BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

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

Avalahalli, Yelahanka, Bengaluru 560064

Bachelor of Engineering

Department of Civil Engineering

V and VI Semester Scheme and Syllabus
2021 Scheme - Autonomous

Approved in the BoS meeting held on 27.05.2023

Program Educational Objectives (PEOs)

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

Vision and Mission of the Department

Vision

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

Mission

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

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(An Autonomous Institution affiliated to VTU, Belagavi)
Yelahanka, Bengaluru-560064

Date: 14.06.2023

CIE and SEE Pattern for 2021 Scheme
(Applicable from the AY 2021-22 onwards)

Important Note:

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Examinations (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 marks out of 50). The student is declared as a pass in the course if he / she 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.

4 CREDIT and 3 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs to be conducted for 40 Marks (90 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10 marks, total **20 marks**.
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks (3 hours).

Question Paper Pattern:

Part - A: Comprises 20 objective type questions carrying 1 Mark each with a total 20 Marks.

Part - B: There will be **5 modules**. Each module will have **TWO questions carrying 16 marks** each. There will be a maximum of three sub section for each question. **Student has to answer any ONE full question from each module.**

SEE Marks = 20 + 80 = 100 marks and can be scale down to 50 marks.

2 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks**.
- Assignments: 2 assignments of each 10marks, total **20 marks.**
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks (2 hours).

Question Paper Pattern:

- The pattern of the question paper is MCQ.
- SEE question paper will be set for 100 questions each of 01 marks. The same is scale down to 50 marks.

1 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10marks, total **20 marks.**
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 50 Marks (1 hours).

Question Paper Pattern:

- The pattern of the question paper is MCQ.
- SEE question paper will be set for 50 questions each of 01marks. The same is scale down to 50 marks.

1 CREDIT LABORATORY COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Cumulative Assessment (CA) of each experiment is 20 Marks (Conduction 10 marks + Records 5 marks +Viva 5marks). The average of all the experiments to be taken for **20 marks.**
- Open Ended Experiments (OE) **10 marks.**
- 2 IAs Test to be conducted for 100 marks. General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.,: 60 marks and Viva: 20 marks. The average of 2 IA marks is scale down to **20 marks**.
- CIE marks =20 (CA) +10 (OE) + 20 (IA test) = 50 marks.
- Student has to score minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks and scale down to 50 Marks.

Examinations to be conducted jointly by Two examiners. All the experiments are to be included for practical examination. General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.,: 60 marks and Viva: 20 marks.

CoE 16/06/2023 Dean AA 16/06/2023 Principal 19/6/23

Scheme of VI Semester

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2021 – 22

Choice Based Credit System (CBCS)

UG PROGRAM: CIVIL ENGINEERING (CV) | **Semester: VI**

Sl. No.	Course category	Course Code	Course Title	Teaching Dept.	Teaching Hours/Week				Credits	Examination			
					L	T	P	PW		Duration	CIE Marks	SEE Marks	Total Marks
1	HS	21HSS61	Project and Finance Management	CV	2	0	0	0	2	2	50	50	100
2	AEC	21AEC62	Bio Informatics	CV	1	0	0	0	1	1	50	50	100
3	AEC	21AEC63	Building Planning and Drawing using Revit Architecture	CV	0	2	0	0	1	1	50	50	100
4	PE	21CV64X	Professional Elective - II	CV	3	0	0	0	3	3	50	50	100
5	OE	21CV65X	Professional Open Elective- I	CV	3	0	0	0	3	3	50	50	100
6	PW	21CV66	Mini Project (Extensive Survey Camp)	CV	0	0	0	4	2	3	50	50	100
7	PC	21CV67	Water Resources and Irrigation Engineering	CV	2	2	0	0	3	3	50	50	100
8	PC	21CV68	Estimation and Costing	CV	2	2	0	0	3	3	50	50	100
9	PC	21CVL69A	Soil Mechanics Laboratory	CV	0	0	2	0	1	3	50	50	100
10	PC	21CVL69B	Structural Detailing Laboratory	CV	0	0	2	0	1	3	50	50	100
11	PC	21CVL69C	Highway Engineering Laboratory	CV	0	0	2	0	1	3	50	50	100
TOTAL					**13**	**6**	**6**	**4**	**21**	**-**	**550**	**550**	**1100**
					29								

Professional Elective- (Group- II)

1.	21CV641	Air pollution Control and Techniques
2.	21CV642	Smart Irrigation Systems and Management
3.	21CV643	Railway, Tunnel, Harbour and Airport
4.	21CV644	Ground Improvement and Reinforced Soil Structures
5.	21CV645	Applications of Artificial Intelligence in Civil Engineering

Open Elective- (Group- I)

1.	21CV651	Occupational Health and Safety
2.	21CV652	Natural Disaster Management
3.	21CV653	Satellite Remote Sensing and GIS
4.	21CV654	Bio-Mimicry

VI Semester Syllabus

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

PROJECT & FINANCE MANAGEMENT (2:0:0) 2
(Effective from the academic year 2023-24)

Course Code	21HSS61	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:0	SEE Marks	50
Total Number of Contact Hours	25	Exam Hours	2 Hours

Course Objectives:

This course will enable students to:

1. Define the fundamentals of Project Management.
2. Identify the strategies involved in selection, prioritization, planning & scheduling of a project.
3. Understand the time value of money & apply it for decision making.
4. Analyse project risk, progress & results.
5. Make awareness about various sources of finance.
6. Gain Knowledge on working capital & capital budgeting.

Module – 1

Preamble: Project Management: Need for project management, management practices to meet the challenges of new economic environment, globalization process, rapid technological advancement, and quality concerns of the stakeholders.

Project Management: Definition of project, characteristics of projects, types of projects, project roles.

Project Selection & Prioritization: Strategic planning process, strategic objectives, identifying potential projects, feasibility study (environment, society), methods of selecting projects, prioritizing projects, securing and negotiating projects.

Hours: 05

Module – 2

Project planning & scheduling: Project scope & check list, work break down structure, project schedule, uncertainty in project schedules.

Project resourcing & risk planning: Abilities needed when resourcing projects, estimate resource needs, cost planning & estimating, risk management planning, risk identification, risk analysis, project quality planning and project kick-off.

Hours: 05

Module – 3

Project performing, progress & results: Project supply chain management, project balanced score card approach, terminate project early, finish project, customer feedback & approval.

Hours: 05

Module – 4

Financial Management: Evolution of financial management, key activities of finance manager, key decision areas in financial management, financial statement with balance sheet. Efficient utilization and generation of monetary resources and funds, a comparative study of finance and economics, Costs and revenue evaluation for various engineering operations.

Capital Budgeting: Types of capital budgeting decisions, capital budgeting proposals, estimating cash flows for project appraisal, green capital budgeting.

Hours: 05

Module – 5

Working capital management: Factors affecting working capital requirement, operating cycle analysis, negative working capital, cash planning & managing cash flows.

Cost of capital and leverage Analysis: Concept, significance, assumptions, factors affecting cost of capital, Leverage Analysis: operating leverage, financial leverage.

Hours: 05

Course outcomes:

The students will be able to:

CO1: Understand the selection, prioritization & initiation of individual projects.
CO2: Understand WBS, scheduling, uncertainty & risks associated in project.
CO3: Identify & Evaluate the progress and results of the project.
CO4: Understand time value of money & use it for decision making.
CO5: Outline capital requirements for starting a business & management of working capital.

Textbooks

1. Timothy J Kloppenborg, Project Management, Cengage Learning, 2nd Edition, 2009.
2. John J Hampton, Financial Management, PHI Publication, 4th edition.

References

1. Pennington Lawrence, Project Management, McGraw-Hill, 1st edition.
2. Joseph A Moder, Philips New Yark, Project Management with CPM & PRT, McGraw-Hill, 2nd edition, 1983.
3. Harold Kerzner, Project Management A system approach to Planning, Scheduling & Controlling, CBS Publication, 2nd Edition,2006.
4. S.D. Sharma, Operations Research, Kedar Nath Ramnath, Meerut, New Edition,2015.
5. M.Y. Khan, Financial Management, Tata Mc-Graw Hill, Fifth Edition,2007.
6. O.P. Khanna, Industrial Engineering & Management, Dhanpat Rai Publications, Second Edition, 1999.

