



RAMAIAH
Institute of Technology

CURRICULUM

Outcome Based Education

Academic year 2026 – 2027

V & VI SEMESTER B.E.
B.E. CIVIL ENGINEERING
Batch- 2024

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 18 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with '**A+**' grade by NAAC in March 2021 for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute has also been conferred autonomous status for Ph.D. program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculties out of which 70% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation.

The Entrepreneurship Development Cell (EDC) and "Ramaiah Evolute" have been set up on campus to incubate startups. MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. The Institute is a member of DELNET, CMTI and VTU E-Library Consortium. The Institute has a modern auditorium, recording studio, and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 75th rank among 1584 top Engineering Institutions & 31st Rank among 131 Schools of Architecture in India for the year 2025.

About the Department:

The Department of Civil Engineering was started as the third department in the institute with an intake of 60 students in the year 1971. Structural Engineering was first Post Graduate program started in the year 1983 of the institute with an intake of 10 students. The UG and PG programs have been accredited by NBA for three years 2021-2024 and 2024-2027 respectively. After obtaining the autonomous status in the year 2007, the department focused towards providing state of the art curriculum development, offering electives of the present day need and techno innovative projects. These initiatives resulted in enhanced performance of the students in terms of increase in placement, increase in the number of students writing competitive examinations and pursuing higher education in the foreign universities.

Further Department of Civil Engineering was recognized as a research centre in the year 1994 leading to PhD/MSc in Civil Engineering under Bangalore University till 1994 and later it was brought under State Technological University VTU. The research centre has attracted 24 research scholars to pursue their degree from this research centre and 30 scholars have completed PhD degree. The areas of research include Structural Engineering, Transportation Engineering, Geotechnical Engineering, Water Resources Engineering and Environmental Engineering.

The Department has close interaction with number of industries and Government agencies through R&D, and consultancy works. It also has MOU's with industries and other institutes for improved interactions and coordination with outside world.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

1. Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
2. Establishing research clusters in emerging areas in collaboration with globally reputed organizations
3. Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at M. S. Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To become a premier Department by adopting state-of-the-art technical knowledge through effective learning processes with research ambience in producing global quality ethical civil engineers, for the development of sustainable society.

MISSION OF THE DEPARTMENT

1. To transform the young minds into employable professionals by providing contemporary technical knowledge and appropriate professional skills through suitable teaching learning process.
2. To provide rigorous training, acquaint the students with necessary skills and leadership qualities along with ethical values to address the complex and multi-faceted civil engineering problems.
3. To provide opportunity to develop their potential by fostering intellectual curiosity to promote them for pursuing higher studies and research through exposure to the modern engineering tools and techno innovative projects.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Bachelor of engineering graduates of Civil Engineering program of M S Ramaiah Institute of Technology shall attain the following PEO's within three to four years of graduation.

PEO1	To perform well in Engineering profession as competent professionals using contemporary technical knowledge and professional skills.
PEO2	To pursue higher education and show intellectual curiosity for lifelong learning.
PEO3	To communicate effectively to work in multi-disciplinary environments embedded with ethical values and social responsibilities.

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAM OUTCOMES (POs):

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7)

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project management and finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-long learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOs):

- PSO1:** Apply the knowledge of basic sciences, geology and environmental science along with the conceptual knowledge of engineering sciences to illustrate the process involved in planning, analysis and design of sustainable civil engineering systems.
- PSO2:** Conduct laboratory experiments/field investigations, and analyze / interpret the experimental results for appropriate conclusions and recommendations to a real-world civil engineering problem with a significant perspective of economy, society and environment.
- PSO3:** Demonstrate professional ethics and implement the principles of project management, business and public policy to lead the project execution as per the design requirement, with the state-of-the-art technology and contemporary skills.

Semester wise Credit Breakdown for B.E Degree Curriculum Batch 2023-27

Semester Course Category	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Basic Sciences (BSC)	08	08	03	03	--	--	--	--	22
Engineering Sciences (ESC)	08	09	--	--	--	--	--	--	17
Humanities, Social Sciences and Management (HSMC)	02	02	--	--	03	03	--	--	10
Ability Enhancement Course (AEC)	02	01	01	01	01	--	--	--	06
Universal Human Values (UHV)	--	--	02	--	--	--	--	--	02
Professional Core Courses (PCC)	--	--	11	12	12	06	04	--	45
Integrated Professional Core Course (IPCC)	--	--	04	04	03	--	04	--	15
Professional Elective Courses (PEC)	--	--	--	--	03	06	03	--	12
Institutional Open Elective Courses (IOE)	--	--	--	--	--	03	03	--	06
Internship (INT)	--	--	--	✓	--	--	--	05	05
Mini Project / Project Work (PW)	--	--	--	--	--	04	--	13	17
Skill Development Course (SDC)	--	--	--	--	--	01	02	--	03
Non Credit Mandatory Courses (NCMC)	--	--	--	--	✓	✓	--	--	--
Total Credits	20	20	21	20	22	23	16	18	160

SCHEME OF TEACHING V SEMESTER

Batch 2024

Sl. No.	SubjectCode	Subject	Teaching Department	Category	Credits				Total contact hours/week			
					L	T	P	Total	L	T	P	S
1	CV51	Design of reinforced concrete Elements	Civil	PCC	3	1	0	4	3	1	0	3
2	CV52	Highway Technology	Civil	IPCC	2	0	1	3	2	0	1	2
3	CV53	Geotechnical Engineering -I	Civil	PCC	2	1	0	3	2	1	0	2
4	CV54	Prestressed concrete	Civil	PCC	3	0	0	3	3	0	0	3
5	CVE55x	Program Elective Course – 1	Civil	PEC	3	0	0	3	3	0	0	3
6	CVL56	Concrete Laboratory	Civil	PCC	0	0	1	1	0	0	1	0
7	CVL57	Highway Engineering Laboratory	Civil	PCC	0	0	1	1	0	0	1	0
8	AL58	Research Methodology & Intellectual property rights	Civil	HSMC	3	0	0	3	3	0	0	3
9	AEC59	Ability Enhancement Course-V	Civil	AEC	1	0	0	1	1	0	0	1
Total					17	2	3	22	17	2	3	17
10	HS510	Environmental Studies *		NCMC	0	0	0	0	1	0	0	0

Professional Elective Course – 1

Sl. No	Sub Code	Subject
1	CVE551	Advanced Concrete Technology
2	CVE552	Irrigation & Hydraulics Structures
3	CVE553	Industrial Wastewater Treatment
4	CVE554	Traffic Engineering
5	CVE555	Building Planning and Services

* Environmental Studies is under the category of NCMC, 1-hour teaching per week has to be allocated in the time table.

Nomenclature: IPCC: Integrated Professional Core Course, PCC: Professional Core Course, HSMC: Humanity and Social Science & Management Courses, PEC: Professional Elective Courses, AEC–Ability Enhancement Courses, NCMC: Non-credit Mandatory Course
Credit Definition: • 1 credit = 1 hour/week of lecture (L) • 1 credit = 2 hours/week of tutorial (T) • 1 credit = 2 hours/week of practical(P) • 1 credit = 1 hour/week of Self Learning Hours (S)
Note: CVE55x, where x=1,2,3,4,5
Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC is 03 and its Teaching–Learning hours (L: T: P) can be considered as (2: 0: 1). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated only by CIE (no SEE). However, questions from the practical part of IPCC can be included in the SEE question paper.
Professional Elective Courses: A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in Engineering and Technology curriculum. Multidisciplinary courses that are added to supplement the latest trend and advanced technology in the selected stream of engineering. Each group provides an option to select one course out of five courses. The minimum student's strength for offering professional electives is 10.
AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines): Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years' degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the course. However,

minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fail to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

SCHEME OF TEACHING VI SEMESTER

Batch 2024

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week			
					L	T	P	Total	L	T	P	S
1	AL61	Management & Entrepreneurship	Civil	HSMC	3	0	0	3	3	0	0	3
2	CV62	Design of Structural Steel Elements	Civil	PCC	3	1	0	4	3	1	0	3
3	CVE63x	Program Elective Course – 2	Civil	PEC	3	0	0	3	3	0	0	3
4	CVE64x	Program Elective Course – 3	Civil	PEC	3	0	0	3	3	0	0	3
5	CVL65	Geotechnical Engineering Lab	Civil	PCC	0	0	1	1	0	0	1	0
6	CVL66	Detailing of Structural Elements Laboratory	Civil	PCC	0	0	1	1	0	0	1	0
7	CVOE0x*	Institutional Open Elective - 1	Civil	IOE	3	0	0	3	3	0	0	3
8	CVP67	Mini Project/ Extensive Survey	Civil	PW	0	0	4	4	-	-	-	-
9	CV68	Technical Skill Enhancement Course	Industry Expert	SDC	0	1	0	1	0	2	0	0
Total								23	22			

Professional Elective Course – 2

Sl. No	Sub Code	Subject
1	CVE631	Principles of Bridge Engineering
2	CVE632	Ground Improvement Techniques
3	CVE633	Environmental Impact Assessment
4	CVE634	Transportation modes and Infrastructure
5	CVE635	Applied Hydraulics

Professional Elective Course – 3

Sl. No	Sub Code	Subject
1	CVE641	Advanced Design of Concrete Structures
2	CVE642	Matrix Method of Analysis
3	CVE643	Solid Waste Management
4	CVE644	Urban Transport Planning
5	CVE645	Design of Formwork & Scaffolding

Nomenclature, PCC: Professional Core Course, **PEC:** Professional Elective Courses, **IOE:** Institutional Open Elective, **PW:** Mini Project, **INT** –Internship

Credit Definition:

- **1 credit = 1 hour/week of lecture (L)**
- **1 credit = 2 hours/week of tutorial (T)**
- **1 credit = 2 hours/week of practical(P)**
- **1 credit = 1 hour/week of Self Learning Hours (S)**

Note: CVE63x, where x=1,2,3,4,5
 CVE64x, where x=1,2,3,4,5
 CVOE0x*, where x=1,2,... continued from previous

L –Lecture, T – Tutorial, P- Practical/ Drawing/ Project work

Professional Elective Courses: A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in Engineering and Technology curriculum. Multidisciplinary courses that are added to supplement the latest trend and advanced technology in the selected stream of engineering. Each group provides an option to select one course out of five courses. The minimum student's strength for offering professional electives is 10.

Institutional Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent department. However, they can take an elective offered by other departments, provided they satisfy the prerequisite condition, if any. Registration to open electives shall be documented under the guidance of the Proctor.

Selection of an open elective shall not be allowed if,

1. The candidate has studied the same course during the previous semesters of the program.
2. The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
3. A similar course, under any category, is prescribed in the higher semesters of the program.
4. The minimum students strength for offering open electives is 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to a group having **not more than 4 students**. The CIE marks shall be awarded by a committee constituted by of the Head of the concerned department. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session as per the rubrics defined by the department. SEE will be conducted by the two examiners appointed by the Institute. SEE marks awarded for the mini project shall be based on the evaluation of project work report, project presentation skill and question and answer session.

Internship - All the students admitted shall have to undergo mandatory internship of 6 - 8 weeks during the intervening vacation of the IV & V semesters / intervening vacation of VI & VII semesters/ VII semester. **A Viva-Voce CIE examination** shall be conducted during VIII semester as per the rubrics defined by the department and the prescribed credits shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements.

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. Incase student fail to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

V SEMESTER

DESIGN OF REINFORCED CONCRETE ELEMENTS

Subject Code: CV51	Credits: 3:1:0
Pre requisites: - Nil	Contact Hours: 45L+30T+45S
Course Coordinator: Dr. Anil Kumar R	

Course Content

Unit I

Introduction to analysis, design and detailing. Concrete making materials, New generation eco-friendly concrete and steel, IS: 456-2000 specifications on materials, durability and mix design. Introduction to different types of design, Concept of limit state design: Philosophy and principle of limit state design, assumptions, standard distribution of variables, Partial safety factors, Characteristic Load and Strength. Introduction to stress block parameters, Concept of balanced, under and over reinforced sections. Limit state of collapse in flexure of rectangular and flanged sections, Limit state of collapse in shear and torsion.

- Pedagogy: Chalk & talk, PPT
- Links: <https://www.youtube.com/watch?v=LOvG39NmATY>
<https://www.youtube.com/watch?v=FAZCqCUjT70>
https://www.youtube.com/watch?v=pIdaC_I6H_M&list=PL51300B0778FB5784

Unit II

Limit state design of beams: Design of singly and doubly reinforced rectangular and flanged beams. Limit state of shear, Types of shear failures –Design for shear strength, Types and design of shear reinforcement.

Detailing as per IS codes of practices.

- Pedagogy: Chalk & talk, PPT
- Links: <https://www.youtube.com/watch?v=0fTvE8aSsiE>
<https://www.youtube.com/watch?v=sGvpvYGKEb8>
<https://www.youtube.com/watch?v=JwiHgkC-6lc>
<https://www.youtube.com/watch?v=iT2pjfYbyZg&list=PL51300B0778FB5784&index=12>

Unit III

Limit state design of slabs and stairs: Introduction to one-way and two-way slabs for different boundary conditions, Design of one-way cantilever slab, simply supported slab, continuous slab. Design of Two way slabs. Introduction to staircases and design of doglegged stair and open well staircases, Importance of bond, anchorage lap length and development lengths. Detailing as per codes of practices.

- Pedagogy: Chalk & talk, PPT
- Links: <https://www.youtube.com/watch?v=6C3trwHjsbE&list=PL51300B0778FB5784&index=16>
<https://www.youtube.com/watch?v=GgatFNtQrBo&list=PL51300B0778FB5784&index=17>
<https://www.youtube.com/watch?v=A9JUGWhEW5A&list=PL51300B0778FB5784&index=18>
<https://www.youtube.com/watch?v=MkFbC74H0mo&list=PL51300B0778FB5784&index=19>
<https://www.youtube.com/watch?v=hxakW1miEcM&list=PL51300B0778FB5784&index=26>

Unit IV

Serviceability limit states: Introduction to working stress method, Elastic behaviour of rectangular section, Under, Balanced and over reinforced sections. Simple Problems on Flexural strength, Deflection and cracking in beams using IS Code provisions. Deflection and cracking – code provisions, Deflection control in design and problems, Problems on calculations of crack width.

- Pedagogy: Chalk & talk, PPT
- Links: <https://www.youtube.com/watch?v=l5RA6XMOtuU>
<https://www.youtube.com/watch?v=PRTLATheW-Q>

Unit V

Limit state of collapse- Analysis and design of columns, design of footings: Design of short axially loaded RC columns with problems, RC Columns with uniaxial moment including Problems, RC Columns with biaxial moments and problems, Design concepts of footing (Limit state), isolated footings with axial load–square and rectangular types. Rectangular Isolated footings with axial load and moment. Detailing as per codes of practices

- Pedagogy: Chalk & talk, PPT
- Links: <https://www.youtube.com/watch?v=-DLyAeASwQM>
<https://www.youtube.com/watch?v=wJWt0dcgafs&list=PL51300B0778FB5784&index=19>
<https://www.youtube.com/watch?v=p6aDP4ycISM&list=PL51300B0778FB5784&index=20>
<https://www.youtube.com/watch?v=YbXnWXcbkcc&list=PL51300B0778FB5784&index=21>
<https://www.youtube.com/watch?v=gaheNSbhD6w&list=PL51300B0778FB5784&index=22>
<https://www.youtube.com/watch?v=8ATp13mOhvg&list=PL51300B0778FB5784&index=24>
<https://www.youtube.com/watch?v=tKGeo4IRQho&list=PL51300B0778FB5784&index=25>

Text Books:

1. Unnikrishnan Pillai and Devadas Menon, “Design of Reinforced Concrete Structures”–Tata Mc Graw Hill Publications. 2020
2. Verghese P C, “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi.
3. IS Codes: IS: 456-2000, SP16, SP34 and SP26
4. ACI and BS codes – NBA/NEP requirements

Reference Books:

1. Sinha SN, “Reinforced Concrete Design”, Tata Mc Graw Hill Publications.
2. Karves R and Shah V L, “Limit State Theory and Design of Reinforced Concrete”, Vidyarthi Prakashan, Pune.
3. Park and Paulay, “Reinforced Concrete”, John Wiley and Sons.
4. Punmia B C, Jain A K and Jain A K, “Reinforced Concrete Design”, Lakshmi Publications, New Delhi.

Web links:

1. <https://www.youtube.com/watch?v=tKGeo4IRQho&list=PL51300B0778FB5784&index=25>
2. <https://www.youtube.com/watch?v=BHMN1O0nsy4>
3. https://www.brainkart.com/article/Limit-State-Design-Philosophy_3422/

Course Outcomes (COs):

Students will be able to:

1. Comprehend and discuss limit state design concepts of Reinforced Concrete elements and able to derive the expressions for limit state analysis. (PO 1, 2, 3, 7, 11, PSO 1,2)
2. Analyse, design and detail rectangular, Tee and Ell beams as per IS:456-2000 and able to develop professional drawing using AutoCAD. (PO 1,2,3,7,11, PSO 1,2)
3. Analyse, design and detail slabs and stair cases for practical boundary conditions and able to develop professional drawing (PO 1,2,3,7,11, PSO 1,2)
4. Explain serviceability criteria of flexural members and to estimate the deflections and cracking (PO 1,2,3,7,11, PSO 1,2)
5. Analyse, design and detail columns and footings and able to develop professional drawings. (PO 1,2,3,7,11, PSO 1,2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Assignment	10	CO1 & CO2
Assignment/ Mini project Work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

HIGHWAY TECHNOLOGY	
Subject Code: CV52	Credits: 2:0:1
Pre requisites: Nil	Contact Hours: 30L+30P+30S
Course Coordinator: Sri. Niranjan G Hiremath and Sri. Charan Prasad	

Course Content

Unit I

Transportation Systems: Transportation developments in India, highway alignment and engineering surveys, new and re-alignment projects, modes of transportation and Intelligent Transport System. **Highway Economics:** Highway user benefits - tangible and intangible - motor vehicle operation cost - annual highway costs, methods of economic analysis – highway financing, BOT, BOOT- Numerical problems.

- Pedagogy / Course delivery tools: Chalk and talk, PowerPoint Presentation
- Link for Multi Modal Urban Transport Systems:
- <https://www.youtube.com/watch?v=5zKuUoCBGnI&t=435s>
- Link for PPP in Infrastructure: <https://nptel.ac.in/courses/105/106/105106188/>

Unit II

Geometric Design: Introduction to highway geometric design, highway cross sectional elements. Sight distances, Horizontal alignment design, Vertical alignment design, Geometrical specification for hill roads. **Traffic Engineering:** Scope, road user characteristics, traffic characteristics, volume studies, speed studies, O & D studies, PCU and highway capacity, Level of service, Accident Studies.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint Presentation
- Link for geometric design of roads using open roads(Bentley):
- https://www.youtube.com/watch?v=fh_P8vAMHoQ
- Link for Intersection design using PTV:
- <https://www.youtube.com/embed/qm8c6cvwWS>

Unit III

Pavement Design: Requirements of highway pavements - Types and design factors, ESWL, design of flexible pavements by IRC method, Mechanistic empirical pavement design, stresses in rigid pavements - wheel load stresses, temperature and frictional stresses, combination of stresses, Numerical Problems, design of rigid pavements by IRC method Numerical Problems. **Bituminous Mix Design:** Introduction, Proportionating of Aggregates-Numerical Problems, Methods of mix design, Marshall Method- Numerical Problems, Super pave mix design.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint Presentation
- Link for Aggregate and Bitumen Experiments:
- <http://www.nitttrchd.ac.in/sitenew1/nctel/civil.php>
- Link for Marshall Mix Design:
- <https://www.youtube.com/watch?v=M1vKNrcRtbU>

Unit IV

Highway Construction: Specifications of materials, construction method and field control checks for various types of pavement layers, Highway Equipment's.

