



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

1.2.1 List of courses newly Introduced in the Academic Year 2023 – 24

S.No.	Program	Course Code	Course Name	Page No.
1	B.E. Civil Engg.	SCSBDPROJ	Design Thinking and Innovation	5
2	B.E. Civil Engg.	SCIB3016	Surface Water Hydrology	7
3	B.E. Civil Engg.	SCIB3017	Soft Computing Techniques in Water Resources Engineering	8
4	B.E. Civil Engg.	SCIB3021	Industrial Wastewater Treatment	9
5	B.E. Civil Engg.	SCIB3029	Artificial Intelligence for Civil Engineers	10
6	B.E. Civil Engg.	SCIB3031	Industry 5.0 for Civil Engineers	11
7	M.E. Structural Engg.	SCIB7021	Industry 5.0 for Structural Engineers	12
8	M.E. Structural Engg.	SCIB7022	Building Automation System	13


(S. Packialakshmi)

HOD/CIVIL

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



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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.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
- 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



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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



Shankar
(R. SANTHALAKSHMI)

Expert member

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/>



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 – Infiltrimeters – 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

 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

 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

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, Nallakuruppan MK, Chengoden R, Koppu S, Iyapparaja 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

 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., &Aruna, 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

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.

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.

PARTA:5 Questions of 6 Marks each – No choice

30Marks

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

70Marks

 New Course Introduced