WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(AN AUTONOMOUS INSTITUTE)

Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University,
Solapur

CHOICE BASED CREDIT SYSTEM (CBCS)

Structure and Syllabus
for
T. Y. B.Tech. Civil Engineering

W.E.F. 2023-24

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Chairman, BOS in Civil Engg.
W.I.T. (Autonomous), Solapur

WALCHAND INSTITUTE OF TECHNOLOGY WIT 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
T	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:

2	**1**	**C**	**E**	**U/P**	**2**	**C**	**C**	**1**	**T / L**
Batch Entry Year		Program Code		U-Under Graduate, P-Post Graduate	Semester No. / Year 1/2/3/…8	Course Type		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

Sample Course Code:

21CEU5CC1T	Design of Steel Structures

A new code is proposed for the 'Self-Learning HSS course' at T. Y. B. Tech. Part-I as follows:

21 AL U 5 SA 9 T

2	**1**	**A**	**L**	**U**	**5**	**S**	**A**	**9**	**T**
Entry year of batch			Common for all programs	UG	Semester number	Self-learning	A /B/C/D/E- Defines the serial number of the course out of all the 5 HSS courses offered in self-learning mode.	The last number '9' in the list is reserved for the self-learning course	Theory

Walchand Institute of Technology, Solapur

Structure of T. Y. B. Tech. Civil Engineering,

(W. E.F. 2023-2024)

Semester- V

Course Code	Theory Course Name	*Engagement Hours*				Credits	FA	SA		Total
		L	T	P	D		ESE	ISE	ICA	
21CEU5CC1T	Design of Steel Structures	3	-	-	-	3	60	40	-	100
21CEU5CC2T	Geotechnical Engineering	3	-	-	-	3	60	40	-	100
21CEU5CC2L	Geotechnical Engineering Lab	-	-	2	-	1	50	-	25	75
21CEU5CC3T	Highway and Tunnel Engineering	3	-	-	-	3	60	40	-	100
21CEU5CC3L	Highway & Tunnel Engineering Lab	-	-	2	-	1	-	-	25	25
21CEU5CC4T	Hydrology and Water Resources Engineering	3	-	-	-	3	60	40	-	100
21CEU5CC5T	Design of Concrete Structures I	3	-	-	-	3	60	40	-	100
21CEU5CC6T	Environmental Engineering-II	3	-	-	-	3	60	40	-	100
21CEU5CC6L	Environmental Engineering-II Lab	-	-	2	-	1	25	-	25	50
21CEU5CC7T	Planning & Design of Public Building	1	-	-	2	2	50	-	25	75
21CEU5SN*8T	HSS Course – Elective (Self-Learning mode)	-	-	-	-	1	50	-	-	50
21CEU5IN9L	Internship-I	-	-	-	-	2	-	-	50	50
	Grand Total	**19**	**-**	**6**	**2**	**26**	**535**	**240**	**150**	**925**

N* indicates the serial number of electives offered in the respective category

Note:

1. The number of students in a Practical/Tutorial batch shall be 20. New batch shall be formed if the number of remaining students (after forming batches of 20) exceeds 9.
2. Internal Continuous Assessment (ICA): ICA shall be a continuous process based on the performance of the student in assignments, class tests, quizzes, attendance and interaction during theory and lab sessions, journal writing, report presentation etc., as applicable.
3. Student shall select one self-Learning course on Humanities and Social Sciences (HSS) at T.Y. Part I i.e., at Semester V. Curriculum for Humanities and Social Sciences, Self-Learning (HSS) is common for all undergraduate engineering programs. Student can select & enroll a 'Self-Learning Module- I' (HSS) Course from following list and appear for examination of the Institute:

21CEU5SN*8T: -Self Learning Module – I (HSS)

Course Code	Course title
21ALU5SA9T	Economics
21ALU5SB9T	Intellectual Property Rights for Technology Development and Management
21ALU5SC9T	Introduction to Sociology
21ALU5SD9T	Stress and Coping
21ALU5SE9T	Professional Ethics & Human Value

OR

The list of approved NPTEL/Online courses/Industry MOOC of minimum eight weeks duration for 'Self-Learning (HSS)' shall be announced by the BOS chairman at the commencement of Semester V. Students shall register and complete one of the courses from approved lists successfully and submit the passing certificate to the department.

More details about NPTEL are available at http://nptel.ac.in

Institute Approved NPTEL- HSS course List

No	Course title	No	Course title
1	Soft skills	15	Management of Inventory Systems
2	Introduction to Modern India Political Thought	16	Economic Growth and Development
3	Intellectual Property	17	Ethic in Engineering Practice
4	Technical English for Engineers	18	Corporate Social Responsibility
5	Developing Soft Skills and Personality	19	Marketing Management –I
6	Educational Leadership	20	Marketing Research and Analysis
7	Microeconomics: Theory & Applications	21	Selected Topics in Decision Modeling
8	Engineering Economics	22	Innovation, Business Models and Entrepreneurship
9	Human Resource Development	23	Simulation of Business Systems: An Applied Approach
10	Project Management for managers	24	Sustainability through Green Manufacturing Systems: An Applied Approach
11	Data Analysis and Decision Making - I	25	Total Quality Management - I
12	E-Business	26	Introduction to Operations Research
13	Working Capital Management	27	Knowledge Management
14	Industrial Safety Engineering		

Walchand Institute of Technology, Solapur

Structure of T. Y. B. Tech. Civil Engineering,

(W. E.F. 2023-2024)

Semester –VI

Course Code	Theory Course Name	*Engagement Hours*				Credits	FA	SA		Total
		L	T	P	D		ESE	ISE	ICA	
21CEU6CC1T	Foundation Engineering	3	-	-	-	3	60	40	-	100
21CEU6CC2T	Hydraulic Structures and Water Power Engineering.	3	-	-	-	3	60	40	-	100
21CEU6CC3T	Design of Concrete Structures II	3	-	-	-	3	60	40	-	100
21CEU6CC3L	Design of Concrete Structures II Lab	-	-	2	-	1	-	-	25	25
21CEU6CC4T	Principles of Management and Quantitative Techniques	3	-	-	-	3	60	40	-	100
21CEU6CC4L	Principles of Management and Quantitative Techniques Lab	-	-	2	-	1	25	-	25	50
21CEU6CC5T	Railway, Airport & Harbour Engineering	3	-	-	-	3	60	40	-	100
21CEU6EN*6T	Core Elective Course-I	3	-	-	-	3	60	40	-	100
21CEU6PR7L	Project on Steel Structures	-	-	-	4	2	50	-	25	75
21CEU6MP8L	Mini project			2		2	-	-	50	50
	Grand Total	**18**	**-**	**6**	**4**	**24**	**435**	**240**	**125**	**800**

N indicates the serial number of electives offered in the respective category*

Note:

1) **Internship-II:**
   a) Students shall undergo field training for a total of 4 Weeks from the fifth semester up to the seventh semester. The concerned 'Seminar' guides will assess the training report at the end of the seventh semester. The field training shall be on any one of the following:
      i. Building Construction
      ii. Road or any other Infrastructure Projects
      iii. Water Resources development/ Environmental Engineering projects

b) **Certificate:** The industry/organization should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of the internship.

c) **Report:** Each student should submit the internship report at the end of the seventh semester with the internship certificate.

d) **Assessment:** Assessment of the Internship will be done at the end of the seventh Semester.

2) Internal Continuous Assessment (ICA): ICA shall be a continuous process based on the performance of the student in assignments, class tests, quizzes, attendance and interaction during theory and lab sessions, journal writing, report presentation, etc., as applicable

3) The batch size for the practical/tutorial is of 15 students. On forming the batches, if the number of remaining students exceeds 7 students, then a new batch be formed.

4) **Core Elective Courses:**

Elective No	**Semester**	**(I) Structural Engineering**	**(II) Geotechnical Engineering & Transportation Engg.**	**(III) Construction Engineering & Management**	**(IV) Environmental Engineering &Hydraulics, Hydrology & Water Resources Engineering**
Core Elective-I	**Semester-VI**	Masonry Structures (Course Code: 21CEU6E16T)	Urban Transportation Planning (Course Code: 21CEU6E46T)	Systems Engineering & Economics (Course Code: 21CEU6E66T)	Waterpower Engineering (Course Code: 21CEU6E86T)
		Structural Analysis by Matrix Methods (Course Code: 21CEU6E26T)	Pavement Analysis & Design (Course Code: 21CEU6E56T)	Advanced Concrete Technology (Course Code: 21CEU6E76T)	Urban Hydrology and Hydraulics (Course Code: 21CEU6E96T)
		Design of Bridges (Course Code: 21CEU6E36T)			Open Channel flow & River Hydraulics (Course Code: 21CEU6E106T)

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-V

21CEU5CC1T

DESIGN OF STEEL STRUCTURES

Teaching Scheme:
Lectures: 3 hours per week, 3 Credits

Examination Scheme:
ISE: 40 marks
ESE: 60 marks

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

1. Select appropriate load combinations for the 'Limit State' design of various elements of steel structures for strength and serviceability.
2. Design of bolted and welded connections.
3. Analyse and design Tension members, Compression members, and flexural members with their connections.
4. Analyse beams and portal frames by plastic analysis approach.
5. Analyse and design a Roof truss for given loading conditions.
6. Design of Column, Column base for given loading conditions.

SECTION-I

Unit 1: Introduction to Design of Steel Structures: **[5 Hrs]**

Steel as a structural member, Philosophy of limit state design for strength and serviceability, partial safety factor for load and resistance, various design load combinations, various types of standards rolled sections, Types of connections (Flexible, rigid, semi-rigid connection), grades of structural steel available as per relevant IS codes specifications, Classification of cross-section such as plastic, compact, semi-compact and slender.

Unit 2: Design of Connections: **[5 Hrs]**

Bolted Connections, Types of bolts and bolted joints, Failure of bolted joints, Specifications of bolted connections (Pitch, gauge, Edge distance, End distance, tacking bolts, etc), Bearing type connection, Shear strength of bolts, bearing strength of bolts, Tensile strength of bolts, Tensile strength of plate, Efficiency of bolted connections, design of eccentric bolted subjected to in-plane and out of plane loading.

Welded connections, types of welded joints, Design strength of fillet weld, Design strength of butt weld, design of eccentric welded connections subjected to in-plane and out-of-plane loading.

Unit 3: Tension Members: **[5 Hrs]**

Various cross sections such as solid threaded rod, cable and angle sections, net effective area of bar, angle, tees and flats, Limit strength due to yielding, rupture and block shear, Load carrying capacity, Design of tension member, connections of member with gusset plate by bolts and welds, Design of tension splice.

Unit 4: Compression Members-Struts: **[4 Hrs]**

Common sections used for compression members, buckling classification as per geometry of cross section, buckling curves, effective length and slenderness ratio, permissible stresses, Load carrying capacity, design of struts, connections of members with gusset plate by bolts and welds.

Unit 5: Columns: **[4 Hrs]**

Simple and built-up section, Design of built-up column, lacing and battening, connection of lacing/battening with main components by bolts and welds, column subjected to axial force and bending moment, column splices, design of eccentrically loaded column subjected to uniaxial bending (check for section strength only), design of beam to column connections using bolt / weld.

SECTION-II

Unit 6: Introduction to Plastic Analysis for Beams and Portal Frames: **[5 Hrs]**

Plastic moment, moment-curvature relationship, plastic hinges, yield spread in section, shape factor for cross-sections, Types of mechanisms, theorem of plastic analysis, collapse load, complete, partial and over complete collapse, application of virtual work method to beams and portal frames.

Unit 7: Beams: **[5 Hrs]**

Laterally supported and unsupported beams, Design of laterally supported/ laterally unsupported beams subjected to low/ high shear. Secondary and main beam arrangement for floor of building, design of beam-to-beam connections using bolt / weld.

Unit 8: Industrial Roof Trusses: **[6 Hrs]**

Various component of an industrial shed, Types of trusses, load calculation and combination, design of purlins, design of members of a truss.

Unit 9: Column Bases: **[4 Hrs]**

Column base under axial load: design of slab base, gusseted base, design of anchor bolts, design of pedestal, Column base for axial load and uniaxial bending.

Unit 10: Introduction to Pre-Engineered Buildings **[3 Hrs]**

Introduction – History - Advantages of PEB - Applications of PEB – Materials used for manufacturing of PEB. Difference between Conventional Steel Buildings and Pre-Engineered building.

Note:

Use of IS: 800-2007, IS 85, IS: Handbook No. 1 for steel section and steel table is permitted for theory examinations.

