



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited A++ Grade by NAAC | 12B Status by UGC | Approved by AICTE

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School of Building and Environment Department of Civil Engineering

1.1.2 List of Courses Revised / Introduced in the Academic Year 2023 – 24

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(S. PACKIALAKSHMI)

HOD/CIVIL

HEAD OF THE DEPARTMENT
DEPARTMENT OF CIVIL ENGINEERING
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Jeppiyapur Nagar, Rajiv Gandhi Salai,
Chennai – 600 119.

**School of Building and Environment
Department of Civil Engineering**

Board of Studies Meeting - Academic Year 2023-2024

The periodic Board of studies meeting, for the Department of Civil Engineering, School of Building and Environment will be held on 11.04.2023, 10.00 am at CADD lab, Civil Department.

Internal members

1. Dr.Devyani Gangopadhyay, Dean, School of Building and Environment
2. Dr.S.Packialakshmi, Associate Professor, Department of Civil Engineering
3. Dr.R.Padmapriya, Associate Professor, Department of Civil Engineering
4. Dr.V.Samathkumar, Professor, Department of Civil Engineering
5. Dr.R.Nirmala, Associate Professor, Department of Civil Engineering

External members

1. Dr.R.Santhakumar, Professor, Department of Civil Engineering, NITTTR, Chennai
2. Dr.R.Saravanan, Associate Professor, CWR, Anna University, Chennai

Agenda:

- Review of Curriculum for the upcoming semester courses
- Implementation of Mandatory Audit Courses for the Undergraduate and Post Graduate Program
- Implementation of Skill enhancement courses for the Undergraduate Civil Engineering Program
- Implementation of Project Based Learning Approach Course
- Implementation of Theory cum Practical courses
- Implementation of the practical course Design Thinking and Innovations



HOD

**School of Building and Environment
Department of Civil Engineering**

Minutes of the BOS Meeting - Academic year 2023-2024

The Board of Studies Meeting for both UG and PG programme is held on 11.04.2022, 10.00 AM at CADD Lab, Civil Department.

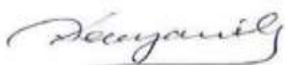
Members Present

- | | |
|--|---------------|
| 1. Dr.Devyani Gangopadhyay
Dean, School of Building and Environment | Convenor |
| 2. Dr.R.Santhakumar
Professor, Department of Civil Engineering, NITTTR, Chennai | Expert Member |
| 3. Dr.R..Saravanan
Associate Professor, CWR, Anna University, Chennai | Expert Member |
| 4. Dr.R.Padmapriya
Associate Professor, Department of Civil Engineering | Member |
| 5. Dr.S.Packialakshmi
Associate Professor, Department of Civil Engineering | Member |
| 6. Dr.V.Sampathkumar
Professor, Department of Civil Engineering | Member |
| 7. Dr.R. Nirmala
Associate Professor, Department of Civil Engineering | Member |

The Dean, School of Building and Environment has initiated the periodic Board of Studies meeting by briefing the agenda to be discussed. After a detailed review among the board of studies members on the updating the syllabus of the courses by keeping in view that the

curriculum shall satisfy the Program Outcomes, Program Specific Outcomes and Program Educational Objectives, the following points were highlighted by the Board of Studies Expert members;

- The Practical heavy courses are blended with theory in which practical hands-on training is recommended for the Under Graduate courses are Advanced Surveying Techniques, Environmental Engineering and Transportation Engineering and Post Graduate Courses are Finite Element Analysis and Seismic Design of Structures.
- The Project Based Learning Approach Courses (PBLA) Construction Management and Advanced Reinforced Concrete Structures, the project shall reflect the concept learnt in the course and innovative.
- The practical course Design Thinking and Innovations shall be incorporated to motivate the design thinking and develop higher order innovation levels of the Undergraduate Civil Engineering students.
- Mandatory Audit Courses like Environmental Science, Basic Health and Hygiene for Engineering, Constitution of India, Human Relations at Work and Yoga. are the noncredit courses offered to Undergraduate Civil Engineering Program and Post Graduate Structural Engineering to understand the life skills required for their future.
- Skill Enhancement Courses include courses on Soft Skills, Communication Skills, Aptitude, Foreign Languages, Entrepreneurship, etc. are included as part of bringing in holistic development among Undergraduate Civil Engineering students.
- The choice of selecting the completion of Community Intern and Internship training / Mini project are suggested to incorporate in the Under Graduate and Post Graduate Curriculum respectively to enhance the creativity, critical thinking and in-depth application oriented learning.



Convenor/Dean



HOD



CRISANTHA KUMAR

Expert member

S20BPB41	ADVANCED SURVEYING TECHNIQUES	L	T	P	EL	Credits	Total Marks
		2	0	2	0	3	100

COURSE OBJECTIVES

- To provides basic knowledge about principles of triangulation and trilateration.
- To know the various methods involved in survey adjustments and theory of errors
- To know basic concepts of photogrammetry and remote sensing
- To develop skills using surveying instruments like plane table and theodolite.
- To apply the concepts on area mapping and column marking.

UNIT 1 TRIANGULATION AND TRILATERATION

9 Hrs.

Triangulation – Principle – Classification of triangulation system–Triangulation figures and layouts- Well conditioned triangle – Strength of figure – Signals and towers – Baseline measurement and extension – Intervisibility of stations – Location of points by intersection and resection – Trilateration – Reduction of slope distances.

UNIT 2 THEORY OF ERRORS

9 Hrs.

Survey adjustments and theory of errors – Introduction – Laws of accidental errors –Probability curve – Principle of least squares – Laws of weights – Probable error – Angle adjustment – Station adjustment – Figure adjustment – Adjustment of triangles – Adjustment of a quadrilaterals.

UNIT 3 AERIAL PHOTOGRAMMETRY AND REMOTE SENSING

9 Hrs.

Aerial Photogrammetry – Basic concepts – Geometry of vertical photographs – Scale and Flying height – Relief displacement - Stereoscopy and Parallax – Photo mosaic – Elements of photo interpretation - Concepts of remote sensing- Energy interaction with earth surface features - Spectral reflectance of vegetation, soil and water - Atmospheric influence on spectral response patterns - Characteristics of Remote sensing satellites and sensors (IRS, Landsat, SPOT).

UNIT 4 PRACTICAL APPLICATIONS OF PLANE TABLE AND THEODOLITE

9 Hrs.

Mapping of an Area using Plane Table Surveying- Setting out simple curve using offsets from chord using Theodolite - Setting out simple curve using Single Theodolite method (Rankin's Method) - Column Footing Foundation marking for commercial building using Theodolite.

UNIT 5 PRACTICAL APPLICATIONS OF AREA MAPPING AND COLUMN MARKING

9 Hrs.

Mapping of an Area using Theodolite - Measurement of X, Y and Z Coordinates and preparation Topographic Map using CAD software - Column marking using Total station coordinates.

Max: 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the triangulation and trilateration concepts and principles.
- CO2 - Carryout Survey adjustments and error rectifications.
- CO3 - Understand the basic concepts of photogrammetry and remote sensing.
- CO4 - Apply the procedure for Area Mapping, curve and Foundation marking
- CO5 - Familiarize in measuring Coordinates.
- CO6 - Perform column marking in the field

TEXT / REFERENCE BOOKS

1. Chandra A.M., Higher Surveying, New Age International Private Limited, 2015
2. James Anderson and Edward Mikhail, Surveying: Theory and Practice, McGraw Hill Education; 7th edition, 2017
3. Thomas. M. Lillesand, Ralph. W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image Interpretation, John Wiley and Sons, Inc., Sixth Edition, 2011
4. George Joseph, Fundamentals of Remote Sensing, Universities Press, Second edition, 2005
5. Manoj K. Arora and R.C. Badjatia, Geomatics Engineering, Nem Chand publishers, First edition, 2011

 Added Contents

 Deleted Contents

 New Course Introduced

SCSBDPROJ	DESIGN THINKING AND INNOVATIONS	L	T	P	EL	Credits	Total Marks
		0	0	4	0	2	100

COURSE OBJECTIVES

- To apply knowledge in Real time problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to Engineering /Non Engineering problems.

Activity 1:

Design thinking introduction:

- Phases of design thinking- a study approach
- Group Discussion on Ideation- Users perspective
- Formation of team – Thinking skills- Brain storming

Activity 2:

Problem identification (phase I)

- Selecting user requirements
- Survey on various user's applications
- Specific Problem selection to proceed with the work – Team presentation on identified problems and various possible solutions.