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER VI

Bio Informatics (1:0:0) 1

(Effective from the academic year 2023-24)

Course Code	21AEC62	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	15	Exam. Hours	1 Hour

Course Objectives:

1. Better understanding of dynamic biological processes and their understanding at molecular level enabled through and correlated using internet and Bioinformatics.
2. To relate the basic knowledge in Genetics & Molecular Biology and see how it can be applied through Bioinformatics perspective.
3. To utilize bioinformatics tools and databases for retrieving, analyzing, understanding and managing biological data.

Module – 1

Preamble: Bioinformatics is an interdisciplinary field mainly involving molecular biology and genetics, computer science, mathematics, and statistics. Data intensive, large-scale biological problems are addressed from a computational point of view.

Biological Data Acquisition

The form of biological information. Retrieval methods for DNA sequence, protein sequence and protein structure information

(3 Hours)

Module – 2

DATABASES

Format and Annotation: Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases – primary sequence databases, protein sequence and structure databases, Organism specific databases.

(3 Hours)

Module – 3

DATA PROCESSING

Data – Access, Retrieval and Submission: Standard search engines; Data retrieval tools – Entrez, DBGET and SRS; Submission of (new and revised) data; Sequence Similarity Searches: Local versus global. Distance metrics. Similarity and homology. Scoring matrices.

(3 Hours)

Module – 4

METHODS OF ANALYSIS

Dynamic programming algorithms, Needleman-wunsch and Smith-waterman. Heuristic Methods of sequence alignment, FASTA, and PSI BLAST.

(3 Hours)

Module – 5

APPLICATIONS

Genome Annotation and Gene Prediction; ORF finding; Phylogenetic Analysis: Comparative genomics, orthologs, paralogs.

(3 Hours)

Course Outcomes: The students will be able to:

CO1: Apply the basic methodology in Bioinformatics to retrieve data.

CO2: Analyse bioinformatics tools and databases for understanding and managing biological data.

CO3: Examine the applications of bioinformatics in allied areas.

Textbooks:

1. Introduction to Bioinformatics by Arthur K. Lesk , Oxford University Press.
2. Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press.
3. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by Durbin, S.Eddy, A.Krogh, G.Mitchison.
4. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press.
5. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall, O"Reilley Media.

References:

1. Bioinformatics The Machine Learning Approach by Pierre Baldi and Soren Brunak.

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Building Planning and Drawing Using Revit Architecture (0:1:0) 1

(Effective from the academic year 2023-24)

Course Code	21AEC63	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:2:0	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	1 Hours

Course Objectives:

This course will enable students to:

1. Describe building information modelling methodology and its benefits.
2. Use different parts of the Revit Architecture user interface and work with different types of architectural elements and families.
3. Use the different views listed in the Project Browser, control the visibility and graphical.
4. Representation of objects in architecture model, and work with elevation, section, and 3D views.
5. Set up a project and transfer standards between projects, add and modify levels in project model, create and modify grids.

Syllabus

Module – 1 **13hrs**

1. New for Revit Architecture - Features for Revit Architecture
2. Introduction to Autodesk Revit Architecture
3. Starting an Architectural Project
4. Wall creation
5. Using Basic Building Components
6. Using the Editing Tools
7. Working with Datum Planes and Creating Standard Views
8. Using Basic Building Components-II

Module – 2 **13hrs**

1. Creating Project Details and Schedules
2. Creating Drawing Sheets, and Plotting
3. Rendering Views and Creating Walkthroughs

Course outcomes Laboratory:

The students will be able to:

CO1: Apply the knowledge to develop the structural components

CO2: Analyze the Architectural Project using the editing tools

CO3: Create the project details and develop the rendering views of the architecture.

ASSESSMENT METHODS

CIE Components (50 Marks)

Three Internal Assessments Tests (MCQ based) each of 40 Marks (duration 01 hour)
Two Assignment: 20 Marks
Two AATs: 20 Marks
Sum of the Assignment and AATs will be out of 40 Marks and scaled down to 20 Marks.
Sum of the three Internal Assessments Tests Marks will be out of 120 Marks and scaled down to 30 Marks.
Internal Assessments from Tests: 30 Marks
Assignment and AAT: 20 Marks
Total CIE Marks: 50 Marks

Semester-End Examination (50 Marks)

- SEE question paper will be set for 50 questions of each of 01 mark.
- The pattern of the question paper is MCQ.

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).
- The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and 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.

Reference:

1. Autodesk Revit 2023 Architecture Basics SDC Publication 2020

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Air Pollution and Control Technologies (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV641	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Identify the contemporary air pollution issues.
2. Analyze the major air pollutants and its effect on human health and environment.
3. Infer upon feasibility of the regulations and policies to manage air pollution.
4. Distinguish between technologies used to control and remove air pollutants.

Module – 1

Introduction to Course: Global Societal concerns - Economic aspects of air pollution prevention and control - Worldwide opportunities as consultant in air pollution mitigation

Air Pollution: Sources and classification; **Air Pollutants**: Definition, Sources, classification and characterization. **Criteria Air Pollutants**

Effects of air pollution: Upon Human health, vegetation and materials.

Industrial Accidents: Meuse Valley Disaster, Bhopal Gas Tragedy, Chernobyl Disaster etc.

Air pollution Episodes (case studies): Acid Rain, Global Warming, Smog, Ozone layer depletion etc.

Self-Learning Component: Literature Study on trend for generation rates of Air Pollution in Karnataka, and Globally.

(9 Hours)

Module – 2

Atmospheric motion and pollutant transport: Types of inversion, Temperature Lapse Rate & Atmospheric Stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Concept of maximum mixing depth and ventilation coefficient. Plume rise and Effective stack height. Estimation of effective stack height and mixing depths. Effect of wind, topography, terrain and structure on Pollutant dispersion.

Development of air quality and Dispersion modeling: Introduction to Dispersion modeling, its applications and limitations. Introduction to Gaussian Plume model and GLC determination.

(8 Hours)

Module – 3

Automobile Pollution: Concept, standards and control methods (inclusive of Innovations such as Electric Vehicles).

Noise Pollution: L_{eq}, Sources, Impacts, Control Measures, Measurement

Indoor Air Pollution: Concept, standards and control methods. **Sick Building Syndrome**

(7 Hours)

Module – 4

Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SO_X, NO_X, CO, NH_3)

Control Techniques: Particulate matter and gaseous pollutants- Design and working of settling chambers, cyclone separators, scrubbers, filters & Electrostatic Precipitator. Comparison of control techniques. Other mechanisms such as Biochemical Processes.

Design based Problems (DP)/Open Ended Problem: Analysis of Air quality and Noise level measurement at different places.

(7 hours)

Module – 5

Policies and Tools for monitoring Air Quality: Air Quality index and Comprehensive Environmental Pollution Index. National Ambient Air Quality Standards. Emission Standards and Inventory. Salient features of legislations on Air Quality. Kyoto Protocol and Montreal Protocol. Geneva Convention on Long-Range Transboundary Air Pollution. e ASEAN Agreement on Transboundary Haze Pollution.

Self-Study: Introduction to Software's in Air Pollution Monitoring: open source tools for air quality data analysis

Design based Problems (DP)/Open Ended Problem: Analysis of Climate related parameters and its relationship on Air Pollution; and vie-versa at different places, distinguished by land-use pattern. **(9 hours)**

Course Outcomes: The students will be able to:

CO1: Distinguish between causes, measurement techniques, impacts and control measures for attributes of Air Pollution.
CO2: Analyze the extent of Impact of Air Pollution with the application of air quality models.
CO3: Critically Evaluate Air Pollution Episodes and Case-studies.
CO4: Propose remedial measures to combat Atmospheric Pollution laden with particulate and gaseous emissions.
CO5: Identify new technologies to Monitor and combat Air Pollution.