TEXT BOOKS

1. Design of Steel Structures, N. Subramanian, Oxford, 2008
2. Limit State Design of Steel Structures, S. K. Duggal.
3. Design of steel structure by Limit State Method as per IS: 800- 2007 by Bhavikatti S.
4. K International Publishing House, New Delhi
5. Limit state design in Structural Steel by Dr M. R. Shiyekar
6. Design of Steel structures by K. S. Sai Ram
7. Design of Steel structures by L. S. Jayagopal and D. Tensing

REFERENCE BOOKS

1. Limit state design of Steel Structure by V. L. Shah & Gore, Structures Publication, Pune
2. Limit State Design of Steel Structures by D. Ramchandra & Virendra Gehlot, Scientific Publishers
3. Design of Steel Structures by K. S. Sai Ram, published by Dorling Kindersley (India) Pvt. Ltd.
4. Structural Design and Drawing Reinforced Concrete and Steel by N. Krishnaraju,
5. Universities Press (India) Pvt. Ltd. Hyderabad.
6. Teaching Resource Material by INSDAG
7. Bureau of Indian Standards, IS800-2007, IS875-1987.
8. Steel Tables SP: 6(1) and SP: 6(6)

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-V

21CEU5CC2T
GEOTECHNICAL ENGINEERING

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	**ISE:** 40 marks
Practical: 2 hours per week, 1 Credits	**ESE:** 60 marks
	ICA: 25 marks
	POE: 50 Marks

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

1. Describe various index properties, and their interrelationship, characterize and classify the soil.
2. Estimate the permeability and seepage through soil mass by applying basic hydraulic flow principles.
3. Evaluate stress distribution within soil mass for various patterns of loading.
4. Determine shear strength along with laboratory process under various drainage conditions.
5. Assess compaction and consolidation settlement of soil for given loading conditions.
6. Determine earth pressure for earth retaining structure.

SECTION-I

Unit 1: Introduction **[6 Hrs]**

Definition of soil and soil engineering, Application areas of soil mechanics, 3- phase soil system.

Index properties of soil: - Terminology used in basic soil properties (Voids ratio, Porosity, Degree of saturation, Percentage air voids, air content, different densities & unit weights) and their interrelationship, Method for determination of field density viz. Sand Replacement and Core Cutter. Specific gravity and its determination methods, Density index.

Soil consistency: - Atterberg's limits and their significance.

Soil classification: - Soil classification based on particle size and consistency, Grain size distribution by mechanical & sedimentation analysis, I.S. classification system of soil, soil structure, and fabric.

Unit 2: Flow of water through soil **[8 Hrs]**

Permeability – head, gradient and potential, Darcy's law and its validity, Factors affecting permeability, Field and laboratory methods of determining permeability, seepage pressure, Quicksandondition, critical hydraulic gradient, Derivation of Laplace's equation, flow net and its application, Construction of flow net, Piping phenomenon, the concept of total, neutral & intergranular stress.

Stress Distribution in Soil: Boussineq's Equation for point load, Vertical pressure under uniformly loaded circular area and uniformly loaded rectangular area, Pressure bulb and its significance, Newmark's Chart.

Unit 3: Shear Strength **[8 Hrs]**

Concept of shear, Coulmob's theory and failure envelope, Total stress approach, effective stress approach and pore water pressure, Representation of stresses on Mohr's circle for different types of soil such as cohesive and cohesion less in terms of total stress & effective stress, Peak and Residual shear strength, Application of shear strength parameters in the field.

Different types of shear tests: - Unconsolidated Undrained (U-U), Consolidated Undrained (C-U), and Consolidated drained test (C-D). Choice of type of test, Box shear test, Triaxial compression test with pore pressures and volume change measurements, Unconfined compression test, Vane shear test, Sensitivity and thixotropy of cohesive soils, factors affecting shear strength.

SECTION-II

Unit 4: Compaction **[6 Hrs]**

Theory of compaction, factors influencing compaction, compacted density. Laboratory Standard and Modified compaction test, Method and measurement of field compaction, field compaction control.

Unit 5: Compressibility and consolidation: Compressibility **[8 Hrs]**

Definition, the compressibility of laterally confined soil, compression of sand and clay, e – p curve, e- log p curve, compression index. **Consolidation: -** Basic terminology, Terzaghi's theory of one-dimensional consolidation, consolidation test, determination of coefficient of consolidation, degree of consolidation, relevance of one-dimensional consolidation to field condition, time factor.

Unit 6: Earth pressure theory **[8 Hrs]**

Concepts, area of application, Earth pressure at rest, active and passive conditions. Rankine's and Coulomb's theory of earth pressure, Graphical Solution-Trial wedge method, Culman's method–Rehbhan's construction and modification. Critical depth of open cut in cohesive soil.

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Term work shall consist of at least eight of following experiments in the laboratory:

1. Specific gravity determination of coarse and fine gained soil
2. Particle size distribution- Mechanical sieve analysis, wet sieve analysis
3. Determination of Atterberg's consistency limits
4. Permeability- Determination of coefficient of permeability
5. Field density determination: Sand replacement & Core cutter method.
6. Proctor compaction test: Light & Heavy
7. Direct box shear test
8. Unconfined compression test
9. Tri-axial test
10. Laboratory Vane Shear Test.
11. One dimensional consolidation test

TEXT BOOKS:

1. Soil Mechanics and foundation Engineering- B.C. Punmia [Laxmi publications (Pvt) Ltd, New Delhi]
2. Geotechnical Engineering- Purushottam Raj [Tata Mcgraw hill company Ltd, New Delhi]
3. Basic and applied Soil Mechanics (Revised Edition) – Gopal Rajan and Rao A.S.R. (New Age, New Delhi. 1998)
4. Soil Mechanics and Foundation Engineering - Dr. K. R. Arora, [Standard Publication]
5. Soil Mechanics and Foundation Engineering -V.N.S. Murthy [UBS publishers and distributors, New Delhi]
6. Geotechnical Engineering- Kasamalkar B.J. [Pune Vidyarthi Griha Prakashan, Pune]
7. Geotechnical Engineering - C. Venkatachalam [New Age International (I) Ltd, New Delhi]
8. Principals of Geotechnical Engineering- Braja M. Das (Cengage Learning India Pvt. Ltd, New Delhi)

REFERENCE BOOKS:

1. Soil Mechanics in Engineering Practice - Terzaghi and Peck, John Wiley and sons, New York
2. Fundamentals of Soil Mechanics - Taylor D.W, [John Wiley, New York]
3. Soil mechanics in theory and practice- Alam Singh [Asian Publishing House, Bombay]
4. Soil Testing -T.W. Lambe [Willey Eastern Limited, New Delhi]
5. Geotechnical Engineering by Shashi K. Gulati & Manoj Datta, Tata McGraw Hill

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T. Y. B. Tech. Civil Engineering - Semester-V

21CEU5CC3T

HIGHWAY & TUNNEL ENGINEERING

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	ISE: 40 marks
Practical: 2 hour per week, 1 Credit	ICA: 25 marks
	ESE: 60 marks

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

1. Choose the ideal alignment for highways after a thorough understanding of planning and different surveys.
2. Design various geometric elements of the highway as per IRC standards.
3. Evaluate the pavement materials through various tests in the laboratory and design the crust thickness of pavements as per IRC standards.
4. Recognize different layers of pavement and illustrate the construction process and also suggest maintenance activities for flexible and rigid pavement
5. Select appropriate methods of tunnel construction in different types of soils.

SECTION-I

Unit 1: Introduction to Transportation Engineering: [7 Hrs]

Modes of transportation, their importance and limitations, and the importance of highway transportation.

Highway Development and Planning: Principles of Highway planning, Road development in India, Classification of roads, road network patterns, Planning Surveys. Salient features of road development plan 2021 and the present scenario of road development in India.

Highway Alignment and Surveys: Requirements, Engineering Surveys.

Unit 2: Highway Geometric Design: [8 Hrs]

Cross Section elements, carriageways, camber, stopping and overtaking sight distances, Sight distance at uncontrolled intersection Horizontal alignment-

Curves, design of superelevation, extra widening, transition curves, Setback distance, and design of vertical curves.

Unit 3: Highway Materials: **[6 Hrs]**

Properties of subgrade and pavement component materials, Tests on subgrade soils (CBR and Plate load tests), properties and requirements of road aggregates and bituminous materials, bituminous mix design by Marshall Method. Applications of Geosynthetics and Modified Binders in road construction.

SECTION-II

Unit 4: Pavement Design: **[9 Hrs]**

Types of pavements, Design parameters, Axle and Wheel load, tyre pressure, ESWL concept, EWL factors, IRC method of flexible pavement design based on CSA method using IRC-37-2018. Analysis of wheel load and temperature stresses of rigid pavement, joints, and Design of Rigid Pavement as per IRC-58-2015.

Unit 5: Highway Construction & Maintenance: **[10 Hrs]**

Specifications, construction steps, and quality control tests for Granular sub-base course, Water Bound Macadam, Wet Mix macadam, bituminous concrete pavement, Cement Concrete pavement, Surface and sub-surface drainage, maintenance of flexible and rigid pavement.

Unit 6: Tunnel Engineering: **[5 Hrs]**

Introduction to tunneling, size, and shape of tunnel and suitability, tunneling through soils, soft and hard rocks, tunnel lining, drainage and ventilation. Demonstration of Tunnel Construction using Tunnel Boring Machine (TBM).

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Name of Tests: -

A. Test on Aggregates:

1. Impact test on aggregate,
2. Abrasion Test on aggregate,
3. Crushing strength test on aggregate,
4. Soundness test on aggregate,
5. Shape test on aggregate

B. Test on Soil:

1. CBR and Compaction test on soil

C. Test on Bitumen:

1. Penetration test,
2. Ductility test,
3. Softening Point test,
4. Specific gravity test,
5. Flash and Fire point test and
6. Viscosity Test on Bitumen.

From the above tests, Minimum of 10 tests have to be performed and assignments on each unit based the on syllabus

D. Functional Evaluation of Pavement: Demonstration of Benkelman Beam Deflection Survey and Demonstration of road roughness survey by MERLIN and Bump Integrator

F. Filed Visits: Highway construction site, Hot Mix Plants, Pug Mill plants, RMC plants and quarry and crusher units.

TEXT BOOKS

1. Highway Engineering by C.E.G. Justo, A. Veeraragavan & S.K. Khanna., Nemchand Bros.
2. Harbour, Dock and Tunnel engineering By R. Shrinivasan, Charotar Publishing House.
3. Transportation Engineering by Subramanian. K.P Scitech Publications, Chennai.
4. Principles of Transportation and Highway Engineering By Rao, G.V., McGraw – Hill Publishing Company Limited, New Delhi.
5. Highway Engineering, Kadiyali L.R, Khanna Publishers, New Delhi

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

T. Y. B. Tech. Civil Engineering - Semester-V

21CEU5CC4T

HYDROLOGY AND WATER RESOURCES ENGINEERING

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	ISE: 40 marks
	ESE: 60 marks

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

1. Estimate runoff, based on rainfall data and watershed characteristics.
2. Estimate design flood for a civil engineering project.
3. Calculate the yield of open well and tube well for various types of aquifers using knowledge of ground water hydrology.
4. Elaborate National and State Water Policies.
5. Select the appropriate water application technique of irrigation, depending upon type of crop, soil moisture and water availability.
6. Select suitable soil & water conservation techniques for particular watersheds.

SECTION-I

Unit 1: Introduction to Hydrology **[7 Hrs]**

Definition, History, and importance of hydrology, The hydrological cycle, Weather and its precipitation potential. Precipitation: Forms and types of precipitation, Different methods of measurement, Factors affecting precipitation at a location, correcting precipitation data, Estimating missing data, Estimation of extreme values, Rain gauge network, Determination of average precipitation over the catchments, Analysis of precipitation data, Mass rainfall curves, Intensity-duration curves, Concept of depth-area- duration analysis, Frequency analysis.

Evaporation and Evapotranspiration: Factor affecting evaporation, Measurement, and control of evaporation upon reservoirs. Evapotranspiration- definition and measurement

Infiltration: Process of Infiltration, Factor affecting infiltration, Infiltration indices, Effect of infiltration on runoff and groundwater recharge.

Unit 2: Rainfall – runoff Relationship [6 Hrs]

Factors affecting runoff, Catchment yield calculations, Rainfall-runoff relationship Hydrograph: Base flow, Separation of base flow, Unit hydrograph – theory, assumptions and limitations, Derivation and use of unit hydrograph, S-curve hydrograph.

Unit 3: Stream gauging [5 Hrs]

Selection of a site, various methods of discharge measurements, Area velocity method, Slope Area method, S.W.F. and other modern methods.

Floods: Definition, Factors affecting, Estimation of peak flow, Rational and other methods, Design flood, hydrograph components, Recurrence period.

