

*Syllabus – III to VIII Semester B.E*



*Outcome Based Education Curriculum*

*2020-2021*

Department of Civil Engineering  
**NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY**  
Mudugurki Village, Venkatagiri Kote Post,  
Devanahalli taluk,  
Bangalore district - 562 164



**An Autonomous College under VTU**

## **DEPARTMENT OF CIVIL ENGINEERING**

### **VISION**

To transform the students as leaders in Civil Engineering to achieve professional excellence in the challenging future.

### **MISSION**

**M1:** To provide the Civil Engineering knowledge and skills for students through an excellent academic environment.

**M2:** Adopting innovative teaching techniques using modern engineering tools for designing, modeling and analyzing the societal and environmental problems.

**M3:** Developing Communication skill, leadership qualities through teamwork and skills for continuing education among the students.

**M4:** To inculcate moral, ethical and professional values among students to serve the society.

**M5:** Validate engineering knowledge through innovative research projects to enhance their employability and entrepreneurship skills.

## **Program Educational Objectives (PEOs)**

- **PEO1:** Graduates in Civil Engineering will apply the technical knowledge for sustainable societal growth.
- **PEO2:** Graduates of civil Engineering will demonstrate designing, modeling and analyzing skills.
- **PEO3:** Graduates in Civil Engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection.
- **PEO4:** Civil Engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values.
- **PEO5:** Civil engineering graduates will have the ability to become entrepreneurs thereby switching over from responsive engineering to creative engineering.

## **Program Outcomes (POs)**

- **PO-1:** Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and Civil Engineering principles to the solution of complex problems in Civil Engineering.
- **PO-2:** Problem Analysis: Identify, formulate, research literature and analyze complex Civil Engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.
- **PO-3:** Design/Development of Solutions: Design solutions for complex Civil Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations.
- **PO-4:** Conduct Investigations of Complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions related to Civil Engineering problems.
- **PO-5:** Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering tools such as CAD, FEM, GIS, etc. including prediction and modeling to complex Civil Engineering activities with an understanding of the limitations.
- **PO-6:** The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Civil Engineering practice.

- **PO-7: Environment and Sustainability:** Understand the impact of the professional Civil Engineering solutions in societal and environmental contexts and demonstrate the knowledge and the need for sustainable development.
- **PO-8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities while following the Civil Engineering practice.
- **PO-9: Individual and Team work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
- **PO-10: Communication:** Communicate effectively on complex Civil Engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO-11: Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage Civil Engineering projects and in multidisciplinary environments.
- **PO-12: Life Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Program Specific Outcome (PSO)**

- **PSO1:** To carryout surveying, prepare layout plans, maps for structures and alignments for canals and roads.
- **PSO2:** To specify, analyze, design, estimate and supervise construction activities such as, test and evaluate foundations and superstructures for buildings, industries, irrigation and hydraulic structures, highways, railways, airports, docks and harbors.
- **PSO3:** To understand the impact of water, air and noise pollution; the methods of waste collection, disposal and processing; specify, design and analyze water supply system, sewerage and industrial effluent conveying and treatment systems.

***Scheme and Syllabus With effect from  
Academic Year 2020-21***

### Third Semester B.E. – Scheme

Sl. No.	Course Code		Course Name	Teaching Dept.	Total Credits	L:T:P:S	Marks	Weekly Load
1	BSC	19CVM31	Integral Transforms And Fourier Series	BS	4	3-2-0-0	100	0+5
2	PCC	19CVT32	Strength of Materials	CE	3	3-2-0-0	100	0+5
3	PCC	19CVT33	Fluids Mechanics and Machinery	CE	3	3-2-0-0	100	0+5
4	PCC	19CVT34	Construction Materials, Stores and Inventory Control	CE	3	3-0-0-0	100	0+5
5	PCC	19CVT35	Engineering Surveying	CE	3	2-2-0-0	100	0+4
6	PCC	19CVT36	Engineering Geology	CE	3	3-0-0-0	100	0+3
7	PCC	19CVL37	Building Material Testing Laboratory	CE	2	1-0-2-0	100	0+2
8	HSMC	19CVH38	Universal Human Values	S&H	3	2-0-2-0	100	2+0
9	HSMC	19CVH39	Constitution of India and Professional Ethics	S&H	1	1-0-0-0	100	1+0
<b>TOTAL</b>					<b>25</b>	<b>21:8:4:0</b>	<b>900</b>	<b>3+29</b>

<b>BSC-Basic Science</b>	<b>PCC – Professional Core</b>	<b>PEC – Professional Elective</b>	<b>MEP – Industrial Elective</b>	<b>HSMC – Humanity and Social Science</b>
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<b>L - Lecture</b>	<b>T - Tutorials</b>	<b>P - Practical</b>	<b>S - Self Study</b>
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## Fourth Semester B.E. – Scheme

Sl. No.	Course Code		Course Name	Teaching Dept.	Total Credits	L:T:P:S	Marks	Weekly load
1	BSC	19CVM41	Applied Calculus and Probability Distributions	BS	4	3-2-0-0	100	0+5
2	PCC	19CVT42	Structural Analysis-I	CE	4	3-2-0-0	100	0+5
3	PCC	19CVT43	Advanced Construction Techniques	CE	3	2-2-0-0	100	0+4
4	PCC	19CVT44	Irrigation and Hydraulic Structures	CE	3	3-0-0-0	100	0+4
5	PCC	19CVT45	Geotechnical Engineering	CE	3	3-0-0-0	100	0+5
6	PCC	19CVT46	Environmental Engineering	CE	3	3-0-0-0	100	2+1
7	PCC	19CVL47	Surveying Practice	CE	2	1-0-2-0	100	0+3
8	PCC	19CVL48	Fluids Mechanics and Machinery Lab	CE	2	1-0-2-0	100	0+2
9	HSMC	19CVH49	Aadalitha Kannada and Vyavaharika Kannada	S&H	1	1-0-0-0	100	1+0
<b>TOTAL</b>					<b>25</b>	<b>20:6:4:0</b>	<b>900</b>	<b>3+29</b>
Internship is to be completed before VII Semester								

<b>BSC-Basic Science</b>	<b>PCC – Professional Core</b>	<b>PEC – Professional Elective</b>	<b>MEP – Industrial Elective</b>	<b>HSMC – Humanity and Social Science</b>
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<b>L - Lecture</b>	<b>T - Tutorials</b>	<b>P - Practical</b>	<b>S - Self Study</b>
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## Fifth Semester B.E. – Scheme

Sl. No	Course Code	Course Name	Teaching Dept.	Total Credits	L-T-P:S	Marks	Weekly Load
1	PCC	19CVT51	CE	4	3-2-0-0	100	0+5
2	PCC	19CVT52	CE	3	2-2-0-0	100	0+5
3	PCC	19CVT53	CE	3	2-2-0-0	100	0+4
4	PEC	19CVT54	CE	3	3-0-0-0	100	0+5
5	PCC	19CVT55	CE	3	2-2-0-0	100	0+4
6	PEC	19CVT56X	CE	3	3-0-0-0	100	0+3
7	PCC	19CVL57	CE	2	1-0-2-0	100	0+2
8	HSMC	19CVH58	CE	3	3-0-0-0	100	2+1
9	HSMC	19CVH59	CE	1	1-0-0-0	100	1+0
<b>Total</b>				<b>25</b>	<b>20:8:2:0</b>	<b>900</b>	<b>3+29</b>
Internship is to be completed before VII Semester							