Textbooks:

1. M N Rao and H VN Rao, Air pollution, 1st Edition, Tata Mc-Graw Hill, 1989.
2. K. Wark, C.F. Warner and W.T. Davis, Air Pollution Control: its Origin and Control, Addision-Wesley, 1998.
3. Daniel Vallero, Fundamentals of Air Pollution. 4th Edition, Academic Press, Burlington, MA, 2008.
4. S.H. Holgate, J.M. Samet, H.S. Koren, and R.L. Maynard, Air Pollution and Health, Eds., Academic Press, 1999.
5. Rajni Kant and Keshav Kant, Air Pollution and Control Engineering, 1st Edition, Khanna Publishers, 2019.

References:

1. De Nevers N., Air Pollution Control Engineering, 3rd Edition, Waveland Press Inc, 2016.
2. Robert Maynard, Stephen Holgate, Hillel Koren and Jonathan Samet, Air Pollution and Health, 1st Edition, Academic Press, 1999.
3. Atmospheric Chemistry and Physics, by John Seinfeld and Spyros Pandis, John Wiley & Sons, 1997.
4. Atmospheric Pollution: History, Science, and Regulation, by Mark Z. Jacobson, Cambridge University Press, Cambridge, 2002.

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Smart Irrigation Systems and Management (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV642	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Recognize the applications of smart sensors and modern tools in irrigation systems.
2. Utilize IoT and cloud computing technologies for water conservation in irrigation systems.
3. Appreciate the significance of modern technologies in farming.
4. Comprehend the irrigation policies and financing of irrigation projects.

Module – 1

Introduction to irrigation development in India: Different types of Irrigation prevalent in India: Warabandi, Shejpali and South Indian systems - Focus of Irrigation in India – Command area development approach and farmer's participation, Major and medium irrigation schemes of India

Irrigation systems and performance indicators: Systems classification - Institutions for irrigation management–Diagnostic Analysis of Irrigation Systems -Rehabilitation and modernization – Performance indicators – Improving system performance – Conjunctive management – constraints faced.

(8 Hours)

Module – 2

Smart irrigation systems: necessity, irrigation methods: overhead, centre pivot, lateral move, micro irrigation systems & it's performance, comparison of different irrigation systems, soil moisture measurement methods.

Smart and hydraulic design of Sprinkler, Automatic drip irrigation Systems, Irrigation for greenhouse cultivation and sensors controlled environment., hydroponics, hi-tech nursery and drone irrigation and fertigation

Practical session: Visit to a greenhouse cultivation site.

(8 Hours)

Module – 3

Sensors: Classification and characteristics, Microcontrollers, Smart sensors, Colorimetry based detection, MEMS Electrochemical Sensors, Dielectric Soil Moisture Sensors, ISFET, Weather sensors, Proximity Sensors, Signal conditioning and converters. Actuators for tool automation: A.C.-D.C. Motors, Stepper motor, Solenoid actuators, Piezoelectric motors, Electric drives, Hydraulic and Pneumatic actuator

IoT and cloud computing for smart agriculture: crop monitoring, resource management (water & energy), precision farming, machinery management, applications of drone in irrigation management.

Practical session: Hands on on sensors in Electronics lab.

(8 Hours)

Module – 4

Technologies for farming: Water quality monitoring, micro-irrigation system, solar pump and lighting system, Fencing, Android based automation, Agricultural Robots, Standards for agriculture.

Irrigation Management: Reservoir and canal management, Command area analysis and

development using RS&GIS, water conservation in Irrigation Scheduling.

Practical session: Demonstration of agricultural robots.

(8 Hours)

Module – 5

Irrigation policy and institutions: Present status of irrigation policy and institutions – Irrigation related conflicts – Institutional transformation needed – Constraints in effecting institutional transformation – Irrigation financing- Central and State financing – Economic instruments: water charges, cess, taxes, subsidies and compensation - Water pricing – Water market – Discounting factors and techniques – Applications of discounting techniques for irrigation project viability.

Practical session: Case Study/ Report and Seminar.

(8 Hours)

Course outcomes:

The students will be able to:

CO1: Apply the basic concepts of engineering for smart irrigation systems and irrigation policies.

CO2: Analyze requirement of sensors for various irrigation systems for automation.

CO3: Design and develop smart technologies for irrigation management

CO4: Evaluate case studies of real-time problems in civil engineering.

CO5: Identify the recent technological developments in smart irrigation systems

Teaching Practice:

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

Text Books

1. Michael, A.M., "Irrigation Theory and Practice", Vikas Publishers, New Delhi, 2000.
2. Dilip Kumar Majumdar., Irrigation Water Management, Prentice Hall Inc., 2004.
3. Rakesh Hooja, Management of Water for Agriculture: Irrigation, Water sheds and Drainage Rawat Publications, New Delhi, 2006.
4. Smart Agriculture: An Approach towards Better Agriculture Management: Editor Prof. Dr. Aqeel-ur-Rehman, OMICS Group,

References:

1. Ronald D. Kay, Farm Management, Planning, Control and Implementation, McGraw-Hill
2. Publishing Co. Ltd., New Delhi, 2007.
3. Pattnaik, P.K., Kumar, R., Pal, S., Panda, S.N.; IoT and Analytics for Agriculture. Springer, 2020. ISBN: 978-981-13-9176-7.
4. Pattnaik, P.K., Kumar, R., Pal, S. Internet of Things and Analytics for Agriculture, Volume 2.
5. Springer, 2020. ISBN: 978-981-15-0662-8.

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Railway, Tunnel, Harbour and Airport (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV643	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Understand the history and development, role of railways, railway planning and development based on essential criteria's.
2. Learn different types of structural components, engineering properties of the materials, to calculate the material quantities required for construction
3. Understand various aspects of geometric elements, points and crossings, significance of maintenance of tracks.
4. Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids
5. Apply design features of tunnels necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

Module – 1

Introduction to Course: Relevance in the Global scenario. Financial bearing on the World Economy. Role in Environmental and Societal concerns. Internship and Job opportunities in private, Government and central government. Significance and application of the course in Civil Engineering.

Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings(Explanation & Sketches of Right and Left hand turnouts only).

(8 Hours)

Module – 2

Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

Recap/Summary of the Course.

(8 Hours)

Module – 3

Tunnel Engineering:

Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation. Technologies for Underground Site Characterization, Invasive Technologies, Noninvasive Technologies.

Harbour Planning:

Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities.

Recap/Summary of the Course.

(8 Hours)

Module – 4

Airport Planning: Air transport characteristics, airport classification, air port planning: objectives, components, layout characteristics, and socioeconomic characteristics of the catchment area, criteria for airport site selection and DGCA & ICAO stipulations, typical airport layouts, Parking and circulation area.
Recap/Summary of the Course.

(8 Hours)

Module – 5

Airport Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.
Recap/Summary of the Course.

(8 Hours)

Course outcomes: The students will be able to:

CO1: Discuss the various components in Railways, Tunneling and Airport Engineering.
CO2: Apply the conceptual knowledge to design the various components in Railways, Tunneling and Airport Engineering.
CO3: Propose solution for real- time scenario in Railways, Tunneling and Airport Engineering.
CO4: Evaluate the latest developments in Railways, Tunneling and Airport Engineering.
CO5: Identify latest techniques and development in Railways, Tunneling and Airport Engineering.

Textbooks:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. Satish Chandra and Agarwal M.M, "Railway Engineering", 2nd Edition, Oxford University Press, New Delhi.
3. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Brothers, Roorkee,
4. C Venkatramaiah, "Transportation Engineering", Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press.
5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi.

References:

1. Mundrey J.S. "A course in Railway Track Engineering". Tata McGraw Hill.
2. Srinivasan R. Harbour, "Dock and Tunnel Engineering", 26th Edition 2013.

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Ground Improvement and Reinforced Soil Structures (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV644	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Create an understanding of the latest technique such as reinforcing the soil.
2. Analyze the need for ground improvement and understand the scope of the same in construction project.
3. Adapt physical and chemical ground improvement techniques using thermal modification, like grouting, shotcreting and grouting.
4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.

Module – 1

Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.

Geosynthetics and Their Functions: Historical developments, Recent developments, manufacturing process woven andnon-woven, Raw materials –Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics.

