



**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(AN AUTONOMOUS INSTITUTE)**

**Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University,
Solapur**


B. Tech Civil Engineering

CHOICE BASED CREDIT SYSTEM (CBCS)

**Structure and Syllabus for
Honors Degree in
Infrastructure Engineering**

S.Y. B. Tech. Civil Engineering W.E.F. 2022-23

T.Y. B. Tech. Civil Engineering W.E.F. 2023-24


Dr. M. G. Kalyanshetta
Chairman, BOS in Civil Engg -
W.I.T. (Autonomous), Solapur



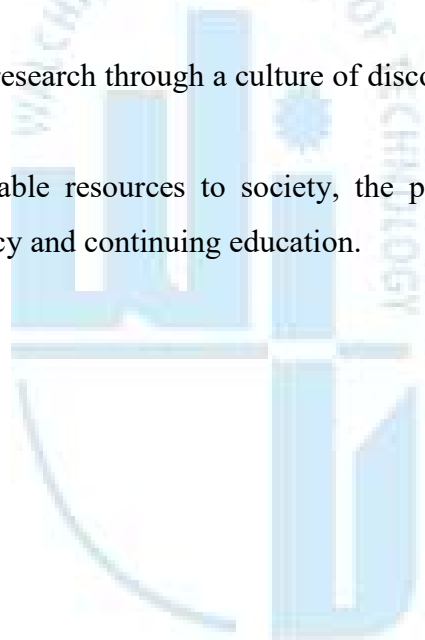
Department of Civil Engineering

Department Vision

The Department of Civil Engineering, Walchand Institute of Technology Solapur, will excel and lead in education, research and innovation; contributing to the advancement of design, construction and maintenance of infrastructure, to enhance the quality of life for humanity in a sustainable way.

Department Mission

1. To provide an outstanding learning experience through a rigorous curriculum of theory and practice that develops students' technical and professional skills to succeed in a wide range of careers.
2. To continually advance research through a culture of discovery, creativity and innovation to benefit humankind.
3. To serve as highly capable resources to society, the profession through professional organizations, consultancy and continuing education.



Civil Engineering
Under Graduate Program
Program Educational Objectives (PEOs)

The Program Educational Objectives for B. Tech. Civil Engineering program are designed to produce competent civil engineers who are ready to contribute effectively to the advancement of Civil Engineering and to fulfill the needs of the community. These objectives are as follows:

1. Graduate will demonstrate peer-recognized technical competency in the analysis, design and construction of Civil Engineering Structures.
2. Graduate will demonstrate leadership and initiative to advance professional and organizational goals with a commitment to ethical standards of profession, teamwork and respect for diverse cultural backgrounds.
3. Graduate will be engaged in ongoing learning and professional development through pursuance of higher education and self-study.
4. Graduates will be committed to create practice of engineering and other professions in a responsible manner contributing to the socio-economic development of the society.

Program Outcomes (POs)

The program outcomes of B. Tech. Civil Engineering Program are summarized as following:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities, relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Engineering graduate in Electronics and Telecommunication Engineering Programme will be able to do-

1. Graduates will be able to survey, conduct geo-technical investigations, plan, analyze, design, estimate and construct residences, public buildings, industrial buildings, townships and infrastructural projects by adopting appropriate construction methods.
2. Graduates will be able to analyze and design the water resources systems, municipal and industrial waste treatment plants with due consideration to pollution free environment.
3. Graduates will be able to use appropriate application software, develop skills necessary for professional practice as a Civil Engineer and prepare themselves for competitive examinations for higher education & for public service commissions.

Legends Used–

L	Lecture Hours/week
A	Tutorial Hours/week
P	Practical Hours/week
FA	Formative Assessment
SA	Summative Assessment
ESE	End Semester Examination
ISE	In Semester Evaluation
ICA	Internal Continuous Assessment
POE	Practical and Oral Exam
OE	Oral Exam
MOOC	Massive Open Online Course
HSS	Humanities and Social Sciences
NPTEL	National Program on Technology Enhanced Learning
F.Y.	First Year
S.Y.	Second Year
T.Y.	Third Year
B.Tech.	Bachelor of Technology

Course Code Format for Honors:

2	1	C	E	U/P	2	H	R	1	T / L
Batch Entry Year		Program Code		U-Under Graduate, P-Post Graduate	Semester No. / Year 1/2/3/...8	Honors Code		Course Serial No. 1-9	T-Theory, L-Lab session