<b>Professional Elective – I</b>		
Sl. No	Course Code	Course
1	19 CVT 561	Basics of Structural Dynamics and Earthquake Resistant Design
2	19 CVT 562	Air pollution controlling and monitoring
3	19 CVT 563	Design of Masonry Structures

<b>PCC – Professional Core</b>	<b>PEC – Professional Elective</b>	<b>MEP – Industrial Elective</b>	<b>HSMC – Humanity and Social Science</b>
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<b>L - Lecture</b>	<b>T - Tutorials</b>	<b>P - Practical</b>	<b>S - Self Study</b>
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## Sixth Semester B.E. – Scheme

Sl. No	Course Code	Course	Teaching Dept.	Total Credits	L-T-P:S	Marks	Weekly Load
1	PCC 19CVT61	Design of Steel Structures	CE	4	3-2-0-0	100	0+5
2	PCC 19CVT62	Estimation and Quantity Surveying in Construction (QS)	CE	3	2-2-0-0	100	0+4
3	PCC 19CVT63	Construction planning Techniques (IC)	CE	4	3-2-0-0	100	0+6
4	PEC 19CVT64X	Professional Elective –II	CE	3	3-0-0-0	100	1+4
5	PEC 19CVT65X	Professional Elective –III	CE	3	3-0-0-0	100	1+4
6	MEP 19CVT66X	Industrial Elective-I	CE	3	3-0-0-0	100	1+4
7	PCC 19CVL67	Concrete and Highway Engineering Lab	CE	2	1-0-2-0	100	0+2
8	PCC 19CVP68	Extensive Survey project	CE	2	1-0-2-0	100	
9	P & T 19CVPT60	Placement Training	PT	1	1-0-0-0	100	0+2
<b>Total</b>				<b>25</b>	<b>20:6:4:0</b>	<b>900</b>	<b>3+31</b>
Internship is to be completed before VII Semester							

<b>Professional Elective–II</b>		
Sl. No	Course Code	Course
1	19 CVT 641	Traffic Engineering and Management
2	19 CVT 642	Remote sensing and GIS
3	19 CVT 643	Sub Surface Exploration and Ground Improvement Techniques

<b>Professional Elective–III</b>		
Sl. No	Course Code	Course
1	19 CVT 651	Repair and Rehabilitation of Concrete structures
2	19 CVT 652	Advanced design of temporary structure
3	19 CVT 653	Solid waste Management

<b>Industrial Elective – I</b>		
Sl. No	Courses Code	Course Name
1	19CVT661	Construction joints and water proofing
2	19 CVT 662	Construction Safety and industrial policies
3	19 CVT 663	Natural Disaster Mitigation and Management

<b>PCC – Professional Core</b>	<b>PEC – Professional Elective</b>	<b>MEP – Industrial Elective</b>	<b>HSMC – Humanity and Social Science</b>
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<b>L - Lecture</b>	<b>T - Tutorials</b>	<b>P - Practical</b>	<b>S - Self Study</b>
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## Seventh Semester B E Scheme

Sl. No	Subject Code		Subject	Teaching Dept.	L-T-P-S	Total Credits	Marks	Weekly load
1	PCC	19 CVT71	Bridge Engineering	CE	2-2-0-0	3	100	1+5
2	PCC	19 CVT72	Pre Stressed Concrete Structures	CE	2-2-0-0	3	100	0+5
3	PEC	19CVT73X	Professional Elective – IV	CE	3-0-0-0	3	100	1+3
4	MEP	19 CVT74X	Industrial Electives- II	CE	3-0-0-0	3	100	0+5
5	MEP	19 CVT75X	Industrial Electives- III	CE	3-0-0-0	3	100	1+3
6	PCC	19 CVL76	Geotechnical Engineering Lab	CE	1-0-2-0	2	100	0+2
7	PCC	19 CVL77	Software Application Lab	CE	0-0-2-0	2	100	0+4
8	PCC	19CVP78	Project Phase -I	CE	0-0-0-2	1	100	0+2
9	Placement Drive (NCET, Job Mela)			CE				
<b>Total</b>					<b>14:4:4:2</b>	<b>20</b>	<b>800</b>	<b>3+29</b>

<b>Professional Elective - IV</b>		
Sl. No	Courses Code	Course
1	19 CVT 731	Railways, Harbor, Airport and Tunnel Engineering
2	19 CVT 732	Advanced Concrete Technology
3	19 CVT 733	Energy efficient and Green Buildings

<b>Industrial Elective - II</b>		
Sl. No	Courses Code	Course
1	19CVT 741	Analysis and Design of Tall Structures
2	19 CVT 742	Computational Structural Mechanics
3	19 CVT 743	Advanced Design of Steel Structures

<b>Industrial Elective - III</b>		
Sl. No	Courses Code	Course
1	19 CVT751	Alternative Building Materials And Technologies
2	19 CVT 752	Industrial wastewater treatment
3	19 CVT 753	Rural water supply and sanitation

<b>PCC – Professional Core</b>	<b>PEC – Professional Elective</b>	<b>MEP – Industrial Elective</b>	<b>HSMC – Humanity and Social Science</b>
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<b>L - Lecture</b>	<b>T - Tutorials</b>	<b>P - Practical</b>	<b>S - Self Study</b>
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## Eighth Semester B E Scheme

<b>S. N o.</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Total Credits</b>	<b>Marks</b>
1.	19CVP81	Internship	3	100
2.	19CVP82	Project Phase-II	3	100
3.	19CVP83	Project Phase-III	4	100
4.	19CVP84	Project Evaluation and Viva voce (External)	4	100
5.	19CVP85	Technical Seminar	1	100
6.	AICTE Activity points (Mandatory)			
<b>Total</b>			<b>15</b>	<b>500</b>

<b>PCC – Professional Core</b>	<b>PEC – Professional Elective</b>	<b>MEP – Industrial Elective</b>	<b>HSMC – Humanity and Social Science</b>
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<b>L - Lecture</b>	<b>T - Tutorials</b>	<b>P - Practical</b>	<b>S - Self Study</b>
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***THIRD SEMESTER***

<b>FOURIER SERIES, TRANSFORMS AND NUMERICAL TECHNIQUES</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVM31</b>	<b>3:2:0:0</b>	<b>4</b>	<b>50:50</b>	<b>3 Hours</b>	<b>BSC</b>
<b>Course Objectives:</b>					
This course will enable students to:					
<ul style="list-style-type: none"> <li>● Have the efficiency in expressing a periodic function in terms of infinite trigonometric series.</li> <li>● Obtain the knowledge of Laplace Transforms.</li> <li>● Acquire the skill in solving the engineering applications problem using Laplace Transforms.</li> <li>● Get the ability to solve the engineering problem using Fourier Transforms.</li> <li>● Develop the proficiency in solving algebraic and transcendental equations and interpolation using numerical methods.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Fourier Series:</b> Periodic functions, Dirichlet's conditions, Euler's Formulae (without proof), Fourier series of periodic functions of period $2l$ and $2\pi$ , Half range Fourier series, Practical harmonic analysis- problems.					
<b>10Hrs</b>					
<b>Module – II</b>					
<b>Laplace Transform:</b> Definition, Laplace Transform of elementary functions. Properties, transform of derivatives, multiplication by $t^n$ and division by $t$ - Problems. Laplace transforms of periodic functions, unit step functions and unit impulse function – Problems.					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>Inverse Laplace Transforms:</b> Inverse Laplace Transforms of standard functions. (Formulae only). Inverse Laplace transform by using completing the squares, partial fractions, shifting property and differentiation - problems. Convolution theorem - problems. Applications - solution of linear differential equations with initial conditions- problems.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Fourier Transforms and Z - Transforms:</b> Complex Fourier transforms, Fourier Sine and Cosine transforms and their inverse transforms – problems.					
Z - Transforms of some standard functions, Damping and shifting rules - problems. Inverse Z –Transforms by partial fraction method.					
<b>10Hrs</b>					
<b>Module – V</b>					
<b>Numerical Methods:</b> Numerical solutions of algebraic and transcendental equations- Regula Falsi Method and Newton Raphson Method (Formulae only) –Problems. Finite Differences-Forward and Backward differences, Newton's Forward and Newton's Backward interpolation formulae. Lagrange's Interpolation formula (without proof)–Problems. Numerical Differentiation using					