Properties and Tests on Materials: Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing and Evaluation of properties

(8 Hours)

Module – 2

Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems

Soil Nailing Techniques: Concept, Advantages and limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.

(8 Hours)

Module – 3

Design of Reinforced Earth Foundations: Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils.

Geosynthetics for Roads Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, enhancing properties of subgrade, Design requirements.

(8 Hours)

Module – 4

Mechanical stabilization:

Shallow and deep compaction requirements, Principles and methods of soil compaction Shallow compaction and methods, Properties of compacted soil and compaction control, Deep compaction and Vibratory methods, Dynamic compaction.

Modification by admixtures:

Stabilization of soil by lime, cement, bitumen, emulsions, lime column, cement column, polymer.

(8 Hours)

Module – 5

Modification by admixtures:

Stabilization of soil by lime, cement, bitumen, emulsions, lime column, cement column, polymer.

Grouting:

Aspects, Groutability, Grouting materials, Suspension grouts and solution grouts, Compaction grouting, Procedure and applications of grouting, Onsite installation techniques Micropiles, Soil nailing, rock anchoring, construction techniques.

(8 Hours)

Course Outcomes:

The students will be able to:

CO1: Apply the basis of reinforced earth construction, geosynthetics and the properties of materials.

CO2: Analyze the requirement of design of earth retaining walls by reinforcement and soil nailing techniques.

CO3: Evaluate the design requirements for foundation and the roads.

CO4: Examine the stabilization necessities by mechanical means and use of admixtures.

CO5: Explore the state-of-the-art developments in ground improvement and reinforced soil structures.

Textbooks:

5. Koerner. R.M, "Design with Geo synthetics", Prince Hall Publications
6. Koerner. R.M. andWesh, J.P, "Construction and Geotechnical Engineering using synthetic fabrics", Wiley Inter Science, New York.
7. Sivakumar Babu G. L., "An introduction to Soil Reinforcement and Geo synthetics", Universities Press, Hyderabad
8. Swami Saran, "Reinforced Soil and its Engineering Applications", I. K. International Pvt. Ltd, New Delhi
9. Venkattappa Rao, G., and Suryanarayana Raju., G. V.S, "Engineering with Geo synthetics", Tata McGraw Hill publishing Company Limited., New Delhi.
10. Raj, P. Purushothama., "Ground improvement techniques"1st Edition, Laxmi Publications, 1999.

References:

6. Jones, "Earth reinforcement and Soil structure", CJEP Butterworths, London
7. Ingold, T.S. and Millar, K.S, "Geotextile Hand Book", Thomas, Telford, London.
8. Hidetoshi Octial, Shigenori Hayshiand Jen Otani, "Earth Reinforcement Practices",Vol. I, A.A. Balkema, Rotterdam
9. Bell F.G, "Ground Engineer's reference Book", Butter worths, London
10. Ingold, T.S, "Reinforced Earth", Thomas, Telford, London.
11. Sarsby R W- Editor, "Geo synthetics in Civil Engineering", Wood head Publishing Ltd and CRC Press, 2007

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - V

Applications of Artificial Intelligence in Civil Engineering (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV645	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Possess a general knowledge of the field of Artificial Intelligence (AI).
2. Recognize and utilize AI techniques to solve civil engineering problems
3. Evaluate new techniques they encounter in application of Civil Engineering.
4. Emphasis on Genetic algorithm, Artificial Neural Network, and Fuzzy Systems.
5. Comprehend in detail the theoretical details of an intelligent system and implement in group projects.

Module – 1

Introduction: Introduction, Historical context, Necessities, AI&ML in modern civil engineering, Introduction to AI, Projects and Implementation, Logical Agents, First order Logic, Classical Planning, Knowledge Representation.

8 Hours)

Module – 2

Uncertain knowledge, reasoning, and learning: Quantifying Uncertainty, Probabilistic Reasoning, Making Simple decision, Making Complex Decision, Forms of Learning, Supervised Learning, Learning Decision Trees, Regression and Classification with Linear Models. Case studies on – decision trees in construction projects (cost & quality), smart cities, and intelligent transport systems.

(8 Hours)

Module – 3

Artificial Neural Networks: Fundamentals of ANN, Back propagation techniques in ANN, Variation and Applications, Research Directions, Applications of ANN in Complex Civil and Structural Engineering Problems. Case studies on ANN techniques in water resources systems, composite structures, intelligent buildings and urban systems and transportation & planning.

(8 Hours)

Module – 4

Fuzzy Systems: Fuzzy Set theory, Fuzzy Systems, Applications.

Genetic Algorithms: Fundamentals of GA, GA Modeling, Applications.

Case studies on applications of GA in concrete technology, structural health monitoring, soil & seismic studies, water distribution systems

(8 Hours)

Module – 5

Hybrid Systems: GA based Back Propagation Network, Fuzzy Back Propagation Networks, Implementations of Fuzzy, GA and Hybrid techniques in Civil Engineering projects. Case studies on climate change adaptation studies, and environmental engineering,

(8 Hours)

Course outcomes:

The students will be able to:

CO1: Interpret the basic concepts, models and functions of AI and Decision Making.
CO2: Investigate the applications of ANN & GA in Civil Engineering.
CO3: Analyse the functions of FS and GA in problem solving and optimisation.
CO4: Tackle Complex system of Engineering problems by implementing AI.
CO5: Recognize the latest improvements about the applications of AI in real world and future scope for Civil Engineers.

Textbooks:

1. Stuart J. Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 4th Edition, Pearson Education Inc., India, 2020.
2. S. Rajasekaran, G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy logic, and Genetic Algorithms Synthesis and Applications", 1st Edition, PHI Learning Pvt. Ltd, Delhi, 2003.

References:

1. Rich, K. Knight, and S. B. Nair., "Artificial intelligence", 3rd Edition, Tata McGraw-Hill, New Delhi, 2009.
2. Luger, George; Stubblefield, William., "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", 5th Edition., Redwood City, CA: Benjamin/Cummings Pub. Co., 2004.

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Occupational Health and Safety (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV651	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Gain historical, economic, and organizational perspective of occupational safety and health.
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify work place problems and safe work practice

Module – 1

Introduction to the course: Relevance of OHS in Global Industrial Scenario and impacts on Economy. Job opportunities as Safety Engineers. OSHA Limitations and the Need for Change.

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. Program Workers' Compensation - Unsafe Acts vs. Unsafe Conditions.

(8 Hours)

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**.**

Indoor Air Quality: Asbestos Awareness - Blood-borne Pathogen

(8 Hours)

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: Standard and Lockout/Tagout - Product Safety: Technical Requirements of Product safety - Process Safety Management. Exit Routes, Emergency Action Plans and Confined Spaces & Entry

(8 Hours)

Module – 4

Health Considerations at Work Place: Types of diseases and their spread, Health Emergency. Principles of Personal Protective Equipment/Clothing, types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability**.** Forklift Safety/Heat Stress/Ladder Safety /Scaffold Safety**.**

(8 hours)

Module – 5

Principles of Industrial Hygiene - 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. OSHA Record Keeping

Design based Problems (DP)/Open Ended Problem: Analysis of Compliance wrt OHS at different Industries/work places.

(8 hours)

Course Outcomes: The students will be able to:

CO1: Compare Occupational Health and Safety management principles for safety and sustainability.

CO2: Analyse principles of OHS while testing for exposure limits, risk assessment, severity rating and risk probability.

CO3: Evaluate accident causation and associated hazards, and consequently Prioritise mitigation measure w.r.t. work-place ergonomics.

CO4: Formulate Occupational Health and Safety Considerations and Policies for Work places.

CO5: Identify latest techniques and developments in Occupational Health and Safety engineering.

Textbooks:

3. Goetsch D.L, "Occupational Safety and Health for Technologists", Engineers and Managers Prentice Hall, 1999.

4. Heinrich H.W, "Industrial Accident Prevention-A Scientific Approach", McGraw-Hill Book Company, 2007.

References:

1. Colling D.A., "Industrial Safety Management and Technology", Prentice Hall, 1990.
2. Della D.E. and Giustina Van Nostrand Reinhold, "Safety and Environmental Management", 1st Edition 1996.