Unit 4: Ground-water Hydrology [5 Hrs]

Occurrence and distribution of ground water, Specific yield of aquifers, Movements of ground water, Darcy's law, Permeability, Safe yield of basin, Hydraulics of well under steady flow condition in confined and unconfined aquifers, Specific capacity of a well, Well irrigation: tube wells, open wells, their design and construction

SECTION-II

Unit 5: Water Resources Development in India and Maharashtra [6 Hrs]

Water Resources Development in India & Maharashtra: National water policy of India, Water Policy of Maharashtra State, Development of irrigation potential through five-year plans, Water resources potential of India, Water Resources development in India, Problems in water resources developments in country and Maharashtra state.

Inter basin transfer of water: Concept of inter basin transfer of water, proposed inter basin transfer of water from surplus regions of India to deficit regions of India, National perspective plan of India-Himalayan rivers component and peninsular rivers component

Unit 6: Irrigation: [6 Hrs]

Irrigation: Definition and necessity of Irrigation, Different systems of irrigation-Flow, Lift, Inundation, Storage. Sources of water-river, well, tanks.

Water Application Methods: Methods of lifting water and application of water to soils, Sprinkler, Drip, Basin, Furrow. Layout of Drip Irrigation System.

Lift Irrigation: Necessity, General Layout, Main Components of a lift irrigation scheme, Elementary design of Lift Irrigation Scheme.

Minor Irrigation System: Necessity and general layout of percolation tanks, Bandhara irrigation, Kolhapur type weirs

Unit 7: Soil and Crop Water requirement: [5 Hrs]

Soils: Types of Soils, Suitability of soils for different crops, Soil moisture, Wilting coefficient, Texture and physical structure, Harmful components in soil, Preparation of soil for irrigation.

Crop Water requirements: Cash crops and food crops, Water requirement of different crops, Duty and Delta, Factors affecting duty and delta, Crop Seasons in Maharashtra and India, Command Area- Gross, Culturable, Irrigable, Calculation of water required

Unit 8: Water Management: [5 Hrs]

Watershed Management: Need of Watershed management, Importance of soil and water conservation measures, Reservoir sedimentation. Techniques for Rainwater harvesting and ground water harvesting.

Water Management: Application of water, Water management and distribution, cooperative water users' organizations, Warabandi, Rotational applications, Assessment of canal revenue-Various methods.

Applications of Remote Sensing and Geographic Information Systems in Water Resources Engineering.

TEXT BOOKS

1. Irrigation Engineering and Hydraulic Structures-S. K. Garg, Khanna Publishers, Delhi.
2. Irrigation and Water Power Engineering- Dr. Punmia, Dr. Pande, Laxmi Publications.
3. Engineering hydrology- K. Subramanya, Tata McGraw- Hill Publishers.
4. Efficient Use of Irrigation Water-G. H. Sankara Reddi, Kalyani Publishers, Noida.
5. Water Management in India-J. V. S. Murthy.
6. Water Management, Conservation, Harvesting and Artificial Recharge- Dr. A. S. Patel, Dr. D. L. Shah, New Age International Publishers.
7. Hydrology and Water Resources-R. K. Sharma, Dhanpat Rai & Sons.

8. Fundamentals of Irrigation Engineering-Bharat Sing, Nem Chand & Bros, Roorkee.
9. Applied Hydrology, K.N. Muthreja, McGraw Hill Publications
10. Water Resources Engineering, PN Modi, Standard Publishers

REFERENCE BOOKS

1. Irrigation theory & Practice – Michael, Vikas Publishing House.
2. Irrigation Structures- Milos Holy-CBIP
3. Water Management-Jaspal Singh, M. S. Acharya , Arun Sharma .Pub- Himanshu Publication
4. Design of Minor Irrigation and Canal Structure- Satyanarayan and R. Murthy

WEBSITES

1. Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation: http://mowr.gov.in/policies-guideline/policies/national-water-policy
2. Maharashtra water resources regulatory authority: https://mwrra.org/
3. National Remote Sensing Center: https://www.nrsc.gov.in/
4. National Water Development Agency: http://nwda.gov.in

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-V

21CEU5CC5T

DESIGN OF CONCRETE STRUCTURES-I

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	ISE: 40 marks
	ESE: 60 marks

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

1. Design appropriate types of slabs for given loadings.
2. Analyze and design suitable types of beams for given conditions.
3. Design beams subjected to combined bending, shear and torsion.
4. Design continuous beams supported on more than two supports.
5. Analyze and design appropriate types of columns.

SECTION-I

Unit 1: Introduction **[6 Hrs]**

Philosophies of Design and their relative advantages and disadvantages, Types and classification of limit states, Characteristics strength and characteristics load, load factor, Partial safety factors. Limit State of Serviceability – Significance of deflection, I.S. Recommendations.

Unit 2: Design of Slabs (Limit state method) **[6 Hrs]**

One Way, one-way continuous, and Two-Way slabs with different end conditions as per IS code, cantilever slab

Unit 3: Limit state of Collapse (Flexure, Shear, and Bond) **[6 Hrs]**

Analysis and Design of singly and doubly reinforced rectangular sections.

Unit 4: Analysis and Design of Flanged Sections **[5 Hrs]**

Analysis and Design of Singly and doubly Reinforced T & L Beams for flexure.

SECTION-II

Unit 5: Design of Continuous beams [6 Hrs]

Design of Continuous beams by Limit State Method.

Unit 6: Limit State of Collapse (Torsion) [8 Hrs]

Behavior of R.C. rectangular sections subjected to torsion, Design of sections subjected to combined bending and torsion, combined shear and torsion, Design of beams for torsion.

Unit 7: Design of columns [8 Hrs]

Analysis and Design of axially and eccentrically (Uni-axial) loaded Circular, Square and Rectangular Columns, Introduction to biaxial bending of columns, Interaction diagrams, Circular columns with helical reinforcement.

NOTE:

1. IS: 456-2000 (Reaffirmed 2021) shall be allowed in In Sem Exam (ISE) and End Sem. Exam (ESE).
2. Unless otherwise mentioned separately, all the design should be by Limit State method.
3. Assignments - One assignment on each topic. Additional two assignments on analysis and design of R.C. members using suitable structural software.

TEXT BOOKS

1. Limit State Theory &Design –Karve & Shah Structures Pub., Pune
2. Reinforced Concrete Design (Limit State) - A.K.Jain
3. Reinforced Cement Concrete - B.C.Punmia
4. Design of R.C.C. structural elements by S.S. Bhavikatti (Volume I &II).
5. Design of Reinforced Concrete Structures by S. Ramamrutham

REFERENCE BOOKS

1. IS: 456-2000(Reaffirmed 2021)
2. Fundamentals of Reinforced Concrete- Sinha &Roy
3. Limit State Design of Reinforced Concrete - P.C. Varghese, Prentice Hall of India, New Delhi.
4. Handbook of Reinforced Concrete: SP-16

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-V

21CEU5CC6T

ENVIRONMENTAL ENGINEERING-II

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	ISE: 40 marks
Practical: 2 hour per week, 1 Credit	ICA: 25 marks
	OE: 25 marks
	ESE: 60 marks

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

1. Explain wastewater characteristics and collection system. Estimate wastewater flow rate and design flows for sewer. Design sewer.
2. Solve the problems on unit operations and processes for wastewater treatment. Analyze and design preliminary and primary treatment units.
3. Explain the activated sludge process (ASP) and biological filtration (TF). Design of ASP, TF oxidation ditch, and waste stabilization pond.
4. Elaborate decentralized treatment system, self-purification of stream and advances in wastewater treatment. Design septic tank. Estimate DO and deficit using Streeter-Phelp's equation.
5. Explain functional elements of solid waste management and processing techniques. Design sanitary landfill for area requirements.
6. Analyze meteorological elements and their relation to air pollution; air and noise pollution control equipment.

SECTION-I

Unit 1: Wastewater and Collection: [7 Hrs]

Wastewater: Sources, Flow rate and variations, Quantitative estimation, Characteristics Gravity sewer collection system: Nomenclature, Manhole, Pumping station, Design of sanitary and storm sewer, Computer application SEWERCAD

Unit 2: Introduction to Wastewater treatment: [7 Hrs]

Wastewater treatment: Philosophy, Unit operations and unit processes, Primary treatment: Screening, Grit removal, settling Biological/Secondary treatment: Fundamentals of aerobic and anaerobic treatment, Classification.

Unit 3: Aerobic Wastewater Treatment: [8 Hrs]

Aerobic attached growth: Conventional Trickling filter (TF) and modifications, Process design and operating parameters (TF), Aerobic suspended growth: Conventional Activated Sludge Process (ASP) and modifications, Process design and operating parameters (ASP), Operational problems (ASP), Process design of oxidation ditch and Waste stabilization pond.

SECTION-II

Unit 4: Decentralized treatment and Disposal: [8 Hrs]

Decentralized treatment: Concept, Septic tank and soakage pit, Anaerobic baffled reactor (ABR), Anaerobic filter (AF), Constructed wetland (CW), Fluidized aerobic bed Technology, Root zone Technology, Duckweed ponds, UASB, Typical system

Advances in wastewater treatment: Moving bed bioreactor (MBBR), Membrane bioreactor (MBR), Sequential Batch Reactor (SBR), Disposal of wastewater: Methods, Effluent standards, Stream pollution: Self- Purification (Stream rejuvenation), DO sag curve, Streeter Phelps's equation for point source, Stream classification, Sludge: Characteristics, thickening, dewatering, digestion, disposal.

Unit 5: Solid Waste: [6 Hrs]

Solid Waste: Characteristics, Generation, Collection and transportation Engineered systems for solid waste processing: Mechanical, Thermal, Biological Sanitary land fill: Location, Components.

Unit 6: Air and Noise pollution: [8 Hrs]

Air Pollution: Meteorological parameters, Ambient air quality monitoring, Air quality standards, Air pollution control: Approaches and equipment for particulate and gaseous pollutants, Noise pollution: Permissible limits of noise pollution, measurement of noise, Control of noise pollution.

INTERNAL CONTINUOUS ASSESSMENT (ICA)

The ICA includes practical work to find the characteristics of water and assignments on eachunit operations

(A) Experiments for the determination of the following (Min. 12)

1. pH value

2. Acidity & Alkalinity
3. Chloride content
4. Hardness
5. Turbidity
6. Residual Chlorine
7. Solids – Total, Suspended, dissolved, volatile and fixed Dissolved Oxygen
8. Most Probable Number
9. Optimum dose of alum by jar test
10. DO
11. BOD
12. COD
13. Sulphates
14. Oil & Grease
15. Demonstration of High-Volume Sampler

(B) Visit to wastewater treatment plant.

Internal Continuous Assessment (ICA) submission shall consist of journals containing

1. Above mentioned Experiments
2. Visit report describing wastewater treatment units of the plants visited.
3. Design of sewerage system by using software or programming.

TEXT BOOKS

1. Nathanson, J. A., "Basic Environmental Technology", PHI Learning private limited, 5th Edition, 2009.
2. Modi, P. N., "Wastewater Engineering" Standard Book House, 6th Edition, 2018.
3. Peavy H, S, Rowe D, R, and Tchobanoglous G, "Environmental Engineering", McGraw-Hill Book Company, Indian Edition, 2017.

REFERENCE BOOKS

1. Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 7th Edition, 2018.
2. "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 2013.
3. "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Housing and Urban Affairs

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-V

21CEU5CC7T

PLANNING & DESIGN OF PUBLIC BUILDING

Teaching Scheme:
Lectures: 1 hours per week, 1 Credit
Drawing: - 2 Hrs/Week, 1 Credit

Examination Scheme:
POE: 50 Marks
ICA: 25 Marks

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

1. Plan and design a "Public Building" according to requirements adhering to National Building Code norms and standards.
2. Prepare "Permission Drawing" for public buildings for obtaining building permission from competent authority by using suitable 'Computer Aided Drawing and Design' application software.
3. Plan and design appropriate building services layout for "Furniture requirement, Electrification points, Water supply and Drainage System" for a building as per standards norms by using suitable 'Computer Aided Drawing and Design' application software.
4. Prepare "Perspective drawing of the building" and "Line plan of any two Public Buildings" by using suitable 'Computer Aided Drawing and Design' application software.
5. Prepare a report on selected Public Building.

INTERNAL CONTINUOUS ASSESSMENT (ICA)

A. Preparation of drawings for any one public building by using AutoCAD

1) Permission Drawing
2) Furniture layout
3) Water supply and Drainage layout along with electrification layout
4) Perspective drawing of the building.

B. Line plan of any two public buildings by using AUTOCAD

C. Report on building project under (A) above.

D. Site visit for the type of public building selected for planning and designing for Internal Continuous Assessment (ICA) submission.