Activity 3:

Problem identification (Phase II)

- Study of an application and its importance to end user.
- Various models of an applications
- Finalize the identified problem

Activity 4:

Design ideation and various stages

- Sketch design diagram
- Architecture or full diagrammatic study

Activity 5:

Review and upgradation

- Review of the ideation (one to one interaction)
- Feedback
- Upgradation plan

Activity 6:

Implementation (Phase I)

- Build the prototype using available resources
- Record Module diagrams

Activity 7:

Implementation (Phase II)

- Display and review of the prototype.
- Record its functionality and its Usage-Technical manual

Activity 8:

Testing

- To test the product design with real time environment
- Record Process-user manual

Activity 9:

IPR-Activity I

- To study various IPR activities
- To prepare for IPR Process
- To file an IPR

Activity 10:

Start-ups Formation

- To exhibit the product to public: feedback approach
- To prepare full documentation
- Start-ups registration/apply patent/publish paper/submit model/prototype/Apply for seed/submit as research proposal

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

- CO1 - Solve real world problems by applying knowledge across domains
- CO2 - Develop various design products, processes or technologies for sustainable and socially relevant applications
- CO3 - Demonstrate knowledge of resource utilization/budgets to Implement appropriate methodologies
- CO4 - Execute tasks by application of engineering standards/ requirements/ design criteria, within timelines
- CO5 - Conduct extended investigation that results in the translation of idea to product / production of a research thesis/ developing a proof of concept.
- CO6 - Communicate well organized technical and scientific findings effectively in written and oral forms, following ethical and professional norms

TEXT / REFERENCE BOOKS

1. Mueller-Roterberg, Christian. "Handbook of Design Thinking." Hochschule Ruhr West (2018).
2. Design Kit by IDEO.org. "The field guide to human centered design." (2015), ISBN: 978-0-9914063-1-9.
3. <https://www.interaction-design.org/literature/article/design-thinking-getting-started-with-empathy>
4. <https://www.interaction-design.org/literature/article/stage-4-in-the-design-thinking-process-prototype>
5. <https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning>
6. <https://uxplanet.org/what-are-insights-aa1f2d1b3b9c>
7. <https://labs.sogeti.com/using-design-thinking-to-design-business-models/>
8. <https://www.northeastern.edu/graduate/blog/implementing-business-model-innovation/>



Added Contents



Deleted Contents



New Course Introduced

S20BLH51	ENVIRONMENTAL ENGINEERING THEORY AND LAB	L	T	P	EL	Credits	Total Marks
		3	0	2	1	4	100

COURSE OBJECTIVES

- To teach students the basic principles and concepts of unit operations and processes involved in water treatment.
- To equip the students with the principles and design of water treatment and distribution.
- To develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.
- To teach students the various methods of sewage disposal and sludge management.

UNIT 1 SOURCES, QUALITY, COLLECTION AND CONVEYANCE OF WATER

9 Hrs.

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics – Drinking Water quality standards - Water supply –Types and design of intake structures –Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

UNIT 2 WATER TREATMENT AND WATER DISTRIBUTION

9 Hrs.

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, screening, sedimentation – coagulation - sand filters - Disinfection - Water softening – Iron and Manganese removal - Defluoridation – Desalination - demineralization process – Requirements of water distribution – System and Methods – Service reservoirs Functions – Network design – Analysis of distribution networks – Appurtenances – Leak detection. Principles of design of water supply in buildings – House service connection – Fixtures and fittings.

UNIT 3 PLANNING AND DESIGN OF SEWERAGE SYSTEM

9 Hrs.

Sewage - Characteristics and composition of sewage-- population equivalent -Sanitary sewage flow estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design - Storm runoff estimation – sewer appurtenances – sewage pumping - drainage in buildings - plumbing systems for drainage - Discharge standards for Effluents.

UNIT 4 TREATMENT OF SEWAGE

9 Hrs.

Objectives – Unit Operations and Processes – Selection of treatment processes – Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber- primary sedimentation tanks - Activated Sludge Process –Rotating biological contactors-Trickling filters - Waste Stabilization Ponds – Sequencing Batch Reactor – UASB - Biogas recovery- Reclamation and Reuse of sewage.

UNIT 5 SEWAGE DISPOSAL AND SLUDGE MANAGEMENT

9 Hrs.

Dilution – Self purification of surface water bodies - Oxygen sag curve – Land disposal – Sewage farming – Sewage sickness - Soil dispersion system. Objectives - Sludge characterization – Sludge Thickening – Dewatering – Drying - ultimate residue disposal – Sludge Management.

PRACTICAL TOPICS

Test on Water – pH, Turbidity, Specific Conductivity, Hardness and Total Solids.

Determination of Optimum Coagulant Dosage by Jar test apparatus.

Determination of residual chlorine in water.

Estimation of suspended, volatile and fixed solids in Wastewater.

Estimation of D.O, B.O.D. and C.O.D in Wastewater.

Max: 60 Hrs.

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1 – Understand the various components of water supply scheme and Quantify water required for a given population.

CO2 – Examine the type and size of reactor required for various unit operations and processes involved in water treatment.

CO3 – Assess the characteristics and composition of sewage, ability to estimate sewage and design sewer.

CO4 – Select type of treatment system and able to perform basic design of the unit operations that are used in sewage treatment.

CO5 – Investigate the performance of various treatment process and acquire knowledge of advance treatment technology and reuse of sewage.

CO6 – Compare the sewage disposal methods and sludge management.

TEXT / REFERENCES BOOKS

1. Peavy, H.S., Rowe, D.R. and Tchobanoglous, G., "Environmental Engineering", McGraw Hill, 2013.
2. Punmia, B.C., Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2010.
3. Wastewater Engineering - Treatment and Reuse, Metcalf and Eddy Inc., (2012), 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Viessman Jr, Hammer J. M, Perez, E.M, and Chadik, P. A, Water Supply and Pollution Control, PHI Learning, New Delhi, 2009.
5. Davis, M.L. and Cornwell, D.A., "Introduction to Environmental Engineering", McGraw Hill., 2013.
6. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
7. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.



Added Contents



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New Course Introduced

S20BPB71	CONSTRUCTION MANAGEMENT	L	T	P	EL	Credits	Total Marks
		2	0	2	0	3	100

COURSE OBJECTIVE

- To acquire a solid foundation in project management concepts, financial analysis, and the role of project managers in construction projects.
- To possess the knowledge and skills necessary to effectively plan and schedule projects with quality control and safe practices.
- To familiarize with guidelines on preparing contract documents
- To equip with the practical skills needed to contribute effectively to construction projects using advanced software tools.

UNIT 1 CONSTRUCTION PROJECT FORMULATION

9 Hrs.

Introduction to project- types of construction project- project organization- characteristics of project- project life cycle -Project Cash Flows – Principles – Types – New Project and Replacement Project Feasibility- Net present value- Benefit cost ratio- Internal Rate of Return-Payback Period-Role of project managers

UNIT 2 PROJECT PLANNING AND SCHEDULING

9 Hrs.

Introduction –Defining Work Tasks-Precedence relationship among Activities-Basic concepts of network analysis - CPM and PERT - Use of CPM and PERT Techniques Problems, and prospects and applications of CPM and PERT - Crashing and Time /Cost Trade-off problems

UNIT 3 QUALITY MANAGEMENT AND SITE SAFETY

9 Hrs.

Introduction to quality - Importance - Types – Inspection - Control and Enforcement-Tools and techniques for quality management - Inspection of materials and machinery - Quality Audits-Statistical quality control - Tools - Control chart – Site management with regard to safety

UNIT 4 CONSTRUCTION CONTRACTS

9 Hrs.

Indian Contracts Act–Elements of Contracts–Types of Contracts–Features–Suitability–Potential Contractual Problems – World Bank Procedures and Guidelines – Transparency in Tenders– Standard Contract Document-Arbitration-Appointment of Arbitrators – Conditions of Arbitration–Powers and Duties of Arbitrator

UNIT 5 BUILDING INFORMATION MODELLING

9 Hrs.

Introduction to Building Information modeling -Creating 3D Modelling of structures using Rivet Architecture-Project management using primavera Software-Quantity Estimation using Autodesk quantity takeoff Software

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Evaluate the feasibility of construction projects based on financial metrics.
- CO2 - Conduct the network analysis for construction projects based on CPM and PERT methods
- CO3 - Manage quality effectively and ensure site safety in construction projects
- CO4 - Navigate the legal and procedural aspects of construction contracts.
- CO5 - Apply advanced software tools to model, manage and estimate construction projects
- CO6 - Create a construction project using BIM techniques

TEXT / REFERENCEBOOKS

1. Kumar Neeraj Jha, "Construction project management", Dorling Kindersley, New Delhi, 2019.
2. Sengupta.B, Guha.H, "Construction management and planning", Tata McGraw Hill, New Delhi, 2021
3. Prasanna Chandra, "Planning, Analysis, Selection, Financing, Implementation and Review", 11th Edition, Tata McGraw Hill, New Delhi, 2016.
4. Sharma.S.C, "Construction engineering and management", Khanna Publishers, New Delhi, 2018.
5. Panner Selvam, "Operation research", PHI India Pvt.Ltd., New sDelhi, 2011.
6. JimmyW.Hinze, "Construction Safety", Prentice Hall Inc., 2002.
7. PunmiaB.C., "Project Planning and Control with PERT and CPM", Laxmi Publications, New Delhi, 4th Edition, 2011.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration: 3 Hrs.