Newton's Forward and Backward interpolation formulae. –Problems. **10Hrs**

**Course Outcomes:**

On completion of this course, the students are able to:

- Demonstrate Fourier series to study the behavior of periodic functions and their applications in engineering problem.
- Find the Laplace transform of different types of functions.
- Use the Laplace transform and inverse Laplace Transform in solving various types engineering application problems.
- Make use of Fourier transform and Z-transform to illustrate discrete/continuous function arising in engineering applications.
- Determine the roots of Algebraic and Transcendental equations and Interpolation arising in engineering applications, using numerical methods.

**Text Books:**

- Dr. B.S. Grewal: "Higher Engineering Mathematics", (Chapters 10, 21, 22, 28, 29, 30), Khanna Publishers, New Delhi, 42nd Edition, 2012, ISBN:9788174 091955.
- N.P. Bali and Dr. Manish Goyal: "A Text Book of Engineering Mathematics", (Chapters 10, 18, 20, 22, 24), Laxmi Publications (P) Ltd., New Delhi, 9th Edition, 2014, ISBN: 9788131808320.

**Reference Books:**

- Erwin Kreyszig: "Advanced Engineering Mathematics", Wiley Pvt. Ltd. India, New Delhi, 9th Edition, 2011, ISBN 13: 9788126531356.
- B.V. Ramana: "Higher Engineering Mathematics", Tata Mc Graw – Hill Publishing Company Limited, New Delhi, 2nd Reprint, 2007, ISBN 13: 978-0-07063417-0.

**E-Resources:**

- <http://bookboon.com/en/essential-engineering-mathematics-ebook>
- <https://www.free-ebooks.net/ebook/essential-engineering-mathematics>
- <https://archive.org/details/AdvancedEngineeringMathematics10thEdition>

<b>Strength of Materials</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT32</b>	<b>3-2-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Study the behaviour of materials within elastic limit subjected to Flexure, Shear and Torsion.</li> <li>● Evaluate the importance of deflection in beams.</li> <li>● Analyze the major and minor principal stresses and their directions.</li> <li>● Describe the buckling behaviour of Columns.</li> <li>● Understand the importance of Compound stresses.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Simple Stress and Strain:</b> Introduction, Properties of Materials, Stress, Strain, Hooke's law, Poisson's Ratio, Stress – Strain diagram for structural steel and non-ferrous materials, Principle of superposition, Deformation of uniform bars.</p> <p><b>Elastic constants:</b> Relationship among elastic constant, Volumetric strain, Stresses in varied sections, Composite Bars &amp; Temperature Stress problems.</p>					
<b>10Hrs</b>					
<b>Module – II</b>					
<p><b>Bending Moment and Shear Force:</b> Introduction, Shearing force, Bending moment, Sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, SFD and BMD with salient values for cantilever beams, simply supported beams. Fixed beam and overhanging beams considering point loads, UDL, UVL and Moment.</p>					
<b>10 Hrs</b>					
<b>Module – III</b>					
<p><b>Torsion of circular shafts:</b> Pure torsion, torsion equation of circular shafts, torsional rigidity and polar modulus, Power transmitted by shaft for solid and hollow circular shafts.</p> <p><b>Elastic stability of columns:</b> Short and long columns, Euler's theory on long columns, Effective length slenderness ratio, radius of gyration, buckling load, Assumptions, derivations of Euler's Buckling load for different end conditions, Limitations of Euler's theory, Rankine's formula. <b>10 Hrs</b></p>					
<b>Module – IV</b>					
<p><b>Deflection of beams:</b> Definitions of slope, deflection, Elastic curve, derivation of differential equation for deflection, Sign convention, Slope and deflection for standard loading cases using Macaulay's method for beams subjected to point loads, UDL and moment.</p> <p><b>Compound stresses:</b> Introduction, Stress components on inclined planes, General two dimensional stress system, Principal planes and stresses, Mohr's circle of stresses.</p> <p>Introduction to Theories of failure. <b>10 Hrs</b></p>					
<b>Module – V</b>					
<p><b>Bending stress in beams:</b> Introduction to Bending stress in beams, Assumptions in pure bending and derivation of Bending equation, Modulus of rupture, section modulus, Flexural rigidity.</p> <p><b>Shear Stress in Beams:</b> Expression for shear stress in beam, Shear stress diagram for rectangular, symmetrical 'I' and 'T' section.</p>					
<b>10Hrs</b>					

**Course Outcomes:**

Students will be able to

- Recognize the fundamental concepts of Stress and Strain under Elastic Limits.
- Analyse problems related to SFD and BMD for beams.
- Design of Shafts to transmit required power and to determine the buckling loads of long Columns.
- Determine deflection and compound stresses in beams under different loading conditions.
- Analyze the bending and shear stress in the beams.

**Text Books:**

- Ferdinand P. Bere, Johnston (jr) and E. Russel “Mechanics of Materials”, Mcgrawhill Publisher, 7<sup>th</sup> Edition, 2016. ISBN:978-9339217624.
- Dr. R. K. Bansal, “A Textbook of Strength of Materials”, Laxmi Publisher, 5<sup>th</sup> Edition, 2012, ISBN: 978-8131808146.
- S. Ramamrutham and R. Narayanan, “Strength of Materials”, DhanpatRai Publishing Company, 14<sup>th</sup> Edition, 2011, ISBN:978-8187433545.
- L. S Srinath, Prakash Desai and AnanthRamu, “ Strength of Materials”, Macmcillian Publishers, 2<sup>nd</sup> edition, 2009. ISBN: 978-0333923924.

**Reference Books:**

- S. S. Bhavikatti, “Strength of Materials”, S. Chand (G/L) & Company Ltd, 4<sup>th</sup> edition, 2013, ISBN: 978-9325971578.
- Dr. B. C. Punmia, Dr. A. K. Jain, “Mechanics of Materials”, Fire wall media, 2002, ISBN: 9788170082156.
- Stephen Timoshenko, “ Strength of Materials”, 3<sup>rd</sup> Edition, CBS Publisher, 2002, ISBN:978-8123910307

**E-Resources:**

- <http://www.vtuupdates.com>>vtunotes
- <http://www.vidhayarthiplus.com>
- <http://www.iitg.ernet.in>>qip>cd\_cell>chapters



