Fire Alarm System, Interface with Architecture/ Structure, Access control, CCTV & Publicaddresssystem-Briefandpurpose,BMS-Briefandpurpose,BMSinterfaceswithElectrical,HVAC,Fire&LifeSafetyandPHE,BMSinterfaceswithairportsystems.BasicsofsoundandBuildingacoustics–Acousticdefectsandpreventionofsoundtransmission

Teaching-LearningProcess	Chalk&Talk,PPTpresentation,Youtubevideos,Nearbysitevisits

Module-3

Heating,Ventilation&Airconditioningsystems :Basics of HVAC - Psychrometry and its importance - Major Components of Air conditioningSystem-FundamentalconceptsofHeattransfer,Air-conditioningsystem,Ventilationsystem, Pressurization Systems and their importance to Life safety, Chilled water system,Cooling towers and major HVAC equipment, Pumping system in HVAC, Importance ofThermalandAcousticInsulation,IntroductionandbasicsofVariableRefrigerantFlow(VRF)systems,Radiantcooling,Underfloordistribution,Chilledbeams–Spaceplanning-ImportanceofStaticweight/Operatingweightsofmechanicalequipment-Importanceof FloorslabandTerraceroofslabopenings/cut-outs

Teaching-LearningProcess	Chalk&Talk,PPTpresentation,Youtubevideos,Nearbysitevisits

Module-4

FireProtectionandLifeSafetySystem :Basics of Fire Protection System - Active Fire protection system - Passive Fire protectionsystem-BasicsofSmokeControlandFireStopSystems-Codes&StandardsandStatutoryCompliance - Fire and its Classes - Hazard Classification based on building occupancy -Means of Egress and its components - Importance of Life Safety - Refuge Area, Fire TowerandFireLift-OccupantLoadandCapacityfactors-FireStoppingMaterials-Compartmentationinabuilding-Smokecontrol&managementinFireZoning–ComponentsofFireCompartments.

Teaching-LearningProcess	Chalk&Talk,PPTpresentation,Youtubevideos,Nearbysitevisits

Plumbingforwatersupplyandsanitarysystem :ScopeofworksinPublicHealthEngineering-Sanitaryfixturesandtypes-Watersupplyandtreatment - Rain water drainage system - Landscape irrigation features – Water demandcalculationbasedonbuildingoccupancy–Pipingfordifferentplumbingsystemsinbuildings–Pumpselection–Plantroomsizing-Sewagetreatmentprocess-Externalwatersupply,storm drainage & sewerage system - Solid waste management - Interfacing PHE system withArchitectandStructuralengineers.

Teaching-LearningProcess	Chalk&Talk,PPTpresentation,Youtubevideos,Nearbysitevisits

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

1. **Understand**ElectricalSystemalongwithsubstationforabuildinginfrastructure
2. **Comprehend**thebasicsofacousticsandELVsystemsinbuilding.
3. **Design**andimplementationofHVACSystem
4. **Implement**FireAlarmSystem(PAS)forbuilding
5. **Understand**theimportanceofwatersupplyandsanitaryplumbingsystemforabuilding

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

SuggestedLearningResources:

TextBooks

1. CodeofPracticeforfiresafetyofbuildings(IS1641–IS1646)
2.

Module-5

ReferenceBooks:

1.
2.

WeblinksandVideoLectures(e-Resources):

- . Online study material
- NPTEL video lectures.

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

- Visit to Actual Repair, Retrofitting and Rehabilitation of Structures sites.
- Imparting knowledge of Techniques and materials for retrofitting.
- Mini Projects to explain the concept of Repair, Retrofit and Rehabilitation of structures.

ROAD SAFETY ENGINEERING		Semester	7
Course Code	**BCV755A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

- To provide students with a comprehensive understanding of the principles, strategies, and techniques related to ensuring safety on roadways.
- To equip students with the knowledge and skills necessary to analyse road safety issues
- To design effective road safety measures, and contribute to the improvement of road safety practices.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.

Module-1

Accident Investigations And Risk Management: Collection Of Accident Data, Assessment Of Road Safety, Methods To Identify And Prioritize Hazardous Locations And Elements, Determine Possible Causes Of Crashes, Crash Reduction Capabilities And Countermeasures, Effectiveness Of Safety Design Features, Accident Reconstruction, Condition And Collision Diagram.

Module-2

Traffic Engineering Studies: Statistical Methods In Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons- Traffic Management Measures And Their Influence On Accident Prevention.

Module-3

Road Safety In Transport Planning And Geometric Design: Vehicle And Human Characteristics, Road Design And Safety Elements, Redesigning Junctions, Cross Section Improvements, Traffic Control, Traffic Calming Measures, Road Safety Furniture

Module-4

Role Of Signs And Markings In Safety: Types Of Signs – Design Specifications – Guidelines For Installation – Role Of Signs In Safety; Types Of Road Markings – Design Specifications – Role Of Road Markings In Safety.