PART A: 10 Question of 2 marks each –No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Added Contents



Deleted Contents



New Course Introduced

S20BLH71	TRANSPORTATION ENGINEERING THEORY AND LAB	L	T	P	EL	Credits	Total Marks
		3	0	2	1	4	100

COURSE OBJECTIVE

- To acquire knowledge on concept of planning, design and construction of highways
- To develop skill in planning, design, construction and facilities in Railways
- To learn the planning, components and functioning of Airports and Harbour Engineering

UNIT 1 HIGHWAY PLANNING AND GEOMETRIC DESIGN ELEMENTS

9 Hrs.

Highway alignment - factors influencing highway alignment - Planning or Engineering surveys for alignment: objectives, conventional and modern methods – Sustainability and its importance in Highway Engineering - Cross section of Urban and Rural Roads – Geometric Design Elements of a highway

UNIT 2 HIGHWAY MATERIALS, DESIGN AND CONSTRUCTION

9 Hrs.

Highway construction materials and its properties – Pavement Components and their role - Types of Pavements: Flexible and Rigid - Design of Flexible and Rigid Pavements (IRC Methods only) - Joints in Rigid Pavements - Construction procedure of Bituminous Roads and Cement Concrete Roads

UNIT 3 RAILWAY PLANNING AND CONSTRUCTION

9 Hrs.

Components of a permanent way and its functions - Coning of wheels, Defects in rails: creep and shift in rails, Track Stress - Gradient - Super elevation and Negative super elevation - Permissible speed on curve (Problems included) - Widening of gauge on curves. - Track construction - Calculation of Materials required for track laying

UNIT 4 STATIONS AND YARDS, POINTS AND CROSSINGS AND SIGNALLING AND INTERLOCKING

9 Hrs.

Types of stations and Types of station yards - Station equipments - Types of Points / Switches - Types of crossing - Design calculation of Turnout - Types of Track junctions - Types of signals and their location – Introduction to Railways in Metro Cities.

UNIT 5 AIRWAYS AND WATERWAYS

9 Hrs.

Classification of airports - Factors influencing the selection of new airport site and ICAO stipulations - Components of Airport - Runway Orientation - Wind Rose Diagram - Aircraft Parking system - Drainage - Airport Zones - Runway and Taxiway Markings and lighting

Ports: Classification, Requirements - Docks: Classification - Harbour: Classification, Requirements - Harbour Layout and Terminal Facilities - Coastal Protection Structures – Inland Water Transport – Container Transportation

Practical Topics

15 Hrs.

Test on Aggregate - Shape test, Los Angeles Abrasion test

Test on Bitumen - Penetration Test, Ductility test, Softening point test, Flash and fire point test, Specific gravity test,

Viscosity test

Test on Mix Design - Marshall Stability Test for bitumen

Test on Subgrade Soil - California Bearing Ratio Test

MAX: 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Apply the geometric design principles to develop appropriate highway alignments and cross-sections
- CO2 - Perform pavement design and analysis for different traffic and environmental conditions
- CO3 - Design track components, including rails, sleepers, fastenings, and ballast, considering factors such as stability, durability, and maintenance requirements.
- CO4 - Apply the principles of various signaling systems, interlocking systems and train control systems.
- CO5 - Apply the design guidelines, standards, and regulations to develop airport layouts
- CO6 - Understand the various aspects of harbor engineering, including harbor layout, breakwater design, navigation channel design, mooring and berthing facilities, and dredging operations.

TEXT / REFERENCE BOOKS

- Khanna S.K., Justo C.E.G. and Veeraragavan A., "Highway Engineering", NemChand Publishers, 2019.
- Kadiyali L.R., "Principles and Practices of Highway Engineering", 7th Edition, Khanna Technical Publication, New Delhi, 2019
- Arora S P and Saxena, "Railway Engineering", Dhanpat Rai Publishers, New Delhi, 2015.
- Khanna S.K., Arora M.G. and Jain S.S., "Airport Planning and Design", NemChand and Bros., Roorkee, 2012.
- Oza H.P. and Oza G.H., "Dock and Harbour Engineering", Charotar Publishing House, 2016
- IRC – 37 "Guidelines for Design of flexible Pavements", IRC, New Delhi, 2001.
- IRC: 58, 2002: "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways", IRC, N. Delhi, 2002.



Added Contents



Deleted Contents



New Course Introduced

SCIB3016	SURFACE WATER HYDROLOGY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To introduce the theoretical concept of water budget and meteorological components.
- To provide the knowledge of rainfall analysis.
- To develop skills in stream flow measurement and water conservation.

UNIT 1 HYDROMETEOROLOGY

9Hrs.

Hydrologic cycle – Global water budget – Practical applications – Hydrometeorology – Constituents of atmosphere – Vertical structure of the atmosphere – general circulation – Transitory system – Air mass – Air front – cyclones – Formation of precipitation – Types and forms of precipitation – Climate and Weather – Meteorological Observations.

UNIT 2 PRECIPITATION

8Hrs.

Measurement of rainfall – Rain gauges – Radar Measurement of rainfall – Rainfall Hyetograph – Intensity Duration and Frequency analysis – Consistency – Missing data – Rain gauge network – Average depth of rainfall analysis – Spatial analysis using GIS – Annual rainfall of India and Tamilnadu

UNIT 3 ABSTRACTIONS

8 Hrs.

Water losses - Initial losses – Interception and depression storage – Evaporation – Evaporimeters – Estimation of Evaporation - Evapotranspiration – Field Measurement – Empirical Equations - Infiltration – Infiltrometers – Infiltration Equations - Infiltration Indices.

UNIT 4 STREAMFLOW MEASUREMENT

8 Hrs.

Stage and Velocity Measurement – Gauges – Current meter and Doppler flow velocity meter- Discharge measurement – Area Velocity method - Area Slope method – Discharge Measuring Structures - Dilution Technique – Stage Discharge relationship – Selection of a Stream Gauging Site.

UNIT 5 RUNOFF AND WATER CONSERVATION

12 Hrs.

Concept of catchment – Linear, Areal and Relief Aspects – Detailed study of Runoff process – Factors affecting Runoff – Hydrograph – Unit Hydrograph – Synthetic Hydrograph –Runoff estimation - Strange and SCS methods – Water Conservation – Rain water and Runoff Harvesting in Rural and Urban Areas - Reservoir Sedimentation.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 – Relate hydrologic cycle, hydrometeorology and formation of precipitation.
- CO2 - Analyse the rainfall intensity, frequency and depth
- CO3 – Estimate different types of losses
- CO4 – Use empirical formulas for estimating stream flow
- CO5 – Understand the hydrological components of hydrograph and rainwater and runoff harvesting.
- CO5 – Estimate the life of reservoir.

TEXT / REFERENCE BOOKS

1. Chow V.T., Maidment D.R., Mays L.W., Applied Hydrology, McGraw Hill Publications, New York, 1995.
2. Subramanya, K., Engineering Hydrology, Tata McGraw Hill Publishers, 2008.
3. Patra.K.C, Hydrology and Water Resources Engineering, Narosa Publications, 2008, Second Edition, New Delhi.
4. Jeya Rami Reddy.P, Hydrology, Laximi Publications, New Delhi, 3 rd Edition, 2016.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each -No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Added Contents

 Deleted Contents

 New Course Introduced

SCIB3017	Soft Computing Techniques in Water Resources Engineering	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To develop understanding of Integrated Water Resources Planning, Development and Management concepts.
- The purpose of this course is to obtain knowledge on various soft computing techniques widely used in water resources engineering.
- To forecast the complex systems in water resources engineering using soft computing techniques.