<b>Fluid Mechanics and Machinery</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT33</b>	<b>3-2-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Understand fluid properties, fluid statics and fluid pressure.</li> <li>● Analyse the system in terms of kinematic concepts related to fluid flow.</li> <li>● Compute the discharge through pipes, notches and weir</li> <li>● Design of uniform open channels of different cross sections including most economical sections</li> <li>● Compute force exerted by jet on different type of vanes and to design impulse turbine and to know operation characteristics under different operating conditions</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Scope and Applications</b> of Fluid Mechanics in Civil Engineering projects.</p> <p><b>Fluids &amp; Their Properties:</b> Introduction to fluids, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Viscosity, Cohesion, Adhesion, Surface tension &amp; Capillarity. Fluid as a continuum, Newton’s law of viscosity (theory &amp; problems). Capillary rise in a vertical tube and between two plane surfaces (theory &amp; problems). Vapor pressure of liquid, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet. Numerical problems.</p> <p><b>Fluid Pressure and Its Measurements:</b> Definition of pressure, Pressure at a point, Pascal’s law, Variation of pressure with depth. Measurement of pressure using simple, differential &amp; inclined manometers. <b>10Hrs</b></p>					
<b>Module – II</b>					
<p><b>Hydrostatic Pressure on Surfaces:</b> Introduction, Definitions Total pressure and Centre of pressure, equations for hydrostatic force and depth of centre of pressure for Vertical and inclined submerged plane surfaces- Problems. Practical applications of Total pressure and centre of pressure.</p> <p><b>Kinematics and Dynamics of Fluid Flow:</b> Introductions, methods of describing fluid motion, types of fluid flow, streamline, path line. Three dimensional continuity equations in Cartesian Coordinates (derivation and problems), Bernoulli’s equation using Euler’s equation of motion with assumptions and limitations(Problems). <b>10 Hrs</b></p>					
<b>Module – III</b>					
<p><b>Flow through pipes:</b></p> <p><b>Head losses</b> - Major loss &amp; Minor loss, Darcy - Weisbach Equation, Hydraulic Gradient line, Total Energy Line, Series and Parallel Network of pipes, Numerical Problems.</p> <p><b>Orifice and mouth piece:</b> Hydraulic coefficients, Concept of Orifice and Mouthpiece (No Numerical Problems).</p> <p><b>Notches and Weirs:</b> Definition of Notch and Weir, Flow through V-notch, Rectangular weir, Cippoletti weir, Corrections for Velocity of Approach, End Contractions, Numerical Problems. <b>10 Hrs</b></p>					
<b>Module – IV</b>					
<p><b>Open Channels Flow:</b> Velocity using Chezy’s and Manning’s equations, Hydraulic Efficient Channels: Rectangular and Trapezoidal channel, Numerical Problems. Specific Energy, Critical Depth, Froude’s Number, Specific Energy Diagram, Subcritical and Supercritical flows, Alternative Depths, Hydraulic Jump, Numerical Problems. <b>10 Hrs</b></p>					

### Module – V

**Impact of Jet on Vanes:** Impact of jet on vanes, Force exerted by the jet on a straight & curved vane (Stationary & Moving). Velocity triangles, Numerical Problems.

**Pumps:** Centrifugal and reciprocating pumps working principle and applications

**Pelton wheel:** Components and working principle. Maximum power, Efficiency, working proportions-problems.

**Francis Turbines:** Components and working principle. Draft Tube: Types, Efficiency of Draft tube and problems.

**10Hrs**

#### Course Outcomes:

Students will be able to

- Solve problems on fluid properties, fluid statics and fluid pressure.
- Analyze the system in terms of kinematic concepts related to fluid flow
- Compute the discharge through pipes, notches and weir
- Design of uniform open channels of different cross sections including most economical sections
- Compute force exerted by jet on different type of vanes and to design impulse turbine and to know operation characteristics under different operating conditions

#### Text Books:

- R.K. Bansal, “A Text book of Fluid Mechanics and Hydraulic Machines”, Laxmi Publications, New Delhi
- P.N. Modi & S.M. Seth, “Hydraulics and Fluid Mechanics”, Standard Book House
- Madan Mohan Das, “Fluid Mechanics and Turbo Machines”, PHI Learning Pvt. Ltd. 2011

#### Reference Books:

- K Subramanya, “Fluid Mechanics and Hydraulic Machines”, Tata McGraw Hill Publishing Co. Ltd.
- K Subramanya, “Fluid Mechanics and Hydraulic Machines-problems and solutions”, Tata McGraw Hill Publishing Co. Ltd.
- Victor L Streeter, Benjamin Wylie E and Keith W Bedford, “Fluid Mechanics”, 5 Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed)

#### E-Resources:

- <https://nptel.ac.in/courses/105/103/105103095/>
- <https://nptel.ac.in/courses/105/105/105105203/>

<b>Construction Materials, Stores and Inventory Control</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT34</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Achieve the basic knowledge of building materials.</li> <li>● Understand the importance of cement and aggregates.</li> <li>● Acquire the knowledge on steel used in construction industry.</li> <li>● Familiarize with wood and modern materials.</li> <li>● Comprehend the concept of stores and inventory management.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Building Materials:</b> Stone as building material; Requirement of good building stones, dressing of stones, Deterioration and Preservation of stone work. Bricks; Classification, Manufacturing of clay bricks, Requirement of good bricks. Field and laboratory tests on bricks; compressive strength, water absorption, efflorescence, dimension and warpage. Cement Concrete blocks, Autoclaved Aerated Concrete Blocks, Sizes, requirement of good blocks. Types of masonry, Plastics and insulation materials, classification, properties, applications. Structure of building materials. <b>10 Hrs</b></p>					
<b>Module – II</b>					
<p><b>Cement, Fine aggregate and Coarse aggregate:</b> Cement – Manufacturing of cement, Types of cements and their uses, Field test and acceptance. Fine aggregate – Natural and manufactured: Sieve analysis, zoning, specific gravity, bulking, moisture content, deleterious materials. Coarse aggregate – Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests. <b>10 Hrs</b></p>					
<b>Module – III</b>					
<p><b>Concrete:</b> Ingredients, Manufacturing Process – batching plants – mixing – transporting – placing – compaction of concrete – curing and finishing, ready mix concrete, mix specification, special concretes and properties, admixtures.</p> <p><b>Reinforcement Steel:</b> Introduction, Types of Reinforcement – prestressing steel – metallic – nonmetallic – sizes – configuration, test methods as per IS 1786, coated steel reinforcement – Types and performance – bond strength, corrosion. <b>10 Hrs</b></p>					
<b>Module – IV</b>					
<p><b>Timber and other materials:</b> Timber, market forms, industrial timber, plywood, veneer, thermocol, panels of laminates, steel – aluminum and other Metallic Materials – composition, aluminium composite panel – mechanical treatment, paints – varnishes – distempers, bitumen and sealants.</p> <p><b>Modern materials:</b> Glass, ceramics, sealants for joints, fibre glass reinforced plastic, clay products, refractories, composite materials – types – applications of laminar composites, fibre textiles – geomembrane and geotextiles for earth reinforcement. <b>10 Hrs</b></p>					

### Module – V

**Stores and Inventory Management:** Stores Management - Purpose of stores, Location and Layout, Cost aspects and Productivity, problems and developments, New developments in storing. Inventory Management – Introduction, Raw materials, WIP, Finished goods, Norms of inventory, Peculiarities in India, Relevant costs.

**10 Hrs**

#### Course Outcomes:

Students will be able to

- Determine suitable materials for construction purpose.
- Demonstrate the use of cement and aggregates.
- Adopt suitable steel and concrete for the construction.
- Identify the functional components of wood and modern materials.
- Exhibit the knowledge of stores and inventory management.