Pavement Distress: Failures and causes in flexible and rigid pavements and remedial measures.

Pedagogy / Course delivery tools: Chalk and talk, PowerPoint Presentation

- Link for Flexible pavement design as per IRC 37:2018:
- <https://www.youtube.com/watch?v=HLVjhGDdsSM>
- Link for Rigid Pavement design as per IRC 58: 2015:
- <https://www.youtube.com/watch?v=nXIXz3vMinU>

Unit V

Pavement evaluation: Structural Evaluation of pavements, Functional evaluation of pavements, Overlay Design Numerical Problems. Highway Drainage: Significance and requirements of highway drainage design of surface and subsurface system, Numerical Problems, Drainage work in hill roads.

- Pedagogy / Course delivery tools: Chalk and talk, PowerPoint Presentation
- Link for Flexible Pavement Construction:
https://www.youtube.com/watch?v=egfRXi8t6WQ&list=UU_JX7j7HYXROO6jCAUmHIw&index=322
- Link for Rigid Pavement Construction:
<https://www.youtube.com/watch?v=CJkeHrlp9tU>

List of experiments:

1. Traffic Simulation using PTV Vissim
2. Proportioning Materials Using Routhfouch method
3. Analysis of flexible pavement using Kenlayer
4. Analysis of flexible pavement using KenSlab
5. Visual Condition Survey of Road
6. Design of subsurface drainage using DRIP Software

7. Estimation of quantities for Flexible Pavement
8. Estimation of quantities for Rigid Pavement
9. Analysis of flexible pavement using KenSlab
10. Visual Condition Survey of Road
11. Estimation of quantities for Flexible Pavement
12. Estimation of quantities for Rigid Pavement

Text Books:

1. Khanna S.K. and Justo C.E.G, “Highway Engineering”, NemChand and Bros, Roorkee.
2. Kadiyali L.R, “Highway Engineering”, Khanna Publishers, NewDelhi
3. Subramanyam. K.P, “Transportation Engineering”, Scitech Publications, Chennai.
4. Khanna SK and Justo CEG, A. Veeraraghavan, “Highway Material Testing Laboratory Manual”, Nem Chand and Bros

Reference Books:

1. Yoder E J and Witczak, “Principles of Pavement Design”, Edition, John Wiley and sons,1975.
2. Yang H Huang “Pavement Analysis and Design”, Pearson Publications, 2008.
3. Roger P. Roess, Elena S. Prassas, William R. McShane, “Traffic Engineering”, Pearson Publications, 2019.
4. Fred L. Mannering, Scott S. Washburn “Principles of Highway Engineering and Traffic Analysis”, Wiley 2020.
5. M. Rashad Islam, Rafiqul.A. Tarefder, “Pavement Design: Materials, Analysis, and Highways”, Mc Graw Hill Publications ,2020.

IRC Codes:

1. IRC 37:2018 “Guidelines for the design of Flexible Pavements”, Fourth Revision.
2. IRC 58:2015 “Guidelines for the design of Plain Jointed Rigid Pavements for Highways”, Fourth Revision.
3. IRC SP 30 2019 “Manual on Economic evaluation of highways in India” Third Revision.

Web links and video Lectures (e- Resources):

1. Link for Superpave Mix Design:
<https://www.youtube.com/watch?v=111RRETEvxk>
2. Link for failures in Flexible Pavement:
<https://www.youtube.com/watch?v=poDl2b4g5c8>
3. Link for failures in Rigid Pavements:
<https://www.youtube.com/watch?v=poDl2b4g5c8>
4. Link for BBD Studies:
<https://www.youtube.com/watch?v=8FPrD28kIVM>
5. Link for FWD Studies:
<https://www.youtube.com/watch?v=yMdp9H57FWo>
6. Link for Romdas Survey:
<https://www.youtube.com/watch?v=lSHtIu17OxY&t=2s>

Course Outcomes (COs):

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

1. Describe transportation systems and carry out economic feasibility analysis for road projects (PO -1,2,3) (PSO1,2)
2. Define highway geometrics and traffic engineering. (PO -1,2,3) (PSO1,2)
3. Characterize materials for pavement construction and design bituminous mixes (PO -1,2,3) (PSO1,2,3)
4. Design the flexible and rigid pavements. (PO -1,2,3,8) (PSO1,2,3)
5. Illustrate the various methods in pavement construction, evaluate Pavements and design drainage systems. (PO -1,2,3) (PSO1,2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course Outcomes addressed
Internal Assessment-I	30	CO1 & CO2 & CO3
Internal Assessment-II	30	CO3,CO4 & CO5
Average of the two internal tests will be taken for 30marks		
Other Components:		
Lab – Experimental work and Record writing	15	CO1 & CO2, CO3, CO4 & CO5
Lab Test	05	
Semester End Evaluation (SEE)		
Course end examination (Answer one question from each unit –internal choice)	100	CO1, CO2, CO3, CO4 & CO5

GEOTECHNICAL ENGINEERING - I	
Subject Code: CV53	Credits: 2:1:0
Pre requisites: Nil	Contact Hours: 30L+30T+30S
Course Coordinator: Dr. N Srilatha	

Course Content

Unit I

Introduction to Geotechnical Engineering: Phase Diagram, Definitions of Voids ratio, Porosity, Percentage Air voids, Air content, Degree of saturation, Moisture content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density and Density Index / Relative density. Interrelationships among the terms and Problems on interrelationships.

Index Properties of Soils and their Determination: Index Properties of soils – Water content, Specific Gravity, Particle size distribution, Relative Density, Consistency limits and indices, In-situ density. Problems on index properties. Importance of index properties in foundation design.

Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation

- Links: <https://nptel.ac.in/courses/105103097>
<https://archive.nptel.ac.in/courses/105/105/105105168/>
- Impartus recording:
<https://a.impartus.com/ilc/#/globalsearch?q=index%20properties&page=1&mode=0000000000>
<https://a.impartus.com/ilc/#/globalsearch?q=atterberg%20limits&page=1&mode=0000000000>

Unit II

Classification of Soils: Purpose of soil classification, basis for soil classification, Particle size classification, Unified soil classification and Indian Standard classification. Plasticity chart and its importance, Field identification of soils, Clay mineralogy

Soil Water & Permeability: Free water and Held water, Capillary phenomenon, Darcy's law- assumptions and validity, coefficient of permeability, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation. Importance of permeability in stability analysis of slopes & earthen dams.

Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation

- Links: <https://nptel.ac.in/courses/105103097>
<https://archive.nptel.ac.in/courses/105/105/105105168/>
- Impartus recording: <https://a.impartus.com/ilc/#/globalsearch?q=classification%20of%20soils&page=1&mode=0000000000>
<https://a.impartus.com/ilc/#/globalsearch?q=permeability%20of%20soils&page=1&mode=0000000000>

Unit III

Stresses in Soils & Seepage Analysis: Effective stress concept - total pressure and effective stress, quick sand phenomenon. Stresses in Soils: Boussinesq's theory – Assumptions; Vertical stress under Concentrated, Line, Strip and circular loaded area with UDL (no derivations). Pressure distribution diagrams; Concept of Isobar diagram and Pressure Bulb; Westergaard's theory; Newmark's chart and its applications. Contact pressure below foundations. Laplace's equation, assumptions and limitations, characteristics and uses of flow-nets. Estimation of quantity of seepage for Dams and sheet pile walls. Determination of phreatic line in earth dams with and without horizontal filter near the toe. Importance of flow-nets & hydraulic gradient in stability analysis of slopes/ earthen dams.

Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor compaction tests, factors affecting compaction, effect of compaction on soil properties, types of field compaction, Field compaction control, Proctor's needle, relative compaction, concept of dynamic compaction & vibro-flotation.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105103097>
<https://archive.nptel.ac.in/courses/105/105/105105168/>
- Impartus recording: <https://a.impartus.com/ilc/#/video/id/3381776>
<https://a.impartus.com/ilc/#/globalsearch?q=compaction%20of%20soils&page=1&mode=0000000000>

Unit IV

Consolidation of Soils: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations (no derivation), determination of Consolidation characteristics of soil (C_c , a_v , m_v and C_v), determination of coefficient of consolidation by square root of time fitting method and logarithm of time fitting method. Normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Types of settlements in soil, estimation of consolidation settlement, Mitigation of consolidation settlement, Numerical on consolidation of soils.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105103097>
<https://archive.nptel.ac.in/courses/105/105/105105168/>
- Impartus recording:
<https://a.impartus.com/ilc/#/globalsearch?q=consolidation%20of%20soils&page=3&mode=0000000000>
<https://a.impartus.com/ilc/#/globalsearch?q=consolidation%20of%20soils&page=3&mode=0000000000>

Unit V

Shear Strength of Soils: Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, conventional and modified failure envelopes, Total and effective shear strength parameters, Concept of pore pressure, Sensitivity and Thixotropy of clays. Determination of shear parameters (C & ϕ) using - Direct shear test, Unconfined compression test and Triaxial compression test; Shear strength tests under different drainage conditions, importance of pore pressure & shear strength in geotechnical applications, Numericals on shear strength of soils.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105103097>
<https://archive.nptel.ac.in/courses/105/105/105105168/>
- Impartus recording:
<https://a.impartus.com/ilc/#/globalsearch?q=shear%20strength%20of%20soils&page=1&mode=0000000000>
<https://a.impartus.com/ilc/#/globalsearch?q=shear%20strength%20of%20soils&page=1&mode=0000000000>

Text Books:

1. **V.N.S. Murthy, (2018)**, "Soil Mechanics and Foundation Engineering", CBS Publishers & Distributors, New Delhi.
2. **Ramamurthy T.N. & Sitharam T.G. (2010)**, "Geotechnical Engineering", S. Chand & Company, New Delhi.
3. **Punmia B.C. (2005)**, "Soil Mechanics and Foundation Engg.", 16th Edition, Laxmi Publications Co., New Delhi.

References:

1. **Alam Singh and Chowdhary G.R. (1994)**, "Soil Engineering in Theory and Practice" CBS Publishers and Distributors Ltd., New Delhi.
2. **Bowles J.E. (1996)**, "Foundation Analysis and Design", 5th Edition, McGraw Hill Pub. Co., New York.

Web links and Video Lectures (e-Resources):

1. <https://www.youtube.com/watch?v=5kAj4BQXReQ>
2. <https://www.youtube.com/watch?v=Qh6wSfVN45s>
3. <https://www.youtube.com/watch?v=t2eEK3c00Mc>
4. https://www.youtube.com/watch?v=LCCJL3m4_6A&t=151s
5. <https://www.youtube.com/watch?v=IJp5diM6ahI>
6. https://www.youtube.com/watch?v=LCCJL3m4_6A
7. <https://www.youtube.com/watch?v=TaPjIvCsfFI>
8. https://www.youtube.com/watch?v=pM-w_cvk1nA&t=307s

Course Outcomes (COs):

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

1. Describe the physical properties of soil and their significance in foundation design. (PO-1, 2 & PSO-1)
2. Classify the soils, evaluate the permeability of soil and its importance instability analysis of earthen structures. (PO-1, 2 & PSO-1)
3. Analyze the seepage flow and estimate the compaction characteristics. (PO-1, 2, 4 & PSO-1)
4. Evaluate the settlement, consolidation characteristics of soil and their significance. (PO-1, 2 & PSO-1)
5. Appraise the shear parameters of soils for foundations. (PO-1, 2 & PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

PRESTRESSED CONCRETE	
Subject Code: CV54	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. Santhosh D	

Course Content

Unit I

Materials, Basic Principles of Pre - Stressing & Analysis of Sections for Flexure:

High strength concrete and steel, Stress-Strain characteristics and properties, Pre-tensioning and Post-tensioning systems with end anchorages, comparison of behavior of reinforced concrete and pre stressed concrete, stresses in concrete due to pre-stress and loads for different types of cross sections, stresses in steel due to loads, Cable profiles, Load balancing concept, Centre of Thrust.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: <https://nptel.ac.in/courses/105106117>
<https://archive.nptel.ac.in/courses/105/106/105106117/>
- Impartus recording: <http://a.impartus.com/ilc/w/v/VvhX>

Unit II

Losses of Pre-Stress & Deflections: Losses in Pre stress, Loss of Pre stress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel, Total Loss. Deflections of pre-stressed members, short term and long term deflections, Elastic deflections under transfer loads and due to different cable profiles. Deflections limits as per IS 1343. Effect of creep on deflection, Methods of reducing deflection. Limit state of serviceability and control of deflections.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: <https://nptel.ac.in/courses/105106117>
<https://archive.nptel.ac.in/courses/105/106/105106117/>
- Impartus recording: <http://a.impartus.com/ilc/w/v/Vvh4>

Unit III

Limit State of Collapse: Flexure and Shear - IS code recommendations, calculation of Ultimate flexural strength of sections. Calculation of principal tensile stress, shear resistance of sections, shear reinforcement.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: <https://archive.nptel.ac.in/courses/105/106/105106117/>

Unit IV

Design of End Blocks: Transmission of prestress in pre-tensioned members, transmission length, Anchorage stress in post-tensioned members. Bearing stress and bursting tensile force, stresses in end blocks, IS code method, provision for the design of end block reinforcement

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: <https://archive.nptel.ac.in/courses/105/106/105106117/>

Unit V

Design of Beams and slabs: Design of pre-tensioned and post-tensioned sections. Permissible stress, design of pre - stressing force and eccentricity, limiting zone of pre-stressing force, cable profile. Design of slabs

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint Presentation
- Links: <https://nptel.ac.in/courses/105106117>
<https://archive.nptel.ac.in/courses/105/105/105105168/>

Text Books:

1. **Krishna Raju N**, “Pre - stressed Concrete”, Tata Mc Graw Hill, New Delhi.
2. **Rajagopalan N**, “Pre - stressed Concrete”, Narosa Publishing House, New Delhi.
3. IS Code: IS1343 (2012) Indian Standard code of practice for Pre stressed concrete, BIS, New Delhi.

References:

1. **Lin T Y and Burns N H**, “Design of Pre - stressed Concrete Structures”, John Wiley and Sons, New York.
2. **Pundit G S and Gupta S P**, “Pre - stressed Concrete”, C B S Publishers, New Delhi.

Web links and Video Lectures (e-Resources):

1. <https://youtu.be/4KYPltsNAWs>
2. <https://youtu.be/Vdx2dNGsuEM>
3. https://youtu.be/2pfHyPy3R_w
4. <https://youtu.be/egoXjG5n8Ik>
5. <https://youtu.be/5G-bqqJbfVQ>
6. <https://youtu.be/xztDNgsY13Q>
7. <https://youtu.be/BIJTWBlguHs>
8. <https://youtu.be/nKUIeJUhXw4>

9. <https://youtu.be/HQtsnWHHO6c>
10. https://youtu.be/IHWEHikKH_Q
11. <https://nptel.ac.in/courses/105106117>

Course Outcomes (COs):

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

1. Understand the requirement of PSC member for present scenario and analysis of stresses of PSC elements for transfer and at working condition. (PO-1, 2 & PSO-1)
2. Understand the efficiency of design of PSC after studying losses and deflection of PSC elements. (PO-1, 2 & PSO-1)
3. Evaluate the ultimate flexural and shear strength for design requirements. (PO-1, 2 & PSO-1)
4. Analyze and design of end block as per I.S code. (PO-1, 2, 3 & PSO-1)
5. Design the beams and slabs sections for different requirement. (PO-1, 2, 3 & PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4&CO5

ADVANCED CONCRETE TECHNOLOGY	
Subject Code: CVE551	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. Lakshmikanth S	

Course Content

Unit I

Concrete ingredients: Chemistry of clinker manufacturing, cement grinding, Portland cement hydration and microstructure, Portland cement types, cement production, and quality control, Influence of cement quality control parameters on Properties, Supplementary cementitious materials and pozzolanic reactions. Sustainability issues of OPC manufacturing and Usage

Aggregates: Effects of aggregates: Maximum size of aggregates, shape and surface texture, strength, density, drying shrinkage, soundness, thermal properties, fines content, and impurities, **Classification of aggregates:** Natural aggregates, Manufactured (synthetic) aggregates: Lightweight aggregates and types, Manufacturing considerations for structural grades of lightweight aggregates

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models

Web links and Video Lectures (e-Resources):

- <https://youtu.be/dgjZEI9PXCs>, <https://youtu.be/YxGhyimtyH0>
- <https://youtu.be/mLeocw2Vd2g>, <https://youtu.be/bCFhC7vYPvI>
- <https://youtu.be/7D8nLgibEQI>, https://youtu.be/oLGzNX_JP0

Unit II

Concrete mix design using IS 10262:2019: Mix design of normal concrete using OPC, partial replacement of fly ash and ground granulated blast furnace slag, mix design of high-strength concrete and self-compacting concrete and Mass concrete.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models

Web links and Video Lectures (e-Resources):

- <https://youtu.be/LMVikTevEQg>

Unit III

Fresh Concrete: Workability of fresh concrete, accelerated and normal curing, **Chemical admixtures:** dispersing admixtures, Early-age properties of concrete, Types of admixtures: Retarders, retarding plasticizers, superplasticizers, Accelerators, Air-entrainers, waterproofing admixtures, corrosion inhibitors, shrinkage reducing

admixtures, underwater admixtures, Viscosity modifying agents.

Types of Concrete: Ordinary and Standard grade concretes, High Strength Concrete, Heat-resisting and refractory concretes, Self-compacting concrete, Fibre-reinforced concrete, pumped concrete, Mass concrete, and Geopolymer concrete.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models

Web links and Video Lectures (e-Resources):

- <https://youtu.be/T4pjWFzd3rA>
- <https://youtu.be/IviIoUhG5WQ>

Unit IV

Hardened Concrete: Stress-strain relationship of hardened concrete, Dimensional stability—shrinkage and creep, types, Phenomenon of creep, Influence of creep on concrete, Mechanism of creep in concrete

Structure of Concrete: Structural levels, Structure of Concrete in Nanometer Scale: C–S–H Structure, Transition zone in concrete, Structure of the transition zone, Significance of transition zone on concrete properties.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models

Web links and Video Lectures (e-Resources):

- <https://youtu.be/PpUnxU57vAM>
- <https://youtu.be/5KtNN7CEaBg>

Unit V

Durability and Nondestructive testing; Pore structure and transport processes: Durability concept, Forms of physical and chemical deterioration, transport process, types and mechanisms. significance of transport process, transport mechanisms: diffusion, electro-migration, combined transport, moisture transport. The concrete environment, the corrosion process. Stages in the deterioration process, carbonation-induced corrosion, and chloride-induced corrosion. Concrete under fire exposure, acid and sulfate attack, and alkali-aggregate reaction.