UNIT 1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

9 Hrs.

Artificial Intelligence; Expert Systems; Artificial Neural Networks: Introduction, Training- Applications.

UNIT 2 APPLICATIONS IN HYDROLOGY

9 Hrs.

Subsurface processes and concepts for groundwater resources evaluation, Unsaturated zone properties: Soil moisture levels, Runoff, Retention curves, Flood Hydrograph, Flow through unsaturated porous media. Application of FEM and BIEM in groundwater modeling, Regional aquifer simulation, Contaminated groundwater systems and their rehabilitation, Development and optimization based management of aquifer systems

UNIT 3 MODEL APPLICATION IN WATER RESOURCES

9 Hrs.

Flood hydrograph at basin scale, classification, Forecasting flood hydrograph, Runoff at watershed scale, prediction of Runoff scale, seepage, dispersion coefficient, total suspended sediments.

UNIT 4 FUZZY LOGIC ALGORITHM

9 Hrs.

Introduction to fuzzy logic algorithm, basic concept, fuzzy system, fuzzy membership, construction of fuzzy model, ANN model testing in water resources, discharge prediction.

UNIT 5 GENETIC ALGORITHM

9 Hrs.

Introduction, basic units of GA, Genetic Algorithm operation, hydrograph simulation.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

- CO1 - Understand the basic concept of artificial Intelligence
- CO2 - Acquire knowledge on application of hydraulic and hydrological modelling softwares.
- CO3 - Estimate runoff and sedimentation using hydrological models.
- CO4 - Understand the basic concept of Fuzzy logic algorithm and ANN model.
- CO5 - Understand the basic concept of Genetic Algorithm
- CO6 - Simulate the hydrograph using Genetic Algorithm

TEXT / REFERENCE BOOKS

1. Blum C (2005) Ant colony optimization: Introduction and recent trends Physics of Life Reviews 2 353–373
2. Vladan Babovic and Maarten Keijzer (2002) Rainfall Runoff Modelling Based on Genetic Programming, Nordic Hydrology, 33 (5) ,33 1-346
3. Klir, GJ. Folger, TA. (1988) Fuzzy Sets, Uncertainty and Information, Prentice-Hall, Englewood Cliff.
4. Zadeh, L. A., (1983) The role of fuzzy logic in the management of uncertainty in expert systems. Fuzzy Sets and Systems 11, 199-227
5. Abdullah SS, Malek MA (2016) Empirical Penman-Monteith equation and artificial intelligence techniques in predicting reference evapotranspiration: a review. Int J Water 10:55–66. doi:10.1504/IJW.2016.073741

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each -No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Added Contents

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 New Course Introduced

SCIB3021	INDUSTRIAL WASTE WATER TREATMENT	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- Enrich the knowledge on sources and characteristics of industrial wastewater.
- Discuss the different methods of waste water treatment such as de-nitrification, membrane separation, air stripping, etc.
- Understand the characteristics and composition of wastewater generated from industrial processes.
- Design and operate effluent treatment plants for joint treatment of raw industrial wastewater and domestic sewerage.

UNIT 1 CHARACTERISTICS OF INDUSTRIAL WASTE WATER

9 Hrs.

Sources of pollution, physical, chemical, organic and biological properties of industrial wastes, difference between industrial and municipal waste waters, effects of industrial effluents on sewers and natural water bodies.

UNIT 2 COMMON TYPES OF TREATMENT PROCESS

9 Hrs.

Pre and primary treatment, equalization, proportioning, neutralization, oil separation by floatation, waste reduction, volume reduction, strength reduction.

UNIT 3 DESCRIPTION OF MAIN TREATMENT METHODS

9 Hrs.

Waste treatment methods, nitrification and denitrification, phosphorous removal, heavy metal removal, Membrane separation process, air stripping and absorption processes, special treatment methods, disposal of treated waste water.

UNIT 4 WASTE WATER FROM DIFFERENT INDUSTRIES

9 Hrs.

Characteristics and composition of waste water and manufacturing processes of industries like sugar, characteristics of industries like food processing industries, steel, petroleum refineries.

UNIT 5 COMPOSITION OF WASTE WATER AND COMMON EFFLUENT TREATMENT PLANTS

9 Hrs.

Characteristics and composition of industries like textiles, tanneries, atomic energy plants and other mineral processing industries, joint treatment of raw industrial waste water and domestic sewage, common effluent treatment plants location, design, operation and maintenance problems.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Distinguish between the quality of domestic and industrial water requirements and Wastewater quantity generation.

CO2 - Understand the industrial process, water utilization and waste water generation.

CO3 - Acquire the knowledge on operational problems of common effluent treatment plants.

CO4 - Impart knowledge on selection of treatment methods for industrial wastewater.

CO5 - Specify design criteria for physical, chemical, and biological unit operations

CO6 - Analyse the waste water Effluent and its treatments

TEXT / REFERENCE BOOKS

1. Metcalf and Eddy, "Wastewater engineering Treatment disposal reuse", Tata McGraw-Hill, 4th Edition, 2002.
2. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hills,
3. 3rd Edition, 1999.3.M.N. Rao and Dutta, "Waste Water treatment", Oxford and IBH publishing, 2009.
4. 4.Mark J. Hammer, Mark J. Hammer, Jr., "Water & Wastewater Technology", Prentice Hall of India, 2013.
5. N.L. Nemerow, "Theories and practices of Industrial Waste Engineering", B H Elsevier, 2007.
6. C.G. Gurnham, "Principles of Industrial Waste Engineering", Wiley, 1955.
7. Web References: 1. <https://nptel.ac.in/courses/105102088>

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

 Added Contents

 Deleted Contents

 New Course Introduced

SCIB3029	ARTIFICIAL INTELLIGENCE FOR CIVIL ENGINEERS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVE

- To familiarize with the basic concepts of artificial intelligence
- To possess knowledge on various optimization methods in Artificial Intelligence
- To apply artificial intelligent techniques in the various fields of Civil Engineering

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to Artificial Intelligence (AI) – History of AI – Types of AI based on capabilities and functionalities – Implementation of AI – Machine Learning, Deep Learning – Natural Learning Process

UNIT 2 INTELLIGENT OPTIMIZATION METHODS

9 Hrs.

Evolutionary Computation- Genetic Algorithms – Artificial Immune Systems - Swarm Intelligence – Particle Swarm Optimization-Ant Colony Optimization - Artificial Neural Networks – Fuzzy Systems – Expert System.

UNIT 3 APPLICATIONS OF AI IN STRUCTURAL ENGINEERING

9 Hrs.

Prediction of compressive strength, Ultrasonic Pulse Velocity and Split tensile strength of concrete using soft computing techniques - Structural health monitoring and optimization – smart cities

UNIT 4 APPLICATIONS OF AI IN TRANSPORTATION ENGINEERING

9 Hrs.

Intelligent Transportation Systems – Traffic Management, Public Transport, Safety Management, Manufacturing and Logistics - various AI applications – AI functions and Use cases.