Program Code	
CE	Civil Engineering
Course Types	
BS	Basic Science
ES	Engineering Science
HU	Humanities & Social Science
MC	Mandatory Course
CC	Core Compulsory Course
SN*	Self-Learning N* indicates the serial number of electives offered in the respective category
EN*	EN* Core Elective N* indicates the serial number of electives offered in the respective category
SK	SK Skill-Based Course
SM	Seminar
MP	Mini project
PR	Project
IN	Internship

Program Code	
CE	Civil Engineering
Honors Code	
HR	Honors in Infrastructure Engineering

Sample Course Code:

21CEU4HR1T	Planning and Design of Rural Roads
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Walchand Institute of Technology, Solapur
Civil Engineering
Honors in Infrastructure Engineering

*Structure of S. Y. B. Tech. Civil Engineering
(W.E.F. 2022-2023)*

Semester- IV

Course Code	Course Name	Engagement Hours			Credits	FA	SA		Total
		L	T	P		ESE	ISE	ICA	
21CEU4HR1T	Planning and Design of Rural Roads	3	-	-	3	60	40	-	100
21CEU4HR1A	Planning and Design of Rural Roads Tutorial	-	1	-	1	-	-	25	25
Grand Total		3	1		4	60	40	25	125

*Structure of T. Y. B. Tech. Civil Engineering
(W.E.F. 2023-2024)*

Semester- V

Course Code	Course Name	Engagement Hours			Credits	FA	SA		Total
		L	T	P		ESE	ISE	ICA	
21CEU5HR1T	Pavement Materials	3	-	-	3	60	40	-	100
21CEU5HR1A	Pavement Materials	-	1	-	1	-	-	25	25
Grand Total		3	1		4	60	40	25	125

*Structure of T. Y. B. Tech. Civil Engineering.,
(W.E.F. 2023-2024)*

Semester- VI

Course Code	Course Name	Engagement Hours			Credits	FA	SA		Total
		L	T	P		ESE	ISE	ICA	
21CEU6HR1T	Applications of Information Technology and Information Systems in Infrastructure Engineering	3	-	-	3	60	40	-	100
21CEU6HR1A	Applications of Information Technology and Information Systems in Infrastructure Engineering	-	1	-	1	-	-	25	25
Grand Total		3	1		4	60	40	25	125

Walchand Institute of Technology, Solapur
Civil Engineering
Honors in Infrastructure Engineering

*Structure of Final Year B. Tech. Civil Engineering
(W.E.F. 2024-2025)*

Semester- VII

Course Code	Course Name	Engagement Hours			Credits	FA	SA		Total
		L	T	P		ESE	ISE	ICA	
21CEU7HR1T	Bridges and Grade Separated Structures	3	-	-	3	60	40	-	100
21CEU7HR1A	Bridges and Grade Separated Structures	-	1	-	1	-	-	25	25
21CEU7HR2L	Mini Project			4	2	50		50	100
Grand Total		3	1	4	6	110	40	75	225

Note: -These courses are to be completed by the student in addition to the courses of B. Tech Civil Engineering.



Walchand Institute of Technology, Solapur

Honors in Infrastructure Engineering
S.Y.B.Tech. (Civil Engineering), Semester-IV
21CEU4HR1T

PLANNING AND DESIGN OF RURAL ROADS

Teaching Scheme:

Lecture: 3 hrs/week, 3 credits

Practical: 1 hrs/week, 1 credit

Examination Scheme:

ESE: 60 Marks

ISE: 40 Marks

ICA: 25 Marks

Course Outcomes: At the end of the course, students will be able to,

1. Able to elaborate the significance of low-cost roads.
2. Capable of analyzing the problem associated with the planning of low-volume roads, and preparing master plans of the rural road networks.
3. Capable of conducting surveys for rural road alignment and remembering specifications of various geometric features of the road.
4. Capable of selecting and analyzing different materials and equipment required for rural road construction.
5. Able to design various drainage structures and cross-drainage works giving due importance to maintenance activities.

SECTION - I

Unit 1: Planning of rural road

[7 Hrs]

Planning database, the concept of network planning Rural roads plan, guidelines laid down in recent 20-year plans and in PMGSY Road alignment and surveys, governing factors for route selection Factors controlling alignment; obligatory points, traffic, geometric designs, economy, special considerations in hilly areas.

Unit 2: Geometric design standards

[7 Hrs]

Classification of rural roads, terrain classification, design speed, basic principles of geometric design cross-sectional elements, camber, and sight distances. Horizontal alignment: general guidelines, superelevation, transition curve, widening and set back distances, vertical alignment: gradient, grade compensation at curves, valley curves, alignment compatibility, lateral and vertical clearances.