END SEMESTER EXAMINATION (Practical - Oral)

1. Practical examination shall be based on assessment of knowledge of students about planning skills and CADD drafting skills related to public building. (Maximum two hours shall be allotted to students to complete given task on CADD during Practical and viva Exam.)
2. In addition, an oral examination shall be based on Practical and ICA.

TEXT BOOKS

1. Building Construction: Arora and Bindra, Dhanpat Rai Publications
2. Building Design and Drawing – Y. S. Sane, Allies Book Stall
3. Principles of Perspective drawing- Shah, Kale, Patki, Tata McGraw Hill Publication Ltd, Delhi
4. Building Construction by Sushil Kumar, Standard Publishers Distributors, Delhi
5. Interior Design- Principles and Practice- M. Pratap Rao, Standard Publishers and Dist.,Delhi
6. Building Planning and Design by Kumar Swami and Kameshwar Rao, Charotar Publishing House.
7. Civil Engg. Drawing- by M. Chakraborty, Published by M. Chakraborty – Kolkata
8. Civil Engineering Drawing – by R.S.Malik, G.S.Meo, Computech Publication Ltd New Asian.
9. Learning 'AutoCAD' software –Omeru

REFERENCE BOOKS:

1. Building Construction by Mckay, W. B. & Mckay, J. M. ,Vol.III and IV, Donhead Publishing Limited
2. Modern Building Construction by Warland D. E., Vol. I and II, Pitman Publishing
3. Building Drawing – Shah, Kale, Patki, Tata McGraw-Hill Education
4. Built Environment by Shah, Kale, Patki, Tata McGraw-Hill Education
5. Construction science – by Edwin Walker, Selwyn Morgan, Hutchinson Educational
6. Time savers standards for buildings – Calendar Pub. McGraw Hill
7. Alternative Building Materials & Technology-by Jagdish ,Reddy, Rao Published by New Age International, New Delhi
8. Nuclear Reactor Materials by C. Smith, Addison- Wesley Pub.

9. Art in everyday life by Goldstein, Oxford Pub.
10. Planning by E and OE – Pub. London Illiffe and Sons Ltd.
11. Inside Outside- Magazine issues.
12. Maintenance of Building- by A.C. Panchdhari, Published by New Age International, New Delhi.
13. Materials for Nuclear Power Reactors- by Hausner, Henry H. And Roboff, Stanley B., Reinhold Publishing Corp
14. Environment and services-by Peter Burberry, Mitchells Building Series
15. Development Control Rules- Building Byelaws of Local Authority.

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-V

21ALU5SA9T

SELF LEARNING - H.S.S. COURSE- ECONOMICS

Teaching Scheme:

Credits: 1 Credits

Examination Scheme:

ESE: 50 marks

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

1. Identify the Basic Economic problems, Resource Constraints
2. Apply various theories of economics for economic growth
3. Identify causes of Inflation consequence and remedies
4. To assess the impact of International Trade, foreign exchange on Indian economy

Course Contents

Unit 1: Introduction

History of Economic thought, Basic Economic problems, Resource Constraints and Welfare maximization, Nature of Economics: Positive and Normative Economics, Micro and Macro Economics, Basic concepts in Economics, The role of State in economic activity, Market and Government failures, New economic Policy in India.

Unit 2: Theories of Economics

Theory of utility and consumer's choice, Theories of Demand, supply and market equilibrium, Theories of firm, production and costs, Market structures, Perfect and imperfect competitions, oligopoly, monopoly

Unit 3: Macroeconomics

An overview of Macroeconomics, measurement and determination of national income, Consumption, saving and investment.

Unit 4: Banking & Inflation

Commercial and Central Banking, Relationship between money, output and prices. Inflation causes, consequences and remedies.

Unit 5: International Influences on Economics

International Trade, foreign exchange and balance payments, stabilization policies, Monetary, Fiscal and exchange rate policies.

TEXT BOOKS

1. Economics: P.A. Samuelson & W.D Nordhaus (McGraw Hill, New York, 1995.)
2. Modern Microeconomics: A. Koutsoyiannis (Macmillan,1975)

REFERENCE BOOKS

1. Microeconomics: R. Pindyck and D.L. Rubinfield. (Macmillan New York, 1989
2. Microeconomics: Gordon, 4th edition, Little Brown & Co., Boston,1987.
3. The Organization of Industry: William F. Shughart II, Richard D. Irwin, Illinois, 1990.

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-V

21ALU5SB9T

SELF LEARNING - H.S.S. COURSE

INTELLECTUAL PROPERTY RIGHTS FOR TECHNOLOGY DEVELOPMENT AND MANAGEMENT

Teaching Scheme:	**Examination Scheme:**
Credits: 1 Credits	ESE: 50 marks

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

1. Explain the importance of the intellectual property rights associated with research and
2. intellectual works
3. Explain the overview of process of acquiring the patents and copyrights for the innovative works.
4. Elaborate the role of Indian IPR system and role of WTO in protecting Intellectual Property Rights
5. Explain how to avoid the plagiarism in the thesis, research papers etc.

Course Contents

Unit 1: Introduction to IPR

Dynamics of Knowledge evolution, creation of ownership domains in the knowledge space using various instruments of IPR

Unit 2: IPR for Engineers and Managers

Outlines concepts of confidentiality and information security, explores their role in technology development and transfer integrating Intellectual Property in project planning, execution & commercialization

Unit 3: IPR and R&D

Discussion on the shifting paradigms of R&D and their linkage to IPR, Introduction to concepts of Valuation of IP & Value Realization

Unit 4: IPR for India

Comparison the Indian IPR system with international IPR frameworks especially in the context of WTO, followed by a few sessions on IPR litigations both for the enforcement of rights and business strategy

Unit 5: IPR and Contemporary Issues

Discussion on contentious issues of current interest such as Biotechnology and Intellectual

Property, Protection of Traditional Knowledge, IPR and Electronic Commerce, TRIPS and Access to Medicines, Copyright issues in creative works, etc.

TEXT BOOKS

1. Prabuddha Ganguli: Intellectual Property Rights Unleashing the Knowledge Economy. Tata McGraw Hill, New Delhi, 2001.
2. Prabuddha Ganguli: Gearing Up for Patents The Indian Scenario. Universities Press India Ltd., Hyderabad, 1998.
3. P. Narayan: Patent Law. Eastern Law Co., Calcutta.

REFERENCE BOOKS

1. Global Dimensions of Intellectual Property Rights in Science and Technology, Author: National Research Council , National Academies Press, 1993.
2. Technology Transfer: Intellectual Property Rights, C Sri Krishna, ICFAI University press (2008) Illinois, 1990.

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-V

21ALU5SC9T

SELF LEARNING-H.S.S. COURSE-

INTRODUCTION TO SOCIOLOGY

Teaching Scheme:	**Examination Scheme:**
Credits: 1 Credits	ESE: 50 marks

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

1. Interpret the effect of various social phenomena on sociology
2. Elaborate the role of urbanization on the society.
3. Evaluate the need of social intuition for better society.
4. Evaluate the role of modernization, industrialization, environmental/ecological changes in the development of society.

Course Contents

Unit 1: Introduction to Sociology

What is sociology, some sociological concepts: social structure, status, role, norms, values etc., Socialization, and culture and change, social stratification - various approaches and concept of social mobility

Unit 2: Population and Sociology

Population and society - Trends of demographic change in India and the world, Human Ecology, Trends of Urbanization in the developing countries and the world.

Unit 3: Social Institutions

Major social institutions - Family and marriage, caste and tribe and organizations:

i. Formal organization (bureaucracy)

ii. Informal Organization

Unit 4: Social Changes

Processes of social change- Modernization (including Sanskritization), industrialization, environmental/ecological changes and development

Unit 5: Social Movements

Social movements - protest movements, reformist movement and radical movements in India

TEXT BOOKS

1. Sociology, L. Broom, P. Selznick and D. Dorrock, 11th Edn. 1990 (Harper International).
2. Sociology: Themes and Perspectives, M. Haralambos, Oxford University Press, 1980.
3. General Introduction to Sociology, Guy Rocher, A. , MacMillan, 1982.

REFERENCE BOOKS

1. Social movements in India, vols. 1-2, 1984, M.S.A. Rao, Manohar Publications.
2. Society in India, David Mandelbaum, 1990, Popular Publications.
3. Social change in modern India, M.N. Srinivas, 1991, Orient Longman Publications.

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-V

21ALU5SD9T

SELF LEARNING - H.S.S. COURSE-

STRESS AND COPING

Teaching Scheme:	**Examination Scheme:**
Credits: 1 Credits	ESE: 50 marks

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

1. Explain nature of stress and identify various sources of stress
2. Elaborate the effects of medical, psychological, and behavioral stress.
3. Explain how social support can mitigate the stress.
4. Explain various stress management techniques.

Course Contents

Unit 1: -Introduction to Stress

Concept of stress-current and historical status, the nature of the stress response

Unit 2: Sources of Stress

Common sources of stress biological, personality and environmental

Unit 3: Coping with Stress

Coping styles defensive behaviors and problem-solving. Consequences of stress - medical, psychological and behavioral

Unit 4: Social Support

The role of social support in mitigating stress

Unit 5: Introduction to Stress Management

Stress management techniques-relaxation, meditation, cognitive restructuring, self-control, bio- feedback and time management, Preparing stress profile of a student

TEXT BOOKS

1. Walt, S. "Stress Management for Wellness". Harcourt Brace & Jovanovich, N.York, 1994.
2. Girdano and G. Everly., "Controlling Stress and Tension", Prentice-Hall, 1986.
3. Monat and R. Lazarus, "Stress and Coping: An Anthology", Columbia Univ. Press, 1985.

REFERENCE BOOKS

1. Weisman, "The Coping Capacity", Human Services Press, 1984.
2. Stress and Coping: The Indian Experience, D.M. Pestonjee, SAGE India; Second edition (1998).

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-V

21ALU5SE9T

SELF LEARNING - H.S.S. COURSE-

PROFESSIONAL ETHICS & HUMAN VALUE

Teaching Scheme:	**Examination Scheme:**
Credits: 1 Credits	ESE: 50 marks

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

1. Explain importance of human values in modern society.
2. Explain how to integrate engineering ethics in their professional practice.
3. Explain about safety measures, responsibility and professional rights in professional Practice.
4. Explain the code of ethics of Global organizations such as ASME, ASCE, and IEEE.

Course Contents

Unit 1: Human Values

Morals, Values and Ethics, Integrity, Work Ethics, Service Learning, Civic Virtue, Respect for others, Living Peacefully, Caring, sharing, Honesty, Courage, Valuing Time, Cooperation, Commitment, Empathy, Self-Confidence, Character, spirituality

Unit 2: Engineering Ethics

Senses of engineering ethics, Variety of Moral Issues, Types of inquiry, Moral Dilemmas Moral Autonomy, Kohlberg's Theory, Gilligan's Theory, Consensus and Controversy, Models of Professional Roles, Theories about Right Action, Self Interest, Customs and Religion.

Unit 3: Safety, Responsibilities and Rights

Safety and Risk, Assessment of safety and Risk, Risk Benefit Analysis and Reducing Risk, The Three Mile Island and Chernobyl Case Studies.

Collegiality and Loyalty, Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Whistle Blowing, Professional Rights – Employee Rights, Intellectual Property Rights (IPR) – Discrimination

Unit 4: Global Issues

Multinational Corporations, Environmental Ethics, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Sample Code of Ethics of ASME, ASCE, IEEE, Institution of Engineers (India), etc.

TEXT BOOKS

1. Bayles, M.D.: Professional Ethics, California: Wadsworth Publishing Company, 1981.
2. Koehn, D.: The Ground of Professional Ethics, Routledge, 1995.
3. R.S. Naagarazan, A Text Book of Professional Ethics & Human Values, New Age International, 2006

REFERENCE BOOKS

1. Camenisch, P.F.: Grounding Professional Ethics in a Pluralistic Society, N.Y.: Haven Publications, 1983.
2. Wuest, D.E.: Professional Ethics and Social Responsibility, Rowman & Littlefield, 1994.

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6CC1T

FOUNDATION ENGINEERING

Teaching Scheme:
Lectures: 3 hours per week, 3 Credits

Examination Scheme:
ISE: 40 marks
ESE: 60 marks

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

1. Evaluate bearing capacity of soil by various analytical and experimental approaches by obtaining the data from soil exploration.
2. Perform geotechnical design of shallow foundation such as isolated footing, combined footing, raft foundation.
3. Apply suitable ground improvement techniques for construction of footing in difficult soil.
4. Perform geotechnical design of deep foundation such as Pile foundation and Caisson foundation
5. Investigate slope stability of embankments

SECTION-I

Unit 1: Introduction: **[06 Hrs]**

General requirements for satisfactory performance of foundations.