UNIT 5 APPLICATIONS OF AI IN ENVIRONMENTAL ENGINEERING

9 Hrs.

Detection of Pollutants in Environment – E-waste Management – Solid waste management using Artificial Intelligence – Smart water Resource management – Case studies.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the foundation of Artificial Intelligence
 CO2 - Adopt various optimization methods in Artificial Intelligence
 CO3 - Apply Artificial Intelligence in structural engineering
 CO4 - Apply Artificial Intelligence in transportation engineering
 CO5 - Apply Artificial Intelligence in solid waste management and Pollution Control
 CO6 - Optimize the water resource management using Artificial Intelligence

TEXT / REFERENCE BOOKS

1. Youqin Huang , Jiayong Li and Jiyang Fu, "Review on Application of Artificial Intelligence in Civil Engineering", Computer Modeling in Engineering and Sciences, Vol. 121, No.3, pp.845-875, 2019
2. Sakshi Gupta, Parveen Sihag, M S Thakur, Utku Kose, "Applications of Computational Intelligence in Concrete Technology", CRC Press, Taylor & Francis Group, 2022
3. Hadi Salehi, Rigoberto Burgueño, Emerging artificial intelligence methods in structural engineering, Engineering Structures, Volume 171, 2018
4. Lakshmi Shankar Iyer, AI enabled applications towards intelligent transportation, Transportation Engineering, Volume 5, 2021
5. Niki Pouyanfar, Samaneh Zare Harofte, Maha Soltani, Saeed Siavashy, Elham Asadian, Fatemeh Ghorbani-Bidkorpbeh, Rüstem Keçili, Chaudhery Mustansar Hussain, Artificial intelligence-based microfluidic platforms for the sensitive detection of environmental pollutants: Recent advances and prospects, Trends in Environmental Analytical Chemistry, Volume 34, 2022.
6. Jie Chen, Shoujun Huang, S. BalaMurugan, G.S. Tamizharasi, Artificial intelligence based e-waste management for environmental planning, Environmental Impact Assessment Review, Volume 87, 2021
7. Kan Hua Yu, Yue Zhang, Danni Li, Carlos Enrique Montenegro-Marin, Priyan Malarvizhi Kumar, Environmental planning based on reduce, reuse, recycle and recover using artificial intelligence, Environmental Impact Assessment Review, Volume 86, 2021.
8. Krishnan SR, Nallakaruppan MK, Chengoden R, Koppu S, lyapparaja M, Sadhasivam J, Sethuraman S. Smart Water Resource Management Using Artificial Intelligence—A Review, Sustainability, 2022.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Added Contents

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 New Course Introduced

SCIB3031	INDUSTRY 5.0 FOR CIVIL ENGINEERS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVE

- To introduce automation in construction and building services to develop smart cities.
- To study the technological developments in engineering and construction.
- To study about the smart construction management.

UNIT 1 CONSTRUCTION AUTOMATION

9 hrs.

Introduction to Construction Automation - Role of automation in project execution, infrastructure project, real estate project-Robotics and automated systems in construction - Off-site automated prefabrication systems -On-site automated and robotic systems- Drones and autonomous vehicles – Exoskeletons.

UNIT 2 INFRASTRUCTURE

9 hrs.

High speed rail construction-metro rail construction - underpass construction – tunneling – high speed building construction -Mivan technology - Technological developments in Architectural, Engineering and Construction– Unmanned Aerial Vehicles.

UNIT 3 AUTOMATION IN BUILDING SERVICES

9 hrs.

Optimization of home automation designs for energy efficiency - Building security systems - Open source home automation softwares - Fire safety auxiliaries –Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development.

UNIT 4 DEVELOPMENT OF SMART CITY

9 hrs.

IOT Technologies used in smart cities- Low Power Wide Area Networks-Radio Frequency Identification-Wireless Sensor Networks-Light Fidelity-Message Queuing Telemetry Transport-Challenges in smart city implementation -Smart parking using IoT-Smart waste management-Smart lighting applications-Smart environment monitoring-Potential applications-smart grids-smart roads-Smart public safety-Smart public transport.

UNIT 5 DATA SCIENCE IN CONSTRUCTION

9 hrs.

Data science in Construction – applications of machine learning - Deep-learning-based visual data analytics for smart construction management – artificial intelligence in predicting project delays- Building Information Modeling (BIM) using Cloud computing technology and Internet of things (IoT).

Max: 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the applications of automation in construction.
CO2 - Know the Technological improvements in infrastructural development.
CO3 - Understand the applications of automation in building services.
CO4 - Assess the Potentials of smart city development.
CO5 - know the applications of data science in construction.
CO6 - Apply the concepts of smart construction management

TEXT / REFERENCE BOOKS

1. Delgado, J. M. D., Oyedele, L., Ajayi, A., Akanbi, L., Akinade, O., Bilal, M., &Owolabi, H. (2019). Robotics and automated systems in construction: Understanding industry-specific challenges for adoption. JI. of Building Engineering, 26, 100868.
2. Garmendia, M., Ribalaygua, C., &Ureña, J. M. (2012). High speed rail: implication for cities, 29, S26-S31.
3. Patil, K., Jadhav, A., &Shingate, N. (2015). Mivan Technology, IJ. of Engineering and Technical Research (IJETR) ISSN, 2321-0869.
4. Novak, T., & Gerstinger, A. (2009). Safety-and security-critical services in building automation and control systems. IEEE Transactions on Industrial Electronics, 57(11), 3614-3621.
5. Janani, R. P., Renuka, K., &Arana, A. (2021). IoT in smart cities: A contemporary survey. Global Transitions Proceedings, 2(2), 187-193.
6. Bilal, M., Oyedele, L. O., Qadir, J., Munir, K., Ajayi, S. O., Akinade, O. & Pasha, M. (2016). Big Data in the construction industry: A review of present status, opportunities, and future trends. Advanced engineering informatics, 30(3), 500-521.
7. <https://www.ti.com/applications/industrial/building-automation/overview.html>

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

 Added Contents

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 New Course Introduced

S38BPB11	ADVANCED REINFORCED CONCRETE STRUCTURES	L	T	P	EL	Credits	Total Marks
		3	0	2	0	4	100

COURSE OBJECTIVE

- To make the students be familiar with the limit state design of advanced reinforced concrete structures
- To design special structures like Shear walls, Bunkers, Silos, flat slabs, grid floor, corbel and deep beams
- To execute a project on modeling, analyzing and designing a special structure.

UNIT 1 LIMIT STATE DESIGN OF BEAMS FOR FLEXURE

9Hrs.

Review of Basic Concepts - Behaviour and Design of Reinforced Concrete members considering flexure, Torsion, combined with flexure and flexural shear, deflection and crack width as per IS456.

UNIT 2 DESIGN OF SHEAR WALLS AND DEEP BEAMS

9Hrs.

Shear walls – Types of shear walls – Design of shear walls. Simply Supported and Continuous Deep beams.

UNIT 3 DESIGN OF SPECIAL RCC MEMBERS

9Hrs.

Flat slabs, Flat plates, Grid floor and Corbel.

UNIT 4 BUNKERS AND SILOS

9Hrs.

Introduction to Limit state design of Bunkers and Silos - Rectangular and Circular types.

UNIT 5 DESIGN PROJECT

9Hrs.

Seismic Behavior and Design of RC Shear Walls - Influence of orientation of shear walls on structural behavior of RC buildings - Design of flat slab for a commercial building - comparison of structural behavior of conventional roof and flat slab system - Design of a deep beam for an aesthetic building

Max.45Hrs.

COURSE OUTCOMES

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

- CO 1 - Design reinforced concrete beams for bending, shear and torsion by Limit State Design method
- CO 2 - Design shear walls and deep beams
- CO 3 –Design the flat slabs, grid floor and corbel.
- CO 4 –Design storage structures like bunkers and silos
- CO 5 - Utilize computer applications for designing RC structures and its components
- CO 6 – Execute a design project using analysis and design software.

TEXT / REFERENCE BOOKS

1. Ashok. K. Jain, "Reinforced concrete – Limit state design", Nemchand & Bros, Roorkee, 1983.
2. Park and Pauley. T. "Reinforced concrete structures", John Wiley & Sons, New York, 1975.
3. Varghese, P.C. "Limit State Design of Reinforced Concrete", Prentice Hall of India Ltd, New Delhi, 2007.
4. Varghese, P.C, "Advanced Reinforced Concrete Design", Prentice Hall of India, 2005.
5. IS 456 -2000 – Code of practice for plain and reinforced concrete.
6. SP 16 (1980) - Design Aids for Reinforced concrete.
7. SP 34(1987) – Hand book on Concrete reinforcement and Detailing.
8. IS 1893:2002 – Indian Standard criteria for earthquake resistant design of structures.
9. IS 13920:1993 Code of practice for ductile detailing of reinforced concrete structures subjected to seismic forces.
10. IS 4326:1993 – Code of practice for earthquake resistant design and construction of buildings.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:100

Exam Duration: 3Hrs.