Unit 3: Soil and material surveys**[8 Hrs]**

Soil investigations for low embankment, high embankment, cut sections, subgrade, Survey for marginal materials and aggregates/low-grade materials Artificial aggregates, waste materials, new materials, and stabilizers Design parameters, pavement components Design of flexible pavement as per IRC: pavement thickness, pavement surfacing Design of semi-rigid pavement: dry lean concrete/lime fly ash concrete bases Design of rigid pavement: cement concrete pavement Design of special pavements: concrete block pavement , interlocking concrete block pavement Choice of pavement type and material.

SECTION - II**Unit 4: Types of road drainage****[7 Hrs]**

Requirements of surface drain; roadside drains, shoulder drains, catch water drains. Requirements subsurface drain. Cross drains; types, requirements, and choice of different types of cross drain. Standard designs of culverts. The standard design of small bridges.

Unit 5: Construction and Specification**[7 Hrs]**

Construction and Specifications: Earth, Sub-base, Base course, and surface course – materials, specifications, and construction steps and use of different equipment, construction of special pavements, construction of fly ash embankments, lime fly ash stabilized soil, lime fly ash bound macadam, lime fly ash concrete, roller compacted concrete, dry lean fly ash concrete, cement stabilized fly ash, quality control in construction, Specifications, and tests for quality control as per IRC.

Unit 6: Maintenance of Rural roads**[8 Hrs]**

Types of maintenance, maintenance of unpaved roads, maintenance of paved roads, maintenance of semi-rigid and roller compacted concrete pavements, maintenance of special pavements, Rehabilitation.

INTERNAL CONTINUOUS ASSESSMENT (ICA):

Internal Continuous Assessment (ICA) shall consist of a minimum of six assignments based on the entire curriculum.

TEXT BOOKS:

1. Khanna, S.K., Justo, C.E.G., and Veeraragavan, A., 'Highway Materials and Pavement Testing', Nem Chand and Bros, Roorkee Reference Books:
2. IRC SP 20 Rural Roads Manual
3. Ministry of Rural Road Development

REFERENCE BOOKS:

1. Principles of Transportation Engineering, Partha Chakroborty and Animesh Das, PHI Publication.
2. Transportation Engineering – An Introduction, Khistry, C.J., PHI Publication.
3. Specifications of Road and Bridge Works (MoRTH) Publication – 5th Revision. New Delhi.
4. IRC: 37-2018, IRC: 58-2015, and other relevant IRC codes



Walchand Institute of Technology, Solapur

Honors in Infrastructure Engineering

T.Y.B.Tech. (Civil Engineering), Semester-V

21CEU5HR1T

PAVEMENT MATERIALS

Teaching Scheme:

Lecture: 3 hrs/week, 3 credits

Tutorial: 1 hrs/week, 1 credit

Examination Scheme:

ESE: 60 Marks

ISE: 40 Marks

ICA: 25 Marks

Course outcome: At the end of the course, students will be able to,

1. Characterize the aggregates with respect to their shape, size, and gradation requirement which are most important in the construction of different pavement layers.
2. Classify the different types of bituminous binders and apply the knowledge in Suggesting suitable binders for road construction.
3. Understand the use of various binder materials that can be used for interface treatment during construction and repair works carried out on roads.
4. Analyse the properties and design the bituminous and cement concrete mixes for road construction.
5. Analyse the effect of weather on the properties and to understand the various tests that are to be conducted to check the adhesion failure in bituminous materials and mixes.

SECTION-I

Unit 1: Soil:**[08 Hrs]**

Introduction materials used for construction of subgrade, aggregate base course, bituminous base, and surface courses of pavements. Understanding different tests: CBR, Durability, Freeze-Thaw, Resilient Modulus, and soil-suction.

Unit 2: Aggregates:**[08 Hrs]**

Origin, Classification, requirements, properties, and tests on road aggregates for flexible and rigid pavements. Importance of aggregate shape factor in the mix design.

Unit 3: Bitumen and Modified Bitumen:**[08 Hrs]**

Origin, preparation, properties and tests, bituminous and modified bituminous road binders; requirements; Criterion for selection of different binders. **Bituminous Emulsions and Cutbacks:** Preparation, characteristics, uses and tests.

SECTION-II**Unit 4: Bitumen Mixes:****[10 Hrs]**

Mechanical properties: Resilient modulus, dynamic modulus and fatigue characteristics of bituminous mixes. Dense and open textured mixes, flexibility and brittleness, common mechanical tests, bituminous mix design methods and specifications.

Unit 5: Weathering and Durability of Bituminous Materials and Mixes: **[10 Hrs]**

Tests on weathered bituminous materials, Adhesion, failure, mechanism of stripping, tests and methods of improving adhesion. Cement Concrete for Pavement Construction: Requirements, and design of mix for CC pavement, IRC and IS specifications and tests, joint filler and sealer materials.