Non-destructive testing on concrete: Rebound hammer and Ultrasonic pulse-velocity tests

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models

Web links and Video Lectures (e-Resources):

- <https://youtu.be/2npeWrad0TU>
- <https://youtu.be/RPZ-dx9SG98>

Text Books:

1. Shetty M.S. & Jain A.K. “ Concrete Technology (Theory and Practice), S. Chand Publishing, 2019
2. P. Kumar Mehta & Paulo J. M. Monteiro “Concrete – microstructure, properties, and materials” McGraw Hill Education
3. Relevant BIS codes: IS:516, IS:456 (2000).

Reference Book:

1. Jon Newman, Ban Seng Choo “Advanced Concrete Technology” volume 1 to volume 4, Elsevier publishers
2. M.L. Gambhir, Concrete Technology: Theory and Practice, McGraw Hill India
3. A. M. Neville, Concrete Technology, Pearson education limited

Web links and Video Lectures (e-Resources):

1. https://youtu.be/WrIR_6v2gZ0
2. https://youtu.be/UHVg8Q_R3oM
3. https://youtu.be/t_M4hD-PneQ
4. https://youtu.be/cL6cTSIQ_O0
5. <https://youtu.be/tvm9u7OCmuo>
6. <https://youtu.be/4fgiODO3y1U>
7. <https://youtu.be/YV-7K0JPMG0>
8. <https://youtu.be/x9VOhBCrtFM>
9. <https://youtu.be/2Q7-o0HZTOE>
10. https://youtu.be/z_QfZUfeOSk

Course Outcomes (COs):

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

1. Explain the significance of cement production, hydration, and aggregates in concrete (PO1, PO2 and PO6)
2. Apply basic scientific and engineering concepts to design mix proportions of different types of concrete using codes of practices (PO1, PO2, PO3 & PO6)
3. Discuss the behavior of admixtures and types concrete and their significance (PO1 and PO2)

4. Discuss the hardened concrete properties and non-destructive testing (PO1, PO2, PO5)
5. Explain the concept of durability, its significance, and the various influencing factors (PO1, PO2 & PO5)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course Outcomes addressed
Internal Assessment-I	30	CO1 & CO2 & CO3
Internal Assessment-II	30	CO3,CO4 & CO5
Average of the two internal tests will be taken for 30marks		
Other Components		
Assignment	10	CO1 & CO2
Assignment	10	CO3, CO4 & CO5
Semester End Evaluation (SEE)		
Course end examination (Answer one question from each unit – internal choice)	100	CO1, CO2, CO3, CO4 & CO5

IRRIGATION AND HYDRAULICS STRUCTURES

Subject Code: CVE552

Credits: 3:0:0

Pre requisites: Nil

Contact Hours: 45L+45S

Course Coordinator: Mrs. Shilpa D N and Dr. Santhosh L G

Course Content

Unit I

Irrigation and Water Requirement of Crops

Introduction. Irrigation - Definition, Necessity, Benefits and ill-effects of irrigation, Types of irrigation systems, Various irrigation methods. Water Requirement of Crops - Classification of soil water, Soil moisture constants, Depth of water application and Frequency of Irrigation-Numerical problems, Crop seasons and Crop Rotation, Crop period and Base period, Duty, Delta, Relationship between Duty and Delta, G.C.A., C.C.A., Intensity of Irrigation-Numerical problems, Irrigation Efficiencies. Irrigation requirements of crops (No Numerical problems).

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, videos
- Links: <https://www.youtube.com/watch?v=5DRdtahH6VY&pp=ygUnbWV0aG9kcyBvZiBpcnJpZ2F0aW9uIGNpdmlsIGVuZ2luZWVyaW5nhttps://www.youtube.com/watch?v=RPRK7hIVbHg>

Unit II

Design of Irrigation Canals

Introduction. Classification of irrigation canals. Procedures for the design of Canals using Kennedy's theory and Lacey's theory, Regime channels, Regime conditions, Cross-Section of regime channel, Lacey's regime Equations-Design Problems, Comparison between Kennedy's and Lacey's theory, Drawbacks in Lacey's theory. Longitudinal section of a canal, Computation of Balancing depth, Cross-section of an irrigation canal. Introduction to barrow pit, spoil bank, Berms.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, videos
- Links: <https://youtu.be/OUV8beq8K1ghttps://youtu.be/JViiENF6TVY>

Unit III

Canal Falls, Cross Regulators, Cross Drainage Works

Canal Regulation: Introduction - Canal fall, Necessity and selection of site for location of canal fall, Types of falls, Hydraulic design principles for Notch type canal fall. Canal Regulators - Cross Regulator, Head Regulator, Functions of Regulators. Cross-

Drainage Works - Introduction. Classification of Cross-Drainage Works, Types of Aqueducts (or Syphon Aqueducts), Factors affecting suitability of Types of Aqueducts (or Syphon Aqueducts).

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, videos
- Links: Canal falls- <https://youtu.be/4rvWWtcB3fE>
- <https://www.youtube.com/watch?v=vzBCYELvvOQ&pp=ygUrZGVzaWduIHByaW5jaXBsZXMGZm9yIE5vdGN0IHR5cGUgY2FuYWwgZmFsYm93D%3D>
- Cross Drainage Works- <https://youtu.be/687VXDxhVBA>

Unit IV

Design of Earthen Dams

Head Works- Introduction, Types of head works, Components of Diversion Head Works, head Works-Earthen Dams, Classification, Types of Earthen dams, Causes of failure of Earthen dams. Theories of Seepage - Design of Impervious floor using Bligh's theory- Design problems

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, videos
- Links: Headwork's: <https://youtu.be/mIm13hrBoMs>

Unit V

Design of Gravity Dams

Gravity Dam – Introduction, Advantages and disadvantages of gravity dams, Forces acting on a gravity dam, Stability analysis- Numerical Problems, Elementary profile and Practical profile of a gravity dam, Design of dam by Gravity Method-Design Problem, Spillways- introduction, factors affecting spillway capacity, types of spillways (only list), Energy dissipaters- Introduction, stilling basin type dissipaters.

- Pedagogy/Course delivery tools:
- Chalk and talk, Power point presentation, videos
- Links:<https://youtu.be/rdaW4pC59MM?list=RDCMUZY-ANi3wxkUSGhAel7T0TGw>

Text Books:

1. K. Subramanya, "Engineering Hydrology", McGraw Hill Education; Fourth edition (2017).
2. P. Jaya Rami Reddy, "Hydrology", Laxmi Publications; Third edition (2016).
3. P.N Modi, "Irrigation, Water resources and Water Power Engineering", STANDARD BOOK HOUSE; Eleventh edition (2014).

Reference Books:

1. Ray K. Linsley, et.al., “Water Recourses Engineering”, McGraw-Hill Publishing Co.; 4th edition (1992).
2. Garg S K, “Irrigation Engineering and Hydraulic Structures”, Khanna Publishers (1976).
3. Punmia B C et.al., “Irrigation and Water Power Engineering”, Laxmi Publications, Sixteenth edition (2019).

Web links and video Lectures (e- Resources):

1. <https://www.youtube.com/watch?v=e7pckUDQ9oI&list=PLbRMhDVUMngdyecGEkCH8BmO8N78lCVqh&index=9>
2. <https://www.youtube.com/watch?v=pEdY37n7CdE&list=PLbRMhDVUMngdyecGEkCH8BmO8N78lCVqh&index=12>
3. https://www.youtube.com/watch?v=eqb2FkF_7wQ
4. <https://www.youtube.com/watch?v=3vgfrwHFNLo>
5. <https://www.youtube.com/watch?v=mIm13hrBoMs>
6. <https://www.youtube.com/watch?v=7juS8WP-L6o>
7. <https://www.youtube.com/watch?v=2MkylO8HC1E>

Course Outcomes (COs):

Students will be able to:

1. State the importance of irrigation, types and methods of irrigation and evaluate water requirements of crops. (PO1, 2, 3)
2. Apply silt theories and design irrigation canals. (PO1,2,4)
3. Design various types of canal regulation and Cross-Drainage Works. (PO1,2,3)
4. Enumerate various types of Head works and design earthen dams (PO1,2,4)
5. Analyze various forces encountered in gravity dams, thereby the design of dams. (PO1,2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project Work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

INDUSTRIAL WASTEWATER TREATMENT	
Subject Code: CVE553	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. Addagada Lavanya	

Course Content

Unit I

Industrial waste and Environment

Water usage in Industry, Difference between domestic and industrial wastewater. Parameters of pollution: Inorganic salts, Acids and Alkalis, Organic matter, suspended solids, Floating solids and liquids, Hot discharges, color, toxic chemicals, microorganisms and foam producing matter. Pollution of receiving body of water. Environmental standards for industrial effluents as per Central Pollution Control Board.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://youtu.be/SRvRFY-c5U?list=PL4SPMn8HFBYBhLHBY8D7iCNek9sWGWPCX>
<https://youtu.be/QO5X0iaq2S8?list=PL4SPMn8HFBYBhLHBY8D7iCNek9sWGWPCX>
- NPTEL Links: https://youtu.be/8FjhsODW1q4?list=PLLy_2iUCG87Cr_rs9sS1zSaR62imd0uB
https://youtu.be/Ar04qG1P8Es?list=PLLy_2iUCG87Cr_rs9sS1zSaR62imd0uB

Unit II

Industrial wastewater treatment

Theories and Practices: Volume Reduction: classifying wastes; conserving wastewater; changing production to decrease wastes; reusing both industrial and municipal effluents as raw water supplies and eliminating batch or slug discharges of process wastes. Concentration Reduction: process changes, equipment modifications, segregation of wastes, equalization of wastes, by-product recovery and proportioning wastes. Pre-treatment of Industrial wastewater –Neutralization: Mixing of wastes and chemical treatment. Equalization and Proportioning: objectives and methods.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, videos
- Links: <https://youtu.be/rdaW4pC59MM?list=RDCMUCY-ANi3wxkUSGhAel7T0TGw>

- NPTEL Links: <https://www.youtube.com/watch?v=rdaW4pC59MM>
https://www.youtube.com/watch?v=rdaW4pC59MM&list=RDCMU CY- ANi3wxkUSGhAel7T0TGw&start_radio=1&rv=rdaW4pC59MM&t=3

Unit III

Effluent Sampling

Significance of sampling, Grab and composite sampling. Removal of suspended solids: Sedimentation- Theory and design of circular Removal sedimentation tank. Flotation- Theory and methods. Screening- theory and methods. Removal of colloidal particles- chemical coagulation and adsorption. Removal of Inorganic Dissolved Solids- Evaporation, Ion exchange and Reverse Osmosis.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://youtu.be/rdaW4pC59MM?list=RDCMU CY- ANi3wxkUSGhAel7T0TGw>
- NPTEL Links: <https://www.youtube.com/watch?v=ciPFC3Y2rkg>
https://www.youtube.com/watch?v=rdaW4pC59MM&list=RDCMU CY- ANi3wxkUSGhAel7T0TGw&start_radio=1&rv=rdaW4pC59MM&t=3

Unit IV

Removal of organic Dissolved Solids

Flowchart indicating Lagooning, Activated-sludge treatment, Trickling filtration, anaerobic digestion, Rotating Biological Contactor (Theory and methods- No design). Treatment of sludge- Anaerobic and Aerobic Digestion, vacuum filtration and Drying Beds. Manufacturing process: flow sheet with sources of wastewater, characteristics of waste and treatment of the following industrial effluents. Dairy industry, Sugar Mill, Paper and pulp Industry, Distillery industry and Plating industry.

- Pedagogy/Course delivery tools: Chalk and talk, Conventional water treatment plant visit, invited lectures from industry people, Power Point Presentation
- Links: <https://youtu.be/R075TPSwMkE?list=RDCMU CY- ANi3wxkUSGhAel7T0TGw>
- NPTEL Links: <https://www.youtube.com/watch?v=ciPFC3Y2rkg>
https://www.youtube.com/watch?v=rdaW4pC59MM&list=RDCMU CY- ANi3wxkUSGhAel7T0TGw&start_radio=1&rv=rdaW4pC59MM&t=3

Unit V

Case studies of design of ETP

Dairy industry, Sugar Mill, Paper and pulp Industry, Distillery industry and Plating industry.

- Pedagogy/Course delivery tools: Chalk and talk, invited lectures from industry people, PowerPoint Presentation, video.
- Links: <https://youtu.be/b2qOEJMvBZw?list=RDCMU CY- ANi3wxkUSGhAel7T0TGw>
- NPTEL Links: <https://www.youtube.com/watch?v=ciPFC3Y2rkg>
https://www.youtube.com/watch?v=rdaW4pC59MM&list=RDCMU CY- ANi3wxkUSGhAel7T0TGw&start_radio=1&rv=rdaW4pC59MM&t=3

Text Books:

1. Industrial Waste Treatment Contemporary Practice and Vision for the Future by Nelson Leonard Nemerow, Elsevier, 2007, ISBN-13: 978-0-12-372493-9.

Reference Books:

1. Waste Water Treatment: Rational Methods of Design and Industrial Practices, 3/E, By M N Rao, Oxford & IBH Publishing Company Pvt. Ltd. (2007), ISBN-13: 978-8120417120
2. Industrial water pollution control, by W.Wesley Eckenfelder, Jr. ,Third Edition, McGraw- Hill, IESBN 0 07 116275-5, 2000.
3. Pollution Control in Process Industries by S P Mahajan, McGraw Hill Education (2017), ISBN-13: 978-0074517727

Web links and video Lectures (e- Resources):

1. <https://youtu.be/SRvRFY-c5-U?list=PL4SPMn8HFBYBhLHBY8D7iCNek9sWGWP CX>
2. <https://youtu.be/QO5X0iaq2S8?list=PL4SPMn8HFBYBhLHBY8D7iCNek9sWGWP CX> https://www.youtube.com/watch?v=HlBYCtJ9_Cw
3. <https://www.youtube.com/watch?v=ciPFC3Y2rkg>
4. <https://youtu.be/b2qOEJMvBZw?list=RDCMU CY- ANi3wxkUSGhAel7T0TGw>

Course Outcomes (COs):

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

1. Describe the nature of industrial wastewater and summarize the pollution of streams. (PO 1,2,3,6)
2. Illustrate the waste reduction techniques and pretreatment. (PO 1,2,3,6)
3. Demonstrate the sampling techniques and primary treatment. (PO 1,2,3,6)
4. Outline the organic treatment of industrial wastewater. (PO 1,2,3,6)
5. Provide wastewater management plan in industrial setup. (PO 1,2,3,6)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course out comes mapped
Internal Test-I	30	CO1, CO2 & CO3
Internal Test-II	30	CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Assignment – MCQ, Quiz, Group presentation	10	CO1, CO2, CO3, CO4 & CO5
Assignment – MCQ, Quiz, Group presentation	10	CO1, CO2, CO3, CO4 & CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

TRAFFIC ENGINEERING	
Subject Code: CVE554	Credits: 3:0:0
Pre requisites: - Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. Vivek R Das	

Course Content

Unit I

Traffic Characteristics, road user characteristics – Human factors including reaction time and vehicular characteristics affecting road design and traffic flow. Traffic Stream Parameters, Speed, Flow Density, Derived Characteristics, Time-Space Diagram

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105101008>

Unit II

Fundamental relations of traffic flow, Traffic Stream models -, Shock wave, Car following models, Lane changing models, Vehicle arrival models, PCU values, Interrupted and Uninterrupted flow

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105101008>

Unit III

Traffic studies - Data collection, analysis and interpretation of results of classified traffic volume, spot speed, speed and delay, origin and destination. Density measurement. Moving observer method, parking studies, Boarding and alighting survey. Driver observance studies. Vehicle trajectory data. Accident audit survey.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105101008>

Unit IV

Highway Capacity - Level of service, factors influencing roadway capacity, capacity of roads at various levels of service, Urban streets, two lane highways, Multi lane highways, Signalized and un-signalized intersection using HCM (US) and Indo HCM. Design features of expressways. **Traffic regulations and control** - Regulation on vehicles, drivers and traffic flow, Traffic control devices – Types & objectives of markings, signs, signals and islands, delineators.

- Pedagogy / Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105101008>

Unit V

Fuel Consumption and Emission – Types of vehicular emissions, Fuel Consumption models, Congestion studies – Measurement of congestion, Counter measures, Pedestrian Studies – Pedestrian flow characteristics, Design principles of pedestrian facilities Design of on street and off-street parking facilities, pedestrian facilities, bus bays, safety devices. Types of grade separated Intersections.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105101008>

Text Books:

1. Kadiyali L.R. “Traffic Engineering and Transportation Planning”-Khanna Publication, New Delhi
2. Salter RJ and Hounsell NB, “Highway, Traffic Analysis and Design”- Macmillan Press Ltd., London.
3. Matson T M, Smith W S , Hurd F W, “ Traffic Engineering, Mc graw Hill Book Co, NY , USA.
4. Drew D R ,” Traffic Flow Theory and Control”, McGraw Hill Book Co, NY, USA.
5. Wohl and Martin, “Traffic System Analysis of Engineers and Planners”- Mcgraw Hill Book Co, New York, USA.

References:

1. Pignataro , “ Traffic Engineering”, John wiley& sons.
2. Nicholas J Garber, Lester A Hoel, “Traffic & Highway Engineering”- Third edition, Bill Stenquist.
3. IRC: SP:41-1994, IRC SP:31-1992, IRC 43-1994, Indian Roads Congress
4. MoRTH “Type Designs for Intersections on National Highways”-Indian Roads Congress
5. MORTH “Manual for Road Safety in Road Design”-Indian Roads Congress
6. IRC3-1983,9-1972,62-1976,64-1990,65-1976,66-1976,67-2001,69-1977,70-1977,73-1980,79-1981,80-1981,86-1983,92-1985,93-1985,99-1988,102-1988,103-1988,106-1990,110-1996 Indian Roads Congress Khanna and Justo, “Highway Engineering”- Nem Chand andBros., Roorkee

Web links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/105101008>
2. <https://youtu.be/oSnTPOK5oZA?list=PLHiD1psy5TmwS8STglH1boZV7PKwt-TO0>
3. <https://www.youtube.com/watch?v=qkQ6ZpJcfhY>
4. <https://www.youtube.com/watch?v=v0zHklOgtHQ>
5. <https://www.youtube.com/watch?v=DmrmtYLabrI>
6. https://www.youtube.com/watch?v=WdljEj_a_dQ
7. https://www.youtube.com/watch?v=-BRVOeu_UZs&list=PLHiD1psy5TmwS8STglH1boZV7PKwt-TO0&index=28

Course Outcomes (COs):

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

1. Define various traffic and road user characteristics (PO 1,2 PSO1)
2. Illustrate the fundamentals of traffic flow theory and it's regulations and control (PO 1,2 PSO1)
3. Classify various types of traffic surveys and understand it's methodology (PO 1,2 PSO1)
4. Analyze and design different types of traffic facilities (PO1,2 & PSO1)
5. Design and appraise a safe and efficient traffic system (PO 3,7 & 8 PSO1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

BUILDING PLANNING & SERVICES	
Subject Code: CVE555	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. Harish M L	

Course Content

Unit I

Basic concepts in the Development of Construction Plans - Choice of Technology
Resource Requirements for Work Activities - Coding Systems and Construction
Method - Defining Work Tasks - Defining Precedence Relationships Among Activities
- Estimating Activity Durations - Estimation

- Pedagogy: Chalk & talk, PPT
- Links: <https://gillilandcm.com/2019/03/26/what-is-construction-project-planning/>
https://www.brainkart.com/article/Choice-of-Technology-and-Construction-Method_3520/

Unit II

Drawing of Building Elements- Drawing of various elements of buildings like various types of footing, open foundation, raft, grillage, pile and well foundation, Drawing of frames of doors, window, various types of door, window and ventilator, lintels and arches, stairs and staircase, trusses, flooring, roofs etc.