#### Text Books:

- Rangawala, Building Construction, Charotar Publishing House Pvt. Ltd., India, 33rd Edition, 2019.
- P. C. Rangawala, “Engineering Materials (Material Science)”, Charotar Publishing House, India, 33rd Edition, 2015, ISBN: 978-93-85039-04-1.
- M. S Shetty, “Concrete Technology Theory and Practice”, S. Chand & Co Ltd., New Delhi, 2007.
- P. Gopalakrishnan and M. Sundaresan, Materials Management and Integrated Approach, PHI Learning Pvt. Ltd., New Delhi, 34th Edition, ISBN: 978-81-203-0027-9, 2012.

#### Reference Books:

- S. K. Duggal: “Building materials”, New Age International Publishers, India, 4th Revised Edition, ISBN 10: 81224337900.
- Rangwala, “Engineering Materials”, Charotar Publishing House Pvt. Ltd., India, 43rd Edition, 2019.
- M. L Gambhir, “Concrete Technology”, 4th edition, McGraw-Hill, 2009.

#### E-Resources:

- <https://nptel.ac.in/courses/105/102/105102088/>
- <https://nptel.ac.in/courses/105/106/105106053/>
- <https://www.rejinpaul.com/2015/03/ce6401-construction-materials-syllabus-notes-question-papers-civil-4th-sem.html>

<b>Engineering Surveying</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT35</b>	<b>2-2-0-0</b>	3	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the basics of surveying and expose to different technics of surveying.</li> <li>• Learn Linear and Angular measurements to arrive at solutions to basic surveying problems.</li> <li>• Understand the principles of tacheometry, geodetic surveying and GPS.</li> <li>• Identify the different errors encountered in surveying.</li> <li>• Compute area and volumes using different methods.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Introduction to Surveying:</b>					
Introduction to Surveying, Definition of surveying, Classification of surveying, Units of measurement, Basic principles of surveying, Precision and Accuracy. Classification of maps, map scale, conventional symbols, topographic maps, map layout.					
<b>Linear measurements:</b>					
Chain and tapes, Ranging of lines, Direct and indirect methods of ranging, Measurement using tapes, Chain and tape corrections, Numerical Problems. Introduction to minor instruments.					
<b>10 Hrs</b>					
<b>Module – II</b>					
<b>Measurement of Directions and Angles:</b>					
Compass survey: Basic definitions; meridians, bearings, magnetic and True bearings. Prismatic and surveyor's compasses, temporary adjustments, declination. Quadrantal bearings, whole circle bearings, local attraction and related problems					
Traverse – open and closed traverse, WCB and Reduced bearing, computation of included angles given the bearings of legs of a closed traverse.					
<b>Levelling:</b>					
Principles and basic Definitions, Types of adjustments and objectives, Temporary adjustments of a dumpy level, booking of levels, Rise and Fall method and Height of Instrument method, Differential levelling, longitudinal & cross section levelling, refraction & curvature correction, reciprocal levelling.					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>Theodolite surveying:</b>					
Theodolites and types, Uses of Theodolite, temporary and permanent adjustment, Measurement of Horizontal and Vertical angle.					
<b>Tacheometry :</b>					
Basic principle, Types of tachometric survey, Tacheometric equation for horizontal line of sight in fixed hair method.					
<b>Contouring:</b> Characteristics of contour, methods of contouring including usage of software's.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Curves:</b>					
Simple Curves - Necessity, types, Definitions, designation of curve, elements of simple curve - settings of simple circular curve by linear method, setting out of simple curves by Rankines deflection					

angle method.

Introduction to compound curve and reverse curve – Introduction to vertical curves.

**Areas and Volumes:**

Calculation of area from cross staff surveying, Calculation of area of a closed traverse by coordinates method. Planimeter – principle of working and use of planimeter to measure areas, Computations of volumes by trapezoidal and prismatic rule.

**10 Hrs**

**Module – V**

**Total station:**

Basic Principle – Classifications - Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system, Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments. Modern positioning systems – Traversing and Trilateration.

**10 Hrs**

**Course Outcomes:** Students will be able to:

- Identify the basics involved in different types of surveying like tape, compass, levelling, Theodolite and total station.
- Recognize the skills in performing measurement of distance, angles, levelling, and curve setting.
- Develop skill to carry out tachometry, geodetic surveying wherever situation demands.
- Apply error adjustment to the recorded reading to get an accurate surveying output.
- Estimate the area of a given plot and quantities of earthwork involved in cuttings and fillings.

**Text Books:**

- Dr B C Punmia, “Surveying Volume I, Lakshmi Publications Pvt Ltd, 6<sup>th</sup> Edition, 2005, ISBN 978-81-700-8853-0.
- Dr B C Punmia, “Surveying Volume II”, Lakshmi Publications Pvt Ltd, 6<sup>th</sup> Edition, 2005, ISBN 978-81-700-8853-0.
- Kanetkar T P and S V Kulkarni, Surveying and Leveling Part I, Pune Vidyarthi Griha Prakashan, 1988, ISBN-10 : 8185825009.

**Reference Books:**

- C Venkatramiah, “Text Book of Surveying, Universities Press (India) Pvt. Ltd, 5th edition, 1996.
- S.K. Roy, “Fundamentals of Surveying”, Prentice-Hall of India Pvt. Limited, 2004, 2<sup>nd</sup> Edition, ISBN: 81-20-312-60-0.
- R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi, ISBN 10: 0198085427.

**E-Resources:**

- [http://lib.uniten.edu.my/libsite/index.php?option=com\\_joomd&view=item&layout=detail&typeid=2&id=202&Itemid=790](http://lib.uniten.edu.my/libsite/index.php?option=com_joomd&view=item&layout=detail&typeid=2&id=202&Itemid=790)
- <http://ascelibrary.org/journal/jsued2>
- [www.survivorlibrary.com/.../engineers\\_surveying\\_instruments\\_1892.pdf](http://www.survivorlibrary.com/.../engineers_surveying_instruments_1892.pdf)

<b>Engineering Geology</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT36</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be learning:</p> <ul style="list-style-type: none"> <li>● To make students to learn</li> <li>● Earth processes and natural hazards.</li> <li>● Earths structures and their impact on engineering construction.</li> <li>● Water resource management and conservation.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Introduction to Engineering Geology-</b> Geologic Structures - Geologic Maps and Stratigraphic Sections- Remote Sensing in Engineering Geology - Physical Properties of Minerals - Optical Properties - Chemical Characteristics of Minerals</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module – II</b>					
<p><b>Origin And Types of Rocks</b> - Origin And Types of Soils - Igneous Rocks - Sedimentary Rocks - Metamorphic Rocks - Weathering - Sediment Transport and Deposition Introduction to Subsurface Exploration - Sampling and Non - Intrusive Methods - Index Properties and Classification of Soils - Index Properties of Rock and Rock Mass - Stress-Strain Behavior of Soil and Rock - In-situ State of Stress</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module – III</b>					
<p><b>Geologic Considerations</b> in Tunneling - Geologic Considerations in Dam Construction - Groundwater - Preliminaries - Groundwater Flow - Groundwater Related Engineering Issues- Groundwater Over Utilization</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module – IV</b>					
<p><b>Plate Tectonics and Earthquake</b> - Earthquake Hazard Assessment- Geologic Hazards - Seismicity and Volcanism - Shoreline Processes - Landslide Hazards - Zoning - Subsidence , Collapsible Soils. Seismic measurement and wave types.</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module – V</b>					
<p><b>HYDROGEOLOGY:</b> Hydrological cycle; distribution of ground water in the earth crust; properties of water bearing geological formation: Aquifers and their types; selection of sites for well locations and spacing of wells; geological, hydrological and geophysical investigations for ground water exploration; artificial recharge of groundwater methods and rainwater harvesting. Sea water intrusion and remedial measures. Bore Hole Problems.</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Course Outcomes:</b>					
<p>Students will be able to</p> <ul style="list-style-type: none"> <li>● Students will be able to</li> <li>● Assess the knowledge of earth and its internal structure.</li> <li>● Explain Earth process and its effect on engineering construction.</li> <li>● Identification and estimation of natural resources.</li> <li>● Recognize good building materials and their properties.</li> <li>● Assess the hydrological condition of the Geological terrain.</li> </ul>					