Module-5

Traffic Management Systems For Safety: Road Safety Audits And Tools For Safety Management Systems, Road Safety Audit Process, Road Safety Improvement Strategies, ITS And Safety.

Course outcome (Course Skill Set)

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

1. Analyse road safety data, identify hazardous locations, and assess safety risks on roadways.
2. Evaluate the effectiveness of road safety interventions and conduct post-implementation analysis.
3. Utilize modelling and simulation techniques to predict and assess the impact of road safety measures.
4. Demonstrate knowledge of traffic control devices, traffic management strategies, and their role

in enhancing road safety.

5. Comprehend the legal and policy framework related to road safety engineering and contribute to policy development.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Traffic Engineering And Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Fundamentals Of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
3. Transportation Engineering – An Introduction, C.Jotin Khisty, B. Kent Lall
4. Fundamentals Of Traffic Engineering, Richardo G Sigua
5. Handbook Of Road Safety Measures, Second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson
6. Road Safety By NCHRP

Web links and Video Lectures (e-Resources):

- NPTEL and YouTube Videos.

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

- Visit to Traffic Police station and traffic monitoring station

CONSERVATION OF NATURAL RESOURCES		Semester	7
Course Code	BCV755B	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

- Learn types of land forms, soil conservation and sustainable land use planning.
- Apprehend water resources, types, distribution, planning and conservation. Water pollution and types of uses.
- Know the types of minerals and rocks.
- Know the atmospheric composition of air, pollution and effects on human beings, animals and plants. Air pollution control.
- Apprehend basics of biodiversity and ecosystems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Power point Presentation
2. Video tube, NPTEL materials
3. Quiz/Assignments/Open book test to develop skills
4. Adopt problem based learning (PBL) to develop analytical and thinking skills
5. Encourage collaborative learning, site visits related to subject and impart practical knowledge.

Module-1

Land: 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.

Module-2

Water: Global water resources, Indian water resources, Resources system planning. Water use sectors- domestic, industrial, agriculture. Water deficit and water surplus basins in India, equitable distribution, Inter-basin water transfers, Interlinking of rivers – Himalayan component, peninsular component, issues involved. Ground water, its potential in India, conjunctive use, recharge of ground water. Contamination of ground water, sea water ingress, problems and solutions.

Module-3

Air: 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, smoke and its control. Ozone depletion –impacts, photochemical changes.

Module-4

Biodiversity: Introduction, Flora and Fauna, Importance of biodiversity, Economic values-medicinal plants, drugs, fisheries biogeochemical cycling. 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.

Module-5

Global warming: concept, indicators, factor and effects. Global climate change-indicators, health impacts, effect on biodiversity. Introduction to global efforts in conservation of biodiversity. .EIA regulations in India, status of EIA in India, list of projects needing environmental clearance under EIA notifications. Case study of hydro power/ thermal power projects

Course outcome (Course Skill Set)

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

1. Apprehend various components of land as a natural resource and land use planning.
2. Know availability and demand for water resources as applied to India.
3. Analyse the components of air as resource and its pollution.
4. Discuss biodiversity & its role in ecosystem functioning.
5. Critically appreciate the environmental concerns of today.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1. P.Jaya Rami Reddy, "A Textbook of Hydrology", University Science Press, New Delhi, 2011.
2. Krishnamurthy K.V., "An advanced textbook of Biodiversity- principle & practices." Oxford and IBH publications Co.Pvt ltd, New Delhi. 2004.
3. Odum, E.P., "Fundamentals of Ecology", W.B sounders, Philadelphia, USA, 1971
4. Singh J.S, Singh S.P & Gupta, S.R., "Ecology, environment and resource conservation", Anamaya publications, 2006

Web links and Video Lectures (e-Resources):

- NPTEL video lectures and YouTube videos.

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

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

VII Semester

ENERGY EFFICIENCY, ACOUSTICS AND DAYLIGHTING IN BUILDING

Course Code	**BCV755C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3+0+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

Course Learning Objectives: This course will enable students to;

1. To facilitate learners to understand climatology, heat ingress in 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.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk, PPT presentations,
2. You tube videos,
3. visit to nearby sites
4. NDT EQUIPMENTS AWARENESS

Module-1

Introduction to Climatology and heat ingress in 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.