- Pedagogy: Chalk & talk, PPT
- Links: <https://dailycivil.com/types-footings-used-building-construction/>
<https://byjusexamprep.com/types-of-footings-i>

Unit III

Building Planning- Classification of buildings, Provisions of National Building Codes and Rules, Building bye-laws, open area, Setbacks, FAR terminology, Design and drawing of Building, Design concepts and philosophies, Preparing sketch plans and working drawings of various types of buildings like residential building, institutional buildings and commercial buildings, site plans.

- Pedagogy: Chalk & talk, PPT
- Links: <https://www.lceted.com/2021/08/classification-of-buildings.html>
<https://atozbuilding.in/2020/05/building-construction-types-buildings-planning-height.html>

Unit IV

Building Services- Introduction of Building Services like water supply, sewerage and drainage systems, sanitary fittings and fixtures, plumbing systems, principles of internal & external drainage systems, principles of electrification of buildings.

- Pedagogy: Chalk & talk, PPT
- Links: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjugo6ocAhXIUGwGHbACB_8QFnoECCQQAQ&url=https%3A%2F%2Fsist.sathyabama.ac.in%2Fsist_coursematerial%2Fuploads%2FSARA5103.pdf&usg=AOvVaw23JqeWNDnsDe19WGt9FQFo&opi=89978449https://www.designingbuildings.co.uk/wiki/Types_of_building_services

Unit V

Air-conditioning systems, types, installation and maintenance costs. Firefighting systems, building safety and security systems. Illumination, artificial lighting, day lighting, laws and principles of illumination. Electric light sources, brief description, Characteristics, starting circuits and application of incandescent and discharge lamps. Design of lighting systems, flood lighting, relevant IS codes. Energy conservation in buildings, Building Technology.

- Pedagogy: Chalk & talk, PPT
- Links: <https://welterheating.com/types-air-conditioners/>
<https://kimbroair.com/blog/different-components-air-conditioner-hendersonville-tn>
<https://sustainabilityworkshop.venturewell.org/buildings/electric-light-sources.html>

Text Books:

1. A Text-Book of Building Construction, S.P.Bindra and S.P.Arora, Dhanpat Rai Publications
2. Building Materials and Construction, Jena and Sahu, Mc. Graw Hill.
3. Materials for Civil and Construction Engineers, Mamlouk and Zaniewski, Pearson

Reference Books:

1. Building Materials and Building Construction, by P C Verghese
2. Building Construction, by B. C. Punmia, Laxmi Publication

Web links:

1. <https://www.vedantu.com/physics/light-sources>
2. https://www.designingbuildings.co.uk/wiki/Types_of_building_services
3. <https://dailycivil.com/types-of-buildings/>
4. <https://www.youtube.com/watch?v=6CebLrFiLlk>
5. <https://www.youtube.com/watch?v=WLLIel9oMgo>

Course Outcomes (COs):

At the end of the course, students will be able to

1. Understand the basic concepts of building plans and construction components of building. (PO 1,3, PSO 1)
2. Illustrate of various Building Elements. (PO 1,3,10, PSO 1)
3. Understand the Classification of buildings as per Provisions of National Building Codes (PO 1,7,8 PSO 1)
4. Illustrate the Building Services like water supply, sewerage and drainage systems, sanitary fittings and fixtures. (PO 1,3,10, PSO 1)
5. Illustrate the air conditioning systems, energy conservative technologies. (PO 1,3,6, PSO 1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

CONCRETE LABORTAORY	
Subject Code: CVL56	Credits: 0:0:1
Pre requisites: Nil	Contact Hours:30P
Course Coordinator: Dr.Lakshmikanth S	

Course Content

EXPERIMENTS FOR CONDUCTION:

1. Mix design of normal conventional concrete of Grade (M25/M30/M40) and High strength concrete as per IS 10262:2009
2. Slump and Compaction factor tests.
3. Flow test and Vee bee consistometer
4. Compressive strength of hardened concrete
5. Split tensile test of hardened concrete
6. Flexural test of hardened concrete
7. NDT – Determination of Compressive strength of Concrete core and concrete specimen by rebound hammer
8. NDT – Determination of Compressive strength/dynamic modulus of Concrete core and concrete specimen by ultrasonic pulse velocity tests
9. Determination of concrete permeability
10. Rapid Chloride penetration test on Hardened concrete
11. Demonstration of Profometer and rebar locator
12. Demonstration of half-cell potential test

Text Books:

1. M S Shetty, “Concrete technology”, Chand S and Co.
2. Gambhir B L, “Concrete Technology”, Tata McGraw Hill, New Delhi

Links:

1. <https://www.youtube.com/watch?v=CHs83nfkTy8>
2. <https://www.youtube.com/watch?v=PlbCpJqWqwU>
3. <https://www.youtube.com/watch?v=Ql5U1k9Sxhg>
4. <https://www.youtube.com/watch?v=t4RDdn6rOwU>
5. <https://www.youtube.com/watch?v=wI5hFajlrrM>

Course Outcome (COs):

Students will be able to:

1. Understand the properties of cement like fineness, specific gravity and normal consistency. (PO 1,2,7 PSO 2,3)
2. Understand the properties of cement like soundness and compressive strength of cement mortar. (PO 1,2,7 PSO 2,3)
3. Design concrete mixes based on properties of material using IS code. (PO 1,2,3,7 PSO 2,3)
4. Describe behavior of harden concrete. (PO 1,2,7 PSO 2,3)
5. Demonstrate use of Nondestructive testing methods on harden concrete. (PO 1,2,3 PSO 2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Weekly evaluation of laboratory manuals/records after the conduction of every experiment.	30	CO1, CO2, CO3, CO4 & CO5
Practical test	20	CO1, CO2, CO3, CO4 & CO5
Semester End Evaluation: 50		
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4 & CO5

HIGHWAY ENGINEERING LABORATORY	
Subject Code: CVL57	Credits: 0:0:1
Pre requisites: Nil	Contact Hours:30P
Course Coordinator: Mr Niranjan Hiremath	

Course Content

1. **Tests on Aggregates:**
 - I) Aggregate Crushing Value Test
 - II) Stone Polishing Value test
 - III) Aggregate Impact Test
 - IV) Shape tests (Flaky, Elongation, Combined Index, Angularity number)
 - V) Specific gravity and water Absorption Test

2. **Tests on Bituminous Materials and Mixes:**
 - I) Specific Gravity Test
 - II) Penetration Test
 - III) Ductility Test
 - IV) Softening point Test
 - V) Flash and fire point Tests
 - VI) Viscosity Test
 - VII) Marshall Stability Test

3. **Tests on Subgrade Materials:**
 - I) California Bearing Ratio test on subgrade soil
 - II) Wet Sieve Analysis

4. **Traffic studies:** Volume and Speed studies.

Links:

1. Aggregate Crushing Value Test:
<https://www.youtube.com/watch?v=1E7LFOuGKyI>
2. Stone Polishing Value Test:
<https://www.youtube.com/watch?v=Bt4rCWZp6zk>
3. Aggregate Impact Value Test:
<https://www.youtube.com/watch?v=Mn7aeorMpTs>
4. Aggregate Shape Test:
<https://www.youtube.com/watch?v=Mn7aeorMpTs>

5. Aggregate Specific Gravity and Water Absorption Test:
<https://www.youtube.com/watch?v=hqXFPq676iM>
6. Specific Gravity Test on Bitumen:
<https://www.youtube.com/watch?v=7ReVXB6VPto>
7. Penetration Test on Bitumen:
https://www.youtube.com/results?search_query=%097.%09Penetration+Test+on+Bitumen+NCTEL
8. Ductility Test on Bitumen: <https://www.youtube.com/watch?v=TE8zYxUJHt0>
9. Softening Point Test on Bitumen: <https://www.youtube.com/watch?v=-yBXl4z70mI>
10. Flash and Fire Point Test on Bitumen:
https://www.youtube.com/watch?v=L5_69I7HLc4

Text Books:

1. Khanna SK and Justo CEG, “Highway Engineering”, NemChand and Bros, Roorkee, revised 10th Edition.
2. Kadiyali L.R, “Highway Engineering”, Khanna Publishers, New Delhi, 10th Edition.

Reference Book:

1. Relevant IS Codes and IRC Codes.
2. Khanna S.K, Justo C.E.G, and Veeraragavan.A, “Highway Material and Pavement Testing Laboratory Manual” Revised 5th Edition 2009, Nemi Chand & Bros.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Characterize aggregates based on mechanical properties. (PO 1,7,8) (PSO2,3)
2. Evaluate bitumen properties for its application in pavements. (PO 1, 7,8) (PSO2,3)
3. Evaluate soil for gradation and strength parameters. (PO 1,7,8) (PSO2,3)
4. Design bituminous mix based on Marshall mix properties. (PO 1,3,6,7,8) (PSO2,3)
5. Characterize the traffic based on volume study. (PO 6,9,9) (PSO2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Weekly evaluation of laboratory manuals/records after the conduction of every experiment.	30	CO1, CO2, CO3, CO4 & CO5
Practical test	20	CO1, CO2, CO3, CO4 & CO5
Semester End Evaluation: 50		
Semester End Examination(SEE)	50	CO1, CO2, CO3, CO4 & CO5

RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS	
Subject Code: AL58	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator:	

Course Content

Unit I

Research Methodology

Introduction: Meaning of Research, Objectives of Research, Types of Research, Ethics in Research, Types of Research Misconduct.

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art, Bibliographic Databases, Conceptualizing Research, Critical and Creative Reading.

Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge flow through Citations, Acknowledgments, and Attributions.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc22_ge08/preview

Unit II

Research Design: Need for Research Design, Important Concepts Related to Research Design: Dependent and Independent Variables, Extraneous Variable, Variable, Common Control, Confounded Relationship, Research Hypothesis, Experimental and Control Groups, Treatments.

Experimental Designs: Introduction to Randomised Block Design, Complete Randomised Design, Latin Square Design, and Factorial Design.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc22_ge08/preview

Unit III

Method of Data Collection: Primary and Secondary Data Collection.

Sampling Design: Sampling fundamentals, Measurement, and Scaling Techniques, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, and Types of Sample Design.

Data Analysis: Testing of Hypotheses: Null Hypothesis, Alternative Hypothesis, Type I and Type II Errors, Level of Significance. Procedure for Hypothesis Testing: Mean, Variance, Proportions. Chi-square Test, Analysis of Variance (One Way ANOVA), and Covariance (ANOCOVA)

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc23_ge36/preview

Unit IV

Intellectual Property Rights

Introduction to IPR: Different forms of IPR, Role of IPR in Research and Development. TRIPS Agreement, Patent Cooperation Treaty (PCT).

Patents: Brief history of Patents-Indian and Global Scenario, Principles Underlying Patent Law, Types of Patent Applications in India, Procedure for Obtaining a Patent. Non Patentable Inventions. Rights Conferred to a Patentee, Basmati Rice Patent Case.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: <https://archive.nptel.ac.in/courses/110/105/110105139/>

Unit V

Design: What is a Design? Essential Requirements for a Registrable Design, Procedure of Registration of a Design,

Trademarks: Essentials of a Trademark, Registration, and Protection of Trademarks, Rights Conferred by Registration of Trademarks, Infringements, Types of Reliefs, Case Studies.

Copyrights: Characteristics of Copyrights, Rights Conferred by Registration of Copyrights, Registration of Copyrights, Infringements, Remedies against Infringement of Copyrights, Case studies

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: <https://archive.nptel.ac.in/courses/110/105/110105139/>

Text Books:

1. C. R Kothari, Gourav Garg, Research Methodology – Methods and Techniques. New Age International Publishers.
2. Dr. B L Wadehra – Law relating to Intellectual property. Universal Law Publishing Co.
3. Dipankar Deb, Rajeeb Dey, Valentina E. Balas “Engineering Research Methodology”, ISSN 1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook), <https://doi.org/10.1007/978-981-13-2947-0>.

Reference Books:

1. David V. Thiel “Research Methods for Engineers” Cambridge University Press, 978-1-107-03488-4

Course Outcomes (COs):

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

1. Possess the knowledge of research and conduct a literature review. (PO-7, PO-9, PO-11)
2. Apply the knowledge of research design and design of experiments. (PO-4, PO-7, PO 9, PO-11)
3. Analyse data collection methods, analysis, and sampling design. (PO-4, PO-7, PO-9, PO-11)
4. Understand the global and Indian scenarios of patents and patent applications. (PO-7, PO-0, PO-11)
5. Acquire the requirements of registration and infringements related to trademarks, copyrights, and designs. (PO-7, PO-9, PO-11)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcome attained
Internal test – 1	30	CO1, CO2, CO3
Internal test – 2	30	CO4, CO5
The average of the two internal tests will be taken for 30 marks		
Other Components		
Assignment	10	CO1, CO2
Quiz	10	CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

FUNDAMENTALS OF PROJECT MANAGEMENT IN CIVIL ENGINEERING	
Subject Code: AEC59	Credits: 1:0:0
Pre requisites: Nil	Contact Hours: 15L+15S
Course Coordinator: Sri Niranjan Hiremath	

Course Content

Unit I

Construction Planning: Basic concepts in the development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships Among Activities - Estimating Activity Durations – Estimating Resource Requirements for Work Activities, Scheduling and controlling Project Organization, Bar Charts, Work Breakdown Structure, Networking techniques, development of network.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint Presentation
- https://onlinecourses.nptel.ac.in/noc19_mg30/preview

Unit II

Critical Path Method (CPM)- Introduction - Slack - Critical Path - Example problem - Activity time estimate - Earliest event time - Latest allowable occurrence time - Combined tabular computations for TE and TL - Start and finish time of activity - Float - Critical activity and Critical path - Problems.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint Presentation
- <https://archive.nptel.ac.in/courses/110/104/110104073/>
- <https://archive.nptel.ac.in/courses/110/104/110104073/>

Unit III

Program Evaluation and Review Technique (PERT)- Introduction - Use of PERT - Time estimate - Frequency distribution - Mean, Variance and standard deviation - Probability distribution - Expected time problem – Problems

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint Presentation
- <https://archive.nptel.ac.in/courses/110/104/110104073/>
- <https://archive.nptel.ac.in/courses/110/104/110104073/>

Unit IV

Resource allocation, Materials management, Cost control in construction, time-cost trade-off.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint Presentation
- https://onlinecourses.nptel.ac.in/noc19_mg30/preview
- <https://www.youtube.com/watch?v=K01PxmyC6Vo>

Unit V

Construction Mechanization: Introduction to Mechanization, Mechanization through construction equipment: earth excavation, moving and hauling, aggregate manufacturing; concrete production and placement- types of equipment, trench-less technology. Factors for selecting equipment and performance and economic life.

- Pedagogy / Course delivery tools: Chalk and talk, Powerpoint Presentation
- <https://www.youtube.com/watch?v=LOASs7vJJ3o>

Text Books:

1. NVR Naidu and T. Krishna Rao, Management and Entrepreneurship, I K International Publishing House Pvt. Ltd, 2nd Edition (2016), New Delhi.
2. Chitkara, K. K “Construction Project Management Plan, Se (English) 2nd Edition, Tata Mcgraw Hill Education Private Limited, 2010.
3. Sharma, J. L, “Construction Management and accounts” Satya Publications, 2013.
4. P.S. Gahlot , B. M. Dhir, Construction Planning and Management, New Age International Publishers, Reprint 2018, New Delhi.
5. Mahesh, Verma, Construction, Planning and Management through System Techniques, Metropolitan Book Co

Reference Books:

1. Peurifoy R L, Construction Planning Equipments and Method, Mcgraw Hill Publication 3rd Edition. New Delhi.
2. Kohli and Uddesh, Project Management Hand Book for Engineering Construction, TMH Publications, New Delhi.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Interpretation of projects and development of network diagram for activities involved in the construction project. (PO 5,10)
2. Compute critical path and floats for a given network diagram using CPM. (PO 3, 9)
3. Analyze the uncertainties in the project network using PERT. (PO 2, 4, 11)
4. Comprehend resource allocation, cost and time in a project. (PO 1, 10)
5. Adopt mechanization concepts in Construction projects. (PO 5,6,10)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course Outcomes addressed
Internal Assessment-I	30	CO1 & CO2 & CO3
Internal Assessment-II	30	CO3,CO4 & CO5
Average of the two internal tests will be taken for 30marks		
Other Components:		
Assignment I/Quiz/Presentation	10	CO1 & CO2, CO3, CO4 & CO5
Assignment II/ Quiz/Presentation	10	
Semester End Evaluation (SEE)		
Course end examination (Answer one question from each unit –internal choice)	100	CO1, CO2, CO3, CO4 & CO5

ENVIRONMENTAL STUDIES	
Subject Code: HS510	Credits: 0:0:0
Pre requisites: Nil	Contact Hours: 15L
Course Coordinator: Dr. Addagada Lavanya	

Course Content

Unit I

Environment, Ecology and Biodiversity

Definition, scope and importance. Multidisciplinary nature of Environmental studies. Food chain and food web. Energy flow and material cycling in ecosystem. Biodiversity and threats to biodiversity. Concept of sustainable development: Definition, objectives and applications.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models
- Link: https://youtu.be/I_bnGkviWOU<https://youtu.be/Ar04qG1P8Es>

Unit II

Natural resources

Forest resources: Ecological importance of forests. Water resources: Global water resources distribution. Mineral resources: Environmental effects of extracting and processing Mineral resources. Food resources: Effects of modern agriculture. Land resources: Soil erosion and Desertification.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos
- Link: <https://youtu.be/vsXv3anIBSU><https://youtu.be/1rOVPqaUyv8>

Unit III

Energy Sources

Growing energy needs. Conventional and non-conventional / Renewable and Non-renewable energy sources. Bio Energy-Ethanol and Bio mass energy. Energy of the future – Hydrogen fuel cells and Nuclear energy. Environmental Impact Assessment (EIA): Definition, Objectives and benefits. Step by step procedure of conducting EIA.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Animations, Models
- Link: <https://youtu.be/mh51mAUexK4>https://youtu.be/XS-eXqppf_w

Unit IV

Environmental Pollution

Definition, Causes, Effects and control measures of Water pollution, Air pollution and Soil/ land pollution. Management of Municipal Solid Waste and treatment methods of municipal solid waste.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos
- Link: <https://youtu.be/NRoFvz8Ugeo> <https://youtu.be/DAQapF-F4Vw>

Unit V

Environmental protection

Global warming and Climate change, Acid rain, Ozone layer depletion. Salient features of Environmental Protection Act, Air & Water Acts. Functions of Central and State Pollution Control Boards.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Open source softwares
- Link: <https://youtu.be/iV-BvYwl4Y8> <https://youtu.be/BYqLRGawoH0>

Text Books:

1. **S M Prakash** – Environmental Studies, Elite Publishers, 2007.
2. **Benny Joseph**- Environmental studies, Tata Mcgraw-Hill 2nd edition 2012.
3. **R Geetha Balakrishna & K G Lakasminarayana Bhatta**- Environmental Studies, S M Publications, 2006-2007.