PART A: 5 Questions of 6 Marks each–No choice

30 Marks

PART B: 2 Questions from each unit of internal choice each carrying 14 Marks

70 Marks



Added Contents



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New Course Introduced

S38BLH21	FINITE ELEMENT ANALYSIS	L	T	P	EL	Credits	Total Marks
		3	0	2	1	4	100

COURSE OBJECTIVES

- To study the basics of the Finite Element Technique, a numerical tool for the solution of different classes of problems.
- To learn the concept of meshing techniques for higher order elements and error evaluations
- To learn the concepts of analysing structures using dynamic equations for one dimensional problem

UNIT 1 INTRODUCTION

9 Hrs.

Boundary Value Problems – Approximate Solutions – Variational and Weighed Residual Methods – Ritz and Galerkin Formulations – Concept of Piecewise Approximation and Finite Element – Displacement and Shape Functions –Weak Formulation – Minimum Potential Energy – Generation of Stiffness Matrix and Load Vector.

UNIT 2 STRESS ANALYSIS

9 Hrs.

Two Dimensional problems – Plane Stress, Plane Strain and Axisymmetric Problems – Triangular and Quadrilateral Elements – Natural Coordinates – Isoparametric Formulation - Numerical Integration – Plate Bending and Shell Elements — Brick Elements – Elements for Fracture Analysis.

UNIT 3 MESHING AND SOLUTION PROBLEMS

9 Hrs.

Higher Order Elements – p and h Methods of Mesh Refinement – ill conditioned Elements – Discretisation Errors
Auto and Adaptive Mesh Generation Techniques -Error Evaluation.

UNIT 4 NONLINEAR, VIBRATION AND THERMAL PROBLEMS

9 Hrs.

Material and Geometric Nonlinearity – Methods of Treatment – Consistent System Matrices – Dynamic Condensation – Eigen Value Extraction - thermal analysis.

UNIT 5 DYNAMIC ANALYSIS AND SOFTWARE APPLICATION

9 Hrs.

Dynamic equations – Consistent and lumped mass matrices - 1-D bar element - Formulation of element stiffness, mass and force matrices - Example problems. Natural frequencies - 1-D bar element - Formulation of element stiffness, mass matrices. Modeling and analysis using recent softwares.

SUGGESTED LIST OF EXERCISES

- Analysis of Structures using Finite element Package – ANSYS.
- Problem Formulation – input parameters – modeling – material properties – boundary conditions.
- Mesh generation – Solution and post processing.
- Modal Analysis, Buckling Analysis, Non-linear analysis, Non-linear material analysis and Contact Analysis of beam, column, beam-column, frames and plate elements.

Max.45Hrs.

COURSE OUTCOME

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

- CO 1 -Understand to apply the various types of approximate methods in Boundary value problems
- CO 2 - Analysis of stress using finite element concept for Two dimensional problems.
- CO 3 - Understand the concept of meshing techniques for higher order elements and error evaluations.
- CO 4 - Study of Non linear, vibration and thermal problems using finite element methods.
- CO 5 - Analysis of structures using dynamic equations for one dimensional problem.
- CO 6 - Formulation of element stiffness matrix and modeling analysis using recent software.

TEXT / REFERENCE BOOKS

- Bhavikatti S.S., "FiniteElementAnalysis", NewAgePublishers, 2007.
- Krishnamoorthy C.S., "FiniteElementAnalysis:TheoryandProgramming", TataMcGraw-Hill, 1995.
- David Hutton, "Fundamentals of Finite Element Analysis", TataMcGrawHill Publishing Company Limited, New Delhi, 2005.
- Bathe, K.J., "FiniteElementProceduresinEngineeringAnalysis", PrenticeHall Inc., 1996.
- Zienkiewicz, O.C. and Taylor, R.L., "The Finite Element Method", McGrawHill, 1987.
- Chandrupatla, R.T. and Belegundu, A.D., "Introduction to Finite Elements in Engineering", Prentice Hall of India, 1997..
- Moaveni, S., "FiniteElementAnalysis Theory and Application with ANSYS", Prentice Hall Inc., 1999.
- <http://www.mech.port.ac.uk/sdalby/mbm/CTFRProg.htm>.
- <http://www.me.mtu.edu/~bettig/MEEM4405>.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

ExamDuration:3Hrs.

PART A: 5 Questions of 6 Mark each –No choice

30Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70Marks

 Added Contents

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 New Course Introduced

S38BLH31	SEISMIC DESIGN OF STRUCTURES	L	T	P	EL	Credits	Total Marks
		3	0	2	1	4	100

COURSE OBJECTIVES

- To study the effect of earthquakes, analysis and design of earthquake resistant Structures.
- To learn the design concepts and cyclic load behavior of RCC, Steel and prestressed concrete elements
- To design buildings for seismic using software packages

UNIT 1 INTRODUCTION

9 Hrs.

Elements of Engineering Seismology–Theory of vibrations Response Spectrum. Seismotectonics and Seismic Zoning of India, Earthquake Monitoring and Seismic Instrumentation, Characteristics of Strong Earthquake Motion, Estimation of Earthquake Parameters.

UNIT 2 EARTHQUAKE HISTORY

9Hrs.

Indian Seismicity–Earthquake History– Earthquake occurrence in the world-causes of earthquake. Behaviour of structures in the past Earthquakes.

UNIT 3 DESIGN CONCEPT AND BEHAVIOR OF STRUCTURES

9Hrs.

Philosophy and Principle of Earthquake Resistant Design, Guidelines for Earthquake Resistant Design SeismicDesignConcepts–Cyclic load behaviour of RCC ,Steel and Pre-stressed Concrete Elements – Designs Spectrum–Principles of capacity design.

UNIT 4 FRAME SAND SHEARWALLS

9Hrs.

Provisions of Seismic Code (IS 1893) – Building systems frames, Shear Wall, Braced frames, combinations –Torsion. Design and Detailing of Frames–Shear Walls and Frame Walls.

UNIT 5 COMPUTATIONAL ANALYSIS, MODERN CONCEPTS

9 Hrs.

Performance of Regular buildings 3D Computer Analysis of building Systems (Theory only) – Structural Configuration– Seismic performance–Irregular Buildings–Soil performance, Modern Concepts–Base Isolation – Adoptive systems–Case Studies.

Max.45Hrs.

SUGGESTED LIST OF EXERCISES

Carry out the Seismic analysis and design of RCC structures & Steel structures (singlestorey & Multistorey buildings)

COURSE OUTCOMES

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

- CO1 – Construct design spectrum, site specific, probabilistic and uniform hazard spectrums.
- CO2 - Understanding of earthquake hazards: sources, magnitude, seismic intensity and site effects
- CO3 – Utilize various IS Codal provisions for seismic design
- CO4 – Understand the principles of performance based seismic design, failure mode control and capacity design
- CO5 – Design RC shear wall frame systems
- CO6 – Design buildings for seismic using various software packages.

TEXT/REFERENCEBOOKS

- Bungale S.Taranath "Structural Analysis and Design of Tall Buildings" - McGraw Hill Book company, NewYork,1999.
- Course Notes"DesignofReinforcedConcreteBuildings",IIT,Kanpur,June1999.
- S.K.Duggal,"EarthquakeResistantDesignofStructures",OxfordUniversityPress,2007.
- Pankaj Agarwal and Manish Shrikhande,"EarthquakeResistantDesignofStructures",PrenticeHall,2007.
- IS13920-2016 ,Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice.
- IS1893-2016, Criteria for Earthquake Resistant Design of Structures
- AnilK.Chopra"Dynamics of Structures"PrenticeHall,2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:100

Exam Duration: 3Hrs.

PART A: 5 Questions of 6 Marks each–No choice

30 Marks

PART B: 2 Questions from each unit of internal choice each carrying 14 Marks

70 Marks

 Added Contents

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 New Course Introduced

SCIB7021	INDUSTRY 5.0 FOR STRUCTURAL ENGINEERS	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To provide a comprehensive understanding of Industry 5.0 and its impact on structural engineering.
- To familiarize students with advanced tools, technologies, and practices in structural analysis and design within the context of Industry 5.0.
- To develop ethical awareness, professionalism, and a forward-looking mindset in the field of structural engineering in the era of Industry 5.0.