Teaching-LearningProcess	Chalk & Talk, PPT presentation, Youtube videos, Nearby site visits

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.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby site visits

Module-3

Energy efficient buildings, Water and Waste management in buildings :Energy efficiency – Energy efficiency in building envelope and energy efficient HVAC and Lighting as per Energy conservation building code (ECBC) 2017, Energy simulation, Energy management system – Renewable energy and Energy Audit. (demand control ventilation) Water Efficiency – Planning and design of water management system, Rain water harvesting, Water efficient design and fixtures, Treatment and reuse and Water efficient landscape system.

Waste management – Types of waste and its treatment methods, Construction and demolition waste management, Waste management in residential, commercial buildings, healthcare facilities.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby site visits

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 – Modelling and Analysis, Greenhouse gas emission.

Different phases of Green building project management.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby site visits

Module-5

Energy Efficient rating :Energy efficiency rating for distribution transformers, diesel generator set, motors, pumps, electrical appliances, lighting fixtures and lifts as per Bureau of Energy Efficiency (BEE). 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.

Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby site visits

Course outcome (Course Skill Set)

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

1. **Comprehend** climatology, shading system and analyze heattransfer mechanism in buildings.
2. **Assess** the design considerations and parameters for lighting, acoustics and indoor air quality.
3. **Develop** solutions for energy efficiency, water efficiency and waste management in buildings.
4. **Calculate** energy savings and CO2 mitigation using web tools such as **ECONIWAS** and **Solar rooftop calculator**.
5. **Adopt** green project management methodology and evaluate building life cycle assessment.
6. **Understand** energy efficiency measures in a building.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books

1. **HarharaIyer G, Green Building Fundamentals, Notion Press**
2. Dr. Adv. HarshulSavla, Green Building: Principles & Practices

Reference Books:

1. The Sustainable Habitat Handbook (6 Volume Set), GRIHA Version 2019
2. National Building Code – 2016, Volume 1&2, Bureau of Indian Standards
3. Energy Conservation Building Code – 2017 (with amendments up to 2020), Bureauof 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

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Precast Members – Systems & Construction		Semester	7
Course Code	**BCV755D**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

- Impart concepts of precast concrete building design
- Comprehend various aspects like selection and planning of structural system and its components, significance, plant and production methods, transportation and erection sequence of precast elements
- Evaluate actual loads, integrating architectural and services requirements, structural modelling & analysis of a precast building
- Design and detailing of precast multi-storeyed building using software.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.
5. Adopt problem-based learning (PBL) to develop analytical and thinking skills.

Module-1

Introduction to Precast and its elements: tractors, end users) and Limitations, Residential, Commercial & Industrial Applications of precast, Materials used, Code provisions and clauses. **Major elements** (Beam, slab, wall, column, foundation, staircase, roof elements, façade) : Classification, Types and shapes, selection, application, erection, advantages, Infra works - Pipes & drains, duct bank, baggage handling tunnel, culvert and sleeper, facia element, pavement and channel.

Module-2

Precast Structural Systems, Production, Storage, & Logistics: Structural System: Skeletal System, Portal Frame system, Large Panel system, Cell Block system and hollow block system, Guide lines of selection – Residential & office buildings, Industrial Buildings, Commercial buildings, Structural Stability and Structural Behaviour.

Plant and Production: Introduction -Types & Process, Production – Design and shop drawings, check lists, Moulding, Casting and its types, Concreting, Curing, Demoulding and inspection.

Storage, Delivery, Handling- introduction and types of equipment, lifting devices, Erection and installation - Horizontal components, vertical components, special elements, Quality Inspection and Tolerance

Module-3

Modelling, Analysis and design of Wall system: Design Basis Criteria: Geometric parameters and Occupancy, Location and Associated Parameters, Systems and material specifications, analysis tools, Loads and Load Combinations – gravity loads, lateral loads (seismic and wind)

ETABS software, Modelling, Analysis and Design of structural elements for RC Wall system: Design of RC wall, beam, slab & staircase, Design for stripping, stacking, transportation and

erection for all elements

Module-4

Joints Connections for RC Wall system, Modelling, Analysis, Design of the Frame system: Joints connections for RC wall system – Wall to foundation, wall to wall horizontal connection, wall to wall vertical connection, beam to wall connection, beam to beam connection, slab to wall – progressive collapse, diaphragm action & slab to beam connection, staircase to beam or wall connection.

Modelling, Analysis and design for Frame system and its connections: ETABS Modelling, Analysis and Design for frame system (foundation, column, beam, slab etc.)

Module-5

Prestressed concrete and Preventive Measures and case studies: Prestressed Concrete, Various types of slab design and its check, Slab to beam connection Preventive Measures – Testing requirements, water tightness, temporary supports, MEP related preventive measures, progressive collapse – introduction and design, common defects and remedies.