Reference Books:

1. **P. Venugopala Rao** – Principles of Environmental Science & Engineering Prentice Hall of India, 1st edition, 2006.
2. **N Balasubramanya & Gurdeep R Chatwal**- Himalaya publishing House, 2007.
3. **Dr. B.S Chauhan**- Environmental studies, university of science press 1st edition

Web links and video Lectures (e- Resources):

1. https://youtu.be/I_bnGkviWOU
2. <https://youtu.be/vsXv3anIBSU>
3. <https://youtu.be/mh51mAUexK4>
4. <https://youtu.be/NRoFvz8Ugeo>
5. <https://youtu.be/iV-BvYwl4Y8>

Course Outcomes (COs):

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

1. Describe the importance of environmental studies, sustainable development and biodiversity (PO-1, 6)
2. Explain the importance and conservation of impacts of natural resources (PO-1, 6)
3. Distinguish the energy sources and identify the alternative energy sources for sustainable development (PO-1, 6)
4. Identify the causes, effects and control measures of pollution in developmental activities (PO-1, 6)
5. Outline the current environmental issues and the role of the agencies for environmental protection (PO-1, 6)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal Test-I	30	CO1, CO2 & CO3
Internal Test-II	30	CO4 & CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Assignment – MCQ, Models	10	CO1, CO2, CO3, CO4 & CO5
Assignment – Quiz, Group Presentation	10	CO1, CO2, CO3, CO4 & CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4 & CO5

VI SEMESTER

MANAGEMENT & ENTREPRENEURSHIP	
Subject Code: AL61	Credits: 3:0:0
Pre requisites: NIL	Contact Hours: 45L+45S
Course Coordinators: Dr. M Shilpa/ Dr. M Rajesh	

Course Content

Unit I

Introduction to Management: Definition of Management, Its nature and purpose, Contributions of F.W. Taylor and Henry Fayol to management theory, Functions of managers.

Planning: Types of plans, Steps in planning, the planning process, Management by Objectives (MBO)

Organizing: The nature and purpose of organizing, Formal and informal organization. Organization levels and Span of management, Principle of span of management, the structure and process of organizing

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc23_mg33/preview
<https://www.digimat.in/nptel/courses/video/110107150/L01.html>

Unit II

Staffing: Situational factors affecting staffing.

Leading: Human factors in managing, definition of leadership, Ingredients of leadership

Controlling: Basic control process, Critical control points and standards, Control as a feedback system, Feed forward control, Requirements for effective controls.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: <https://nptel.ac.in/courses/110107150>

Unit III

Introduction to Entrepreneurship: The Foundations of Entrepreneurship: What is an Entrepreneurship? The benefits of Entrepreneurship, The potential drawbacks of Entrepreneurship; Inside the Entrepreneurial Mind: From Ideas to Reality: Creativity, Innovation and Entrepreneurship, Creative Thinking, Barriers to Creativity

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://www.youtube.com/watch?v=Hgj_kRrvbhQ&list=PL7oBzLzHZ1wXW3mtolxV5nIGn48NLKwrb

Unit IV

The Entrepreneurial Journey: Crafting a Business Plan: The benefits of creating a business plan, the elements of a business plan; Forms of Business Ownership and Buying an Existing Business: Sole proprietorships and partnership.

Launching the Business: Franchising and the Entrepreneur: Types of Franchising, the benefits of buying a Franchise

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links:<https://www.youtube.com/watch?v=Tzzfd6168jk&list=PLyqSpQzTE6M8EGZbmNUuUM7Vh2GkdbB1R>
https://www.youtube.com/watch?v=5RMqxtMwejM&list=PLyqSpQzTE6M9zMkP_Sm81k9U8NjaVJkR

Unit V

Small Scale Industry: Definition, Characteristics, types, role of SSI in Economic Development, steps to start SSI- Govt. Policy towards SSI, Institutional support- TECKSOK, KIADB, KSSIDC, KSIMC, DIC, NSIC, SIDBI, KSFC.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links:<https://www.nptel.ac.in/courses/110/105/110105067/>

Text Books:

1. Harold Koontz, H. Weihrich, and A.R. Aryasri, Principles of Management, Tata McGraw-Hill, New Delhi, 2004.
2. Essentials of Entrepreneurship and Small Business Management – Norman Scarborough & Jeffrey Cornwall (Pearson, 2016)
3. Management and Entrepreneurship by K. R. Phaneesh, Sudha Publications, Bangalore

References:

1. Innovation & Entrepreneurship – Peter Drucker (Harper, 2006)
2. Entrepreneurship: The Art, Science, and Process for Success – Charles Bamford & Garry Bruton (McGraw-Hill, 2015)
3. Management and Entrepreneurship-NVR Naidu, T Krishna Rao, I.K. International Publishing House Pvt. Ltd.@ 2008
4. Poornima M Charantimath, Entrepreneurship Development and Small Business Enterprises, Pearson Education, 2006.

Course Outcomes (COs):

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

1. Plan and organize for the manpower in the given type of organization (PO-6,8,10)
2. Use staffing Leading and controlling functions for the given organization. (PO-6,7,8,9)
3. Analyze the advantages and potential drawbacks of Entrepreneurship. (PO-6,7,8)
4. Develop a basic business plan and analyze the benefits of buying Franchise. (PO-3,5,6,7,10)
5. Identify the various institutions that provide financial support to small scale industries. (PO-6,10)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30marks.		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DESIGN OF STRUCTURAL STEEL ELEMENTS	
Subject Code: CV62	Credits: 3:1:0
Pre requisites: Nil	Contact Hours: 45L+30T+45S
Course Coordinator: Dr. Anil Kumar R	

Course Content

Unit I

Bolted Connection: Introduction, Design Philosophies, Limit State Method, Concepts in design of connections, codal provisions and usage of HSFG bolts. Transfer of forces in bolted connections. Failure of bolted connections, simple and eccentric bolted connections, Beam to beam to column connections, Introduction to stiffened and unstiffened connections (concepts only).

- Pedagogy: Chalk & talk, PPT
- Links: <https://www.digimat.in/nptel/courses/video/105105162/L01.html>
<https://www.digimat.in/nptel/courses/video/105105162/L40.html>
<https://m.youtube.com/watch?v=FeAlg1loe8U>
https://www.nptelvideos.com/civil_engineering/design_of_steel_structures.php

Unit II

Welded Connections: Concepts in design of connections, Codal provisions, types of welds, Defects in welds, simple and eccentric welded connections, Beam to beam and beam to column connections.

- Pedagogy: Chalk & talk, PPT
- Links: <https://www.google.com/search?q=Design%20of%20welded%20connections%20nptel&tbm=vid>
<https://www.slideshare.net/AshishVivekSukh/welded-connections-in-steel-structures-limit-state-design-of-steel-structures>
<http://ecoursesonline.iasri.res.in/mod/page/view.php?id=127486>

Unit III

Tension Members: Introduction, Types of sections, Grades of steel, Codal provision, shear lag and block shear, Analysis & Design of tension members with different cross sections, Lug angles (concept only).

- Pedagogy: Chalk & talk, PPT
- Links: <https://www.apsed.in/post/design-of-tension-members-in-steel-structures-as-per-is-800-2007>
<https://www.slideshare.net/sabnabaiju/design-of-tension-members>
<https://www.studocu.com/en-us/document/university-of-hawaii-at-manoa/environmental-engineering/lect-5-7-tension-members-ppt/11623747>

Unit IV

Compression Members: Codal provisions, Slenderness ratio, Analysis and design of simple compression members (angles and I-Sections), built – up member with Lacings and battens, Column splices, Column bases and Gusseted bases (Bolted and welded connections)

- Pedagogy: Chalk & talk, PPT
- Links: <https://theconstructor.org/structural-engg/design-of-steel-compression-members/4896/>
<http://ecoursesonline.iasri.res.in/mod/page/view.php?id=2498>

Unit V

Flexural Members: Codal provision, Lateral buckling, Web buckling and crippling, Analysis of laterally restrained and unrestrained beams. Design of laterally restrained and unrestrained simple beams and their connections.

- Pedagogy: Chalk & talk, PPT
- Links https://www.youtube.com/watch?v=nd3WRss4y_w
<https://www.google.com/search?q=design%20of%20beams%20in%20steel%20structures%20npTEL&tbm=vid>
<https://www.google.com/search?q=Design%20of%20bolted%20connection%20as%20per%20IS%20800&tbm=vid>

Text Books:

1. Subramanian. N, “Design of Steel Structures”, Oxford University Press, New Delhi
2. K.S. Duggal, “Design of Steel Structures”, Tata Mcgraw Hill, New Delhi

Reference Books:

1. Gaylord and Gaylord, “Design of Steel Structures”, Mcgraw Hill Publications, New York.
2. Relevant IS Codes: IS800, 2007, “SP:6 (Part I) Structural Engineering Hand Book”, BIS, New Delhi.

Web links:

1. <https://www.youtube.com/watch?v=XLzTB4KLCxU&pp=ygUTYm9rbHRlZCBjb25uZWNoaW9ucw%3D%3D>
2. <https://www.youtube.com/watch?v=mYOdkumR7ps&pp=ygUnd2VsZGVkIGNvbmlY3Rpb25zIGluIHN0ZWVzIGNvbmlY3Rpb25z>

3. <https://www.youtube.com/watch?v=1ntF4217JU&pp=ygUldGVuc2lvbiBtZW1iZXJzIGluICBzdGVlbCBjb25uZWNoaW9ucw%3D%3D>
4. <https://www.youtube.com/watch?v=Kfndzy8iTzE&pp=ygUqY29tcHJlc3Npb24gbWVtYmVycyAgaW4gIHNoZWVzIGNvbm5lY3Rpb25z>
5. <https://www.youtube.com/watch?v=s6NlqFSlQRw&pp=ygUoZGVzaWdob25uZWNoaW9ucw%3D%3D>

Course Outcomes (COs):

Students will be able to:

1. Design of steel elements with different types of bolted connections. (PO 1,2,3,7,11 PSO 1&2)
2. Design of welded connections between different elements. (PO 1,2,3,7,11,PSO 1&2)
3. Analysis and design of tension members with different cross sections. (PO 1,2,3,7,11 PSO 1&2)
4. Analysis and design of compression members with different cross sections and columnbases. (PO 1,2,3,7,11 PSO 1&2)
5. Analysis and design of laterally restrained and unrestrained beams. (PO 1,2,3,7,11 PSO 1&2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1 to CO5
Assignment	10	CO1 to CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

PRINCIPLES OF BRIDGE ENGINEERING	
Subject Code: CVE631	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Mr. Raje Gowda	

Course Content

Unit I

Introduction: Definition, classification of bridges, components of bridge, Site Selection for Bridges, Hydraulic design for linear waterway & economical span.

- Pedagogy/Course delivery tools: Chalk and talk, invited lectures from industry people, PowerPoint Presentation, video.
- Links: https://www.youtube.com/watch?v=klw2Sb6U_Ik&t=2009s

Unit II

RCC Box culvert: Introduction, Behavior of Box girder bridges, Design of box culvert subjected to class 70R (T) vehicle and 70R (W) vehicle.

- Pedagogy/Course delivery tools: Chalk and talk, invited lectures from industry people, Powerpoint Presentation, video.
- Links: <https://www.youtube.com/watch?v=tVrp4M9HoxY>

Unit III

RCC Slab Culvert: Introduction, Behavior of slab culvert, Design and detailing of slab culvert subjected to 70R (T) vehicle, 70R (W) vehicle and Class A loading.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://www.youtube.com/watch?v=trXqga2z1J4>

Unit IV

T-Beam Bridge: Introduction, Behavior of T-beam bridge, Design and detailing of slab panel, cross girder, main girder using COURBON'S Method, subjected to 70R (T) vehicle.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: https://www.youtube.com/watch?v=klw2Sb6U_Ik&t=2009s

Unit V

Substructure, Foundations and Bearings: Definition of pier and abutment, behavior of pier and abutment, loads to be considered on pier and abutment, types of foundations for pier and abutment, Importance of bridge bearings, sketches of different types of bearings

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://www.youtube.com/watch?v=v8UwdPqS3FI>
<https://www.youtube.com/watch?v=2-0mRsaAgCk>

Text Books:

1. Johnson D Victor, “Essentials of Bridge Engineering”, Oxford & IBH Publishing Co New Delhi.
2. Krishna Raju N, “Design of Bridges”, Oxford & IBH Publishing Co New Delhi.

Reference Books:

1. SP Bindra, Dhanpat Rai & Sons, “Principles and Practice of Bridge Engineering”, New Delhi.
2. IRC 6–2000 Standard Specifications and Code of Practice for Road Bridges Section II Loads and Stresses, The Indian Road Congress New Delhi.
3. IRC-21, IS456 (2000), SP-16, SP-34.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=klw2Sb6U_Ik&t=2009s
2. <https://www.youtube.com/watch?v=trXqga2z1J4>
3. <https://www.youtube.com/watch?v=1Duo236fMzM>
4. <https://www.youtube.com/watch?v=tVrp4M9HoxY>

Course Outcomes (COs):

Students will be able to

1. Demonstrate the components of bridge and define the load flow mechanism. (PO-1, 2 & PSO-1)
2. To design box culvert as per IRC specifications. (PO-1, 2& PSO-1)
3. To design slab culverts as per IRC specifications. (PO-1, 2 & PSO-1)
4. To design T-beam bridges as per IRC specifications. (PO-1, 2 & PSO-1)
5. Identify different types of foundations, bearings and piers on bridge. (PO-1, 2 & PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

GROUND IMPROVEMENT TECHNIQUES	
Subject Code: CVE632	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. N Srilatha	

Course Content

Unit I

Introduction: Need and objectives of ground improvement, Factors to be considered in the selection of best ground improvement technique. Classification of ground improvement techniques - Economic considerations and suitability.

Mechanical and Hydraulic Modification: Principle of densification, Mechanical modifications - shallow compaction, Deep compaction methods - In-situ densification of cohesive and cohesion less soils, Effect of compaction on properties of soil. Objectives of Hydraulic modification, methods of dewatering systems - open sumps and ditches, well point system, deep well point system, vacuum dewatering and Electro-Osmosis method. Hydraulic modification by Preloading technique, vertical drains, sand wicks and prefabricated vertical drains. Design of vertical drains.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105108075>
- Video Links: <https://www.youtube.com/watch?v=fbrBqep6IhE>
<https://www.youtube.com/watch?v=bRQAMVJY7uA>

Unit II

Physical and Chemical Modification: Introduction on modification using admixtures Lime, Cement, Bitumen, stabilization using municipal solid waste and industrial wastes. Using chemicals - Calcium chloride and lignin. Lime piles, modification by deep grouting and thermal modification methods.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105108075>

Unit III

Modification by Inclusions and Confinement: Concept of Soil reinforcement -Types of reinforcing materials - Advantages and disadvantages of strip reinforcement - Functions and applications of various Geo-synthetic materials. Mechanism, Advantages and Practical applications of Reinforced earth -Components of Reinforced Earth. Design principles of Reinforced soil structures - Failure modes in Reinforced soil structures.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105108075>

Unit IV

In-Situ Ground Reinforcement: Soil nailing - Objectives - Advantages - Components of soil nail wall - Types and construction procedure of soil nail wall. Ground anchorage-objectives and applications, Uplift capacity of anchors. Crib wall- applications - stability aspects in designing crib walls. Gabions and Mattresses - advantages and applications. Rock bolts - Types - Applications - Functions - Bolting principles.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105108075>
- Video Links: <https://www.youtube.com/watch?v=bynP8npA2X0>
<https://www.youtube.com/watch?v=CE0NiWmqW2U>

Unit V

Other Miscellaneous Methods: Micro Piles - Types – Advantages - Limitations - Applications. Diaphragm walls - Applications. Touch piles - Advantages - Design procedure. Soil Liners - Types - Applications. Sources and type of ground contamination - Impact of contamination on geo-environment. Remediation of contaminated sites.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: <https://nptel.ac.in/courses/105108075>
- Video Links: <https://www.youtube.com/watch?v=wUlQyiHfex0>
<https://www.youtube.com/watch?v=UF9FLUioZv8>

Text Books:

1. “Ground Improvement techniques”, Dr. P. Purushotham Raju, University Science Press, 1999.
2. Manfred R. Hausmann, “Engineering principles of ground modification”, McGraw–Hill Publishing Co. 1990.

Reference Books:

1. Robert M. Koerner: Construction and Geotechnical Methods in Foundation Engg, McGraw Hill.
2. Ingles O.G. and Metcalf J.B., “Soil Stabilization – Principles and practice”, Butterworths, London, 1972.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=y6_md5ZG-o
2. <https://nptel.ac.in/courses/105108075>
3. https://www.youtube.com/watch?v=2GIU_wtFJKU
4. <https://www.youtube.com/watch?v=wiPpqCpp2po>
5. <https://www.youtube.com/watch?v=p-F1X47pZj4>

Course Outcomes (COs):

At the end of the course, students will be able to

1. Identify the problems associated with the existing ground conditions (PO-1, 2, 5 & PSO-1).
2. Select and implement soil stabilization techniques based on soil conditions in the field (PO-1, 3,5,6 & PSO-1&3).
3. Acquire knowledge on soil reinforcement techniques (PO-3,6 & PSO-1).
4. Apply in-situ reinforcement techniques (PO-3 & PSO-1).
5. Identify the ground improvement techniques such as Micro piles, Touch piles and application of different types of soil liners (PO- 6 & 7).

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

ENVIRONMENTAL IMPACT ASSESSMENT	
Subject Code: CVE633	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. Addagada Lavanya	

Course Content

Unit I

Introduction to EIA

Definition of EIA, need for EIA, EIS, FONSI, Utility of EIA, Scope of EIA, Step by step procedure for conducting EIA, REIA, CEIA, Limitations of EIA, Frame work of EIA, EIA Guidelines for developmental projects.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: https://youtu.be/8vymf1fip2w?list=PLLy_2iUCG87CkrNdXME16BCptwGx1f167
https://youtu.be/E_oRwSRdgcQ?list=PLLy_2iUCG87CkrNdXME16BCptwGx1f167
- NPTEL Links: https://www.youtube.com/watch?v=WlqeZH_0jqQ
https://www.youtube.com/watch?v=4pZ1V0_kkNY

Unit II

Developmental projects

Description of affected environment with factors and indices, Methodologies of EIA – Adhoc method, Checklist method, Matrices method, Network method and Overlay method.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation, videos
- Links: https://youtu.be/E_oRwSRdgcQ?list=PLLy_2iUCG87CkrNdXME16BCptwGx1f167
<https://youtu.be/cnVH8xVYsqw?list=RDCMUCY-ANi3wxkUSGhAel7T0TGw>
- NPTEL Links: <https://youtu.be/cnVH8xVYsqw?list=RDCMUCY-ANi3wxkUSGhAel7T0TGw>

Unit III

Assessment and Prediction of Impacts

Assessment and prediction of impacts on attributes- Air environment, Soil environment, Noise environment.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://www.youtube.com/watch?v=tCSjMoIn7I8>
<https://www.youtube.com/watch?v=hDQa797i7qU&list=RDLVtCSjMoIn7I8&index=3>
https://youtu.be/Vq_bD40UsmI
- NPTEL Links: <https://youtu.be/tCSjMoIn7I8?list=RDLVtCSjMoIn7I8>

Unit IV

Assessment and Prediction of Impacts

Assessment and prediction of impacts on attributes - Water and Groundwater Environment and Socio-Economic and Human Health Impacts. Public participation in environmental decision making, objectives of public participation and public participation techniques. Practical consideration in preparing in EIA and EIS

- Pedagogy/Course delivery tools: Chalk and talk, Conventional water treatment plant visit, invited lectures from industry people, Power Point Presentation
- Links: https://www.youtube.com/watch?v=HIBYCtJ9_Cw
<https://www.youtube.com/watch?v=vc6oEybFgwY>
<https://www.youtube.com/watch?v=KGdHD7mH0PE>
- NPTEL Links: <https://www.youtube.com/watch?v=u-VSu1YolBw>

Unit V

EIA for Projects

EIA for Water Resource Project, Highway Project, Iron ore Mining Project, Metro Project, Multistoried Building Project.