TEXT BOOKS

1. Principles of Pavement Design', Yoder, E.J., and Witczak, 2nd ed. John Wiley and Sons, 1975.
2. 'Design of Functional Pavements', Yang, , McGraw Hill Book Co.
3. 'Test Book of Highway Engineering', Khanna and Justo, 'Nemchand brothers, Roorke- 2004. Huang, 'Pavement Analysis', Elsevier Publications
4. F.L. Roberts, P.S. Kandhal, E.R. Brown, D.Y. Lee, and T.W. Kennedy "Hot Mix Asphalt Materials, Mixture Design and Construction," National Asphalt Pavement Association Research and Education Foundation, Second Edition, 1996, USA.
5. 2. Y.H. Huang "Pavement Analysis and Design," 2nd Edition, 2004, Pearson Prentice Hall, USA 3. Asphalt Institute, SP-1: Performance Grading of Asphalt Binder – Specifications and Testing.

REFERENCE BOOKS

1. RRL, DSIR, 'Bituminous Materials in Road Construction ', HMSO Publication.
2. RRL, DSIR, 'Soil Mechanics for Road Engineers', HMSO Publication.
3. ISI and IRC Publications on relevant topics.
4. Freddy L.Roberts, Prithvi S. Kandhal, Ray Brown, Dah-Linn Lee, Thomas W. Kennedy,'Hot Mix Asphalt Materials, Mixture Design and Construction, NAPA Education Foundation, Lanham, Maryland.
5. Asphalt institute, 'The Asphalt Hand Book'.





Walchand Institute of Technology, Solapur

Honors in Infrastructure Engineering

T.Y.B.Tech. (Civil Engineering), Semester-VI

21CEU6HR1T

APPLICATIONS OF INFORMATION TECHNOLOGY AND INFORMATION SYSTEMS IN INFRASTRUCTURE ENGINEERING

Teaching Scheme:

Lecture: 3 hrs/week, 3 credits

Tutorial: 1 hrs/week, 1 credit

Examination Scheme:

ESE: 60 Marks

ISE: 40 Marks

ICA: 25 Marks

Course Outcomes: At the end of the course, students will be able to,

1. Take overview of information technology in civil engineering
2. Connect digital tools to construction practice and apply techniques to optimize solutions.
3. Perform Modeling and analysis of structural systems
4. Adopt 3D Printing in construction
5. Design and construct industrial applications through automation and manage and apply linear project construction like roads.
6. Use Building information modeling tools.

SECTION-I

Unit 1: Introduction Overview of IT Applications in Construction [08 Hrs]

Unit I: Introduction to IT Applications in Civil Engineering, Overview of information technology in civil engineering, Importance of IT in improving efficiency and productivity, Current trends and emerging technologies in the field

Unit 2: Optimization Techniques Linear [08 Hrs]

Dynamic and Integer Programming - Branch and Bound Techniques – Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems – Software applications

Unit 3: Structural Analysis and Design Software [08 Hrs]

Overview of structural analysis and design software, Modeling and analysis of structural systems: Design optimization and code compliance using software tools

SECTION-II

Unity 4: Computer Application Advanced planning and scheduling concepts [08 Hrs]

Computer applications – Case study – Adoption of 3D Printing in construction.

Unit 5: Automation Techniques Introduction [06 Hrs]

Automation techniques in Surveying, Design and Construction – Automation in Road, Tunnel and Bridge Construction.

Unit 6: Building Information Modeling [06 Hrs]

Introduction to BIM and its benefits in civil engineering projects, BIM software tools and their functionalities, Creating and managing BIM models for design coordination

INTERNAL CONTINUOUS ASSESSMENT:

Internal Continuous Assessment (ICA) shall consist of minimum six assignments based on the entire curriculum.

TEXT BOOKS:

1. BIM and Construction Management: Proven Tools, Methods, and Workflows" by Brad Hardin and Dave McCool
2. "Computer Applications in Civil Engineering" by Nii O. Attoh-Okine
3. "Computer Applications in Structural Engineering" by C.S. Vishwanatha

REFERENCE BOOKS:

1. Sham Tickoo (2017), Autodesk Navisworks 2017, BPB Publications



Walchand Institute of Technology, Solapur

Honors in Infrastructure Engineering

Final Year B.Tech. (Civil Engineering), Semester-VII

21CEU7HR1T

BRIDGES AND GRADE-SEPARATED STRUCTURES

Teaching Scheme:

Lecture: 3 hrs/week, 3 credits

Practical: 1 hrs/week, 1 credit

Examination Scheme:

ESE: 60 Marks

ISE: 40 Marks

ICA: 25 Marks

Course Outcomes: At the end of the course, students will be able to,

1. Identify the suitable techniques to construct the structure based on site condition
2. Prepare the work schedule for any type of superstructure construction.
3. Identify the techniques to implement in the construction of the Embankment, Retaining wall, and breast wall in hill road.
4. Identify the suitable method and equipment to construct a Road, dam, Harbour, River work, and pipelines.
5. Prepare a suitable plan for the erection of new plants like Batching and mixing plants, Ready mix concrete plants at the site.
6. Manage and maintain the equipment and its cost control.

SECTION-I

Unit 1: Introduction to Bridges

[08 Hrs]

Basic Elements of a Bridge. Types of bridges and grade-separated structures for highways, standard specifications for road bridges, and grade-separated structures to fulfill traffic and Structural and Hydraulic design requirements.

Unit 2: Sub Structure Construction

[07 Hrs]

Techniques of Box jacking – Pipe Jacking -underwater construction of diaphragm walls and basement- Tunnelling techniques – Piling techniques -Dewatering and stand-by Plant equipment for underground open excavation.

Unit 3: Superstructure Construction [07 Hrs]

Launching girders, bridge decks, and offshore platforms – Material handling - erecting lightweight components on tall structures - Erection of articulated structures - Fabrication and erection of steel trusses and frames. Bridge testing for safe carrying capacity, strengthening of bridges, and aesthetical treatments. Bridge bearings, joints, approaches, and construction and maintenance aspects.

SECTION -II

Unit 4: Construction of Embankment & Retaining Wall [08 Hrs]

Embankment Construction - Ground improvement techniques, Retaining and Breast walls on the hill road, wing walls and approaches, and cofferdams.

Unit 5: Equipment Management [07 Hrs]

Factors affecting selection of equipment and methods –Planning - Equipment Management in Projects - Maintenance Management – Replacement - Cost Control of Equipment – Depreciation Analysis, Methods of calculation of depreciation- Safety Management.

Unit 6: Time planning – project work breakdown [07 Hrs]

Time planning – project work breakdown determining activities involved, assessment of duration, CPM / PERT network analysis, work scheduling, methods of work scheduling, factors affecting work scheduling, and Problems. Planning Control System – resource production, project cost, project time, codification and project management, information system, use of software

INTERNAL CONTINUOUS ASSESSMENT:

Internal Continuous Assessment (ICA) shall consist of minimum of six assignments based on the entire curriculum

TEXT BOOKS:

1. D. Johnson Victor, “Essentials of Bridge Engineering”- Oxford, IBH publishing company.
2. Ponnuswamy, “Bridge Engineering”-McGraw Hill Publication, 1989.
3. K.K. Chitkara. “Construction Project Management Planning, Scheduling and Controlling”- Tata McGraw Hill publications
4. S.C. Sharma “Construction Equipment and its Management”- Khanna Publishers

REFERENCE BOOKS:

1. Vazirani Ratwani & M. G. Aswani, “Design of Concrete Bridges”- Khanna Publishers, New Delhi
2. “Design of Bridges”- Dr. Krishna Raju, Oxford & IBH Publishing Company Limited.
3. “Analysis and design of Bridges”- M. A. Jayaram, Sapna Publishers, Bangalore.
4. Peurifoy, R.L., and Clifford, JS “Construction Planning Equipment and Method”- McGraw Hill Book Co. Inc
5. Relevant IRC & ASTM Standard



Walchand Institute of Technology, Solapur

Honors in Infrastructure Engineering
Final Year B.Tech. (Civil Engineering), Semester-VII

21CEU7HR2L

MINI PROJECT

Teaching Scheme:

Practical: 4 hrs/week, 2 credit

Examination Scheme:


ICA: 50 Marks

ESE: 50 Marks

Student/s shall carry out a 'Mini Project' in any one of the following subjects: Highway Construction, Highway Planning and Management, Quality Assurance and Quality Control, Bridge and Flyover Construction, Environmental Impact Assessment of Highway Project, Traffic Management of Highway Project, Safety in Road Construction, Sustainable materials, and Pavement Design, etc.

The project shall consist of Prototype design, working models, Laboratory experiments, Process modification/development, Simulation, Software development, Data analysis, Survey etc.

The student is required to submit a 'Project Report' based on the work. The Mini project shall be assessed by the domain subject teachers for ICA.


Dr. M. G. Kalyanshetti
Chairman, BOS in Civil Engg -
W.I.T. (Autonomous), Solapur