Soil Exploration: - Necessity, Planning, Exploration methods, Different types of boring- Hand and continuous flight augers, Wash boring, Rotary drilling. Soil sampling- Disturbed and Undisturbed. Rock drilling and sampling. Core barrels, Core boxes, Core recovery, RQD.

Unit 2: Bearing Capacity Analysis: **[08 Hrs]**

Bearing capacity – Ultimate, safe and allowable. Modes of failure, Terzaghi's bearing capacity equation with derivation, I S code method of bearing capacity (IS 6403 -1981), Effect of water table, Eccentricity of load.

Field Test for Bearing Capacity Evaluation: - Plate load test, Standard Penetration test and Pressure meter test. Test procedures and limitations.

Foundation Settlement: Immediate settlement – computations as per IS 8009 – 1976 (part–I) approach and from plate load test observations. Consolidation settlement, Total settlement, Differential settlement, Tolerable settlement, Angular distortion.

Unit 3: Foundation Construction in Difficult Soil: [09 Hrs]

Guide lines and care to be exercised in weak and compressible soil, Expansive soil, Collapsible soil, Corrosive soils

Ground Improvement Techniques: - Pre compression, Sand drains, Vibro-floatation, Grouting, Soil reinforcement Foundations on filled up soils. Contamination of soils and foundation problems.

Geotextiles and its applications: - Geotextiles- Definition and Types, Functions of Geotextiles, Different applications in Civil Engineering (Roads, Railways, Embankments, Earth Retainment, Erosion control etc.)

SECTION-II

Unit 4: Shallow foundations: [06 Hrs]

Design of Isolated, Combined, Strap footing (Rigid analysis), Raft foundations (Conventional method), Floating foundations (RCC design is not expected)

Unit 5: Deep foundation [08 Hrs]

Pile foundation: Classification, Single pile capacity for RCC cast in situ pile in Cohesive, non-cohesive and mixed soils by Static method, Dynamic formulae, Negative skin friction. Under reamed piles- equipment, construction and precautions. Load carrying capacity of pile group, Group action of piles- Spacing of piles in a group, group efficiency- empirical formulae.

Caisson Foundations: Box, Pneumatic, open (well) caissons, Shapes of well, components. Forces on caisson, grip length, well sinking, practical difficulties and remedial measures

Unit 6: Cofferdams: [04 Hrs]

Various Types, Cell fill material, Stability of cellular cofferdam

Sheet Piles: Classifications, Design of cantilever sheet pile in cohesion less (approximate method) and cohesive soils. Design of anchored sheet pile by free earth support method

Unit 7: Slope Stability **[04 Hrs]**

Stability of finite slopes- slip circle method, Semi graphical and graphical methods- Swedish slip circle method, Method of slices, Friction circle method. Fellenius construction to locate critical slip center, Stability No and its use.

FIELD TESTS

A) Field tests: -

1. Standard penetration test
2. Plate Load test

B) Visit to foundation construction sites and preparation of report.

C) Laboratory work: -

1. Swelling pressure test
2. Vane shear test

TEXT BOOKS

1. Soil Mechanics and foundation Engineering -B.C. Punmia (Laxmi publications Pvt. Ltd, New Delhi)
2. Geotechnical Engineering- Purushottam Raj (Tata Mcgraw hill company Ltd, New Delhi)
3. Principals of Foundation Engineering – Braja M. Das (Cengage Learning India Pvt. Ltd, New Delhi)
4. Geotechnical Engineering - C. Venkatachalam (New Age International Ltd, New Delhi)
5. Soil mechanics and foundation engineering- V.N.S. Murthy (UBS publisher's and distributers, New Delhi)
6. Foundation Design Manual- Dr. N.V. Nayak (Dhanpat Rai and Sons)
7. Foundation Engineering- Kasamalkar B.J. (Pune Vidyarthi Griha, Pune)
8. SP36-1 Compendium of Indian Standards on Soil Engineering Part 1
9. SP36-2 Compendium of Indian Standards on Soil Engineering Part 2

10. Design of sub structure- Swami Saran (Oxford and IBH Publications)

REFERENCE BOOKS

1. Foundation analysis and design- Bowles J. E. (Tata McGraw hill company Ltd New Delhi)
2. Foundation design and construction- Tomlinson (M.J. English Language Book Society, Essex)
3. Foundation Design- Teng W.C, (Prentice Hall publications)
4. Soil mechanics in theory and practice- Alam Singh, (Asian Publishing House, Bombay)

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6CC2T

HYDRAULIC STRICTURES AND WATER POWER ENGINEERING

Teaching Scheme:
Lectures: 3 hours per week, 3 Credits

Examination Scheme:
ISE: 40 marks
ESE: 60 marks

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

1. Plan and design the reservoirs depending upon the water resources potential.
2. Analyze and design Gravity dams and Earth dams (Simple Designs).
3. Elaborate the design principles of Arch dams.
4. Carry out Hydraulic Design of spillways.
5. Select appropriate method of river training depending upon river characteristics.
6. Estimate water power potential at a site.

SECTION-I

Unit 1: Dams and Reservoir Planning **[05 Hrs]**

Dams – Necessity, types of dams, selection of site for dams, selection of type of dam, Introduction to dam instrumentation

Planning of Reservoirs: Storage calculations, Control levels, silting of reservoirs, reservoir sedimentation surveys, reservoir losses. Use of remote sensing for reservoir sedimentation surveys.

Unit 2: Gravity and Arch Dams **[08 Hrs]**

Gravity Dams - Forces acting on dam, design criteria, theoretical and practical profile, high and low dam, stability calculations, materials and methods of Construction, Galleries, joints, Dam Instrumentation, Computer Application for Design of Dam. Decommissioning of dams

Arch Dams – Types, Layout of Constant angle and Constant radius arch dam, Forces acting on arch dams.

Unit 3: Earth Dams: **[05 Hrs]**

Components and their functions, Design Criterions; Seepage through and below earth dam, Application of Slip circle method, Inverted Filters, Downstream Drainage, relief wells, Construction of earth dam

Unit 4: Spillways and Outlets through Dams **[05 Hrs]**

Spillways: Necessity and different types, factors affecting choice and type of spillway, elementary hydraulic design, jump height and tail water rating curve, energy dissipation below spillway, gates for spillway. Spillway operations for different discharge values.

Outlets through Dams: types and energy dissipation in outlets transition.

SECTION-II

Unit 5: Weirs on Permeable Foundations: **[06 Hrs]**

Weirs on Permeable Foundations: Theories of seepage, Bligh's creep theory, Khosla's theory of exit gradient, Piping and undercutting, Concept of flow net etc. Kolhapur type weirs- working principles, suitability and construction.

Unit 6: Canals and Canal Structures **[06Hrs]**

Canals: Types, Alignment, Design – Kennedy's and Lacey's Silt theories, Canal losses, Typical canal sections, canal lining – Necessity and types, Economics of canal lining.

Canal Structures (Introduction): Cross drainage works and canal regulatory works – Aqueduct, Culvert, Super passage, Level Crossing, Cross and Head regulator, Canal Siphon, Canal Escape, canal fall, canal outlets

Unit 7: River Training Works ad Water logging **[05 Hrs]**

River and River Training Works: Types of rivers, Meandering phenomenon, Types of river training works, river navigation.

Water Logging and Drainage: Causes, effects, preventive and curative measures, alkaline soils, soil efflorescence, drainage arrangements

Unit 8: Hydropower Engineering **[05 Hrs]**

Elements of Hydropower Engineering: Power crisis and competing uses of water, need of harnessing solar energy. Types of water power plants, small hydropower plants, layout and components of each type, Intakes, Conveyance system, Surge tanks, Power house types, components and layout, tail race. Managing power demand using various sources of power

TEXT BOOKS:

1. Irrigation Engineering – S. K. Garg , Khanna Pub. Delhi
2. Irrigation and Water Power Engineering - Priyani , Charoter pub. House, Anand
3. Irrigation and Water Power Engineering – Punmia, B. C.
4. Irrigation – Bharat Singh, NEW CHAND & bros. Roorkee
5. Irrigation Engineering Vol. I – Varshhey and Gupta
6. Engineering Hydrology - K. Subramanya
7. Design of Canals – Circular of Government of Maharashtra, 18 February 1995
8. Irrigation Water Power & Water Resource Engineering, Arora, Standard Publishers

REFERENCE BOOKS:

1. Design of Small Dam – U. S. B. R., OXFORD & IBH pub.co.
2. Engineering for Dam Vol. I, II, III – Justinn, Creager and Hinds
3. Design of Hydraulic Structures Vol. I & II – Leliavsky
4. River Behavior, Management and Training - CBIP Publication

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6CC3T

DESIGN OF CONCRETE STRUCTURES – II

Teaching Scheme:
Lectures: 3 hours per week, 3 Credits
Practical: 2 hours per week, 1 Credit

Examination Scheme:
ISE: 40 marks
ICA: 25 marks
ESE: 60 marks

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

1. Analyze and design, R.C.C. Stairs and Column Footings.
2. Analyze and design, R.C.C. Retaining walls and Water tanks.
3. Analyze Pre stress concrete sections.
4. Determine loss of Pre stress and perform the design of Pre stress Beams.
5. Analyze and perform the design of the End Blocks of post-tensioned P.S.C. girder.

SECTION-I

Unit 1: Staircases **[06 Hrs]**

Types of stairs, design of simply supported and Dog-legged stairs, Open well stairs with solid waist slab.

Unit 2: Analysis and Design of Column Footings **[05 Hrs]**

Design of isolated square and rectangular column footing, column footings subjected to eccentric load.

Unit 3: Analysis and design of retaining wall **[05 Hrs]**

Analysis and Design of cantilever and counterfort retaining walls

Unit 4: Design of water tank (Working Stress method) **[06 Hrs]**

Design criteria, permissible stresses, Design of circular, rectangular GSR by IS code method.

SECTION-II

Unit 5: Pre-stressed concrete **[05 Hrs]**

Introduction, concepts, systems and methods of pre-stressing.

Unit 6: Analysis of Symmetrical and unsymmetrical sections **[04 Hrs]**

Analysis of Symmetrical and unsymmetrical sections, thrust line, cable profiles.

Unit 7: Losses in pre-stress **[04 Hrs]**

Losses in pre-stress. - Pre & Post tensioned members.

Unit 8: Design of Pre-stressed concrete beam **[05 Hrs]**

Design of rectangular and Symmetrical I section.

Unit 9: End Block **[05 Hrs]**

Analysis and design of end blocks by various methods, Stress concentration.

Note: IS: 456-2000 (Reaffirmed 2021) and IS 3370 (Part II & IV) shall be allowed in University Exam. All designs shall be by Limit State Method unless otherwise mentioned.

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Assignments on each topic of above syllabus. Additional one assignment on analysis and design of R.C. component using suitable structural software.

TEXTBOOKS

1. Design of R.C.C. structural elements - S.S. Bhavikatti (Volume I & II).
2. Design of Reinforced Concrete Structures - S. Ramamrutham
3. Reinforced Cement Concrete - B.C. Punmia
4. Reinforced Cement concrete - Jain Vol.I & II
5. Prestressed Concrete – N. Krishnaraju.
6. Prestressed Concrete – P. Dayaratnam
7. Prestressed Concrete – S. Ramamrutham

REFERENCEBOOKS

1. IS: 456-2000 (Reaffirmed 2021) and IS 1343-2012 , IS 3370 (Part I to IV) -2021
2. Prestressed Concrete – T.Y.Lin John Willey & sons, Newyork.
3. Prestressed Concrete – Sinha & Roy, S.Chand & Co., New Delhi
4. Prestressed Concrete – Leon Hardt.
5. Reynolds's reinforced concrete Designer's Handbook
6. Limit State Design of Reinforced Concrete - P.C. Varghese, Prentice Hall of India, New Delhi.
7. Handbook of Reinforced Concrete: SP-16

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6CC4T:
PRINCIPLES OF MANAGEMENT AND QUANTITATIVE TECHNIQUES

Teaching Scheme:
Lectures: 3 hours per week, 3 Credits
Practical: 2 hour per week, 1 Credit

Examination Scheme:
ISE: 40 marks
ICA: 25 marks
OE: 25 marks
ESE: 60 marks

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

1. Demonstrate decision making and communication as a member of a team as well as Lead a team for effective management of construction projects.
2. Apply the Optimization techniques for decision making in construction industry.
3. Explain the lean construction technique and its use in construction industry
4. Carry out ABC analysis, break even analysis and calculate EOQ and Inventory costs for construction project.
5. List the various types of master libraries in the ERP system.
6. Use Statistical Methods and Control charts (X, R, p, c charts) for quality control of materials and workmanship in Civil Engineering projects.