- Pedagogy/Course delivery tools: Chalk and talk, invited lectures from industry people, PowerPoint Presentation, video.
- Links: https://www.youtube.com/watch?v=HIBYCtJ9_Cw
<https://www.youtube.com/watch?v=vc6oEybFgwY>
<https://www.youtube.com/watch?v=KGdHD7mH0PE>
- NPTEL Links: <https://www.youtube.com/watch?v=u-VSu1YolBw>

Text Books:

1. Y. Anjaneyulu and Valli Manickam, “Environment Assessment Methodologies”, B.S Publications, Hyderabad, 2007.
2. R.K Jain et.al Van Nostrand, “Environmental Impact Analysis” – Reinhold Company, 1977.

Reference Books:

1. Larry W Canter, “Environmental Impact Assessment” –McGraw – Hill International Editions, 1996.
2. Guidelines for EIA of Developmental Projects, Minister of Environment and Forests, GOI.

Web links and video Lectures (e- Resources):

1. https://youtu.be/8vymfIfip2w?list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67
2. https://youtu.be/E_oRwSRdgcQ?list=PLLy_2iUCG87CkrNdXME16BCptwGx1fl67
3. https://www.youtube.com/watch?v=HlBYCtJ9_Cw
4. <https://www.youtube.com/watch?v=KGdHD7mH0PE>
5. <https://www.youtube.com/watch?v=vc6oEybfGwY>

Course Outcomes (COs):

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

1. Ability to describe the fundamental concepts of EIA. (PO 1,6,9 & PSOs 1)
2. Ability to identify various attributes and methods of EIA. (PO 1,2,5,6 & PSOs 1)
3. Ability to apply prediction and assessment methods to EIA of air, water and noise environment. (PO 1,2,5 & PSOs 1,2)
4. Ability to assess the impacts on soil & ground water, Socio-economic and human health impacts and explain techniques of public participation in EIA. (PO 1,6,7 & PSOs 1,3)
5. Ability to apply suitable method of EIA for developmental projects. (PO 1,3,5,6 & PSOs 1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4&CO5

TRANSPORTATION MODES AND INFRASTRUCTURE	
Subject Code: CVE634	Credits: 3:0:0
Pre requisites: -Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. Vivek R Das	

Course Content

Unit I

Introduction to Railway Engineering: Advantages of railways as transportation mode, typical cross sections, suitability of different gauges, Coning of wheels, components of the permanent way- Rails, Sleepers, Ballast and Fixtures-functions, types, requirements, Quantity calculations of railway track components.

- Pedagogy: Chalk & talk, PPT
- Links: <https://nptel.ac.in/courses/105107123>

Unit II

Geometrics of Railway: Gradients, super elevation, cant deficiency, Negative super elevation, speed restrictions on turnouts, design of turn outs, points and crossings.

- Pedagogy: Chalk & talk, PPT
- Links: <https://nptel.ac.in/courses/105107123>

Unit III

Airport Engineering: Features & role of Airways in transportation, Aircraft characteristics, Air transportation planning, site selection, Airport components and diagram, Runway Orientation, basic length and corrected length of runway length, Taxiway-Turning radius, exit taxi way, design factors and elements.

- Pedagogy: Chalk & talk, PPT
- Links: <https://nptel.ac.in/courses/105107123>

Unit IV

Harbour Engineering: Harbours-types & components. Natural phenomenon affecting the design of harbours. Wind, waves, tides & currents. Breakwaters -types, wharf and quays, Jetties and piers. Dry dock and wet docks, spillways & navigational aids.

- Pedagogy: Chalk & talk, PPT
- Links: https://www.youtube.com/watch?v=5UIUHBSMj5U&list=PLmRuqPJhrsb4o5w1O-P_STCluiZkXiVWf

Unit V

Urban Transportation Systems: System Approach in transport planning. Advantages of mass transportation, general transportation problems in urban centres, interrelationship between land use and transportation, urban road patterns, Transit Capacity. Advanced transportation systems

- Pedagogy: Chalk & talk, PPT
- Links: <https://nptel.ac.in/courses/105105204>

Text Books:

1. S.C Saxena and S.P Arora “A Text Book of Railway Engineering”, Dhanpat Raj Publications.
2. Satish Chandra and MM Agarwal “Railway Engineering”, Oxford Press Publications. 14
3. Rangawala “Airport Engineering”, Charotar Publications.
4. R Srinivasan “Harbour dock and tunnel Engineering”, Charotar Publications.
5. Kadiyali L.R, “Traffic Engineering and Transport Planning”, Khanna Publishers, New Delhi.

Reference Books:

1. S.C Saxena “Airport Engineering”, Dhanpat Raj Publications.
2. SK Khanna, MG Arora and SS Jain “Airport planning and Design”,
3. Dr. SP Bindra “A Course in Docks and Harbour Engineering”, Dhanpat Raj Publications

Course Outcomes (COs):

At the end of the course, students will be able to

1. Identify different components of railway track and select right materials for construction. (PO 1,5,6,8) (PSO1)
2. Compute the various geometric features of railways for a given set of requirements. (PO 1,3,5,6) (PSO1)
3. Describe the importance of airway system, characteristics of aircrafts and planning of airport facilities. (PO 1,6,9) (PSO1)
4. Describe factors affecting design of harbours. (PO 1, 6,10) (PSO1)
5. Describe the problems in urban transportation system. Demonstrate planning of urban transport facilities. (1,2,3,4,5,6,7,10,11) (PSO1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

APPLIED HYDRAULICS	
Subject Code: CVE635	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Mrs. Shilpa D N and Dr. Santhosh L G	

Course Content

Unit I

Boundary Layer Theory and Drag & Lift: Introduction. Laminar and Turbulent flows. Boundary Layer- definition, thickness of B.L, Boundary Layer along a long thin plate and its characteristics, Prandtl's Boundary layer equations, Laminar boundary layer, Turbulent boundary layer. Laminar sub-layer, Separation of boundary layer, methods of controlling boundary layer. Flow around submerged objects: Introduction. Drag and Lift - definitions, types of drag, dimensional analysis of drag and lift, drag on a sphere, cylinder, flat plate and airfoil, Lift on a circular cylinder and airfoil.

- Pedagogy/Course delivery tools: Chalk and talk, invited lectures from industry people, PowerPoint Presentation, video.
- Links: https://youtu.be/9njAGk_DcFg <https://youtu.be/j9MYPXkd3Bk>

Unit II

Energy and Momentum Principles in Open Channel Flow: Introduction, classification of flow in open channels, types of channels, velocity distribution in channel section, pressure distribution in open channel, Energy and Momentum principles, description of specific energy curve, channel transitions, Metering flumes – Venturi flume, Standing wave flume.

- Pedagogy/Course delivery tools: Chalk and talk, invited lectures from industry people, Power point Presentation, video.
- Links: <https://www.youtube.com/watch?v=bfaM06Ds7NI&pp=ygU1RW5lcmd5IGFuZCBNb21lbnR1bSBQcmduY2lwbGVzIGluIE9wZW4gQ2hhbm5lbCBGbG93OiA%3D>

Unit III

Gradually Varied Flow in Open Channel: Introduction. Dynamic equations of Gradually Varied Flow, characteristics of flow profiles, Control sections, analysis of flow profiles- Gradually Varied Flow computations, practical applications.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://youtu.be/S9k8bO8QTD0>

Unit IV

Rapidly Varied Flow in Open Channels: Introduction. Hydraulic Jump - Momentum equation for the Jump, classification of jumps, characteristics of jump in a rectangular channel, Hydraulic jump as an energy dissipater, location of the jump. Rapidly Varied Flow computations, Flow over spillways and weirs.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://www.youtube.com/watch?v=u50EMhG9LsE&pp=ygUmUmFwaWRseSBWYXJpZWQgRmxvdvBpbiBPcGVuIENoYW5uZWxzOiA%3D>

Unit V

Unsteady Flow in Open Channel Flow: Introduction, dynamic equation for unsteady flow, Monoclinical rising wave, Wave propagation, Surges in open channels, Flood Routing – Channel routing, Muskingum method.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://www.youtube.com/watch?v=kQnWoMdPwDU&pp=ygUkVW5zdGVhZHkgRmxvdvBpbiBPcGVuIENoYW5uZWwgRmxvdzog>

Text Books:

1. P.N. Modi & S.M.Seth, “Hydraulics & Fluid Mechanics Including Hydraulics Machines”, Standard Book House New Delhi, 22nd edition (2017)
2. K. Subramanya, “Flow in Open Channel Flow”, McGraw-Hill; Fifth edition (2019)

Reference Books:

1. VenTeChow, “Open Channel Hydraulics”, McGraw Publishing Company Ltd. New York., (2001)
2. Chaudhry, M Hanif, “Open-Channel Flow”, Springer, 2nd Edition (2008)

Web links and video Lectures (e- Resources):

1. <https://www.youtube.com/watch?v=xT5Ow63BK7I>
2. <https://www.youtube.com/watch?v=8RWelXNskFg>
3. https://www.youtube.com/watch?v=rhEcBRBR3CA&list=PLdYNNqCArF5xcxzNsCGe5ER_1aq81hxH1&index=10
4. <https://www.youtube.com/watch?v=GpDAiEvrWtU>
5. <https://www.youtube.com/watch?v=9Hk6O25JbJU>
6. https://www.youtube.com/watch?v=DxzS_NkSr5wA
7. <https://www.youtube.com/watch?v=TRZ80WEXEHw>

Course Outcomes (COs):

At the end of the course, students will be able to

1. Describe the boundary layer formation and estimate the drag and lift forces acting on it. (PO-1,2,3)
2. Apply Energy and Momentum principles in Open Channel Flow. (PO-1,2,3)
3. Describe and analyze Gradually Varied Flow in Open Channel. (PO-1,2,3)
4. Analyze Gradually Varied Flow in Open Channel and describe flow over spillways. (PO-1,2,3)
5. Describe Unsteady Flow in Open Channel and Flood routing (PO-1,2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4&CO5

ADVANCED DESIGN OF CONCRETE STRUCTURES

Subject Code: CVE641

Credits: 3:0:0

Pre requisites: Nil

Contact Hours: 45L+45S

Course Coordinator: Mr. Raje Gowda

Course Content

Unit I

Introduction: Retaining walls: Design of Cantilever retaining wall and Counter fort retaining wall.

- Pedagogy/Course delivery tools: Chalk and talk, invited lectures from industry people, Powerpoint Presentation, video.
- Links: https://www.youtube.com/watch?v=klw2Sb6U_Ik&t=2009s

Unit II

Footings: Design of Raft (slab base) and combined footing.

- Pedagogy/Course delivery tools: Chalk and talk, invited lectures from industry people, Powerpoint Presentation, video.
- Links: <https://www.youtube.com/watch?v=tVrp4M9HoxY>

Unit III

Water Tanks: Design of circular water tanks resting on ground Rigid base. Design of Circular, Square, Rectangular rigid base water tanks.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://www.youtube.com/watch?v=trXqga2z1J4>

Unit IV

Bunkers and Silos: Design of bunkers, silos using Janssen's Theory and Airy's Theory.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: https://www.youtube.com/watch?v=klw2Sb6U_Ik&t=2009s

Unit V

Design of Flat Slabs and Grid Slabs

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://www.youtube.com/watch?v=v8UwdPqS3FI>
<https://www.youtube.com/watch?v=2-0mRsaAgCk>

Text Books:

1. N. Krishna Raju “Advanced Reinforced Concrete Design”, CBS Publishers and distributors Pvt. Ltd., Third edition, 2017.
2. P.C. Varghese, “Advanced Reinforced Concrete Design”, Prentice Hall of India Pvt. Ltd., New Delhi, 2017.
3. Relevant BIS codes of practices

Reference Books:

1. Park R and Paulay T, John “Reinforced concrete structures”, Wiley & Sons.
2. Fintel Mark, “Hand book on Concrete Engineering”, Van Norstrand Reinhold Company.
3. Unnikrishnan Pillai & Devdas Menon “Reinforced Concrete Design”, TMH Publications.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=klw2Sb6U_Ik&t=2009s
2. <https://www.youtube.com/watch?v=MWaCkMs5F7w&list=PL0hmgzMMenSsXhf>
3. <https://www.youtube.com/watch?v=8Zsr9s8mv1A>

Course Outcomes (COs):

Students will be able to

1. design different types of retaining walls as per Codal provisions. (PO-1, 2 & PSO-1)
2. design different types of footings as per Codal provisions. (PO-1, 2 & PSO-1)
3. design rigid and flexible water tank as per Codal provisions. (PO-1, 2 & PSO-1)
4. design bunkers and silos as per Codal provisions. (PO-1, 2 & PSO-1)
5. design flat and ribbed slabs as per Codal provisions. (PO-1, 2 & PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4&CO5

MATRIX METHOD OF ANALYSIS	
Subject Code: CVE642	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. Anil Kumar R	

Course Content

Unit I

Introduction: Structural systems, Geometrical and material nonlinearities. Static and Kinematic indeterminacy. Concepts of stiffness and flexibility. Flexibility and stiffness matrices of truss and beam elements.

- Pedagogy/Course delivery tools: Chalk and Talk, Presentation
- Link for you tube videos: 1. <https://www.youtube.com/watch?v=8shs6UjnFcw>
<https://www.youtube.com/watch?v=n5YOCx8Wc2A>
<https://www.youtube.com/watch?v=IJLSxeBd3LQ>

Unit II

Element Flexibility Method: Transformation of system forces to element forces in flexibility method. Assembly of structure flexibility matrix in element flexibility method, Flexibility method applied to trusses and continuous beams.

- Pedagogy/Course delivery tools: Chalk and Talk, Presentation
- Link for you tube videos: <https://www.youtube.com/watch?v=j710vnmGMSk>
<https://www.youtube.com/watch?v=b7VEMoVvLMw>

Unit III

Element Stiffness Method: Transformation from system forces to element forces in stiffness method, Assembly of structure stiffness matrix in element stiffness method. Stiffness method applied to continuous beams and rigid frames.

- Pedagogy/Course delivery tools: Chalk and Talk, Presentation
- Link for you tube videos: <https://www.youtube.com/watch?v=dtEx4npl2dk>
<https://www.youtube.com/watch?v=6uQB5kPfy8Y>

Unit IV

Direct Stiffness method: Local and Global coordinate systems, Stiffness matrices of truss and beam elements in global coordinates, Analysis of beams by Direct Stiffness method.

- Pedagogy/Course delivery tools: Chalk and Talk, Presentation
- Link for you tube videos <https://tinyurl.com/ykt27v3s>
<https://tinyurl.com/7kcwy445>

Unit V

Storage Techniques: Half band, skyline storage, Equation solvers, Frontal solvers, Band width consideration, Algorithms and flowcharts, Solution of equations, Uses of commercial packages.

- Pedagogy/Course delivery tools: Chalk and Talk, Presentation
- Link for you tube videos: 1. <https://www.youtube.com/watch?v=jk2LILvTzsI>
https://www.youtube.com/watch?v=ep3X_TXlwh0

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

Reference Books:

1. Pundit and Gupta, “Theory of Structures”, Vol II, TMH Publications, New Delhi
2. A K Jain, “Advanced Structural Analysis”, Nemchand Publications, Roorkee
3. CS Reddy, „Basic Structural Analysis “, TMH Publications, New Delhi

Web links:

1. <https://archive.nptel.ac.in/courses/105/105/105105180/>
2. <https://archive.nptel.ac.in/courses/105/105/105105109/>
3. <https://www.classcentral.com/course/swayam-matrix-method-of-structural-analysis-14192>

Course Outcomes (COs):

Students will be able to:

1. Describe structural systems and application of the concepts of flexibility and stiffness matrices. (PO 1,2,3 PSO 1)
2. Adopt flexibility matrices to solve problems in trusses, beams, rigid frames and grids (PO 1,2,3 PSO 1)
3. Adopt stiffness matrices to solve problems in trusses, beams, rigid frames and grids (PO 1,2,3 PSO 1)
4. Adopt direct stiffness methods to solve problems in trusses, beams, rigidframes and grids (PO 1,2,3 PSO 1)
5. Describe various storage schemes and standard commercial packages (PO 1,3 PSO 1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment tool	Marks	Course outcomes attained
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks		
Other components		
Quiz/Assignment	10	CO1 & CO2
Quiz/Assignment/Mini project work	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

SOLID WASTE MANAGEMENT	
Subject Code: CVE643	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. Addagada Lavanya	

Course Content

Unit I

Introduction to Solid Wastes: Definition of solid wastes, classification and characteristics of solid wastes, Municipal Solid Waste (Management and Handling) Rules, Biomedical Waste Handling Rules and Recycled Plastic Usage Rules.

- Pedagogy/Course delivery tools: Chalk and talk, invited lectures from industry people, PowerPoint Presentation, video.
- Links: <https://www.youtube.com/watch?v=HE-4UJncOQ0>

Unit II

Collection of Solid Waste: Systems of collection of solid wastes, transfer stations, collection equipment's, route optimization techniques and numerical problems on route optimization, processing techniques of solid wastes (principle of operation and function only).

- Pedagogy/Course delivery tools: Chalk and talk, invited lectures from industry people, PowerPoint Presentation, video.
- Links: <https://www.youtube.com/watch?v=NaGbBEU5OfQ>

Unit III

Composting: Composting, factors affecting composting process, aerobic and anaerobic composting, Indore and Bangalore method of composting, mechanical composting process, vermicomposting.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://www.unep.org/news-and-stories/story/how-composting-can-reduce-our-impact-planet>

Unit IV

Landfills: Sanitary landfilling, trench method, area method, ramp method and pit method, factors considered for a landfill site selection, cell design, leachate collection systems, control of gas movement and gas recovery systems.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <https://www.youtube.com/watch?v=Wzo5sv4IrIw>

Unit V

Incineration: Incineration process, factors affecting incineration process, air pollution prevention in incinerators, pyrolysis process, plastic waste, biomedical waste and its Impact on health, industrial solid waste recycling and recovery-electronic industry, sugar industry and thermal power plants.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: https://www.youtube.com/watch?v=J2HTEJhns_c

Text Books:

1. George Tchobanoglous et.al., “Integrated Solid Waste Management”, McGraw- Hill, Inc. New York, 1993.
2. Howard S.Peavy et.al., “Environmental Engineering”, Mc-Graw-Hill Book Company, New York, 1985.