Case Studies - Residential Project, Commercial Project

Course outcome (Course Skill Set)

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

1. Comprehend the necessity of precast construction
2. Adopt the appropriate mould and method for casting, transportation, and erection.
3. Compute loads (Dead, Superimposed, Live, Wind, Seismic) of various elements & services and select appropriate vertical & lateral load resisting systems for the various loads acting on the building
4. Create and analyze a precast building model using ETABS software
5. Design of precast building including connections, adhering to the code requirements & functional aspects

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. IS 15916, Building Design and Erection Using Prefabricated Concrete
2. IS 13920, Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces
3. Precast Concrete Structures Paperback – 12 June 2019 by Kim S. Elliott
4. Precast Concrete Structures – 2018 by Hubert Bachmann and Alfred Steinle Specifications

Web links and Video Lectures (e-Resources):

- E-learning content on L&T EduTech Platform.

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

- Site visit to understand Precast construction

Deep Excavation and Tunnels		Semester	8
Course Code	**BCV801A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

- Introduce various underground structures such as tunnels, caverns, shafts, and stations
- Explain the construction methodology, support systems and challenges in the construction of Tunnels, caverns, shafts, and stations.
- Explain design aspects in the field on geotechnical/rock engineering and tunnelling, Instrumentation, and monitoring of tunnels
- Impart knowledge on the field challenges to the students through introduction of problem statements in each module and to assess the comprehension of course through case studies as project work

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.

Module-1

Introduction to underground constructions and tunnelling: General Description of Various Tunnels and other underground structures, Components of a tunnel, Stress around an underground opening, Methods of excavations, Subsurface investigation
Surface investigation, Sampling Techniques, Laboratory and in-situ testing of soil and rock, Indian standard codes

Module-2

Construction, challenges and solutions for Caverns, shaft and underground stations: Factors affecting the choice of method of tunnel construction, Cut and cover method, Bored method, Drill and blast method, Sequential excavation method and shaft method, Norwegian tunnel boring method (NTM), New Austrian tunnel boring method (NATM), Methods of construction of caverns and shafts and underground stations, Challenges and solutions for execution of these methods, Different types of Tunnel boring machines.

Module-3

Design methodology, Instrumentation and monitoring for tunnels: Rock mass classification, Geotechnical and geological inputs for design, Empirical, semi empirical and joint set analysis, Numerical 2D modelling and final support recommendations, Need for Instrumentation and monitoring in tunnels, Types of Instruments - Planning and execution

Module-4

Support systems and design software for tunnels: Need for pre-excavation support system, Fore piling, Bolts and Anchors, Shotcrete, wire meshes, lattice girders and integrated support systems, Different types of retaining structures and their applicability. Secant piles, Sheet piles, contiguous piles and soldier piles and D wall. Requirement of investigation to be carried out for underground structure, Preparation geotechnical interpretation report for design of retaining structure, Numerical analysis to be performed for temporary / permanent retaining system, Introduction to software to be used in embedded retaining system, Case studies.

Module-5

Indian and International Code provisions: Introduction to interpretation using Rock data, Introduction to Wallap, Introduction to Plaxis Introduction to RS-2, Introduction to CIRIA 143, Wallap and their application Practical application & case studies

Course outcome (Course Skill Set)

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

1. Comprehend the different soil investigation techniques, rock mass classifications, components of different underground structures and their functions.
2. Design and apply different construction methodologies for tunnels, Caverns and shafts in different soil and rock conditions
3. Evaluate the suitability of different excavation supports such as sheet piles, soldier piles, diaphragm walls and tunnel support for different soil and rock conditions
4. Create an instrumentation monitoring plan for tunnel construction
5. Comprehend the use of different software tools in deep excavations and apply code provisions for mitigating water ingress and seepage in excavations and tunnels

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. CIRIA -C760 "Guidance on Embedded retaining wall design"
2. David Chapman, Nicole Metje, Alfred Stark " Introduction to Tunnel Construction "2017 , CRC Press

Web links and Video Lectures (e-Resources):

- E-learning content on L&T EduTech Platform.

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

- Site visit to understand deep excavation and tunnelling process

Advanced Design of RC Structures		Semester	VII
Course Code		CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives: The Course will enable students

- To make students to learn principles of Structural Design,
- To design different types of structures and to detail the structures.
- To evaluate performance of the structures

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Black board teaching/power point presentation
2. Regular review of the students by asking questions based on topics covered in the class

MODULE-1

- Design of R C slabs by yield line method.
- Design of RCC overhead circular and rectangular water tanks with supporting towers

MODULE-2

- Design of grid or coffered floors.
- Design of flat slabs

MODULE-3

- Design of R C Chimneys.
- Design of continuous beams with redistribution of Moments