**Text Books:**

- Text book of Geology by P.K. Mukherjee, World Press Pvt. Ltd. Kolkatta. ISBN-13 9788187567547
- Foundations of Engineering Geology, by Tony Waltham (3rdEd.) Universities Press. ISBN 9780415469609
- Principles of Engineering Geology and Geotechnics by Dimitri P. Krynine and William R. Judd. ISBN 13: 9788123906034
- Structural Geology (3rd Ed.) by M. P. Billings, Published by Prentice Hall of India Pvt. Ltd. New Delhi
- Text of Engineering and General Geology by Parbin Singh, Published by S. K. Kataria and Sons, New Delhi. ISBN: 8188458511, 9788188458516.
- A text book of Engineering Geology by ChennaKesavulu, MacMillan India Ltd.
- Engineering Geology Laboratory Manual by Satyanarayana Swamy B.S. (1985), Eurasia Publishing House, New Delhi
- A Text Book of Mineralogy by Dana, E.S & Ford, W.E. (1985), WELLY, Delhi

**Reference Books:**

- Civil Engineering - Engineering Geology, nptel.ac.in/courses/105/105/105105106
- Rock Mechanics for Engineers by Dr. B. P. Verma, Khanna Publishers, New Delhi.
- Ground water geology by Todd D.K. John Wiley and Sons, New York.
- Physical Geology by Arthur Holmes, Thomson Nelson and Sons, London.
- Ground water assessment, development and management by K. R. Karanth, Tata McGraw Hills
- Rutley's Elements of Mineralogy by Read, H.H. (1984), 26th ed., CBS, N. Delhi R2. Billings, Marland P (1987) Structural Geology, 3rd ed., PHI, Delhi

**E-Resources:**

- [https://books.google.co.in/books/about/Textbook\\_of\\_Engineering\\_Geology.html?id=W-aXSbdjB1cC](https://books.google.co.in/books/about/Textbook_of_Engineering_Geology.html?id=W-aXSbdjB1cC)
- [https://books.google.co.in/books/about/Engineering\\_Geology.html?id=ViNDDAAAQBAJ&redir\\_esc=y](https://books.google.co.in/books/about/Engineering_Geology.html?id=ViNDDAAAQBAJ&redir_esc=y)
- [https://books.google.co.in/books/about/Engineering\\_Geology.html?id=Izm6IUVDcUC&redir\\_esc=y](https://books.google.co.in/books/about/Engineering_Geology.html?id=Izm6IUVDcUC&redir_esc=y)
- <https://nptel.ac.in/courses/105105106/>



<b>Building Material Testing Laboratory</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVL37</b>	<b>1-0-2-0</b>	<b>2</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.</li> <li>● Ability to function on multi-disciplinary teams in the area of materials testing.</li> <li>● Ability to use the techniques, skills and modern engineering tools necessary for engineering.</li> <li>● Understanding of professional and ethical responsibility in the areas of material testing.</li> <li>● Ability to communicate effectively the mechanical properties of materials.</li> </ul>					
<b>Syllabus</b>					
<ol style="list-style-type: none"> <li>1. Tests on Fine aggregates–Specific gravity, Sieve analysis and Bulking.</li> <li>2. Tests on Coarse aggregates–Specific gravity and Sieve analysis.</li> <li>3. Tension test on Mild steel bars: verification of stress and strain behavior.</li> <li>4. Compression test on Cast iron.</li> <li>5. Test on CR Stone.</li> <li>6. Test on bricks, tiles and building blocks: strength, water absorption and efflorescence.</li> <li>7. Torsion test on Mild Steel circular sections.</li> <li>8. Bending test on Wood Under two point loading.</li> <li>9. Shear Test on Mild steel.</li> <li>10. Impact test on Mild Steel (Charpy and Izod).</li> <li>11. Hardness tests on ferrous and non-ferrous metals–Brinell’s, Rockwell and Vicker’s.</li> </ol>					
<b>Course Outcomes:</b>					
<p>Students will be able to</p> <ul style="list-style-type: none"> <li>● Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.</li> <li>● Identify, formulate and solve engineering problems of structural elements subjected to flexure.</li> <li>● Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.</li> <li>● Apply the required knowledge in the area of testing of construction materials and components of construction elements experimentally.</li> <li>● Differentiate the construction materials with regard to quality as per IS code standards.</li> </ul>					
<b>Text Books:</b>					
<ul style="list-style-type: none"> <li>● Dr. B. C Punmia:“Mechanics of Materials Volume-I”,(Chapters1-3,7), Lakshmi Publications, 1<sup>st</sup>Edition, 2014, ISBN:978-81-318-0646-3.</li> <li>● M L Gambhir and Neha Jamwal, “Building and construction materials-Testing and quality control”, McGraw Hill education (India)Pvt. Ltd.,2014.</li> </ul>					
<b>Reference Books:</b>					
<ul style="list-style-type: none"> <li>● Davis, Troxell and Hawk, “Testing of Engineering Materials”, International, Student Edition – McGraw Hill Book Co. New Delhi.</li> <li>● Holes K A, “Experimental Strength of Materials”, English Universities Press Ltd, London.</li> <li>● Suryanarayana A K, “Testing of Metallic Materials”, Prentice Hall of India Pvt. Ltd. New</li> </ul>					

Delhi.

- Kukreja C B, Kishore K. and Ravi Chawla “Material Testing Laboratory Manual”, Standard Publishers & Distributors 1996.

**E-Resources:**

- [www.eng.mu.edu/CEEN162-Lab1-S09-Sieve-SpecificGravity.pdf](http://www.eng.mu.edu/CEEN162-Lab1-S09-Sieve-SpecificGravity.pdf)
- [www.reviewmylife.co.uk/blog/compression-of-cast-iron-experiment](http://www.reviewmylife.co.uk/blog/compression-of-cast-iron-experiment)
- [www.madinpoly.com/pdf/1/CE-Material%20Testing%20Lab.pdf](http://www.madinpoly.com/pdf/1/CE-Material%20Testing%20Lab.pdf)
- [www.santarosa.edu/~yataiia/E45/Bend%20Test%20of%20wood.pdf](http://www.santarosa.edu/~yataiia/E45/Bend%20Test%20of%20wood.pdf).