UNIT 1 INTRODUCTION TO INDUSTRY 5.0 AND ITS IMPACT ON STRUCTURAL ENGINEERING

9 Hrs.

Overview of Industry 5.0 and its key features - Role of structural engineers in Industry 5.0 - Integration of advanced technologies (AI, IoT, Robotics) in structural engineering - Digital transformation in structural design and analysis - Industry case studies on the application of Industry 5.0 in structural engineering

UNIT 2 ADVANCED STRUCTURAL ANALYSIS AND DESIGN TOOLS IN INDUSTRY 5.0

9 Hrs.

Application of artificial intelligence (AI) in structural analysis and design - Integration of Building Information Modeling (BIM) and Structural Analysis Software - Automated design optimization techniques - Performance-based design approaches in Industry 5.0 - Case studies on the use of advanced analysis and design tools

UNIT 3 COLLABORATIVE DESIGN AND CONSTRUCTION PRACTICES IN INDUSTRY 5.0

9 Hrs.

Collaborative design platforms and virtual collaboration tools - Digital twin technology and its applications in structural engineering - Real-time monitoring and control systems for construction projects - Integration of prefabrication and modular construction in Industry 5.0 - Industry case studies on collaborative design and construction practices

UNIT 4 SUSTAINABLE AND RESILIENT DESIGN IN INDUSTRY 5.0

9 Hrs.

Sustainable design principles and practices in Industry 5.0 - Resilient design strategies for structural engineering - Life-cycle assessment and green building certifications - Smart materials and their applications in sustainable design - Case studies on sustainable and resilient design in Industry 5.0

UNIT 5 ETHICS, PROFESSIONALISM, AND FUTURE TRENDS IN INDUSTRY 5.0

9 Hrs.

Ethical considerations in Industry 5.0 for structural engineers - Professional responsibilities and standards in the digital era - Emerging trends and future prospects in structural engineering - Continuous professional development and lifelong learning in Industry 5.0

COURSE OUTCOMES

- CO1 - Analyze and evaluate the implications of Industry 5.0 on structural engineering practice.
- CO2 - Apply advanced structural analysis and design tools to solve complex engineering problems.
- CO3 - Implement collaborative design and construction practices using virtual platforms and digital twin technology.
- CO4 - Incorporate sustainable and resilient design principles in structural engineering projects.
- CO5 - Demonstrate ethical behavior and professionalism in the field of structural engineering in Industry 5.0.
- CO6 - Adapt to future trends in the field of Structural Engineering

Max. 45 Hrs.

TEXT / REFERENCE BOOKS

1. Brown, P., & Marr, B. (2020). The Rise of Industry 5.0 and How It Will Transform the Economy. Forbes.
2. Gürbüz, B., & Koç, M. (2021). A Conceptual Framework for Industry 5.0: The Next Industrial Revolution.
3. Wang, C., & Xu, X. (2020). The evolution paths of Industry 4.0 and Industry 5.0: A comparative analysis.
4. Xiong, Z., & Lu, Y. (2021). Application of Artificial Intelligence in Structural Engineering: A Comprehensive Review.
5. Li, Y., & Ren, L. (2020). Integration of BIM and Structural Analysis Software: A Review.
6. Zhang, Y., & Khiabani, H. (2020). Optimization in Structural Engineering: A Review.
7. Liu, D., & Liu, Q. (2021). Digital Twin in Construction: Recent Advances and Future Trends.
8. Zhu, Q., & Zhao, Y. (2020). Real-Time Monitoring and Control Systems for Construction Projects.
9. El Zohairy, Y. (2020). Design for Manufacturing and Assembly in Construction: A Comprehensive Review.
10. Piroozfar, P. A., et al. (2021). Sustainable Building Design: Current State and Future Challenges.
11. Devasia, S., & Selvan, M. P. (2020). Resilient Design Approaches for Structural Engineering.
12. Ashour, A. F., et al. (2020). Smart Materials in Structural Engineering: A Review.
13. NSPE Code of Ethics for Engineers.
14. Amadi-Echendu, J. E., et al. (2021). Engineering Ethics and Integrity: Challenges in Industry 5.0.
15. Attaran, M. (2020). Challenges for Structural Engineers in the Era of Industry 5.0.



Added Contents



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New Course Introduced

SCIB7022	BUILDING AUTOMATION SYSTEM	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To outline the need for Building Automation Systems to create better environments for people to work and live in.
- To familiarize the students with building automation systems applied to various services for efficient energy management.
- To Learn the concept of Intelligent design and Construction

UNIT 1 INTRODUCTION

12 Hrs.

Introduction and Origins of the Intelligent Buildings Concept - Definition and characteristics of Intelligent Buildings with brief history and contemporary concept. Automated buildings, Responsive buildings, Evaluation of natural ventilation in buildings and indoor wind speed.

UNIT 2 ENERGY MANAGEMENT AND SERVICES

13 Hrs.

Demands on building and services, Control systems, Study of development of Computer Integrated Building from single function systems to integrated solutions. Use of building intelligence in energy management. Factors that affect energy use in buildings - functional factors, environmental factors, envelope factors, air-conditioning systems factors, energy source factors and electrical systems factors. Fenestration design for optimal daylighting.

UNIT 3 KEY ISSUES FOR INTELLIGENT BUILDINGS

10 Hrs.

Multiple activity settings, Generic analysis of space utilization. Models for shared space use. The development of briefing process including design activity and building elements, life cycles, Coordination between life cycle, building technologies. Study of issues related to site, shell, skin, services and technology.

UNIT 4 INTELLIGENT DESIGN AND CONSTRUCTION

10

Hrs. Effective Space utilisation, Energy conservation through site selection, siting & orientation. Energy conservation through integration of building and site, site planning & site design. Expectations of user, effective communication of architectural concepts to user, Locating people and information, Introduction to building efficiency with respect to life cycle costs.

Max. 45 Hours

COURSE OUTCOMES

- CO1- Understanding various concepts of natural ventilation, heating, ventilation and cooling strategies systems and the origin of intelligent buildings.
- CO2- Integration of building services and demonstration of various energy saving practices.
- CO3- Analyzing and interpreting various factors and building components that impact the energy management
- CO4- Critically evaluating and studying the importance of life cycle cost assessment and various issues and parameters relating to building automation.
- CO5- Analyzing and designing the various components and techniques for building automation and installation techniques through effective space utilization.
- CO6- Analyzing through intelligent design and Construction for the efficiency of Building life cycle.

TEXT/REFERENCE BOOKS

1. Henrik Missen, Industrialized Building and Modular Design, C & CA K, 1972.
2. Konz T, Manual of Precast concrete Construction, Vol, I, II, III, Banverlag GMBH, 1971.
3. William P. Spence, Construction Materials, Methods, and Techniques, 2006.
4. Bansal, N.K., Hauser, G., & Minke, G., Passive Building Design, Elsevier, Amsterdam, 1994
5. Directory of Indian Building Materials Products Building materials and Technology Promotion Council and Centre for Symbiosis of Technology, Environment Management, Bangalore, 2000-2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

Exam Duration:3Hrs.

PART A:5 Questions of 6 Marks each – No choice

30Marks

PART B:2 Questions from each unit of internal choice, each carrying 14 Marks

70Marks



Added Contents



Deleted Contents



New Course Introduced

**School of Building and Environment
Department of Civil Engineering**

Board of Studies Meeting - Academic Year 2023-2024

The second periodic Board of studies meeting for the Academic Year 2023-2024 for the Department of Civil Engineering, School of Building and Environment will be held on 21.11.2023 at 10.00 pm at CADD Lab, Department of Civil Engineering.

Internal members

1. Dr.Devyani Gangopadhyay, Dean, School of Building and Environment
2. Dr.S.Packialakshmi, Associate Professor, Department of Civil Engineering
3. Dr.R.Padmapriya, Associate Professor, Department of Civil Engineering
4. Dr.V.Sampathkumar, Professor, Department of Civil Engineering
5. Dr.R.Nirmala, Associate Professor, Department of Civil Engineering

External members

1. Dr.R.Santhakumar, Professor, Department of Civil Engineering, NITTTR, Chennai
2. Dr.R.Saravanan, Associate Professor, CWR, Anna University, Chennai

Agenda:

- Review of Curriculum for the upcoming semester courses of Civil Engineering and Structural Engineering Program
- Inclusion of software application in Design of Steel structures and Advanced Design of Steel Structures



HOD



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School of Building and Environment Department of Civil Engineering

Minutes of the BOS Meeting - Academic year 2023-2024

The periodic Board of Studies Meeting for both UG and PG programme is held on 21st November, 2023 at 10.00 PM at CADD Lab, Department of Civil Engineering

Members Present

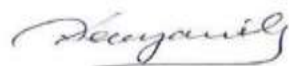
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|--|---------------|
| 1. Dr.Devyani Gangopadhyay,
Dean, School of Building and Environment | Convenor |
| 2. Dr.R.Santhakumar,
Professor, Department of Civil, NITTTR, Chennai | Expert Member |
| 3. Dr.R.Saravanan,
Associate Professor, CWR, Anna University, Chennai | Expert Member |
| 4. Dr.R.Padmapriya,
Associate Professor, Department of Civil Engineering | Member |
| 5. Dr.S.Packialakshmi,
Associate Professor, Department of Civil Engineering | Member |
| 6. Dr.V.Sampathkumar,
Professor, Department of Civil Engineering | Member |
| 7. Dr.R.Nirmala,
Associate Professor, Department of Civil Engineering | Member |

The board of Studies members appreciated the structure of Curriculum planned for the current semester courses covering the Lifeskills, basic science skills, Engineering Science skills, Program Core / electives etc.