MODULE-4

- Design of R C bunkers
- Design of R C silos

MODULE-5

Formwork: Introduction, Requirements of good formwork, Materials for forms, choice of formwork, loads on formwork, Permissible stresses for timber, Design of formwork, Shuttering for columns, Shuttering for slabs and beams, Erection of Formwork, Action prior to and during concreting, Striking of forms. Recent developments in form work

Course outcomes (Course Skill Set):

On completion of this course, students can:

1. Achieve Knowledge of design and development of problem-solving skills
2. Understand the principles of Structural Design.
3. Design and develop analytical skills.
4. Summarize the principles of Structural Design and detailing
5. Understands the structural performance

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE (maximum marks 50)

- 50 marks for CIE are split into **30 marks** for three Internal Assessment Tests and 2**0 marks** for other assessment methods mentioned in 22OB4.2.
- The first test at the end of 30-35% coverage of the syllabus, the second test after covering 65-70% of the syllabus and the third test for 95-100% coverage of syllabus
- The student must secure 40% of 50 marks to qualify in the CIE

SEE (Max 100 Marks scaled downed to 50 Marks)

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students must answer 5 full questions, selecting one full question from each module.

Marks scored by the student shall be proportionally scaled down to 50 Marks

Suggested Learning Resources:

Recommended Reading:

1. Krishna Raju. N., "Advanced Reinforced Concrete Design", CBS Publishers & Distributors
2. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, "Comprehensive RCC Design", Laxmi Publications, New Delhi
3. Pillai S. U. and Menon D., "Reinforced Concrete Design", Tata McGraw-Hill,3rd Ed, 1999
4. Relevant IS Code Books
5. Shah.H.J, "Reinforced Concrete", Vol-1 and Vol-2, Charotar, 8th Edition –2009 and 6th Edition – 2012 respectively. 5. Gambhir.M.L, "Design of Reinforced Concrete Structures", PHI Pvt. Ltd, NewDelhi, 2008

Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=undsd92MM8w&list=PLbQO4xhI7wEDIYv90NoF7veaJIohpuf0Q

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

- Conduction of technical seminars on recent research activities
- Group Discussion

Semester-VIII

PROJECT MANAGEMNET AND FINANACE			
Course Code:		CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:3:0:0	SEE Marks	50
Total Hours of Pedagogy		Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To understand what are the objectives of project management.
- To outline the principles followed in carrying out a project.
- To demonstrate knowledge and understanding of engineering and management principles.
- To function effectively as an individual, and as a member or leader in diverse teams.
- To understand the concepts of finance and accounts carried out in project management.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and talk
2. Power point Presentation, video
3.Group Discussions

Module-1

Project Implementation, Monitoring and Control

Project representation: Role of project managers ,relevance with objective of organization, preliminary manipulations ,Basic Scheduling concepts :Resource levelling ,Resource allocation ,Setting a base line, Project management information system: Importance of contracts in projects: Team work in Project Management: Formation of Effective terms

Teaching-Learning Process	Chalk and talk method/Power Point Presentation

Module-2

Project planning and time management

Purpose, Project scheduling, activity definition, activity sequencing, activity duration estimating, schedule development, schedule control, project management using CPM\PERT- Network basics, Network development, PERT analysis, advantages. Computerized network analysis- features of PM software, capabilities of PM software, multi project analysis,

Teaching-Learning Process	Chalk and talk method/Power Point Presentation

Module-3

Project Evaluation, Auditing and Other Related Topics in Project Management

Project Evaluation: Project auditing: Phase of project audit Project closure reports, computers, e-markets in Project Management:

Teaching-Learning Process	Chalk and talk method/Power Point Presentation

Module-4

Project appraisal: Objectives, essentials of a project methodology – Market appraisal – Technical appraisal – Financial appraisal – Socio – economic appraisal – Management appraisal

Teaching-Learning Process	Chalk and talk method/Power Point Presentation

Module-5

Finance and Accounting

Source of finance: Term Loans: Capital Structure: Financial Institution Accounting Principles: Preparation and Interpretation of balance sheets, profit and loss statements , Fixed Assets, Current assets, Depreciation methods

:Break even analysis:

Teaching-Learning Process	Chalk and talk method/Power Point Presentation

Course outcome (Course Skill Set)

1. Ability to study the current market trends and choose projects.
2. Ability to prepare project feasibility reports.
3. Ability to implement the project effectively meeting government norms and conditions.
4. Ability to understand the role and responsibility of the Professional Engineer.
5. Be able to assess social, health, safety issues based on the reasoning received from the contextual knowledge.
6. Ability to choose projects which benefit the society and organization

Suggested Learning Resources:

Text Book and Reference

1. Project Management Institute A Guide to the Project Management Body of Knowledge PMBOK Guide (Sixth Edition), Sept 2017
2. James C.Van Horne, Fundamentals of Financial Management, Person Education 2004.
3. Kuster J., Huber, E., Lippmann, R., Schmid, A., Schneider, E., Witschi, U., Wust, R. Project Management Handbook,2015
4. Khanna, R.B.,Project Management, PHI 2011.
5. Prasanna Chandra, Financial Management, Tata McGraw-Hill,2008.
6. By Carl S. Warren, James M. Reeve, Jonathan Duchac.Financial and Managerial Accounting,2016
7. PaneerSelvam, R., and Senthilkumar, P., Project Management, PHI, 2011.

Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=m4KU7Mo1Iqw
https://www.youtube.com/watch?v=2v1GEBfma5k
https://www.youtube.com/watch?v=DL1S6sdr5tA
https://www.youtube.com/watch?v=1mHaBKAamIU

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

- Quizzes
- Assignment
- Seminars

Metros and Seaports Engineering		Semester	8
Course Code	**BCV801D**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

- Elaborate on the salient features and types of Transit oriented development and its significance
- Explain the planning, Analysis, design and execution of elevated and underground Metro viaducts, tunnels including monitoring systems and stations
- Explain the design and Analysis of Earth retaining structures used in Metro systems
- Introduce the future trends and technologies in Transportation systems.
- Introduce the salient features of seaports
- Explain the different permanent and enabling structures in seaports

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills

Module-1

Introduction to Mass Rapid Transit System (MRTS) and Planning of Metros: Overview of Metro, Transit Oriented Development, Feasibility Study for MRTS Project, Sustainable and Smart Technologies, Recent Advancements & Future Technologies (High Speed Rail Technology, 'Maglev & Ground Effect Trains etc.). Basic Interfacing Principles – Alignment, Urban level planning, constraints and restrictions, Building Information Modelling in Metros, HVAC Systems, Tunnel Ventilation System, Public Health Engineering, Fire Alarm System etc.

Module-2

Design, Construction and Quality Control: Introduction to Contracts, Overview of FIDIC standards, Introduction to Quality Systems, Precasting Yard Development, Types of Precast Super Structure, Precast Mould development, Formwork System Overview, introduction to Precast Erection, Superstructure launching Methods, Obligatory Spans, substructure and foundation Construction Methodology, Challenges in Foundation Construction Alignment / Span configuration of elevated structures, Soil condition and type of foundations, Substructure system, Choosing type of Pier based on alignment profile, Rail / Over Head Equipment mast, Station overall layout, Pier arm - spine wing / cantilever and Platform- precast/cast-in-situ system. Erection methods and case studies Overview of Elevated station, Analysis and Design, Spine beam method, Design of station components, Loads and introduction to IRC/IRS Codes, 'Analysis and Design of superstructure, Substructure and foundation, 'Introduction to Modelling Software - STAAD Pro .

Module-3

Earth Retaining systems, Underground Metro Stations, Tunnels and monitoring systems: Underground Stations and its configurations, Shoring Systems, supporting systems, Construction Methodology (Bottom Up method/ Top Down method), Tunnelling methods and monitoring systems, Earth retaining structures, Secant pile wall design, Guide walls, Introduction to Loads, Load combinations, Fire resistant criteria and Floatation check, 2D & 3D model generation, SOD restrictions & Element sizing for UG Stations, Design of all the components of UG station.

Module-4

Introduction to Seaports: Introduction and evolution of Ports and Harbors, Terminologies, Over view of Marine Structures, Operation and components of Ports, Site investigation and survey, Approach facilities and navigational aids. Design considerations and functional requirements of typical port structures, Breakwater Structures, Berthing structures, Piers, Wharfs, Jetties, Quays, Dolphins, Fenders, Dredging facilities, Shipyard structures (dry dock and floating dock), Shore protection and Reclamation

Module-5

Enabling structures: Cofferdams and Dewatering – Case study, Load Out Jetty (LOJ) – Design of retaining structure, Elevated platform and Hydraulic ramp. Casting Yard Planning and Mould Optimisation. Piling Gantry – Layout, Loading. Rock Works – Breakwater construction, Revetment. Floating Stability/Caisson launching – Casting bed, Ballasting. Modular Construction – Modularisation, Erection.