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Natural Disaster Management (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV652	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Understanding of comprehensive emergency management from a planning and policy perspective.
2. Understanding of the role of federal, state, and local governments in disaster planning and policies.
3. Secure Knowledge of mitigation planning and policy strategies

Module – 1

Introduction to the course: Relevance in the global scenario, Economics of planning, designing & executing a water supply scheme, Global Opportunities in the areas of Water conservation/ Source remediation and Water management, internship opportunities in the areas of water management.

Introduction to Disasters: Definitions: Disaster, Hazard, Vulnerability, Resilience, Disaster Preparedness - Classification of Disasters - Causes for Disasters - Impacts of Disasters on Society, Environment, Economics, Politics, Health, etc. - Types of Vulnerability - The Sphere Project.

(8 Hours)

Module – 2

Approach to Disaster Risk Reduction: Phases of Disaster Management Cycle - Culture of safety, prevention, mitigation, and preparedness - Community-based Disaster Risk Reduction - Structural and Non-structural mitigation measures.

(8 Hours)

Module – 3

Inter-Relationship between Disasters and Development: Linkage between Development and Disasters -Impact of Development Projects on Environment and Society - Climate Change Adaptation - IPCC - India's Participation - Relevance of Indigenous Knowledge, Appropriate Technology, and Local Resources.

(8 Hours)

Module – 4

Disaster Risk Management in India: Hazards-Vulnerability Profile of India - Components of Disaster Relief: Water, Sanitation, Food, Shelter, Health, etc. -National Policy and Disaster Management - Institutional Framework for Disaster Management in India - Role of NGOs in Disaster Risk Reduction - Role of Armed Forces during Disasters.

(8 hours)

Module – 5

Disaster Management: Applications and Case Studies and Field Works: Application of Information Technology, Remote Sensing Technology, and Geographic Information System in Disaster Risk Reduction - Case Studies on Landslide Hazard Zonation, Seismic Assessment of Buildings and Infrastructures, Drought Assessment, Coastal Flooding Assessment, Storm Surge Assessment, Fluvial and Pluvial Floods Assessment, Forest Fires Assessment.

(8 hours)

Course Outcomes: The students will be able to:

CO1: Understand various types of disasters, their causes and impacts on environment and society.

CO2: Identify different phases of disaster management cycle.

CO3: Assess vulnerability and prepare disaster risk reduction measures.

CO4: Analyse the vulnerability profile of India, and Prepare hazard zonation maps for all types of hazards.

CO5: Apply the knowledge of disaster management through various case studies.

Textbooks:

3. J.P. Singhal, "Disaster Management", Laxmi Publications, 2010.
4. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.
5. Pardeep Sahni and Madhavi Malalgoda, Ariyabandu, "Disaster Risk Reduction in South Asia", PHI Learning Private Limited, Delhi. 2017.
6. K. Gupta Anil and S. Sreeja Nair, "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi. 2011.
7. Kapur Anu, "Vulnerable India: A Geographical Study of Disasters", IIAS and Sage Publishers, New Delhi, 2010.

References:

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2. National Disaster Management Policy, Government of India, New Delhi, 2009.

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Satellite Remote Sensing and GIS (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV653	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Comprehend the basic concepts of remote sensing.
2. Analyze satellite imagery and extract the required information
3. Extract the GIS data and prepare the thematic maps.
4. Use the thematic maps for various applications

Module – 1

Introduction: Relevance in the Global scenario. Financial bearing on the World Economy. Role in Environmental and Societal concerns. Internship and Job opportunities. Significance and application of the course in Civil Engineering.

Remote Sensing: Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques.

Applications: The above topic is required for concept of remote sensing.

(8 hours)

Module – 2

Remote Sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. sensors, sensor resolutions (spatial, spectral, radiometric and temporal). Basics of digital image processing- introduction to digital data, systematic errors(Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity , Earth Rotation) and non-systematic [random] errors(Altitude, Attitude). Image enhancements (Gray Level Thresholding, level slicing, contrast stretching), image filtering.

Applications: The above topic is required for different platform and sensor in satellites

(8 hours)

Module – 3

Geographic Information System: Introduction to GIS; components of a GIS; Geographically Referenced Data, Spatial Data- Attribute data-Joining Spatial and attribute data, GIS Operations: Spatial Data Input – Attribute data Management, Geographic coordinate System, Datum; Map Projections: Types of Map Projections, Projected coordinate Systems. UTM Zones.

Applications: The above topic is required for processing satellite imageries.

(**8 hours)**

Module – 4

Data Models: Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database, Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, and Data conversion.

Applications: The above topic is required for creating different thematic maps

Module – 5

Integrated Applications of Remote sensing and GIS: Applications in land use land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location Based Services And Its Applications. Bhuvan website satellite imagery download and Google Earth integrating imageries.
Applications: The above topic is required for planning and implementation**.**

(8 hours)

Course outcomes:
The students will be able to:

CO1: Comprehend the various data collection and delineate various elements from the satellite imagery
CO2: Apply the knowledge of remote sensing in different features of ground information to create raster or vector data
CO3: Analysis of different thematic maps for various sectors.
CO4: Propose the latest technology to process satellite imageries.
CO5: Identify latest techniques and trends in GIS and cost effective aspects for analyzing Satellite data.

Teaching Practice:

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

Textbooks

1. Narayan Panigrahi, "Geographical Information Science", and ISBN 10: 8173716285 / ISBN 13:9788173716287, University Press2008.
2. Basudeb Bhatta, "Remote sensing and GIS" , ISBN:9780198072393, Oxford University Press2011
3. Kang – T surg Chang, "Introduction to Geographic Information System". Tata McGraw Hill Education Private Limited2015.
4. Lilles and, Kiefer, Chipman,"RemoteSensingandImageInterpretation",Wiley2011.

References

1. 1. Chor Pang Lo and Albert K.W Yeung, "Concepts &Techniques of GIS", PHI,2006
2. John R. Jensen, "Remote sensing of the environment", an earth resources perspective–2nd edition– by Pearson Education2007.
3. Anji Reddy M., "Remote sensing and Geographical information system", B. S. Publications2008.
4. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, "Principals of Geo physical Information system", Oxford Publications2004.
5. S Kumar,"Basics of remote sensing & GIS", Laxmi publications 2005

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Bio-Mimicry (3:0:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV654	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

5. Develop an understanding about natural systems.
6. Imitate the natural designs and processes, so as to sustainably solve current challenges.
7. Devise innovation methodology with biomimicry design principles and apply to real-time societal issues.

Module – 1

Introduction to Course: Relevance of Biomimicry in the Global scenario. Financial bearing of Biomimicry on the World Economy. Role of Biomimicry in Environmental and Societal concerns. Internship and Job opportunities as Biomimicry Consultant and Expert.

Need for bio-inspired design: Introduction to Biological vs Human Solutions. Solution vs. problem driven approaches, Industrial ecology - Biomimicry and sustainability.

(8 Hours)

Module – 2

Introduction to Biomimicry: biomimicry - bionics – bio-mimetics - origins of biomimicry - nature's laws, strategies and principles - Nature as a model, measure and mentor - animal architecture - complexity of natural organisms and systems - Relationship between nature and architecture.

(8 Hours)

Module – 3

Introduction to Biomimicry Systems: Biomimicry Approach to Change, Evolution and rate of Innovation, Design Process- Requirements, abstraction, process. Problem decomposition.

(8 Hours)

Module – 4

Discussion of Case Studies: Focus on Shelters - Focus on Food - Focus on Mobility

(8 hours)

Module – 5

Discussion of Case Studies: Focus on Healing Ourselves - Focus on Cleansing - Focus on Energy.

Design based Problems (DP)/Open Ended Problem: Exploration for Application of Bio-mimicry at different places, with detailed reporting.

Summary of the Course

(8 hours)

Course Outcomes: The students will be able to:

CO1: Identify the three essential elements of biomimicry.

CO2: Apply pivotal readings in environmental history to evaluate the human-nature connection, environmentalism, and the biophilia hypothesis.

CO3: Examine creatively the various processes and systems in nature.

CO4: Devise practical solutions to current societal challenges.