- Dr.R.Padmapriya, Associate Professor, Internal Board of Studies member has proposed to incorporate the software applications to the Under Graduate Students of Civil Engineering in the Course Design of Steel Structures – II and also for Post Graduate Students in the Course Advanced Design of Steel Structures – II by including the following contents:

Tekla software contents such as Introduction to Tekla software, Basic 3D

Modeling, System Components, Interactive Modeling & Building Custom Components, Modeling Techniques, Structural Profiles and Materials, Numbering and reports, Principles of working with drawings are included under Unit – II in Core Theory Course in Semester 6 of U.G. program and Semester 2 of P.G. program respectively.



Convenor/Dean



HOD


(RISANTHA CUMAR)

Expert member

SCIA1603	DESIGN OF STEEL STRUCTURES - II	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- To learn the design of Plate girders, Industrial structures, water tanks, Bunkers, Silos and Light gauge sections.

UNIT 1 PLATE GIRDERS

9 Hrs.

Introduction - types of sections - elements of plate girder - general considerations - end panel design - tension field action - design of plate girders with solid webs - flange splices - connection of flanges to web - stiffener design various types of stiffeners.

UNIT 2 ROOF TRUSSES AND INDUSTRIAL STRUCTURES

9 Hrs.

Roof trusses - Roof and side coverings - Design loads, Design of purlin and elements of truss - end bearing Design of gantry girder. Introduction to Tekla software, Basic 3D Modeling, System Components, Interactive Modeling & Building Custom Components, Modeling Techniques, Structural Profiles and Materials, Numbering and reports, Principles of working with drawings

UNIT 3 WATER TANKS

9 Hrs.

Introduction - permissible stresses - thickness specifications - elevated tanks - circular tanks - rectangular tanks - pressed steel tanks.

UNIT 4 BUNKERS AND SILOS

9 Hrs.

Introduction - Janssen's theory - Airy's theorem - Design parameters - Design criteria - analysis of bins Hopper bottom - design of bins.

UNIT 5 LIGHT GAUGE SECTIONS

9 Hrs.

Design of light gauge steel members - local and post buckling of thin elements - light gauge steel compression members - tension members - beams and connections.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the basic elements in plate girders with codal provisions of Limit State method as per Indian Standards
- CO2 - Identify the sectional properties from Steel tables for designing the Roof trusses with several Loading condition.
- CO3 - Design water tanks with different shapes.
- CO4 - Analyze and design Bunkers and Silos.
- CO5 - Designing the various light gauge steel members.

TEXT / REFERENCE BOOKS

- Subramanian N., "Design of Steel Structures", Oxford University Press, 2008.
- Ramchandra S., & Virendra Ghelot, "Design of Steel of Structures", Volume 1, Scientific Publishers, New Delhi, 2009.
- Duggal S.K., "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, New Delhi, 1st Edition, 2010.
- Punmia B.C., Ashok Kumar Jain & Arun Kumar Jain, "Design of Steel Structures", Vol. I and II, Arihant Publications, Mumbai, 1998.
- Dowling P.J., Knowles P.R., Owens G.W., "Structural Steel Design", The Steel Construction Institute, Butterworth's, London, 1988.

CODE BOOK

- IS: 800-2007, "Indian Standard for General Construction in Steel - Code of Practice" (Third Revision).
- IS: 801-1975, : Code of practice for use of cold - formed light gauge steel structural members in general building construction
- SP 6(1) - 1964 Hand book for Structures Engineers
- IS: 811 - 1987, "Specification for cold formed light gauge structural steel sections.
- IS: 804-1998 Code of practice for rectangular pressed steel tanks.
- IS: 805 - 1995 Code of practice for use of steel in gravity water tanks.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each Unit of internal choice – each question carries 16 marks

80 Marks

Added Contents

Deleted Contents

New Course Introduced

SCIB5203	ADVANCED DESIGN OF STEEL STRUCTURES	L	T	P	EL	Credits	Total Marks
		3	0	0	1	3	100

COURSE OBJECTIVES

- To learn the various modes of structural connections between a beam and a column.
- To conduct plastic design of beams and frames
- To design the components of pre-engineered building and tall structures
- To design cold formed steel column and beams

UNIT 1 STRUCTURAL CONNECTIONS

9Hrs.

Types of connections- Bolted and welded connections – Seated Connections – Unstiffened and Stiffened – Moment Resistant Connections – Clip angle Connections – Split beam Connections – Framed Connections – Introduction to Tekla software, Basic 3D Modeling, System Components, Interactive Modeling & Building Custom Components, Modeling Techniques, Structural Profiles and Materials, Numbering and reports, Principles of working with drawings

UNIT 2 PLASTIC ANALYSIS OF STRUCTURES

9Hrs.

Introduction, Shape factor, classification of section, elastic and plastic section moduli - Combined mechanisms, Analysis of portal frames, Effect of axial force - Effect of shear force on plastic moment– Design of continuous beams.

UNIT 3 PRE ENGINEERED INDUSTRIAL BUILDING

9Hrs.

Design of gantry girder subjected to lateral loads and axial loads, Analysis and design of roof truss, Design of Purlins- wind pressure

UNIT 4 ANALYSIS AND DESIGN OF SPECIAL STRUCTURES

9Hrs.

Design of self supporting chimney and guyed steel stacks- Stresses due to wind and earthquake forces – Design of foundation –Gust factor method. Towers- Basic structural configurations – free standing and guyed towers – loads on towers– wind loads – foundation design.

UNIT 5

DESIGN OF COLD

FORMEDS TEELSTRUCTURES

9Hrs.

Behaviour of Compression Elements - Effective width for load and deflection determination – Behaviour of Unstiffened and Stiffened Elements – Design of webs of beams – Flexural members – Lateral buckling of beams – Shear Lag – Flange Curling – Design of Compression Members – Wall Studs.

Max.45Hrs.

Course Outcomes

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

- CO1 - Design the connections of steel beam and column joint
- CO2 – Conduct plastic analysis for beams and frames
- CO3 - Design the components of pre-engineered building
- CO4 – Design tall structures like chimney and towers
- CO5 – Understand codal provisions and properties of light gauge steel sections
- CO6 - Design the beams and columns using cold formed steel sections.

TEXT / REFERENCEBOOKS

1. Owens G.W. and Cheal B.D., "Structural Steelwork Connections", Butterworths, London, 1989.
2. Dayaratnam P., "Design of Steel Structures", A.H. Wheeler & Co. Ltd., Allahabad, 1996.
3. Subramanian N., "Design of Steel Structures", Oxford University Press, 2008.
4. Murthy S.S. and Santhakumar A.R., "Transmission Line Structures", McGraw Hill Publishing Co. Ltd., 1990.
5. Wie Wen Yu, "Design of Cold Formed Steel Structures", McGraw Hill Book Company, New York, 1996.
6. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Design of Steel Structures" Vol. I and II, Arihant Publications, Mumbai, 1998.
7. Duggal.S.K., "Limit State design of steel structures", Tata McGraw Hill Publishing Company, New Delhi, 2010.
8. IS: 800-2007, Indian Standard for General Construction in Steel, Code of Practice.
9. IS:801-1975, : Code of practice for use of cold – formed light gauge steel structural members in general building construction.
10. SP 6(1) – 1964 Hand book for Structures Engineers.
11. IS 811 - 1987, "Specification for cold formed light gauge structural steel sections.
12. IS 875-2015 part 3 Code of practice for design loads.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:100

Exam Duration: 3Hrs.

PART A: 5 Questions of 6 Marks each–No choice

30 Marks

PART B: 2 Questions from each unit of internal choice each carrying 14 Marks

70 Marks



Added Contents



Deleted Contents



New Course Introduced