Reference Books:

1. A.D. Bhide and B.B. Sudareshan, “Solid Waste management in Developing Countries”, NEERI, Nagpur 1983.
2. S.K Garg “Environmental Engineering (Vol II)” Khanna Publishers, New Delhi 2009.
3. Robert A. Corbit, “Standard Handbook of Environmental Engineering”, McGraw Hill Inc, New Delhi, 1990.
4. P. Aarne Vesilind, William Worrel and Reinhart, “Solid Waste Engineering”, Thomson Brooks, Cole.
5. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Govt. of India, 2000.
6. Management and Handling Rules for Municipal Solid Waste and Biomedical Waste and Plastic Waste, MOEF publications.

Web links:

1. <https://www.youtube.com/watch?v=HE-4UJncOQ0>
2. <https://www.youtube.com/watch?v=NaGbBEU5OfQ>
3. <https://www.unep.org/news-and-stories/story/how-composting-can-reduce-our-impact-planet>
4. <https://www.youtube.com/watch?v=Wzo5sv4IrIw>

Course Outcome (COs):

At the end of the course, students will be able to

1. Describe the components of solid waste management and the laws governing it. (PO - 1, 2 & PSO-1)
2. Prioritize the solid waste processing methods and analyze collection systems to propose optimized routes for waste collection. (PO - 1, 2 & PSO-1)
3. Implement and control the composting process for treatment of organic fraction of solid waste. (PO - 1, 2 & PSO-1)
4. Design of sanitary landfills and control their conditions of operation and maintenance. (PO - 1, 2 & PSO-1)
5. Evaluate the conditions of operation and maintenance of incinerators. Identify the waste recovery systems and impacts of plastic waste on environment. (PO - 1, 2 & PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment/Mini project	10	CO1, CO2 & CO3
Assignment/ Quiz/ Mini project	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4&CO5

URBAN TRANSPORT PLANNING	
Subject Code: CVE644	Credits: 3:0:0
Pre requisites: - Nil	Contact Hours: 45L+45S
Course Coordinator: Mr. Charan Prasad M	

Course Content

Unit I

Scope of Urban Transport Planning: Interdependence of land use and transportation system. Land use transportation Models. Approach to transport planning, Stages in transport planning. Forecast of future conditions and plan synthesis. System Approach in Transport Planning

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models
- Link: <https://archive.nptel.ac.in/courses/105/107/105107067/>
<https://archive.nptel.ac.in/courses/105/106/105106058/>
<https://nptel.ac.in/courses/105105204>

Unit II

Various Transportation Surveys & Inventories of transport facilities: Trip generation: trip purpose, factors affecting trip generation and attraction– category analysis– Analysis/ Numerical Problems.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models
- Link: <https://archive.nptel.ac.in/courses/105/107/105107067/>
<https://archive.nptel.ac.in/courses/105/106/105106058/>
<https://nptel.ac.in/courses/105105204>

Unit III

Trip distribution: Growth Factor Method, Synthetic Methods- Fratar and Furness Methods, Gravity model, Analysis/ Numerical Problems.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models
- Link: https://www.civil.iitb.ac.in/tvm/nptel/204_InTse/web/web.html
<https://archive.nptel.ac.in/courses/105/105/105105208/>

Unit IV

Factors affecting Modal Split Analysis: Characteristics of modal split, model split in Urban transport planning-problems. Trip assignment, assignment techniques, traffic forecasting, Analysis/ Numerical Problems

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models
- Link: https://www.civil.iitb.ac.in/tvm/nptel/204_lnTse/web/web.html
- <https://archive.nptel.ac.in/courses/105/105/105105208/>

Unit V

Public Transport and Intermediate Public Transport in Indian Cities: Intermodal transportation and coordination of different modes of transport, role of metro rail. Urban transport planning for small and medium cities. Difficulties in transport planning, computer application in transportation planning.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models
- Link: <https://archive.nptel.ac.in/courses/105/107/105107067/>
<https://archive.nptel.ac.in/courses/105/106/105106058/>
<https://nptel.ac.in/courses/105105204>

Text Books:

1. Kadiyali, LR, “Traffic Engineering and Transport Planning”, Khanna Publishers.
2. Subash C Saxena, “A Course in Traffic Planning and Design”, Dhanapat Rai & Sons, Delhi, 1989.

Reference Books:

1. Jothi Kristey & Lal, “Introduction to Transportation Engineering”, PHI, New Delhi.
2. Huchinson. AG, “Urban and Regional Models in Geography and Planning”, John Wiley and Sons, London.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Describe land use pattern, transportation needs and forecast present conditions for the development of feasible urban transport system. (PO1,2,3 PSO1,2)
2. Generate transportation inventories and solutions for the trip generation and attraction. (PO1,2,3 PSO1,2)
3. Demonstrate trip distribution us in various trip distribution models. (PO1,2,3 PSO1,2)
4. To characterize the modals split on various travel modes and assign the trips generated. (PO1,2,3 PSO1,2)
5. To characterize the transportation means for various categories to cities and apply the latest computer for transportation planning. (PO1,2,3 PSO1,2)

Web links:

1. <https://youtu.be/77EN038oc-0>
2. <https://youtu.be/i6JsaC5Hxuk>
3. <https://youtu.be/HHFWsvigE6Y>
4. <https://youtu.be/N41fduE7Z2U>
5. <https://youtu.be/FFtvoYZfjsU>

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

DESIGN OF FORMWORK & SCAFFOLDING	
Subject Code: CVE645	Credits: 3:0:0
Pre requisites: - Nil	Contact Hours: 45L+45S
Course Coordinator: Mr. Harish M.L.	

Course Content

Unit I

Form Materials and Pressures on Formwork: Lumber – Types – Finish – Sheathing boards - Working stresses – Repetitive member stress – Plywood – Types and grades – Textured surfaces and strength – Reconstituted wood – Steel – Aluminium Form lining materials – Hardware and fasteners – Nails in Plywood – Bolts lag screw and connectors – Bolt loads. Pressures on Formwork - Concrete density – Height of discharge – Temperature – Rates of Placing – Consistency of concrete – Live loads and wind pressure – Vibration Hydrostatic Adjustment for nonstandard condition.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links:https://www.youtube.com/watch?v=JWJKTmptRpI&ab_channel=CivilEngineeringDepartment_LJIET

Unit II

Shores and Form Design: Simple wood stresses Slenderness ratio. Allowable loads. Tubular steel shores & Patented shores. Site Preparation-Size and spacing. Steel Tower Frames. Safety practices. Horizontal shoring for multi-levels. More concentrated shore loads. T-heads, Two-tier wood shores, Ellis shores, Day tansure grip, Baker Roos shores, Safway Symons shores, Beaver Advance shores, Dead shores, Raking and Flying shores. Basic simplification. Beam formulas–Allowable stresses

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links:https://www.youtube.com/watch?v=JWJKTmptRpI&ab_channel=CivilEngineeringDepartment_LJIET

Unit III

Planning, Site Equipment and Plant for Formwork: Overall Planning – Detailed Planning – Standard units – Corner units – Schedule for column formwork – Formwork elements – Planning at Tender stage – Development of basic system – Planning for maximum reuse – Economical form construction – Planning examples – Crane size, effective scheduling estimate – Recheck plan details – Detailing the forms. Crane arrangement – Site layout plan – Transporting plant – Formwork beams – Formwork ties – Wales – Scaffold frames - Form accessories – Vertical transport table formwork. Design of formwork, Wooden Ballies and its limitations

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: https://www.youtube.com/watch?v=JWJKTmptRpI&ab_channel=CivilEngineeringDepartment_LJIET

Unit IV

Deflection, Bending & Lateral Stability: Shear, Bearing – Examples in wall forms – Slab forms – Beam form – Ties, Anchors and Hangers – Column forms – Examples in each. CPWD specifications, construction practices, IS codal requirements, stripping time.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: https://www.youtube.com/watch?v=JWJKTmptRpI&ab_channel=CivilEngineeringDepartment_LJIET /

Unit V

Dome Forms, Tunnel Forms, Slip Form Sand Safety Practices for Scaffolds: Shells of translation and revolution - Hemispherical - Parabolic - Barrel vaults –Hypar Shells – Conoidal Shells - Folded plates – Shell form design – Building theform – Placing concrete – Strength requirements – Tunnel forming components –Curb and Invert forms. Arch and Wall forms & Telescopic forms. Concrete placementmethods – Cut and Cover construction – Continuous Advancing slope method & Bulk head method. General design considerations influence of placing equipment.Tolerances. Form construction for Shafts. Slipforms – Principles, Types, Advantage &Functions of various components. Planning of Slipform operations – Desirablecharacteristics of concrete. Common problems faced. Safety in slip forms - Specialstructures built with Slipform Technique & Codal provisions. Types of scaffolds –Putlog and Independent scaffold, Single pole scaffolds, fixing ties, Spacing of ties,Plan Bracing, Knots & Safety nets.

- Pedagogy/Course delivery tools: Chalk and talk, Power point Presentation
- Links: https://www.youtube.com/watch?v=JWJKTmptRpI&ab_channel=CivilEngineeringDepartment_LJIET

Text Books:

1. Robert L. Peurifoy and Garold D. Oberlender, “Formwork for Concrete Structures”, Third Edition McGraw-Hill, 1996.
2. Hurd, M.K., “Formwork for Concrete”, Special Publication No.4 Sixth Edition, American Concrete Institute, Detroit, 1995.

References:

1. Michael. P. Hurst, “Formwork”, Construction Press, London and New York, 1997.
2. Austin, C.K., “Formwork for Concrete”, Cleaver–Hume Press Ltd., London, 1996.
3. Tudor Dinescu and Constantin Radulescu, “Slip form Techniques”, Abacus Press, Turn Bridge Wells, Kent, 1992.
4. “Guide for Concrete Formwork”, American Concrete Institute Detroit, Michigan, 1996.
5. “Safety Requirements for Scaffolding”, American National Standards Institute, New York, 1994.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=JWJKTmptRpI&ab_channel=CivilEngineeringDepartment_LJIET
2. <https://www.youtube.com/watch?v=hDIL9EU59Hw>
3. https://www.youtube.com/watch?v=xSCYsb_d3Ao
4. https://www.youtube.com/watch?v=O_hnj_GCC3w
5. <https://www.youtube.com/watch?v=u9znpTdVqRI>

Course Outcomes (COs):

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

1. Describe various types of materials and forces acting on formwork. (PO-1, 2 & PSO-1)
2. Analyze and design the shores and formwork. (PO-1, 2 & PSO-1)
3. Provide detailed planning for scaffolding. (PO-1, 2 & PSO-1)
4. Analyze the deflection of formwork. (PO-1, 2 & PSO-1)
5. Analyze and design of various types of shells. (PO-1, 2 & PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination(SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4 & CO5

GEOTECHNICAL ENGINEERING LAB	
Subject Code: CVL65	Credits: 0:0:1
Pre requisites: Nil	Contact Hours: 30P
Course Coordinator: Dr. J. Sumalatha & Dr. N. Srilatha	

Course Content

1. Determination of Specific gravity and moisture content
2. Grain size analysis of soil sample (sieve analysis)
3. In situ density by core cutter and sand replacement methods
4. Relative Density of sands
5. Consistency limits – Liquid limit by Casagrande’s and Cone Penetration methods, Plastic limit & Shrinkage limit
6. Standard Proctor Compaction Test.
7. Coefficient of permeability by constant and variable head methods.
8. Determination of shear strength parameters using Unconfined compression test.
9. Determination of shear strength parameters using Direct shear test
10. Determination of shear strength parameters using Triaxial Compression test.
11. Demonstration of Consolidation test – Determination of compression index and coefficient of consolidation.
12. Demonstration of Hydrometer test, Modified Proctor’s test & Proctor’s needle.

Text Books:

1. Punmia B.C. (2005), “Soil Mechanics and Foundation Engg.”, 16th Edition, Laxmi Publications Co., New Delhi.
2. Alam Singh and Chowdhary G.R., “Soil Engineering in Theory and Practice” CBS Publishers and Distributors Ltd., New Delhi
3. Gopal Ranjan and Rao A.S.R. (2000), “Basic and Applied Soil Mechanics”, New Age International (P) Ltd., New Delhi.

Reference Books:

1. Bowles J.E. (1996), „Foundation Analysis and Design” 5th Edition, McGraw Hill Pub. Co. New York.
2. BIS Codes of Practice: IS 2720

Web links and Video Lectures (e-Resources):

1. Link for Specific gravity and moisture content
<https://www.youtube.com/watch?v=nfv8zDJXlt0>
<https://www.youtube.com/watch?v=N2J-tvEeI4c>
2. Link for Grain size analysis of soil sample
<https://www.youtube.com/watch?v=CAezS3mPzOc>.
3. Link for In situ density by core cutter and sand replacement method
<https://www.youtube.com/watch?v=C10dklH12W0>
4. Link for Relative Density of sands
<https://www.youtube.com/watch?v=ZRpZHPwy4ks>
5. Link for Consistency limits
<https://www.youtube.com/watch?v=QcBrSKwnDRY>
<https://www.youtube.com/watch?v=qAqIkktaqKM>
6. Link for Standard proctor Compaction Test
<https://www.youtube.com/watch?v=AP-lvZqLDYM>.
7. Link for Coefficient of permeability by constant and variable head methods
https://www.youtube.com/watch?v=68cmPG_Pyow
<https://www.youtube.com/watch?v=c7IiNzsSGZY>
8. Link for Shear strength parameters using Unconfined compression test
<https://www.youtube.com/watch?v=M4TNKwuSnAk>
9. Link for Shear strength parameters using Direct shear test Consolidation test
<https://www.youtube.com/watch?v=x18whfs8oCA>
10. Link for Shear strength parameters using Triaxial Compression test.
<https://www.youtube.com/watch?v=LUNg4dN2EB0>
11. Link for Consolidation test <https://www.youtube.com/watch?v=kFWYrD9sG7c>
12. Link for Hydrometer test, Modified Proctor's test & Proctor's needle
<https://www.youtube.com/watch?v=TT0gbVJSuTw>
<https://www.youtube.com/watch?v=tqHNK67IgG4>
<https://www.youtube.com/watch?v=ZGCzJYQ1fGU>

Course Outcomes (COs):

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

Student will be able

1. To determine the index properties of soils. (PO- 1,2, 3,4,8,9,11 & PSO – 1,2).
2. Classify different soils based on their gradation and plasticity characteristics. (PO- 1,2,3, 4,8,9,11 & PSO – 1,2)
3. To determine the field density of cohesive and cohesion less soils.(PO- 1,2,3, 4,8,9,11 & PSO – 1,2)

4. To determine the permeability of different types of soils.(PO- 1,2,3, 4,8,9,11 & PSO – 1,2)
5. To evaluate shear strength of different types of soils. (PO- 1,2,3, 4,8,9,11 & PSO – 1,2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course Outcomes addressed
Weekly evaluation of laboratory manuals/records after the conduction of every experiment.	30	CO1, CO2, CO3, CO4 & CO5
Practical test	20	CO1, CO2, CO3, CO4 & CO5
Semester End Evaluation: 50		
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4 & CO5

DETAILING OF STRUCTURAL ELEMENTS LABORATORY	
Subject Code: CVL66	Credits: 0:0:1
Pre requisites: Nil	Contact Hours: 30P
Course Coordinator: Dr B Suguna Rao	

Course Content

Part–A – RCC Elements

1. Beams: Simply supported, Cantilever and Continuous
2. Slabs: One-way, Two-way and One-way Continuous
3. Foundations: Isolated & Combined Footing (Beam & Slab type)
4. Staircase: Doglegged
5. Retaining wall: Cantilever Type & Counterfort Type
6. Water Tanks: Circular and Rectangular in Plan (Rigid and Flexible Base)

Part–B – Steel Elements

1. Beam to Beam connection: Bolted and Welded
2. Beam to Column connection: Bolted and Welded
3. Column Bracket connection: Bolted and Welded
4. Built-up Columns with Lacings & Battens
5. Column bases and Gusseted bases with bolted & welded connections
6. Column Splices

Text Books:

1. N. Krishnaraju “Structural Design & Drawing Reinforced Concrete & Steel”, University Press.
2. Krishnamurthy “Structural Design and Drawing (Concrete Structures)”, CBS publishers, New Delhi. Tata Mc Graw publishers.
3. IS Codes: SP-34, SP-16, SP-6 (1,2), IS456 (2000), IS800(2007).

Reference Books:

1. B.C. Punmia “Reinforced Concrete Structures” Laxmi Publishing Co.
2. Subramanian.N, “Design of Steel Structures”, Oxford University Press, New Delhi.
3. S.K. Duggal, “Design of Steel Structures”, Tata McGraw Hill, New Delhi.

Web Links:

1. Link for working with AutoCAD: <https://youtu.be/cmR9cfWJRUI>
2. Link for Design of RC Members
<https://archive.nptel.ac.in/courses/105/105/105105105/>
3. Detailing of beam: <https://www.youtube.com/watch?v=-MFCSI25324>
4. Detailing of RC Structures: <https://www.youtube.com/watch?v=OtGZM99vFLg>
5. Link for Design of Steel Structures
<https://archive.nptel.ac.in/courses/105/105/105105162/>
6. Detailing of Steel structures: <https://www.youtube.com/watch?v=SaBfN5G2Yjk&list=PL6ZsanlrqSeDV6KxzPZSNiZ6hsI3zABTT>

Course Outcomes (COs):

At the end of the course, students will be able to

1. To detail the RC members as per SP 34 and SP16. (PO- 1,5)
2. Detail the reinforcement of different types of staircase and foundation as per IS 456:2000, IS 34 and SP16. (PO- 1,5,6)
3. Detail the reinforcement of retaining wall and water tank as per IS 3370 code provisions. (PO- 1,5,6)
4. Detail the different connection in steel members as per IS 800: 2007, SP 6. (PO- 1,5,6)
5. Detail the built-up column with lacing and batten system, column bases & column splices as per IS 800: 2007, SP 6. (PO- 1,5,6)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course Outcomes addressed
Weekly evaluation of laboratory manuals/records after the conduction of every experiment.	30	CO1, CO2, CO3, CO4 & CO5
Practical test	20	CO1, CO2, CO3, CO4 & CO5
Semester End Evaluation: 50		
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4 & CO5

EXTENSIVE SURVEY CAMP	
Subject Code: CVP67	Credits: 0:0:4
Pre requisites: CV32, CV34, CV42, CVL47, CVL48	Contact Hours: 30P
Course Coordinator: Dr. Santhosh L G	

Course Content

An extensive survey training involving investigation and design of the following projects. The student shall submit a project report consisting of designs and drawings.