<b>UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVH38</b>	<b>2-0-2-0</b>	<b>3</b>	<b>50:50</b>	<b>3</b>	<b>HSM</b>
<b>Course Objectives:</b>					
<p>The objective of the course is four fold:</p> <ul style="list-style-type: none"> <li>● Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.</li> <li>● 2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence</li> <li>● 3. Strengthening of self-reflection.</li> <li>● 4. Development of commitment and courage to act.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Course Introduction - Need, Basic Guidelines, Content and Process for Value Education</b>					
<ol style="list-style-type: none"> <li>1. Purpose and motivation for the course, recapitulation from Universal Human Values-I</li> <li>2. Self-Exploration–what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration</li> <li>3. Continuous Happiness and Prosperity- A look at basic Human Aspirations</li> <li>4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority</li> <li>5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario</li> <li>6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.</li> </ol>					
<b>Module – II</b>					
<b>Understanding Harmony in the Human Being - Harmony in Myself!</b>					
<ol style="list-style-type: none"> <li>7. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’</li> <li>8. Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility</li> <li>9. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)</li> <li>10. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’</li> <li>11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail</li> <li>12. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life.</li> </ol>					

Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

### **Module – III**

#### **Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

14. Understanding the meaning of Trust; Difference between intention and competence

15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

### **Module – IV**

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

**Course Outcomes:**

This course also discusses their role in their family. It, very briefly, touches issues related to their role in the society and the nature, which needs to be discussed at length in one more semester for which the foundation course named as “H-102 Universal Human Values 2: Understanding Harmony” is designed which may be covered in their III or IV semester.

During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

**Text Books:**

- Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

**Reference Books:**

- Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of Stuff (Book).
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi Small is Beautiful - E. F Schumacher.
- Slow is Beautiful - Cecile Andrews
- Economy of Permanence - J C Kumarappa
- Bharat Mein Angreji Raj – Pandit Sunderlal
- Rediscovering India - by Dharampal
- Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
- India Wins Freedom - Maulana Abdul Kalam Azad
- Vivekananda - Romain Rolland (English)
- Gandhi - Romain Rolland (English)

<b>CONSTITUTION OF INDIA, PROFESSIONAL ETHICS &amp; HUMAN RIGHTS</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVH39</b>	1-0-0-0	<b>1</b>	<b>50:50</b>	<b>3</b>	<b>HSM</b>
<b>Course Objectives:</b>					
This course will enable students to: <ul style="list-style-type: none"> <li>• To provide basic information about Indian constitution.</li> <li>• To identify individual role and ethical responsibility to wards society.</li> <li>• To understand human rights and its implications.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.					
<b>Module – II</b>					
Directive Principles of State Policy & Relevance of Directive Principles State Policy. Fundamental Duties, Union Executives–President, Prime Minister Parliament Supreme Court of India.					
<b>Module – III</b>					
State Executives Governor Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91 <sup>st</sup> Amendments.					
<b>Module – IV</b>					
Special Provision for SC&ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights – Meaning and Definitions, Legislation Specific Themes in Human Rights – Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchyats and Co-Operative Societies.					
<b>Module – V</b>					
Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.					

**Course Outcomes:** On completion of this course, the students are able to:

- Have general knowledge and legal literacy and thereby to take up competitive examinations
- Understand state and central policies, fundamental duties
- Understand Electoral Process, special provisions
- Understand powers and functions of Municipalities, Panchayats and Co- operative Societies, and
- Understand Engineering ethics and responsibilities of Engineers.

**Text Books:**

- Durga Das Basu: "Introduction to the Constitution of India", (Students Edn.)
- Prentice –Hall EEE, 19th / 20th Edn., 2001
- Charles E. Haries, Michael S Pritchard and Michael J. Robins "Engineering Ethics" Thompson Asia, 2003-08-05.

**Reference Books:**

- M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
- M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice– Hall of India Pvt. Ltd. New Delhi, 2004
- Brij Kishore Sharma, "Introduction to the Constitution of India", PHIL earning Pvt. Ltd., New Delhi, 2011.
- Latest Publications of Indian Institute of Human Rights, New Delhi.

## ***FOURTH SEMESTER***



<b>APPLIED CALCULUS AND PROBABILITY DISTRIBUTIONS</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVM41</b>	<b>3:2:0:0</b>	<b>4</b>	<b>50:50</b>	<b>3 Hours</b>	<b>BSC</b>
<b>Course Objectives:</b>					
This course will enable students to:					
<ul style="list-style-type: none"> <li>● Acquire the knowledge of calculus of complex functions.</li> <li>● Develop the proficiency in solving Numerical integral and Initial value problems.</li> <li>● Obtain the knowledge of probability distributions.</li> <li>● Learn concept of the Joint distributions and Markov's chains.</li> <li>● Known the importance of statistical inference in engineering.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Complex Variables:</b>					
Complex variables: Functions of a complex variable, derivative of complex functions. Analytic functions, (No problems by using limits). Cauchy's-Riemann equations in Cartesian and polar forms, Harmonic functions – problems (No problems by using limits). Construction of analytic functions by using Milne-Thomson method -problems.					
Complex integration: Line integrals -problems. Cauchy Theorem (no problems on verification of the theorem) and Cauchy's integral formula -problems.					
<b>10 Hrs</b>					
<b>Module – II</b>					
<b>Numerical Methods:</b> Numerical Integration-Trapezoidal rule, Simpson's 1/3rd and 3/8th rule. Numerical solutions of ordinary differential equations of first order and first degree- Picard's method, Taylor's Series method, Modified Euler's Method, Runge-Kutta Method of 4th order and Milne's Predictor Corrector Method (without proof) –Problems					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>Random Variables and Probability Distribution:</b> Discrete and continuous Random Variables, Probability density function and distributions. Binomial, Poisson, Exponential and Normal distributions.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Joint Probability and Markov's Chain:</b> Joint Probability distribution of two discrete random variables. Expectations, correlation and covariation.					
Probability vectors, stochastic matrices, fixed point matrices, regular stochastic matrices, Markov's Chains, higher transition probabilities, stationery distribution of regular Markov's Chains.					

10 Hrs

**Module – V**

**Sampling and inference:** Sampling Distribution, Testing of hypothesis, level of significance, confidence limits, test of significance of large samples, sampling of variables, central limit theorem, confidence limits for unknown means, Students t-distribution and Chi-square test.

10 Hrs

**Course Outcomes:** On completion of this course, the students are able to:

- Use the concepts of analytic functions and complex integration in engineering application problems.
- Solve the Numerical integral and Initial value problems arising in engineering applications, using numerical methods.
- Apply probability distributions in analyzing the probability models arising in engineering field.
- Apply Joint probability distributions and Markov's chains in analyzing the probability models arising in engineering field.
- Use the concept of sampling analysis in analyzing the statistical models arising in engineering field.

**Text Books:**

- Dr. B.S. Grewal: "Higher Engineering Mathematics", (Chapters 20,26,27,30,32), Khanna Publishers, New Delhi, 42nd Edition, 2012, ISBN: 9788174091955.
- N.P. Bali and Dr. Manish Goyal: "A Text Book of Engineering Mathematics", (Chapters: 19,21), Laxmi Publications (P) Ltd., New Delhi, 9th Edition, 2014, ISBN: 9788131808320.
- Seymour Lipschutz and Marc Lars Lipson: "Probability", (Chapters: 5 and 8), McGraw Hill Education (India) Private Limited, Chennai, Special Indian Edition, 2010, ISBN: 978-0-07-014622-8.

**Reference Books:**

- Erwin Kreyszig: "Advanced Engineering Mathematics", Wiley Pvt. Ltd., India, New Delhi, 9th Edition, 2011, ISBN 13: 9788126531356.
- B.V. Ramana: "Higher Engineering Mathematics", Tata McGraw – Hill Publishing Company Limited, New Delhi, 2nd Reprint, 2007, ISBN 13: 978-0-07063417-0.

**E-Resources:**

- <http://bookboon.com/en/essential-engineering-mathematics-ebook>
- <https://www.free-ebooks.net/ebook/essential-engineering-mathematics>
- <https://archive.org/details/AdvancedEngineeringMathematics10thEdition>
- <http://www.zums.ac.ir/ebooks/mathematics/essential-engineering-mathematic>.