SECTION-I

Unit 01: Definition and Functions of Management; Planning: [04 Hrs]

Process of planning, Management by objectives; Organizing: Formal and informal organization, centralization, decentralization, line, line and staff, functional organization; Leading, directing, controlling and coordination; Communication process, motivation

Unit 02: Importance of Decision Making, steps in decision making [10 Hrs]

Decision under certainty: Linear Programming, Formulation of simple L-P model, Graphical method, Simplex method, Duality.

Application of Linear Programming in 'Transportation Problems': North-West corner method, least cost method, Vogel's Approximation method (Only Initial Basic Feasible. Solution) and Application of Linear Programming in 'Assignment problems.

Unit 03: Decision under uncertainty: **[04 Hrs]**

Wald's, Savage, Hurvitz and Laplace criterion of optimism and regret, expected monitory value, Theory of games (dominance pure and mixed strategy).

Decision under risk: Decision tree.

Unit 04: Lean Construction and Sampling Work Technique: **[05 Hrs]**

Introduction to Lean Construction. Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).

Introduction to Sampling/ Work Sampling; Survey/ Foreman delay survey; Value Stream/ Process Mapping.

SECTION-II

Unit 05: Inventory control: **[07 Hrs]**

Introduction, inventory cost, EOQ analysis, ABC analysis, safety stocks. Break even analysis

Unit 06: Construction ERP: **[08 Hrs]**

Benefits, best practices: ISO Documents, Responsibilities, Document Directory Structures, Safety Measures, Approval system for Purchase, Work Orders and Billing, User permissions, The master libraries in the ERP system – Resources Master Library, Construction Activity Specifications Master Library

Unit 07: Unit Quality control: **[07 Hrs]**

Concept, Statistical Methods, Control charts (X, R, p, c charts)

INTERNAL CONTINUOUS ASSESSMENT (ICA)

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

TEXT BOOKS

1. A Textbook of Organizational Behaviour, CB Gupta, S. Chand Publications
2. Construction Engineering & Management, S.C. Sharma & S.V. Deodhar, Khanna Book Publishing
3. Optimization Techniques, S.S. Rao, Wiley Eastern India
4. Operation Research, Hamdy A. Taha, Operation Research, Prentice Hall of India, New Delhi, 8th Ed.2011
5. Store Management, Menon K. S., Store Management, McMillan Co. New Delhi, 2nd Ed. 1998.
6. Statistical Quality Control, E. L. Grant, Statistical Quality Control, Wiley International Education, 6th Ed.
7. Udo Linden, Mrunalini Kulkarni, Hit-Office Construction ERP technical manual, Engineering Design Software and Services Pvt. Ltd., Pune, April 2018 Edition.

REFERENCE BOOKS

1. Total Quality Management, Ponia & Sharma, Khanna Publishing House, Delhi
2. Engineering Management: Industrial Engineering & Management, S.C. Sharma, Khanna Publishing House, Delhi
3. Principles and Practice of Management, Prasad, L.M, Sultan Chand
4. Organizational Behaviour, L.M. Prasad, Sutan Chand and Sons.
5. Handbook of Construction Management, Joy PK, Macmillan
6. Construction Project Management, Jha, Pearson
7. Total Quality Management, Gopal, PHI Publications
8. Industrial Engineering & Operations Management, S.K. Sharma. S.K. Kataria & Sons
9. Principles of Operation Research: Prentice Hall of India, 2nd Ed.1925,Wagner H. M.
10. Operation Research: Shaum's outline series, Richard Bronson Govindsami N., Tata McGraw Hill , 2nd Ed.2004
11. Material Management, Gopal Krishnan, Sudeshan,
12. Handbook of Quality Control, Juran J. M., A. B. Godfrey, Mc Graw- Hill

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6CC5T

RAILWAY, AIRPORT & HARBOUR ENGINEERING

Teaching Scheme:
Lectures: 3 hours per week, 3 Credits

Examination Scheme:
ISE: 40 marks
ESE: 60 marks

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

1. Acquires capability of choosing alignment and also designing geometric aspects of railway track.
2. Understand the working principle of point or switch and design the simple left-hand or right-hand turnout.
3. Illustrate different types of signals and explain the working principles of the railway interlocking system.
4. Decide the orientation of the runway by the wind rose diagram and design the length and geometric features of the runway and taxiway respectively.
5. Explain the various features in Harbours and Ports, their construction, coastal protection works, and coastal Regulations to be adopted.

SECTION-I

Unit 1: Railway Planning and Design: **[8 Hrs]**

Significance of Road, Rail, Air, and Water transports – Coordination of all modes to achieve sustainability – Elements of the permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, Various resistance and their evaluation, Hauling capacity, Tractive effort, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, superelevation, widening of gauge on curves.

Unit 2: Points and Crossings: **[8 Hrs]**

Important terms, crossings, types of crossings, switch, types of switches, Number and angle of crossings, Layout of Turn-out, Design of Turnout.

Unit 3: Signaling and Interlocking: **[6 Hrs]**

Signaling and Interlocking: Objects of signaling, types of signals, Interlocking, and devices used in interlocking. Modern Signaling methods.

SECTION-II

Unit 4: Airport Planning: **[8 Hrs]**

Air transport characteristics-airport classification-airport planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations, Typical airport layouts, Case studies, Parking and circulation area.

Unit 5: Airport Design: **[8 Hrs]**

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

Unit 6: Dock and Harbours Engineering: **[7 Hrs]**

Definition of Basic Terms: Harbor, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Dredging – Maintenance of Ports and Harbours – Navigational aids.

TEXT BOOKS

1. Railway Engineering by Satish Chandra and Agarwal M.M., Oxford University Press, New Delhi
2. Airport Engineering by Khanna & Arora – Nemchand Bros, New Delhi.
3. Docks and Harbour Engineering by Bindra S.P. – Dhanpathi Rai & Sons, New Delhi.
4. RDSO Codes

REFERENCES

1. 'Railway Engineering' by Saxena & Arora – Dhanpat Rai, New Delhi.
2. 'Transportation Engineering Planning Design' by Wright P.H. & Ashfort N.J. – John Wiley & Sons.
3. 'Airport Engineering' by Virendra Kumar, Dhanpat Rai Publishers, New Delhi.
4. 'Transportation Engineering' by Srinivasa Kumar R, University Press, Hyderabad
5. Railway and track Engineering- by Mundrey J.S.- Tata McGraw-Hill Education
6. Docks and Harbour Engineering Oza, Charotar Publication House

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6E16T

CORE ELECTIVE-I: MASONRY STRUCTURES

Teaching Scheme:
Lectures: 3 hours per week, 3 Credits

Examination Scheme:
ISE: 40 marks
ESE: 60 marks

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

1. Select various types of masonry units based on their properties.
2. Classify defects and crack in masonry and suggest remedial measures.
3. Apply various formulae for finding compressive strength of masonry units.
4. Determine permissible stresses and design criteria as per IS: 1905 and SP-20.
5. Design different types of masonry walls for different load considerations.

SECTION-I

Unit 1: Masonry Units, Materials, types and masonry construction [10 Hrs]

- Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.
- Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

Unit 2: Permissible stresses [5 Hrs]

Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

Unit 3: Design Considerations [7 Hrs]

Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars. Design criteria,

design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers

SECTION-II

Unit 4: Design of walls subjected to concentrated axial loads [8 Hrs]

Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.

Unit 5: Design of walls subjected to eccentric loads [7 Hrs]

Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.

Unit 6: Design of laterally and transversely loaded walls [7 Hrs]

Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels and slabs. In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.

TEXT BOOKS

1. Henry, A.W., "Structural Masonry", Macmillan Education Ltd., 1990.
2. Dayaratnam P, "Brick and Reinforced Brick Structures", Oxford & IBH, 1987.
3. M. L. Gambhir, "Building and Construction Materials", Mc Graw Hill education Pvt. Ltd.

REFERENCE BOOKS

1. IS 1905–1987 "Code of practice for structural use of un-reinforced masonry-(3rd revision) BIS, New Delhi.
2. SP 20 (S&T) – 1991, "Hand book on masonry design and construction **(1st** revision) BIS, New Delhi.

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6E26T

CORE ELECTIVE-I: STRUCTURAL ANALYSIS BY MATRIX METHODS

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	ISE: 40 marks
	ESE: 60 marks

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

1. Describe the concepts of flexibility and stiffness method of analysis for simple problems.
2. Analyze continuous beams, rigid frames and trusses by using element flexibility method.
3. Analyze continuous beams, rigid frames and trusses by using element stiffness method.
4. Analyze continuous beams, trusses by direct stiffness method.
5. Evaluate secondary stresses

SECTION-I

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

Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, flexibility and stiffness matrices of beam and truss elements.

Unit 2: Element Flexibility Method: **[08 Hrs]**

Force transformation matrix, global flexibility matrix, analysis of continuous beams, rigid frames and trusses.

Unit 3: Element Stiffness Method: **[07 Hrs]**

Displacement transformation matrix, global stiffness matrix, analysis of continuous beams, rigid frames and trusses.

SECTION-II

Unit 4: Effects of Temperature Changes and Lack of Fit: **[06 Hrs]**

Related numerical problems by flexibility and stiffness method as in Unit 2 and Unit 3

Unit 5: Direct Stiffness Method Beams: **[09 Hrs]**

Local and global coordinates systems, global stiffness matrices of beam, analysis of continuous beams**.**

Unit 6: Direct Stiffness Method Trusses: **[09 Hrs]**

Local and global coordinates systems, global stiffness matrices of truss element. Analysis of trusses.

TEXT BOOKS

1. Weaver W. and Gere J. H., "Matrix Analysis of Framed Structures", CBS Publications, New Delhi.
2. Rajasekaran S., "Computational Structural Mechanics", PHI, New Delhi.
3. Madhujit Mukhopadhay and Abdul Hamid Sheikh, "Matrix and Finite Element Analysis of Structures", Ane Books Pvt. Ltd.

REFERENCE BOOKS

1. Godbole P. N. et.al, "Matrix Method of Structural Analysis", PHI ltd, New Delhi.
2. Pundit and Gupta, "Theory of Structures Vol II", TMH publications, New Delhi
3. A K Jain, "Advanced Structural Analysis", Nemchand Publications, Roorkee.
4. Manikaselvam, "Elements of Matrix Analysis and Stability of Structures", Khanna Publishers, New Delhi.
5. H. C. Martin, "Introduction to Matrix Methods in Structural Analysis", International textbook company, McGraw Hill

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6E36T

CORE ELECTIVE-I: -DESIGN OF BRIDGES

Teaching Scheme:
Lectures: 3 hours per week, 3 Credits

Examination Scheme:
ISE: 40 marks
ESE: 60 marks

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

1. Identify the various elements of bridges along with evaluation of various loads acting on the bridges as per the IRC bridge code
2. Design the Solid Deck slab and T Beam Bridge superstructure for two lane and four lane bridges.
3. Design various components of substructure such as Pier, Abutments, foundations
4. Design Bearing and expansion joint
5. Carry out maintenance and repair of the bridge.

SECTION-I

Unit 1: Introduction: **[05 Hrs]**

Components of bridges, Classification, importance of bridges, Investigation for Bridges

Unit 2: Standard specification for Road Bridges **[09 Hrs]**

I.R.C. bridge code, width of carriageway, clearances, loads to be considered i.e., D.L., L.L., Impact load, wind load, Earthquake load, Longitudinal force, Centrifugal force, buoyancy, Earth pressure, water current force, thermal force etc. Introduction to prestressed concrete bridges - PSC Box girder bridges

Unit 3: General design considerations for R.C.C. & P.S.C. Bridges. **[09 Hrs]**

Relative costs of bridge components. Design of reinforced concrete deck slab for two lane and four lane bridges, Pigeaud's theory, beam and slab and T–beam, Courbon's theory.

SECTION-II

Unit 4: Construction Techniques: [08 Hrs]

Construction of sub structure footing, piles, caissons, construction of reinforced earth retaining wall and reinforced earth abutments, super structure – erection method for bridge deck construction by cantilever method, Inspection maintenance and repair of bridges.

Unit 5: Design of Bridge Components: [08 Hrs]

Design of sub structure, abutments, Piers, approach slab, well foundation

Unit 6: Bearing and expansion joints [06 Hrs]

Forces on bearings, Types of bearings, design of elastomeric bearings, expansion joints.