CO5: Familiarize with the latest know-hows and technologies in Bio-mimicry.

Textbooks:

1. Benyus J.M., “Biomimicry. Innovation Inspired by Nature”, Perennial, 2002.
2. Gould J., “Animal Architects, Building the Evolution of Intelligence”, Basic Books, 2007.

3. Bar-Cohen Y., “Bio-mimetics Biologically Inspired Technologies”, Taylor& Francis, 2006.
4. Mazzoleni I., “Architecture Follows Nature - Biomimetic Principles for Innovative Design”, CRC Press.

References:

1. Heinrich B., “The Thermal Warriors. Strategies of Insects Survival”, Harvard University, 1996.
2. Pearce P., “Structure in Nature is a Strategy for Design”, The MIT Press, 1990.
3. Shuker K., “The hidden power of animals. Uncovering the secrets of nature”, Reader’s Digest, 2001.

Web Links:

1. http://www.biomimicry.net
2. http://biomimicry.typepad.com/
3. http://www.rdg.ac.uk/Biomim/
4. http://www.extra.rdg.ac.uk/eng/BIONIS/
5. http://www.scq.ubc.ca/?p=321
6. http://www.architecture2030.com
7. http://www.asknature.org/

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Mini Project: Extensive Survey Camp (0:0:0:2) 2

(Effective from the academic year 2023-24)

Course Code	21CV66	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:0:4	SEE Marks	50
Total Number of Contact Hours	30	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Understand the practical applications of Surveying.
2. Use Total station and other Measurement Equipment.
3. Work in teams and learn time management, communication and presentation skills

Module – 1

Introduction: Relevance in the Global scenario. Financial bearing on the World Economy. Role in Environmental and Societal concerns. Internship and Job opportunities. Significance and application of the course in Civil Engineering.

NEW TANK PROJECTS (NTP):

a. Reconnaissance survey for selection of site and conceptualization of project.

b. Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.

c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement

d. Design and preparation of drawing with report.

Applications: The above topic is required for town planning (5 Hours)

Module – 2

WATER SUPPLY AND SANITARY PROJECT (WSSP):

a. Reconnaissance survey for selection of site and conceptualization of project.

b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.

c. Preparation of village map by using total station.

d. Survey work required for laying of water supply

e. Location of sites for water tank. Selection of type of water tank to be provided. (Ground level, overhead and underground).

f. Design of all elements and preparation of drawing with report

Applications: The above topic is required for water supply for existing and new town/village (5 Hours)

Module – 3

HIGHWAY PROJECT:

a. Reconnaissance survey for selection of site and conceptualization of project.

b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points.

The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.

c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.

d. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.

Applications: The above topic is required for road survey. (5 Hours)

Module – 4

RESTORATION OF AN EXISTING TANK:

a. Reconnaissance survey for selection of site and conceptualization of project.

b. Alignment of center line of the existing bund, Longitudinal and cross sections of the center line.

c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement.

d. Design of all elements and preparation of drawing with report.

Applications: The above topic is required for survey of existing tank and extension.

(5 Hours)

Module – 5

TOWN/HOUSING / LAYOUT PLANNING:

a. Reconnaissance survey for selection of site and conceptualization of project.

b. Detailed survey required for project execution like contour surveys

c. Preparation of layout plans as per regulations

e. Centerline marking-transfer of centre lines from plan to ground

f. Design of all elements and preparation of drawing with report as per regulations

Applications: The above topic is required for new town planning and layout

(5 Hours)

Module – 6

Drone Surveying: UAV Surveying flight plan, collection of GPS way points, flight mission, post processing of images, image processing 3D Mapping, preparation of digital elevation model, digital surface model. Digital terrain model using suitable software tool (Bentley context capture).

Applications: The above topic is required for quick survey for large area with accuracy.

(5 Hours)

Course outcomes: The students will be able to:

CO1: Apply surveying knowledge and tools effectively for the projects

CO2: Comprehensive task solve surveying problems.

CO3: Analyze the town planning, layout and water supply projects.

CO4: Propose alternative surveying techniques and methods.

CO5: Identify latest techniques and trends in surveying and cost effective in surveying.

CIE procedure for Mini-Project (50 Marks):

Evaluation of project work has to be carried out in two phases.

Phase I: Evaluate the project with respect to literature survey. It has to be evaluated for 100 marks (Guide: 60marks and Evaluators: 40marks) and scale down to 20 marks.

Phase II: Evaluate the project with respect to implementation and result discussion: It has to be evaluated for 100 marks (Guide: 30marks, Evaluators: 30marks and Project Report: 40marks) and scale down to 30 marks.

Phase I (20marks) + Phase II (30marks) = 50 Marks.

SEE Procedure for Mini-Project (50 marks):

Evaluate the project work for 100 marks and scale down to 50 marks.

Textbooks

1. B.C. Punmia, "Surveying Vol.2", Laxmi Publications pvt. Ltd., New Delhi, 2008.
2. Kanetkar T P and S V Kulkarni, Surveying and Leveling Part 2, Pune Vidyarthi Griha Prakashan, 2006.

Reference Books

1. S.K. Duggal, Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2011.
2. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers, 2001.
3. Chandra, A.M, Higher Surveying, New Age International (P) Limited, Third Edition, 2002.

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Water Resources and Irrigation Engineering (2:1:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV67	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Understand basic concepts of engineering hydrology and irrigation structures
2. Apply fundamentals of irrigation engineering and determine crop water requirement
3. Compute abstractions in hydrology and their estimations
4. Analyze runoff and streamflow potential using hydrographs
5. Design canals, pipelines and irrigation water demand for a command area

Module – 1

Introduction to Course: Relevance in the Global scenario. Water and World Economy. International water law. Role in Environmental and Societal concerns. Internship and Job opportunities. Significance and application of the course in Civil Engineering. Hydrologic cycle, Global and National Water resources, World water budget, national economic growth, National water policy and water scarcity.

Precipitation –Forms, Types, Measurement of precipitation, Hyetograph, Rain gauge network, Mean precipitation over an area, Estimation of missing rainfall data, Double mass curve technique, Return period, Plotting positions, I.D.F. curves, PMP, Problems on frequency analysis. Catchment – definition, stream pattern, description of the basin.

Practical Session: Computation of rainfall at various time scales for Bengaluru Rural and Urban. **(8 Hours)**

Module – 2

Evaporation: process, factors affecting Evaporation, Measurement using IS Class A Pan, Estimation using empirical formulae, Evaporation losses in reservoirs and remedies. Effect of evaporation on reservoirs

Evapotranspiration- factors, measurement using lysimeters, Blaney Criddle method of estimation. Variation of consumptive use in a crop season

Infiltration: factors affecting infiltration capacity, measurement (double ring infiltrometer). Horton's infiltration equation, infiltration indices and problems

Practical Session: Industrial Visit to Hydro-meteorological station at Karnataka State Natural Disaster Monitoring Cell (KSNDMC)

(8 Hours)

Module – 3

Runoff- Types of runoff, Factors affecting runoff, Basin yield, Rainfall-runoff correlation, Estimation of runoff with empirical equations – Dicken's formula, SCS curve number method. Flood routing and Urban flooding –causes and mitigation

Stream flow – Introduction, classification of stream, watershed and Integrated watershed management, Stream gauging, measurement of discharge, stage-discharge relations.

Hydrographs– Definition, Factors affecting flood hydrograph, Components of a hydrograph, Base flow separation, Effective rainfall, Unit Hydrograph- Definition, Assumptions and Limitations of Unit hydrograph, Derivation of units of hydrograph, Unit hydrograph from

complex storms, Unit hydrograph of different durations

Practical Session: Group discussion strategies for mitigation of urban flood in metropolitan cities.

(8 Hours)

Module – 4

Introduction: Relevance in the Global scenario. Indian context of agricultural economy, Drought management and dams in India.

Irrigation – Definition, Necessity, Aspects of Irrigation, Types of irrigation systems, Various irrigation methods, and innovation in smart irrigation with sensors and hydroponics. Demonstration of Sprinkler and Drip Irrigation systems

Water Requirement of Crops – Classification of soil water, Soil moisture constants, Depth of water applied, and Frequency of irrigation, irrigation scheduling- problems.