- 1) **Preliminary studies** using Remote Sensing and GIS tools, GPS. Watershed Delineation using Digital Elevation Model satellite images.
- 2) **General instructions:** Reconnaissance of the sites.
- 3) **New Tank Project:** The work shall consist of
 - i) Alignment of center line of the proposed bund, longitudinal and crosssections along the center line.
 - ii) Capacity Contour surveys.
 - iii) Details at Waste weir and sluice points.
- 4) **New Canal Project:** The work shall consist of
 - i) Alignment of center line of the proposed canal, longitudinal and crosssections along the center line.
 - ii) Design of canal regulations work and cross-drainage work.
- 5) **Restoration of an Existing Tank:** The work shall consist of:
 - i) Alignment of centre line of the existing bund, Longitudinal and Crosssections along the Centre Line
 - ii) Capacity surveys, Details at sluice and waste weir
- 6) **Water Supply and Sanitary Project:** Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. Preparation of village map by any suitable method of surveying (like plane tabling), location of sites for ground level and overhead tanksunderground drainage system surveys for laying the sewers.
- 7) **Highway Project:** Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road. (Drawing should be preferably done using

AutoCAD).

8) Residential Layout planning: Reconnaissance Survey, Field Data Collection – Coordinates, existing buildings and any other natural or man-made features. Preparation of Residential Layout Plan - Plot boundaries are drawn, Roads and intersections are designed, Setbacks and open spaces are marked, Levels and contours are generated, Storm drains are drawn.

- Pedagogy/ Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models
- Link: Surveying: https://youtu.be/chhuq_t40rY
- Link: Higher Surveying: <https://nptel.ac.in>
- Link: Drones: <https://https://www.equinoxsdrones.com/blog/10-major-pros-cons-of-unmanned-aerial-vehicle-uav-drone>
- Link: Quantity survey: <https://youtu.be/TnaAQ4-a7JI>
- Link: Image interpretation: <https://youtu.be/X8jirWMSDOI>,
<https://https://www.youtube.com/watch?v=GF27RMbck0g>
- Link: Remote Sensing: <https://youtu.be/eABubdXSYO8>
- Link: GIS: <https://youtu.be/vJAQHA5XQWI>
- Link: Applications of RS& GIS: <https://youtu.be/SVa66vO08So>

Text Books:

1. **G S Srivastava** – Introduction to Geoinformatics, McGraw Hill Education, 2014.
2. **S K Duggal** – Surveying – Vol I, Tata McGraw Hill publishing company Ltd, New Delhi, 4th edition, 2013.

Reference Books:

1. **Punmia B C** – Surveying Vol. 1 & 2, Standard book house, Laxmi Publications Pvt. Ltd., New Delhi, 2005.
2. **S K Roy** – Fundamental of Surveying, Prentice Hall of India, New Delhi, 2008.
3. **Charles D. Ghilani** - Elementary Surveying: an introduction to geomatics, Prentice Hall, 13th edition, 2012.
4. **A M Chandra** – Higher Surveying, New Age International, 2005.
5. **K V G Gokhale**–Principles of Engineering Geology, B S Publication, Hyderabad, 2011.
6. **J R Jensen** –Introductory digital image processing: a remote sensingperspective,

Prentice Hall, 2nd edition, 1996.

7. **T M Lilles and & R W Kiefer** – Remote sensing and image interpretation, John Wiley & Sons, 4th edition, 2000.

Web links and Video Lectures (e-Resources):

1. <https://a.impartus.com/ilc/#/video/id/590602>
2. <https://a.impartus.com/ilc/#/video/id/2027011>
3. <https://a.impartus.com/ilc/#/video/id/2066396>

Course Outcomes (COs):

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

1. The components of a proposed new tank. (PO-3, 5, 8, 9, 10, 11)
2. Canal cross-sections, canal regulation and cross drainage works. (PO-3, 5, 8, 9, 10, 11)
3. Redesign of the tank bund, surplus weir and increase in the reservoir capacity. (PO-3, 4, 5, 6, 8, 9, 10, 11)
4. Comprehensive water supply and sewage system for a specified community. (PO-2, 3, 4, 5, 6, 8, 9, 10, 11)
5. Alignment and re-alignment of Roads, residential layout planning. (PO-3, 5, 8, 9, 10, 11)

Course Assessment and Evaluation:

Assessment Tool	Marks	Course Outcomes addressed
CIE Internal assessment Field work carried out	30	CO1, CO2, CO3, CO4, CO5
Preparation of CAD drawings and report submission, test and viva-voce	20	CO1, CO2, CO3, CO4, CO5
Standard examination, Viva- Voce	50	CO1, CO2, CO3, CO4, CO5
CIE+SEE	100	

TECHNICAL SKILL ENHANCEMENT COURSE	
Subject Code: CV68	Credits: 0:1:0
Pre requisites: Nil	Contact Hours:30T
Course Coordinator: Dr. Asha M Nair	

Course Content

Unit 1 Pre-Construction Stage

1. **Process of tendering**
→ Understanding project types, tendering, eligibility, bidding process.
2. **Contracts**
→ Contract types like EPC (Engineering, Procurement, and Construction), BOT (Build, Own, Operate, Transfer), PPP (Public Private Partnership) etc., risk sharing, scope, payment terms.
3. **Project budget**
→ Estimation, contingencies, funding, inflation, escalation clauses.
4. **Planning for a project**
→ WBS (PERT, CPM) scheduling, resource loading.
5. **Risks**
Risk identification, analysis and mitigation

Unit 2 Site Preparation & Design Stage

1. **Soil Investigation and reading of reports**
→ Bore log interpretation, soil bearing capacity, recommendations.
2. **Design considerations for execution engineers**
→ Interpreting design, staging, scaffolding, temporary works.
3. **Activities at the construction site and departments involved**
→ Site setup, stores, site engineer, QA (quality assurance)/QC (quality control), safety, planning, billing.
4. **Safety at site**
→ Toolbox talks, hazard identification, PPE (personal protective equipment), emergency plans.
5. ISO certification for quality, environment and safety.

Unit 3 Construction Equipment's

1. **Evolution of Construction Equipment**
→ Manual → mechanical → Semi-automated.
2. **Equipment & Productivity**
→ Cranes, pavers, TBM, batching plants etc.
3. **Productivity and Utilization of Equipment**
4. **Site-based innovation / Case Studies**

Unit 4 Execution, Quality & Finishing

1. **Execution methods**
→ Methods to execute different structural elements, shuttering, detailing, site issues, curing etc.
2. **QA/QC – Importance**
→ ITPs (Inspection and Test Plan), inspections, materials testing's, NDT tests, NCRs (Non-conformance reports), final handing over.
3. **Specifications / Method of Measurements**
→ IS codes, CPWD schedule of rates, billing, deductions

Unit 5 Innovations & Professional Practice

1. **Lean Construction**
→ Waste reduction, value stream mapping, Last Planner System.
2. **Evolution of Concrete Technology and Cement Materials**
→ From lime concrete to OPC, PPC, GGBS, geopolymers concrete.
3. **Site-based innovation / Case Studies**
→ Case study

Course Outcomes (COs):

On successful completion of this course, students will be able to

1. Comprehend the different phases involved in Pre-construction stage (PO-1, 2, 3, 6, 10,11, PSO-1,2,3)
2. Appraise the site investigation reports and plan the activities in the design stage. (PO-1, 2, 3, 6, 10,11, PSO-1,2,3)
3. Discuss on the evolution of construction equipments and its productivity and utilization (PO-1, 2, 3, 6, 10,11, PSO-1,2,3)
4. Explain the importance of quality control and adherence to IS code during execution (PO-1, 2, 3, 6, 10,11, PSO-1,2,3)
5. Elaborate on the evolution of concrete technology and lean construction (PO-1, 2, 3, 6, 10,11, PSO-1,2,3)

GEO-ENVIRONMENTAL ENGINEERING	
Subject Code: CVOE01	Credits: 3:0:0
Pre requisites: Nil	Contact Hours: 45L+45S
Course Coordinator: Dr. J Sumalatha	

Course Content

Unit I

Introduction to Geo-Environmental Engineering

Importance and Scope of Geo-Environmental engineering – formation of soils - multiphase behavior of soil – role of soil in Geo-Environmental applications – sources of waste –classification and management of waste – sources of ground contamination – sources of heavy metals - impact of ground contamination on Geo-Environment.

- Pedagogy/Course delivery tools: -Chalk and Talk, Power point presentations &Videos
- Links: -<https://www.youtube.com/watch?v=Fp-wA1zBIRA>
- <https://www.youtube.com/watch?v=yY1BxbO73f0>

Unit II

Soil-Water-Contaminant Interactions and waste disposal facilities

Soil-water-contaminant interactions and its implications – contaminant transport processes (advection, dispersion and loss / gain of solute mass) – column test and contaminant transport parameters - Waste disposal facilities, Parameters controlling the selection of site for Municipal Solid Waste (MSW) and Hazardous Waste (HZ) landfills. Locational criteria as per Central Pollution Control Board (CPCB) and Ministry of Environment and Forests (MoEF) guidelines - Site investigation criteria

- Pedagogy/Course delivery tools: -Chalk and Talk, Power point presentations &Videos
- Links: -<https://www.youtube.com/watch?v=9XbcaPJm8xU>
- <https://www.youtube.com/watch?v=dtPi8UGG1Gg>

Unit III

Landfill Components

Components of Landfill layout - Site infrastructure - landfill capacity – landfill section – components of hazardous waste landfill - Types and functions of liner and cover systems - Compacted clay liner - selection of soil for liner – site development for a landfill – phase development – phased operation - stability of a landfill –surface water drainage system - Management of Leachate and gas - components of leachate collection

and removal system –record keeping criteria and site procedures – environmental monitoring system - final cover criteria – phase closure – post-closure criteria – Closure and post closure monitoring system

- Pedagogy/Course delivery tools:-Chalk and Talk, Power point presentations &Videos
- Links: -<https://www.youtube.com/watch?v=n8KdoMYYWnE>
- <https://www.youtube.com/watch?v=gxX6gvGustY>

Unit IV

Geo-synthetics in waste containment facilities

Functions of various types of Geosynthetics – importance of Geosynthetics in waste containment – applications of Geomembranes in landfill components – role of geotextiles in the design of landfill system – applications of Geonets and Geopipes – functions of Geogrids – Geosynthetic Clay Liners (GCLs) – specifications for bentonite in GCLs – interactions between soil and Geosynthetics – Vertical barriers / Cutoff walls – design of Slurry walls.

Remediation of Contaminated soil: Investigation of contaminated soil and assessment of contamination levels in soil – importance of soil remediation - Factors influencing the selection of remediation technique -, in-situ / ex-situ soil remediation techniques, isolation / containment method – bioremediation techniques - thermal remediation - pump and treat method – phytoremediation.

- Pedagogy/Course delivery tools:-Chalk and Talk, Power point presentations &Videos
- Links: -<https://www.youtube.com/watch?v=p-F1X47pZj4>
- <https://www.youtube.com/watch?v=ZQzy9HLIEHk>
- <https://www.youtube.com/watch?v=cPXnGHLlZuY>

Unit V

Advanced Soil Remediation techniques

Electro-kinetic remediation of soils – Soil Flushing and Soil Washing – Efficiency of chemical solutions in soil washing – column leaching tests - Immobilization Technique - Amendments used in solidification / immobilization – organic and inorganic amendments (lime, cement and Sodium Hydroxide)

- Pedagogy/Course delivery tools: -Chalk and Talk, Power point presentations &Videos
- Links: -<https://www.youtube.com/watch?v=LTRGBI6kQFA>
- https://www.youtube.com/watch?v=Tdc2wRKW_0M

Text Books:

1. Daniel, D.E. (1993). Geotechnical Practice for Waste Disposal. Chapman, and Hall, London.
2. Koerner, R.M. (2005). Designing with Geosynthetics. Fifth Edition. Prentice Hall, New Jersey.
3. Reddi L.N and Inyang HI (2000) Geoenvironmental Engineering: Principles and Applications, Marcel Dekker Inc Publication
4. R. N. Yong (2000) Geoenvironmental Engineering: Contaminated Soils, Pollutant Fate, Mitigation Lewis Publication.

Reference Books:

1. Dr. G V Rao and Dr. R S Sasidhar (2009) Solid waste Management and Engineered Landfills, Saimaster Geoenvironmental Services Pvt. Ltd. Publication.
2. Ayyar TSR (2000) Soil engineering in relation to environment, LBS centre for Science and Technology, Trivandrum.
3. Hari D. Sharma, Krishna R. Reddy (2004) Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies, Publisher: John Wiley & Sons Inc.
4. Hari D Sharma and Sangeeta P Lewis, Waste containment systems, waste stabilization and landfills: Design and evaluation, John Wiley & Sons, Inc.
5. Donald L. Wise, Debra J. Trantolo, Hilary I. Inyang, Edward J. Cichon (2000), Remediation Engineering of Contaminated Soils, Publisher: Marcel Dekker Inc.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=jwJC_Pzg8vw
2. https://www.youtube.com/watch?v=Bx8DHR_bm0k
3. <https://www.youtube.com/watch?v=Jb2CS4VMJfM>
4. <https://www.youtube.com/watch?v=WDpwuDqcBho>
5. <https://www.youtube.com/watch?v=JMe4wYbO8ac>
6. https://www.youtube.com/watch?v=6HTRFx_xSYU

Course Outcomes (COs):

Students will be able to

1. Understand the impact of contamination on geoenvironment. (PO-1, 2, 6 & PSO-1)
2. Analyze the contaminant transport processes in soil (PO-1, 2, 6 & PSO-1)
3. Understand the role of various components of landfill systems. (PO-1, 2,6 & PSO-1)
4. Evaluate the uses of different liner systems and the selection of soil remediation technique (PO-1, 2,6 & PSO-1)
5. Assess the suitability and advantages of various chemicals in soil remediation (PO-1, 2, 6 & PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) : 50 Marks		
Assessment Tool	Marks	Course outcomes addressed
Internal test-I	30	CO1, CO2 & CO3
Internal test-II	30	CO3, CO4 & CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz / Assignment	10	CO1, CO2 & CO3
Assignment	10	CO3, CO4 & CO5
Semester End Examination (SEE)	100 (Scale down to 50)	CO1, CO2, CO3, CO4&CO5

INTELLIGENT TRANSPORT SYSTEMS	
Subject Code: CVOE02	Credits: 3:0:0
Pre requisites:	Contact Hours: 45L+45S
Course Coordinator: Dr. Vivek R Das	

Course Content

Unit I

Introduction to Intelligent Transportation Systems (ITS): Definition, objectives, Historical Background, Benefits of ITS –ITS. ITS User Services. ITS Applications. Strategic Needs Assessment and Deployment. Regional ITS Architecture Development Process. ITS Standards. ITS Evaluation. ITS Challenges and Opportunities.

- Pedagogy / Course delivery tools: Chalk and talk, Power Point Presentation
- Link [https://nptel.ac.in/courses/ 105101008](https://nptel.ac.in/courses/105101008)

Unit II

Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

Telecommunications in ITS: Information Management, Traffic Management Centres (TMC). Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centres; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts

- Pedagogy / Course delivery tools: Chalk and talk, Power Point Presentation
- Link [https://nptel.ac.in/courses/ 105101008](https://nptel.ac.in/courses/105101008)

Unit III

Traffic engineering - Fundamental relations of traffic flow, Traffic Stream models - , Shock wave, Car following models, Lane changing models, Vehicle arrival models, PCU values, Interrupted and Uninterrupted flow. Signalized intersection design and Analysis based on IRC, HCM and Indo –HCM. Numerical Problems. Traffic Simulation. Numerical Problems. Application of IOT, Machine learning in traffic management.

- Pedagogy / Course delivery tools: Chalk and talk, Power Point Presentation
- Link [https://nptel.ac.in/courses/ 105101008](https://nptel.ac.in/courses/105101008)

Unit IV

Transportation Network Analysis – Basic Introduction to Travel demand modelling, Trip generation, Distribution, Modal Split and Trip Assignment. Transit Capacity, Factors influencing Transit Capacity, Bus Scheduling, ITS functional areas: Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS)

- Pedagogy / Course delivery tools: Chalk and talk, PowerPoint Presentation
- Link [https://nptel.ac.in/courses/ 105106058](https://nptel.ac.in/courses/105106058)

Unit V

ITS applications: Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing. Parking Management; Transportation network operations; commercial vehicle operations; public transportation applications; Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITS implementations in developed countries, ITS in developing countries. Case Studies

- Pedagogy / Course delivery tools: Chalk and talk, Power Point Presentation
- Link [https://nptel.ac.in/courses/ 105101008](https://nptel.ac.in/courses/105101008)

Text Books:

1. P K Sarkar & A K Jain, “Intelligent Transportation System”, PHI Learning Private Limited
2. L R Kadiyali, “Traffic Engineering and Transport Planning”, Khanna Publishers
3. Choudury M A and Sadek A, “Fundamentals of Intelligent Transportation Systems Planning” Artech House.
4. R Srinivasa Kumar, “Intelligent Transportation Systems”, Orient Black Swan,2022
5. Sumith Ghosh, Tony S Lee, “Intelligent Transportation System”, CRC Press, 2010
6. IRC 93 1985, Guidelines for Design and Installation of Road Traffic Signals

Reference Book:

1. Kan Paul Chen, John Miles, “Recommendations for World Road Association (PIARC)” ITS Hand Book 2000.
2. Sussman, J. M., “Perspective on ITS”, Artech House Publishers, 2005.
3. US Department of Transportation, “National ITS Architecture Documentation”, 2007 (CD- ROM). Turban.
4. E and Aronson. J. E, “Decision Support Systems and Intelligent Systems”,

Prentice Hall

5. Highway Capacity Manual, Transportation research Board, USA
6. B G Hutchison, Principles of Urban Transport, McGraw-Hill Inc., USA

Web links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/105101008>
2. <https://youtu.be/oSnTPOK5oZA?list=PLHiD1psy5TmwS8STglH1boZV7PKwt-TO0>
3. <https://www.youtube.com/watch?v=qkQ6ZpJcfhY>
4. <https://www.youtube.com/watch?v=v0zHklOgtHQ>
5. <https://www.youtube.com/watch?v=DmrmtYLabrI>
6. https://www.youtube.com/watch?v=WdljEj_a_dQ
7. https://www.youtube.com/watch?v=-BRVOeu_UZs&list=PLHiD1psy5TmwS8STglH1boZV7PKwt-TO0&index=28
8. <https://www.youtube.com/watch?v=qkQ6ZpJcfhY&list=PLHiD1psy5TmwS8STglH1boZV7PKwt-TO0&index=17>

Course Outcomes (COs):

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

1. Understand the background and architecture of ITS (PO -1,3,6)
2. Appreciate the data collection techniques and information management through telecommunication methods (PO – 1,2,5,8)
3. Comprehend the application of ITS in various traffic management methods (PO- 1 to 5)
4. Understand the network analysis and applicability of ITS (PO-1 to 5)
5. Demonstrate the application of ITS with case studies (PO – 1,5,6,7)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	Marks	Course Outcomes addressed
Internal Assessment-I	30	CO1 & CO2 & CO3
Internal Assessment-II	30	CO3, CO4 & CO5
Average of the two internal tests will be taken for 30marks		
Other Components:		
Assignment	10	CO1 & CO2
Assignment	10	CO3, CO4 & CO5
Semester End Evaluation (SEE)		
Course end examination (Answer one question from each unit –internal choice)	100	CO1, CO2, CO3, CO4 & CO5