Course outcome (Course Skill Set)

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

1. Create the basic layout of elevated and underground metro stations as per laid down codes and regulations
2. Interpret design recommendations and Codes of Practice for Elevated and Underground Metros and select suitable construction practices
3. Design the earth retaining systems for the excavations of underground stations
4. Comprehend the different permanent and enabling structures of seaports and harbors
5. Design Enabling structures of Ports and Harbors

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Indian Standard code - IS 456, Guidance on embedded retaining wall design CIRIAC760
2. David Chapman, Nicole Metje, Alfred Stark " Introduction to Tunnel Construction "2017 , CRC Press
3. M. Ramachandran ,"Metro Rail Projects in India- A Study in Project Planning "2011, Oxford University Press
4. Srinivasan, R., Harbour, Dock & Tunnel Engineering, Charotar Publishing House
5. Bindra, S.P., A course in Docks and Harbour Engineering, Dhanpat Rai & Sons
6. Port Design - Guidelines and recommendations by C. A. Thoresen, Tapir Publications

Web links and Video Lectures (e-Resources):

- E-learning content on L&T EduTech Platform.

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

- Site visits

Energy Conservation in Buildings		Semester	8
Course Code	**BCV802A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

- To facilitate learners to understand climatology, heat ingress in building and energy efficiency.
- To expose the learners to comfort in buildings.
- To impart fundamental knowledge on Life cycle assessment and Energy conservation.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.

Module-1

Introduction to Climatology and heat ingress in 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- Daylighting and its metrics – Strategies for daylighting 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 and energy efficient HVAC and Lighting as per Energy conservation building code (ECBC) 2017, Energy simulation, Energy management system – Renewable energy and Energy Audit. (demand control ventilation) Water Efficiency – Planning and design of water management system, Rain water harvesting, Water efficient design and fixtures, Treatment and reuse and Water efficient landscape system.

Waste management – Types of waste and its treatment methods, Construction and demolition waste management, Waste management in residential, commercial buildings, healthcare 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 – Modelling and Analysis, Greenhouse gas emission. Different phases of Green building project management.

Module-5

Energy conservation: Energy efficiency rating for distribution transformers, diesel generator set, motors, pumps, electrical appliances, lighting fixtures and lifts as per Bureau of Energy Efficiency (BEE). 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 (Course Skill Set)

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

1. Comprehend climatology, shading system and analyze heat transfer mechanism in buildings.
2. Assess the design considerations and parameters for lighting, acoustics and indoor air quality.
3. Develop solutions for energy efficiency, water efficiency and waste management in buildings.
4. Calculate energy savings and CO2 mitigation using web tools such as ECONIWAS and Solar rooftop calculator.
5. Adopt green project management methodology and evaluate building life cycle assessment.
6. Implement energy conservation measures in buildings.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. HarharaIyer G, Green Building Fundamentals, Notion Press
2. Dr. Adv. HarshulSavla, Green Building: Principles & Practices
3. The Sustainable Habitat Handbook (6 Volume Set), GRIHA Version 2019
4. National Building Code – 2016, Volume 1&2, Bureau of Indian Standards
5. Energy Conservation Building Code – 2017 (with amendments up to 2020), Bureau of Energy Efficiency.

Web links and Video Lectures (e-Resources):

- E-learning content on L&T EduTech Platform.

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

- Visit to green buildings

Occupational Health and Safety		Semester	8
Course Code	**BCV802B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	
Examination type (SEE)	**Theory**		

Course objectives:

- Gain an historical, economic, and organizational perspective of occupational safety and health
- Investigate current occupational safety and health problems and solutions.
- Identify the forces that influence occupational safety and health.
- Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
- En**courag**e collaborative (Group Learning) Learning in the class.
- Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
- Seminars and Quizzes may be arranged for students in respective subjects to develop skills.

Module-1

Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation

Module-2

Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis , Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations

Module-3

Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. Electrical Safety, Product Safety: Technical Requirements of Product safety.

Module-4

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability

Module-5

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors

Course outcome (Course Skill Set)

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

- Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
- Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
- Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
- Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
- Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Goetsch D.L., (1999), "Occupational Safety and Heal th for Technologists, Engineers and Managers", Pren tice Hall.
2. Heinrich H.W., (2007), "Industrial Accident Prevent ion - A Scientific Approach", McGraw-Hill Book Company
3. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "Industrial Safety and Poll ution Control Handbook
4. Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
5. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/114106017

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

- http://nptel.ac.in

Green Buildings		Semester	8
Course Code	**BCV802C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

- Understand the Definition, Concept & Objectives of the terms cost effective construction and green building
- Apply cost effective techniques in construction
- Apply cost effective Technologies and Methods in Construction
- Understand the Problems due to Global Warming
- State the Concept of Green Building 6. Understand Green Buildings

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

Module-1

Introduction to the concept of cost effective construction -Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks Lime Poszolana Cement- Gypsum Board- Light Weight Beams- Fiber Reinforced Cement Components Fiber Reinforced Polymer Composite- Bamboo- Availability of different materials- Recycling of building materials – Brick- Concrete- Steel- Plastics - Environmental issues related to quarrying of building materials

Module-2

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

Module-3

Global Warming – Definition - Causes and Effects - Contribution of Buildings towards Global Warming - Carbon Footprint – Global Efforts to reduce carbon Emissions Green Buildings – Definition – Features Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings – Embodied Energy in Materials Green Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.