Crop Characteristics- Crop co-efficient, Crop seasons, Crop period and Base period, Consumptive use in a crop season, Duty, Delta (Relationship between them) - problems and Irrigation Efficiencies. Applications of drones in irrigation management.

Practical Session: Group activity: Technical Study of Sprinkler irrigation system in campus.

(8 Hours)

Module – 5

Design of Irrigation Canals: Introduction. Classification of irrigation canals, command area and types. Design of Canals –Silt theories, Kennedy's theory, Design procedure by Kennedy's theory- Design Problems, Lacey's theory, Regime channels and Regime conditions and design equations,-Design problems. (refer IS 10430: 2000 and IS 7112:2002)

Typical Canal section: Longitudinal section of a canal, Balancing depth, C/s of an irrigation canal, barrow pit, spoil bank, Berms

Reservoir Planning: Types of reservoirs, Investigations of reservoir planning, Selection of site for a reservoir, Zones of storage in a reservoir, Reservoir yield, Mass curve and Demand curve, determination of reservoir capacity using mass curve. Reservoir operations of a multipurpose projects (IS 7323 : 1994)

Practical Session: Industrial Visit to Markonahalli Dam, Yediyur.

Recap/Summary of the Course

(8 Hours)

Course outcomes:

The students will be able to:

CO1; Apply basics of hydrological science to engineer water resources for mankind.

CO2: Estimate quantity of various water forms in hydrological processes, empirically and through field measurements.

CO3: Correlate runoff and stream flow studies using hydrograph analysis.

CO4: Design irrigation canals and compute water requirement of crops for a command area.

CO5: Evaluate case studies on global water scarcity, water-smart cities and reservoir management.

Teaching Practice:

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

Text Books

1. 1. Subramanya, K. “Engineering Hydrology”, 4e. Tata McGraw-Hill Education, 2013.
2. 2. Rami Reddy, P. Jaya.”, A Text book of Hydrology”, Laxmi publications New Delhi, 3rd Edition, 2013.
3. 3. Punmia, B. C., Pande Brij Basi Lal, Ashok Kumar Jain, and Arun Kumar Jain. “Irrigation and water power engineering”. Laxmi Publications, Ltd., 2009.

References:

1. Modi, P. N., “Water Resources and Water Power Engineering”. Standard book house, Delhi, 9th Edition, 2014.
2. 2. Patra, Kanhu Charan. “Hydrology and Water Resources Engineering”. Alpha Science International, 2008.

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

Estimation and Costing (2:1:0) 3

(Effective from the academic year 2023-24)

Course Code	21CV68	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project.
2. Comprehend and apply the concept of Valuation for Properties
3. Create the Tender and Contract document.

Module – 1

Introduction to Course: Issues in Global construction market and their role towards economy;

Job opportunities: Quantity Surveyor, Valuator, Billing Engineers Introduction to estimates and related terms: Definitions of estimation and valuation. Significance (application) of the Course. Purpose of estimation. Type of estimates, data required for estimation as a pre requisite. Meaning of an item of work, and enlisting the items of work for different Civil Engineering projects. Units of measurement. Mode of measurement of building items/ works.

Introduction to components of estimates: face sheet, abstract sheet (BOQ), measurement sheet, Rate Analysis, lead statement. Provisional sum& prime cost items, contingencies, work charge establishment, centage charges.

Taking out quantities-PWD Method (short wall/long wall method) and center line method of taking quantities, Procedure of taking out quantities for different assignments in term work as per IS 1200- Load bearing structure and RCC Framed structure, Deduction rules for different work as per IS 1200; **(8 hours)**

Module – 2

Estimation of quantities in RCC Structures: Slab, beam, column, footing, retaining wall with Bar bending schedule Estimation of quantities for Manhole, septic tanks.

Estimation of quantities for Roads: Road estimation, earthwork estimation, detailed estimate and cost analysis for roads. Estimation of quantities in Steel Roof Truss.

(8 hours)

Module – 3

Specifications: Meaning & purpose, types drafting detailed specifications for materials, quality, workmanship, method of execution, mode of measurement and payment for major items like, excavation, stone/ brick/block masonry, plastering, ceramic tile flooring, R.C.C. work.

Rate Analysis: Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Working out Rate Analysis for the items mentioned in specifications above. Task work or out turn, factors effecting task work.

Exposure to Latest Schedule of rates pertaining to KPWD-SOR, CPWD-SOR

(8 Hours)

Module – 4

Tenders: Definition. Methods of inviting tenders, tender notice, tendering procedure, Pre and post qualification of contractors, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders. Comparative statement, Pre-bid conference, acceptance/ rejection of tenders. Various forms of BOT &Global Tendering, E-tendering.

Methods of Executing Works: PWD procedure of work execution, administrative approval, budget provision, technical sanction. Methods of execution of minor works in PWD: Piecework, Rate List, Daily Labour. Introduction to registration as a contractor in PWD.

Purpose of valuation: Meaning of price, cost and value. Factors affecting 'value'. Types of value: only Fair Market Value, Book Value, Salvage/ Scrap Value, Distressed Value and Sentimental Value. Concept of free hold and lease hold property. Estimation versus valuation. Meanings of depreciation & obsolescence.

(8hours)

Module – 5

Contracts: Definition, objectives & essentials of a valid contract as per Indian Contract Act (1872), termination of contract. Types of contracts: only lump sum, item rate, cost plus. Conditions of contract: General and Specific conditions. Conditions regarding EM, SD, and time as an essence of contract, conditions for addition, alteration, extra items, testing of materials, defective work, subletting, etc. Defect liability period, liquidated damages, retention money, interim payment or running account bills, advance payment, secured advance, final bill.

Recap/Summary of the Course

(8 Hours)

Course outcomes:

The students will be able to:

CO1: Prepare detailed and abstract estimates for roads, building and its secondary components

CO2: Prepare valuation reports of buildings.

CO3: Interpret Contract documents of domestic and international construction works

CO4: Perform in a group on latest trends related to quantity surveying field and prepare report for the same.

CO5: Perceive the recent technological developments in civil engineering.

Teaching Practice:

- Classroom teaching (chalk and Talk).
- Power Point Presentation.
- Using Information and Communication Technology (ICT).
- Audio and Video Visualization Tools.
- Industrial / Site Visit.

Textbooks:

3. B N Dutta, Estimating and Costing in Civil Engineering: Theory and Practice: UBS, Publishers, 8th edition, 2018.
4. Rangwala, Estimating and Costing: Charothar, 22nd edition, 2018.
5. Chakraborty, Estimating, Costing Specifications & valuation in Civil Engineering Sharda Publication, 7th edition, 2017.
6. B S Patil, Civil Engineering Contracts and estimates, University Press, 3rd Edition 2018.

7. Roshan Namavati, Theory and Practice of Valuation, Lakhani Publishers,10th Edition 2017.

References:

1. IS 1200-Part 1 to Part 25, Bureau of Indian Standards.
2. Specifications for Roads and bridge works, MORTH Manual,2017, 2nd edition.
3. CPWD Schedule of rates, CPWD,2019 edition.
4. KPWD Schedule of rates, KPWD,2019 edition.
5. P N Khanna, Indian Practical Civil Engineers' Handbook, CBS Publishers 2019

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Soil Mechanics Laboratory (0:0:1) 1

(Effective from the academic year 2023-24)

Course Code	21CVL69A	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. To carry out laboratory tests and to identify soil as per IS code procedures
2. To perform laboratory tests to determine the index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

LIST OF EXPERIMENTS

PART – A

1. Determination of specific gravity and water content of the given soil sample.
2. Determination of in-situ density of fine grained and coarse-grained soil.
3. Determination of particle size distribution of given soil sample.
4. Determination of Atterberg's limits of the given soil sample
5. Determination of OMC and MDD for the given soil for a typical project.

PART – B

6. Determination of permeability coefficient for fine- and coarse-grained soil.
7. Determination of undrained cohesion using unconfined compression test.
8. Determination of undrained cohesion using vane shear test.
9. Determination of cohesion and angle of internal friction of soil by Direct Shear Test.
10. Determination of cohesion and angle of internal friction of soil by triaxial test.
11. Determination of consolidation characteristics of the soil sample.