INTERNAL CONTINUOUS ASSESSMENT (ICA) & OE

1. Internal Continuous Assessment (ICA) shall consist of minimum six assignments based on each topic of syllabus.
2. Oral examination shall be based on the assignment and the knowledge of student in the topics mentioned in the syllabus.
3. The visit of Bridge site should be carried out to understand the various components of bridge, its construction, repair and maintenance

TEXT BOOKS

1. Essentials of Bridge Engg. by D. Johnsons Victor, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Design of RCC Bridges- Jagdish Jayaram
3. Reinforced Concrete Structures – Vol. II by Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications.

REFERENCE BOOKS

1. Concrete Bridge Practice by Dr. V. K. Raina, Tata McGraw Hill
2. Bridge Engg. by S. Ponnuswamy, Tata McGraw Hill
3. K. S. Rakshit, Design and Construction of Highway Bridges, New Central Book

IRC CODES

1. IRC 6 (2000), Section II: Loads and stresses.
2. IRC 16 (1989), Section for priming of base course with bituminous primers
3. IRC 18 (2000), Design criteria for PC road bridges (post tensioned concrete)
4. IRC 21(2000), Section III: Cement concrete (Plain and reinforced)
5. IRC 78 (2000), Section VII: Foundations and substructures
6. IRC 83 (1982), Section IX: Bearings, Part I: Metallic bearings (1994)
7. IRC 83 (1987), Section IX: Bearings, Part II: Elastomeric bearings (1994)
8. IRC 83 (1987), Section IX: Bearings, Part III: POT and PTFE bearings (1994)

WEBSITES:

1. www.mahapwd.com
2. www.irc.org.in

Walchand Institute of Technology, Solapur

T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6E46T

CORE ELECTIVE-I: URBAN TRANSPORTATION PLANNING

Teaching Scheme:
Lectures: 3 hours per week, 3 Credits

Examination Scheme:
ISE: 40 marks
ESE: 60 marks

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

1. Design and carry out surveys to provide the data required for transportation planning.
2. Prepare zonal demand generation and attraction regression models.
3. Prepare demand distribution models and modal split models for mode choice analysis.
4. Develop and calibrate trip generation rates for specific types of land use developments.
5. Compare among planning alternatives that best integrate multiple objectives such as technical feasibility and cost minimization

SECTION-I

Unit 1: Land use and Transportation System [06 Hrs]

Land use and Transportation System: Introduction-Urban system Components-Concepts and definitions-Criteria for measuring urban sprawl— Location theory-urban growth or decline

Unit 2: Transportation Planning Process: [08 Hrs]

Introduction-Definition-Factors to be considered; Land use transportation planning; systems approach-Stages-Inventory of Existing Conditions- Difficulties in implementation.

Unit 3: Transport Surveys: [08 Hrs]

Basic Movements- Study Area-Zones-Surveys- Planning of different types of surveys and interpretation, Travel demand; Traffic surveys for mass transit system planning.

SECTION-II

Unit 4: Trip Generation and Distribution: [06 Hrs]

Factors governing trip generation and attraction – Application of Regression Analysis-Methods of trip distribution; Growth and Synthetic Models Calibration and Application of gravity model. -Category analysis. Problems

Unit 5: Modal Split and Assignment: [06 Hrs]

Factors affecting modal split; Modal split in transport planning; Principles of traffic assignment; assignment techniques. Problems

Unit 6: Land Use Models [05 Hrs]

Lowry Model-Hansen's Accessibility Model-Density -Saturation Gradient Model-Problems (Except on Lowry Model).

Unit 7: Mass Transit Systems: [05 Hrs]

Types- Capacity, Fleet planning and Scheduling.

TEXT BOOKS

1. Traffic Engineering and Transportation Planning' - Kadiyali, L. R., Khanna Publication, New Delhi, 2009.
2. "Transportation Engineering –An Introduction"- Jotin Khisty and B. Kent Lall, PHI, New Delhi, 3rd Indian Edition, 2006.
3. `Principles of Urban Transport System Planning' - Hutchinson, B.G., McGraw Hill Book Co., London, UK, 1982.

REFERENCE BOOK

1. Institute of Traffic Engineers - An Introduction to Highway Transportation Engineering, New York., 1982.

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T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6E56T

CORE ELECTIVE-I: -PAVEMENT ANALYSIS & DESIGN

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	ISE: 40 marks ESE: 60 marks

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

1. List and explain the various factors affecting the design and performance of pavements.
2. Calculate the stresses in flexible pavement
3. Calculate the stresses in rigid pavements.
4. Design the crust thickness of flexible and rigid pavements.
5. Design the overlay thickness for existing pavement as per IRC standards

SECTION-I

Unit 1: Types of Pavements: **[08 Hrs]**

Types of pavements – Factors affecting the design of pavements – wheel loads –ESWL Concept- tyre pressure – contact pressure, Material characteristics – Environmental and other factors.

Unit 2: Stresses In flexible Pavement: **[08 Hrs]**

Stresses in the flexible pavement – layered systems concept – one layer system – Business Two-layer system – Burmister Theory for Pavement Design.

Unit 3: Stresses in Rigid Pavements: **[08 Hrs]**

Westergaard's theory and assumptions, Stresses due to curling, stresses and deflections due to loading, frictional stresses, and stresses in dowel bars & tie bars.

SECTION-II

Unit 4: Design of Flexible Pavements: [10 Hrs]

Factors affecting design. deflection studies in flexible pavements. present serviceability index. IRC guidelines for flexible pavements. pavement performance and methods-AASHTO and Asphalt Institute method. need for overlays, overlays design methods for flexible and rigid pavements.

Unit 5: Design of Rigid Pavements: [10 Hrs]

Factors effecting Design - Wheel load & its repetition, subgrade strength & proportion, strength of concrete - modulus of elasticity. reinforcement in slab. design of joints. design of dowel bars. design of tie bars. IRC and AASHTO methods of Rigid Pavement design

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

REFERENCE BOOKS

1. Concrete Pavements, AF Stock, Elsevier, Applied Science Publishers.
2. Pavement and Surfacing for Highway & Airports, Micheal Sargious, Applied Science Publishers Limited.
3. Haas and Hudson `Pavement Management System', McGraw Hill Book Co., New York.
4. HRB/TRB/IRC/International Conference on Structural Design of Asphalt Pavements.
5. Relevant IRC Publications
6. CMA Hand Book

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T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6E66T
CORE ELECTIVE-I:
SYSTEM ENGINEERING AND ECONOMICS

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	ISE: 40 marks
	ESE: 60 marks

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

1. Analyze the Systems in Engineering planning, design and management
2. Build the model of system in Planning and Engineering
3. Carry out 'Economic Evaluation' of Engineering system
4. Explain Microeconomics for Engineers and Planners
5. Analyze the Systems in Engineering planning, design and management

SECTION-I

Unit 1: Mapping the Terrain of the Systems Approach: [12 Hrs]

Introduction, The Nature of Science, Engineering Planning, Design, and Management, The Systems Approach, Steps in Systems Analysis, Classification of Systems, Systems Characteristics, Systems Analysis and Decision-Making Models and Model-Building.

Unit 2: Problem Solving and Designing in Engineering and Planning [12 Hrs]

Introduction, Problem Solving and Designing Hierarchy: Problem-space, Trees, and Semi-lattices, Measurement and Scaling Sources of Data Measurement Scales of Measurement, System Model Types and Model- building Model Types, Models Used in Planning and Engineering.

SECTION-II

Unit 3: Basic Engineering Economics and Evaluation: [08 Hrs]

Introduction, Notations, Simple Interest Compound Interest, Uniform Series of Payments, Compound Amount Factor (CAF), Sinking Fund Factor (SFF), Present Worth Factor (PWF), Capital Recovery Factor (CRF), Uniform Gradient Series, Discrete Compound Interest Factors, Uniform Continuous Cash Flow and Capitalized Cost Evaluation, Feasibility Issues, Evaluation Issues, The Evaluation Process Values, Goals, Objectives, Criteria, and Standards,

Estimation of Costs, Impacts, and Performance Levels, Capital, Operating, and Maintenance Costs, User Costs, Impacts Performance Levels

Unit 4: Evaluation of Alternatives Economic and Financial Concepts: [06 Hrs]

Analysis Techniques Economic Evaluation Methods (Efficiency Analysis), Cost-effectiveness Analysis, Multi-criteria Evaluation, Method Benefit-Cost Analysis, The Willingness-to-pay Concept, Depreciation and Taxes, Reporting Results

Unit 5: Basic Microeconomics for Engineers and Planners: [08 Hrs]

The Scope of Economics and Microeconomics, Some Basic Issues of Economics, Demand for Goods and Services, Contents, Demand, Supply, and Equilibrium Sensitivity of Demand; Factors Affecting Elasticities Income, Elasticities Price, Elasticities Elasticity and Total Revenue Price Elasticity of Supply, Kraft Demand Model, Direct and Cross Elasticities, Consumer Surplus Costs, Laws Related to Costs, Average Cost, Marginal Cost, Consumer Choice**.**

TEXT BOOKS:

1. Systems Engineering With Economics, Probability, And Statistics, Second Edition, C. Jotin Khisty Jamshid Mohammadi Adjo A. Amekudzi J. Ross Publishing
2. Principles of Engineering Economy- E. L. Grant, W. G. Ireson, R. S. Leavenworth,Wiley International Education, 7th Ed.

REFERENCE BOOKS

1. Systems Engineering and Analysis, 4th edition. Prentice-Hall, Upper Saddle River, NJ. Bowman, M. (2003)
2. NASA Systems Engineering Handbook, NASA/SP-2007–6105 Rev 1. Military Bookshop, 2007. ISBN: 9781780391380.
3. Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities. 4th ed. Wiley, 2015. p. 304. ISBN: 9781118999400.
4. Engineering Economics - L.P. DeGarmo, W. G. Sullivan, J. A. Bantadelli, McMillan India Co. New Delhi, 8th Ed. 1984

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T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6E76T

CORE ELECTIVE-I:

ADVANCED CONCRETE TECHNOLOGY

Teaching Scheme:
Lectures: 3 hours per week, 3 Credits

Examination Scheme:
ISE: 40 marks
ESE: 60 marks

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

1. Select proper admixtures to obtain concrete of desired properties
2. Adopt appropriate type of special concrete for desired results
3. Design a concrete mix of required strength and workability properties
4. Adopt appropriate method for repairs and rehabilitation of concrete structures

SECTION-I

Unit 1: Introduction: **[06 Hrs]**

Review of cements including blended cement, chemical and physical process of hydration. Aggregates-Coarse aggregates, Natural sand, Crushed sand.

Unit 2: Addition to Concrete: **[04 Hrs]**

Review of types covering pulverized fuel ash, ground granulated blast furnaces slag and silica fume, Rice husk Ash, manufacture, physical characteristics, effects on properties of concretes. Admixtures: - Plasticizers, Super plasticizers, retarder, accelerators, Curing compounds and their effects on properties of concrete.

Unit 3: Properties of Fresh Concrete **[04 Hrs]**

Workability setting, bleeding and segregation. Theory and application principles governing in concrete placing and compaction of concrete Durability & permeability, microstructure and carbonation of concrete, fire resistance

Unit 4: Special Concretes: **[06 Hrs]**

High performance concrete, High Strength concrete, fiber reinforced concrete, Light weight concrete, High density and radiation shielding concrete, High volume fly ash concrete, Self-compacting concrete, Recycled concrete.

SECTION-II

Unit 5: Special Processes & technology for particular types of structures: **[04 Hrs]**

Mass concrete, Sprayed concrete, Ferro-cement concrete, pumped concrete, Roller compacted concrete, Sustainability of concrete industry.

Unit 6: Ready mixed Concrete: **[04 Hrs]**

Types of plants, Concrete specification, Process adopted for central RMC plant, Distribution & transport, Code recommendations, quality control.

Unit 7: Mix design: **[08 Hrs]**

Review of methods & philosophies, mix design for special purpose (High grade concrete), variability of results.

Unit 8: Quality concepts: **[03 Hrs]**

Definitions, principles & standards, quality control in concrete Construction, tools for quality management.

Unit 9: Repair & rehabilitation: **[05 Hrs]**

Visual inspection of concrete structure, distress in concrete, Non-destructive test, crack repair techniques, damage assessment procedure, deterioration- causes & prevention, strengthening techniques.