Module-4

Green Building rating Systems- BREEAM – LEED - GREEN STAR -GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weight age. Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only)

Module-5

Utility of Solar Energy in Buildings Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

Green Composites for Buildings Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage

Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

Course outcome (Course Skill Set)

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

1. Understand cost effective building materials
2. Choose environment friendly construction procedure
3. Design eco-friendly buildings to reduce global warming
4. Understand the different green rating of buildings
5. Estimate energy saving in construction

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Harhara Iyer G, Green Building Fundamentals, Notion Press 2. Dr. Adv. Harshul Savla, Green Building: Principles & Practices

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=THgQF8zHBW8
- https://www.youtube.com/watch?v=DRO_rIkywxQ.

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

- Students have to visit a building which is green rated and prepare a report

INTEGRATED BUILDING SERVICES		Semester	8
Course Code	**BCV802D**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

- Understand Electrical System along with substation for a building infrastructure
- Learn ELV System and its interface with other allied services
- Design and implement HVAC System
- Learn and implement Fire Alarm System (PAS)
- Understand and implement importance of Public Health Services

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos, NPTEL materials
4. Quiz/Assignments/Open book test to develop skills.

Module-1

Advanced Electrical System Design for Buildings: Basics of Electrical System, Electrical terminologies, Major Electrical equipment, Building power distribution and its schemes, Fundamentals of Power& distribution transformers, HT, LT, DG Sets, Cables & Wires, UPS and its importance, Introduction of HT, LT switchgears systems, Importance of Lighting design & different Light fixtures used in buildings – Interior, external, street & offices, RMU, HT consumer, Substation Building in Master plan - Space planning for RMU,HT, DG set, HSD yard, Space provision for Electrical Equipment including Substation, Various equipment clearance requirements, HVAC, PHE, FPS service-electrical load input for designing electrical power distribution, Pedestals & ceiling support requirement for all Electrical equipment.

Module-2

Extra Low Voltage System for Infrastructure: Introduction & Brief of ELV Systems, Concept of Building Management System (BMS) & Fire Alarm System, Interface with Architecture/ Structure, Access control, CCTV & Public address system - Brief and purpose, BMS - Brief and purpose, BMS interfaces with Electrical, HVAC, Fire & Life Safety and PHE, BMS interfaces with airport systems.

Module-3

Heating, Ventilation & Air conditioning systems: Basics of HVAC - Psychrometry and its importance - Major Components of Air conditioning System - Fundamental concepts of Heat transfer, Air-conditioning system, Ventilation system, Pressurization Systems and their importance to Life safety, Chilled water system, Cooling towers and major HVAC equipment, Pumping system in HVAC, Importance of Thermal and Acoustic Insulation, Introduction and basics of Variable Refrigerant Flow (VRF) systems, Radiant cooling, Underfloor distribution, Chilled beams – Space planning - Importance of Static weight / Operating weights of mechanical equipment - Importance of Floor slab and Terrace roof slab openings / cut-outs

Module-4

Fire Protection and Life Safety System: Basics of Fire Protection System - Active Fire protection system - Passive Fire protection system - Basics of Smoke Control and Fire Stop Systems - Codes & Standards and Statutory Compliance - Fire and its Classes - Hazard Classification based on building occupancy - Means of Egress and its components - Importance of Life Safety - Refuge Area, Fire Tower and Fire Lift - Occupant Load and Capacity factors - Fire Stopping Materials - Compartmentation in a building - Smoke control & management in Fire Zoning - Components of Fire Compartments.

Module-5

Public Health Engineering: Scope of works in Public Health Engineering - Sanitary fixtures and types - Water supply and treatment - Rain water drainage system - Landscape irrigation features – Water demand calculation based on building occupancy – Piping for different plumbing systems in buildings – Pump selection – Plant room sizing - Sewage treatment process - External water supply, storm drainage & sewerage system - Solid waste management - Interfacing PHE system with Architect and Structural engineers.

Course outcome (Course Skill Set)

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

1. Understand Electrical System along with substation for a building infrastructure
2. Learn ELV System and its interface with other allied services.
3. Design and implement HVAC Systems
4. Learn and implement Fire Alarm System (PAS)
5. Understand and implement importance of Public Health Services

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

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Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Building Services Integration, P K Barton, Barry G Fryer, David Highfield, ISBN-13 978-0419120308, SPON Press, 1983

Web links and Video Lectures (e-Resources):

- E-learning content on L&T EduTech Platform.

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

- Site visits