Course outcomes Laboratory:

The students will be able to:

CO1: Apply the basic knowledge to interpret the physical and index properties of the soil.
CO2: Classify the soil based on index properties and field identification.
CO3: Evaluate the OMC and MDD, plan and assess field compaction program.
CO4: Estimate the shear strength and consolidation parameters to assess strength and deformation characteristics.

Examination pattern:

- **SEE** will be conducted for 3 hours.
- **Two** experiments, one from **Part A** and one from **Part B** has to be completed.
- Questions for Part A and Part B is given on a lotto basis and oral viva-voce is conducted.
- In **Record** and in **CIE**, for each experiment the weightage of marks is as follows,

(i) Aim, Procedure and writeup- 15% marks

(ii) Conducting the practical including calculation, graphs and results – 70% marks

(iii) Viva- Voce- 15% marks

Note:

- In CIE and SEE, if there is change of experiment then subsequently 15% marks with respect to aim, write up and procedure shall be deducted.
- CIE can have the similar QP pattern as SEE and shall be accordingly evaluated.

Alternate Assessment Methods: Seminar/Assignment/MOOC/Online Course/Project Based Learning/Group Assignment/Minor-Project

Textbooks:

1. Das, Braja M., "Principles of Geotechnical Engineering", 7th Edition, Boston: PWS, 2010. Print.
2. Murthy, V N. S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", 10th Edition, New York: Marcel Dekker, 2003. Print.

Reference:

1. Code, Indian Standard. "IS 1498–1970." Classification and identification of soils for general engineering purposes (first revision).
2. IS 1904 (1986): Code of practice for design and construction of foundations in soils: General requirements.
3. IS 2720-1 (1983): Methods of test for soils.

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Structural Detailing Laboratory (0:0:1) 1

(Effective from the academic year 2023-24)

Course Code	21CVL69B	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	3 Hours

Course Objectives:

Course Objectives:

This course will enable students to:

6. Understand the Scale Factors and Sections of drawings.
7. Understand the detailing of RC and Steel Structural member.

List of Experiments

PART A

Introduction to Course: Relevance in the Global scenario. Financial bearing on the World Economy. Internship and Job opportunities. Significance and application of the course in Civil Engineering.

Detailing of RCC Structures:

1. Beams – Simply supported, Cantilever and Continuous.
2. Slab – One way, Two way and One-way continuous.
3. Staircase – Doglegged and Open well
4. Cantilever Retaining wall
5. Counter Fort Retaining wall
6. Circular Water Tank, Rectangular Water Tank.
7. Portal Frame
8. Demonstrate the bar bending through model

(17 hours)

PART B

Detailing of Steel Structures:

1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens.
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted.
5. Beams with Bolted and Welded.
6. Gantry Girder.
7. Work in team and develop the DSS working drawing.

(17 hours)

PART C

Open ended Experiments

(6 hours)

Course outcomes:

The students will be able to:

CO1: Prepare detailed working drawings of RCC and Steel Structures.

CO2: Students will be able to work in team to complete the project.

Examination pattern:

- **SEE** will be conducted for 3 hours.
- **Two** experiments, one from **Part A** and one from **Part B** has to be completed.
- Questions for Part A and Part B is given on a lotto basis and oral viva-voce is conducted.
- In **Record** and in **CIE**, for each experiment the weightage of marks is as follows,

(i) Aim, Procedure and writeup- 15% marks

(ii) Conducting the practical including calculation, graphs and results – 70% marks

(iii) Viva- Voce- 15% marks

Note:

- In CIE and SEE, if there is change of experiment then subsequently 15% marks with respect to aim, write up and procedure shall be deducted.

1. CIE can have the similar QP pattern as SEE and shall be accordingly evaluated.

Alternate Assessment Methods: Seminar/Assignment/MOOC/Online Course/Project Based Learning/Group Assignment/Minor-Project

Textbooks

1. José Calavera, "Manual for Detailing Reinforced Concrete Structures to EC2"' University Press, 2011

References

1. N Subramanian, "Design of Reinforced Concrete Structures", PHI, New Delhi, Recent Edn
2. P C Varghese, "Limit State Design of Reinforced Concrete Structures", PHI, New Delhi Recent Edn

B.E CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Highway Engineering Laboratory (0:0:1)1

(Program Core from the academic year 2023-24)

Course Code	21CVL69C	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Conduct tests on Bitumen (as per IS:1206) and determine the grade of Bitumen for Pavement Construction as per IRC standards.
2. Conduct tests on Pavement materials (as per IS:2386) and determine the Quality of aggregates as per IRC standards.
3. Evaluate the Flexible Pavements on field as per IRC standards.
4. Gain the Skill related to use of modern Engineering and IT tools for the Design of Flexible Pavement.

Part A - Tests on Bitumen

Experiment 1: Bitumen Cone Penetration test.
Experiment 2: Bitumen Ductility test.
Experiment 3: Bitumen Softening Point test.
Experiment 4: Bitumen Flash and Fire Point test.
Experiment 5: Bitumen Viscosity test.
Experiment 6: Bitumen Stripping Value test.
Experiment 7: Demonstration of Marshall Stability test.
Experiment 8: Demonstration of Bitumen Extraction Test.
All experiments 3 hours each/ week

Part B – Tests on Pavement Materials

Experiment 9: Coarse Aggregate Shape and Angularity test.
Experiment 10: Coarse Aggregate Impact test.
Experiment 11: Coarse Aggregate Crushing strength test.
Experiment 12: Coarse Aggregate Los-Angeles Abrasion test.
Experiment 13: Coarse Aggregate Specific Gravity and Water Absorption test.
Experiment 14: Dynamic Cone Penetration Test for Flexible Pavement.
Experiment 15: Road Roughness Measurement using Merlin Cycle.
Experiment 16: Benkelman Beam Deflection Test for Flexible Pavement.
All experiments 3 hours each/week

Course outcomes:

The students will be able to:

CO1: Conduct tests on Bitumen (as per IS:1206) and determine the grade of Bitumen for Pavement Construction as per IRC standards.

CO2: Conduct tests on Pavement materials (as per IS:2386) and determine the Quality of aggregates as per IRC standards.

CO3: Evaluate the Flexible Pavements on field as per IRC standards.

CO4: Gain the Skill related to use of modern Engineering and IT tools for the Design of Flexible Pavement.

Examination pattern:

- **SEE** will be conducted for 3 hours.
- **Two** experiments, one from **Part A** and one from **Part B** has to be completed.
- Questions for Part A and Part B is given on a lotto basis and oral viva-voce is conducted.
- In **Record** and in **CIE**, for each experiment the weightage of marks is as follows,

(i) Aim, Procedure and writeup- 15% marks

(ii) Conducting the practical including calculation, graphs and results – 70% marks

(iii) Viva- Voce- 15% marks

Note:

- In CIE and SEE, if there is change of experiment then subsequently 15% marks with respect to aim, write up and procedure shall be deducted.

  CIE can have the similar QP pattern as SEE and shall be accordingly evaluated.

Alternate Assessment Methods: Seminar/Assignment/MOOC/Online Course/Project Based Learning/Group Assignment/Minor-Project

Textbooks:

1. Khanna & Justo, Highway Materials Testing Laboratory manual, NemChand Bros 2nd edition, 2011.
2. L. R. Kadiyali, Highway Engineering, Khanna publishers, 2018, 10th edition.
3. IS: 2386-Part 1 to Part-16, method of testing for aggregates of concrete, BIS New Delhi, 2010.
4. IS: 1206-Part 2 & Part 3, Methods for testing Bituminous materials, New Delhi.

References:

1. IRC 111-2009, Specifications for Dense Graded Bituminous Mixes, New Delhi.
2. ASTM D1559-76, Test Method for Resistance of Plastic Flow of Bituminous Mixtures Using Marshall Apparatus, American Society for Testing and Materials, USA.
1. IRC 81- 1997, Guidelines for strengthening of flexible road pavements using Benkelman beam deflection technique, New Delhi.