FIELD EXPIREMENTS

It shall consist following experiments:

1. Tests on fresh concrete Workability tests,
2. Hardened concrete: Strength test- compression, flexure
3. Effects of additives in concrete: Effects on workability and strength ofconcrete.
4. Effects of admixtures in concrete: Effects on workability and strength ofconcrete.
5. Mix design for high performance concrete: Experimental
6. Non-destructive testing of concrete-
    - Rebound hammer,
    - Ultra-sonic pulse velocity test

TEXT BOOKS

1. Concrete Technology, Theory and Practice by M.S. Shetty, S, Chand Publications, New Delhi
2. Concrete Mix Design- N. Krishna Raju - Sehgal Publishers

REFERENCE BOOKS

1. High performance concrete by P.C. Aitkin, Tailor and Francis, New York NY 10016
2. Concrete Technology by A.R. Santhakumar, Oxford university press, New Delhi
3. Concrete Technology by Neville, Pearson education limited, London
4. Advanced Concrete Technology Constituent materials- John Newman, Ban Seng Choo- London Press.
5. Concrete- P.K. Mehta, P J M Monteiro, - Prentice Hall, New Jersey

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T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6E86T

CORE ELECTIVE-I:

WATER POWER ENGINEERING

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	ISE: 40 marks
	ESE: 60 marks

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

1. Estimate the available hydropower in a project
2. Select suitable types of hydro-power system for particular site conditions
3. Design penstock and anchor blocks
4. Analyze the different types of loads on power plants
5. Design the components of Tidal power plant

SECTION-I

Unit 1: Introduction: **[05 Hrs]**

Sources of energy, types of power station, choice of type of generation, component of water power project, types of hydro power schemes, general layouts of various hydropower schemes.

Unit 2: Estimation of hydro power potential: **[04 Hrs]**

Basic water power equation, gross head, net head nature of supply, storage and pondage. Method of computing hydrographs, mass curves, flow duration curves. Nature of demand: Load curve, load duration curves, load factor, plant factor, plant use factor, firm power secondary power.

Unit 3: Intake structures **[05 Hrs]**

Types, level of intake, hydraulics of intake structures, trash rack, transition, conduit intake gates.

Unit 4: Conduits: **[03 Hrs]**

Types, economic section, power canals, pen-stock types, hydraulic design and economic diameter pipe supports, anchor blocks, tunnels – classification, location and hydraulic design, tunnel linings.

Unit 5: Air Dispersion & Equations of Continuity: **[05 Hrs]**

Surge Tank: Functions and behavior of the surge tanks, location, types of surge tanks, basic design criteria of simple surge tank, forebay.

SECTION-II

Unit 6: Power station: **[05 Hrs]**

General arrangements of a power station, power house, sub-structure and super structure, underground power station – necessity principal, types, development and economics.

Unit 7: Turbines: **[05 Hrs]**

Classification of turbines, characteristics of different types, choice of type of turbine, turbine setting and cavitation's.

Unit 8: Tail race: **[04 Hrs]**

Functions, types, channel and tunnel draft tubes, function and principal types.

Unit 9: Pumped storage plants **[04 Hrs]**

Purpose and general layout of pumped storage schemes, main types, typical arrangements of the upper reservoirs, economics of pumped storage plants.

Unit 10: Tidal power stations: **[05 Hrs]**

Classification according to the principle of operation and general description of different types, depression power plants.

TEXT BOOKS:

1. Hydro Power Structures – R. S. Varshney (ISBN 8185240787)
2. Water Power Engineering – M. M. Dandekar, Vikas Pub. House Pvt. Ltd.
3. Water Power Engineering – P. K. Bhattacharya, Khanna Pub., Delhi
4. Water Power Engineering – M. M. Deshmukh, Dhanpat Rai and Sons
5. Textbook Of Water Power Engineering- Sharma R. K. , Sharma T. K Publisher: S Chand & Company Ltd.

REFERENCE BOOKS:

1. Water Power Development – E. Mosonvi, Vol. I & II
2. Hydro-electric Engineering Practice – G. Brown, Vol. I, II & III
3. Hydro – Electric Hand Book – Creager and Justin 73 w.e.f. academic year 2018-19 T. E. (CIVIL) PART

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T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6E96T

CORE ELECTIVE-I:

URBAN HYDROLOGY AND HYDRAULICS

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	ISE: 40 marks
	ESE: 60 marks

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

1. Develop intensity duration frequency curves for urban drainage systems.
2. Develop design storms to size the various components of drainage systems
3. Apply best management practices to manage urban flooding.
4. Prepare master drainage plan for an urbanized area.

SECTION-I

Unit 1: Introduction: **[06 Hrs]**

Urbanization and its effect on water cycle, Urban hydrologic cycle, Trends in urbanization Effect of urbanization on hydrology

Unit 2: Precipitation Analysis: **[08 Hrs]**

Importance of short duration of rainfall and runoff data, Methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration -Frequency (IDF) curves, Design storms for urban drainage systems

Unit 3: Approaches to urban drainage: **[08 Hrs]**

Time of concentration, Peak flow estimation approaches, Rational method, NRCS curve number approach, Runoff quantity and quality, Waste- water and stormwater reuse, Major and minor systems.

SECTION-II

Unit 4: Elements of drainage systems: **[06 Hrs]**

Open channel, underground drains, appurtenances, pumping, and source control.

Unit 5: Analysis and Management: **[08 Hrs]**

Stormwater drainage structures, Design of stormwater network, Best Management Practices– Detention and retention facilities, swales, constructed wetlands, models available for stormwater management.

Unit 6: Master drainage plans: **[08 Hrs]**

Issues to be concentrated upon – typical urban drainage master plan, interrelation between water resources investigation and urban planning processes, planning objectives, comprehensive planning, use of models in planning.

TEXT BOOKS

1. 'Manual on Drainage in Urbanized area' by Geiger W. F., J Marsalek, W. J. Rawls and F. C. Zuidema, (1987 – 2 volumes), UNESCO,
2. 'Urban Hydrology' by Hall M J (1984), Elsevier Applied Science Publisher.
3. 'Hydrology – Quantity and Quality Analysis' by Wanielista M P and Eaglin (1997), Wiley and Sons.
4. 'Urban Hydrology, Hydraulics and Stormwater Quality: Engineering Applications and Computer Modelling' by Akan A.O and R.L. Houghtalen (2006), Wiley International.

REFERENCE BOOKS

1. 'Stormwater Detention for Drainage' by Stahre P and Urbonas B (1990), Water Quality and CSO Management, Prentice Hall.
2. 'Urban water cycle processes and interactions' by Marsalek et al (2006), Publication No. 78, UNESCO, Paris (http://www.bvsde.paho.org/bvsacd/cd63/149460E.pdf)
3. 'Frontiers in Urban Water Management – Deadlock or Hope' by Maksimovic C and J A Tejada-Guibert (2001), IWA Publishing.

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T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6E106T

CORE ELECTIVE-I: OPEN CHANNEL AND RIVER HYDRAULICS

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 hours per week, 3 Credits	ISE: 40 marks
	ESE: 60 marks

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

1. Demonstrate basic principles of the open channel flow.
2. Analyze the various types of flows viz. uniform and non-uniform flow, gradually varied flow, rapidly varied flow etc.
3. Explain the mechanics of sediment transport
4. Apply the knowledge of open channel hydraulics to river engineering.
5. Apply the knowledge of dimensional analysis to develop different hydraulic models

SECTION-I

Unit 1: Basic fluid flow concepts **[05 Hrs]**

Classification of open channel flow, Velocity and pressure distribution. Energy and Momentum Equation applied to open channel flow, Energy and momentum coefficients, Channel Geometry and geometrical elements.

Unit 2: Uniform and critical flow computations: **[05 Hrs]**

Energy depth relationships, Resistance formulae, Concepts of first and Second hydraulic exponent, Determination of critical and normal depth, hydraulically most efficient channel sections, Channel transitions.

Unit 3: Gradually varied flow: **[06 Hrs]**

Different equation governing GVF, Classification analysis and control sections of profiles, Computation of GVF profiles by different methods.

Unit 4: Rapid varied flow: **[06 Hrs]**

Type, Analysis and characteristics of Hydraulic jump in rectangular channels, Location of jump, Introduction to jump in non-rectangular channel and on sloping floor, Use of jump as Energy dissipater. Flow Measurement –Weir, spillways, critical depth flumes.

SECTION-II

Unit 5: River gauging: **[05 Hrs]**

Dominant discharge, Methods of gauging, current meter rating curve, automatic water level recorder, stage discharge relationship of a river.

Unit 6: Fluvial Hydraulics- **[07 Hrs]**

Sediment transport, Mode of sediment motion and formation, Threshold movement, Total sediment load, Suspended and bed load Theories, Reservoir Sedimentation.

Unit 7: River Management and Training: **[06 Hrs]**

Type of river, river morphology, meandering and braiding of River training work-Classification Types-Guide banks, Groynes, Deflectors, Embankments, Cut-offs, Bank Protection Stable channel nature river training works, river morphology.

Unit 8: Similitude and model analysis: **[05 Hrs]**

Basic principles, fixed bed and models, distorted models.

TEXT BOOKS

1. Open channel Hydraulics – Ven Te Chaw, McGraw Hill book Co. New York.
2. Flow through open channel – Ranga Raju
3. Flow in open channel –K. Subramanya, Tata McGraw Hill Publications
4. Mechanics of Sediment transport and alluvial river problems-R. J. Garde New Age Publications New Delhi.

REFERENCE BOOKS

1. Open Channel Flow-F. M. Henderson.
2. River Gauging –Chitale and Hiranandani
3. River Mechanics-Vol. I &II, Hsieh Wen Shen.

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T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6PR7L

PROJECT ON STEEL STRUCTURES

Teaching Scheme:	**Examination Scheme:**
Drawing: 4 hours per week, 2 Credits	OE: 50 marks
	ICA: 25 marks

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

1. Design and assemble the various components of Industrial shed with roof truss or portal frame or gable Frame and prepare their detailed computer aided drawing
2. Design the various components of Building frame/Foot bridge/Welded plate girder and prepare their detailed computer aided drawing
3. Analyse the steel structure using standard structural engineering application software
4. Create report for the structure as per Analysis and Design.

Course Content

PROJECT ON STEEL STRUCTURES (LABORATORY)

Unit 1: INDUSTRIAL SHED:

Design of industrial shed including roof truss, purlin, gantry girder, columns, bracing system, column bases along with their connections and concrete pedestal

Unit 2: Any One of the following:

a) **Welded Plate Girder:** Design of welded plate girder, design of cross section, curtailment of flange plates, stiffeners and their connections.

b) **Foot Bridge:**Influence lines, cross beam, main truss, Raker, joint Details, support details

c) **Building Frames**: Building with Secondary and main beams, column and column bases, beam-to beam connection, column-beam-connection, design of typical members.

d) **Offshore Structures**: Offshore structures containing elements like jackets, topside platforms, equipment foundations etc. Further, these components can be designed using circular and hollow square sections etc.

e) **Pre-Engineered Buildings:** Design of PEB frame under the influence of Dead, Live, Collateral, Wind, Seismic and Other applicable Loads.

Note:

1. Sample verification of analysis results shall be made by using software for any one problem.
2. Maximum number of students in a group not more than three to five for design.

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Site visits: Report should contain structural details with sketches.

TEXTBOOKS

1. Design of Steel Structures, N. Subramanian, Oxford, 2008
2. Limit State Design of Steel Structures, S.K. Duggal.
3. Design of steel structure by Limit State Method as per IS: 800- 2007 by Bhavikatti S. S, I
4. K International Publishing House, New Delhi
5. Limit state design in Structural Steel by Dr. M. R. Shiyekar

REFERENCEBOOKS

1. Limit state design of Steel Structure by V. L. Shah & Gore, Structures Publication, Pune
2. Limit State Design of Steel Structures by D. Ramchandra & Virendra Gehlot, Scientific Publishers
3. Design of Steel Structures by K. S. Sai Ram, published by Dorling Kindersley (India) Pvt. Ltd.
4. Structural Design and Drawing Reinforced Concrete and Steel by N. Krishnaraju,
5. Universities Press (India) Pvt. Ltd. Hyderabad.
6. Teaching Resource Material by INSDAG
7. Indian Standard Codes: IS 800-2007, IS 875-1987 Bureau of Indian Standards.
8. Steel Tables SP: 6(1) and SP: 6(6)

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T. Y. B. Tech. Civil Engineering - Semester-VI

21CEU6MP8L

MINI PROJECT

Teaching Scheme:	**Examination Scheme:**
Practical: - 2 Hrs/Week, 2 Credit	ICA: 50 Marks

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

1. Conduct and write the Literature Survey
2. Carry out Theoretical Formulation
3. Synthesize and compose the subject Knowledge
4. Develop working prototypes /simulation models / Conduct extensive parametric research
5. Draft the progress reports and make presentations.

Student/s shall carry out 'Mini Project' in any one of the following subjects: Sustainable materials, Green Buildings, Applications of SDGs, Sustainable systems, engineering materials for Sustainability, EIA, LCA, Impact of Environmental Policies etc.

The project shall consist of Sustainable Engineering 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.

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