Structural Analysis-I					
Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
19CVT42	3-2-0-0	4	50:50	3 hours	PCC
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the concept of different structural systems.</li> <li>• Learn the analysis of arches and cables.</li> <li>• Get an exposure to deformation of different structural elements.</li> <li>• Learn the concept of analysis in any continuous beam and rigid beam.</li> <li>• Understand strain energy method for analysis of deflection of beam and truss.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Introduction:</b> Forms of structures, Conditions of equilibrium, Degree of freedom, one, two and three dimensional structural systems, Determinate and indeterminate structures, Degree of Indeterminacy. Analysis of trusses: Method of joints and Method of sections.</p>					
<b>10 Hrs</b>					
<b>Module – II</b>					
<p><b>Arches and Cables:</b> Three hinged parabolic and circular arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.</p>					
<b>10 Hrs</b>					
<b>Module – III</b>					
<p><b>Deflection of beams:</b> Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts. Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections</p>					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<p><b>Analysis of beams:</b> Fixed beams, Clapeyron's theorem of three moments for continuous beams with different end conditions.</p> <p><b>Slope deflection method:</b> Continuous beams and rigid frames (with and without sway) – Symmetry and anti-symmetry – Simplification for hinged end – Support displacements</p>					
<b>10 Hrs</b>					
<b>Module – V</b>					
<p><b>Energy principles and energy theorems:</b> Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the point of application of single load, Castigliano's theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit load method.</p>					
<b>10 Hrs</b>					
<b>Course Outcomes:</b>					
<p>Students will be able to</p> <ul style="list-style-type: none"> <li>• Identify different structural systems.</li> <li>• Analyse the trusses by different methods.</li> </ul>					

- Determine forces and moments in arches and cables under different loading conditions.
- Compute the deflection of structural elements by different methods.
- Determine support moments for beams under different support conditions.

**Text Books:**

- S SBhavikatti: “Structural Analysis-Vol.I”,(Chapters1,7,8,12), Vikas Publishing House, 4thEdition, 2009, ISBN:9788125927907.
- S Ramamrutham and R Narayan: “Theory of Structures”, (Chapters 1,4,6,9), Dhanpat Rai Publishing Company Private Limited, New Delhi, 9thEdition, 2014, ISBN:978-9384378103.

**Reference Books:**

- V. N Vazirani: “Analysis Of Structures Vol. 1: Analysis, Design And Details Of Structures”, (Chapters 1,6,9), International Student Edition, Mcgraw Hill Book Co., New York, 2008, ISBN:978-8174091406.
- ReddyC.S:“BasicStructuralAnalysis”,(Chapters1,6,8),TataMcGrawHill,New Delhi, 3rdEdition, 2010, ISBN:9780070702769.

**E-Resources:**

- <http://elearning.vtu.ac.in/elcmys/13/enotes/eceem/gr.pdf>
- [http://elearning.vtu.ac.in/elcmys/e-con/stru\\_ana/ch5/html/0004.htm](http://elearning.vtu.ac.in/elcmys/e-con/stru_ana/ch5/html/0004.htm)
- [http://elearning.vtu.ac.in/elcmys/p2/cv42/Chapters\\_05/html/0004.htm](http://elearning.vtu.ac.in/elcmys/p2/cv42/Chapters_05/html/0004.htm)
- <http://elearning.vtu.ac.in/elcmys/struana.html>

<b>Advanced Construction Techniques</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT43</b>	<b>2-2-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>● Learn various construction techniques and methods.</li> <li>● Understand the sequence of activities in construction.</li> <li>● Able to get knowledge on sub - structure construction.</li> <li>● Analyze the various technique of super structure construction.</li> <li>● Acquire knowledge of construction equipment's.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Construction Techniques:</b> Different types of structures - Load Bearing Structure - Framed Structure – Components parts of Load bearing and framed structures - Load transfer mechanism. <b>Construction Methods</b> –Introduction to Precast construction techniques. Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Building automation -Case studies of residential, office buildings and other buildings in each zones.					
<b>10 Hrs</b>					
<b>Module – II</b>					
<b>Construction Practices:</b> Details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork –Foundation – Plinth – Superstructure. Building Foundations - Types of foundations. Masonry – Types of Masonry - Bond in masonry. Construction joints – movement and expansion joints – centering, shuttering and scaffoldings and its types. Special types of form work – Slip form. Flooring – Types of Flooring. Roofing and different types of Roof finishes. Weather and water proof.					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>Sub Structure Construction:</b> Techniques of Sub Structures –Jacking Techniques – Pipe and Box Jacking. Various Piling Techniques. Tunneling -Process and Sequence of Tunneling techniques, tunneling in soft soil and rocks. Under water construction Techniques – cofferdam and its types – diaphragm walls and sheet piles - well and caisson and its types. Dewatering and stand by equipment.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Super Structure Construction:</b> Bridges – Component and parts, Types of Bridge Deck Systems. Bridge launching techniques – Span by Span method –Balance Cantilever Method – Progressive Placement Method – Incremental Launching method. Concept of Pre Stressing – Pre Tensioning and Post Tensioning, Merits and Demerits. Articulated structures - Erection of articulated structures.					
<b>10 Hrs</b>					
<b>Module – V</b>					
<b>Construction Equipment:</b> Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting - Equipment for material handling and erection of structures – types of cranes - Equipment for dredging, trenching, tunneling.					
<b>10 Hrs</b>					

**Course Outcomes:**

Students will be able to

- Recognize different construction techniques.
- Adopt various techniques and practices for construction.
- Identify and apply various activities of Sub Structure and Super Structure Construction.
- Select suitable equipment's for specific operations.

**Text Books:**

- Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods",
- 5th Edition, McGraw Hill, Singapore, 1995.
- Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", DhanpatRai and Sons, 1997.
- Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi.

**Reference Books:**

- Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publish- ers, 1999.
- Sharma S.C. "Construction Equipment and Management", Khanna Publishers New Delhi, 2002.
- Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2012.
- Mahesh Varma, "Construction Equipment and its Planning and Application", Met- ropolitan Book Company, New Delhi, 1983.

<b>Irrigation and Hydraulic Structures</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT44</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Understand the necessity, scope of irrigation and able to compute the water requirements of crop.</li> <li>● Demonstrate theories of Canal design and apply the concept to design lined and unlined canals and detail out the cross sections.</li> <li>● Prepare planning, design and operational requirements of storage reservoir, gravity dams and analyse for its stability.</li> <li>● Design the hydraulic structures on permeable foundation.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p>Introduction: Definition. Benefits and ill effects of irrigation. Sources of water for irrigation. Systems of irrigation: Surface and ground water, flow irrigation, Lift irrigation, Bhandhara irrigation. Methods of irrigation in India – Potential and development</p> <p>Irrigation and water requirements of crops: Definition of duty, Delta and Base period, Relationship between Duty, Delta and Base period, Factors affecting duty of water. Irrigation efficiency, Frequency of irrigation. <span style="float: right;"><b>10Hrs</b></span></p>					
<b>Module – II</b>					
<p>Canals: Definition. Types of canals, Alignment of canals. Design of canals by Kennedy’s and Lacey’s methods. Lined canals: types of lining, selection of types of lining, economics of lining, design of lined canals. Cross drainage works: types- selection of suitable type of CD works- aqueduct and Syphon aqueduct- determination of maximum flood discharge and waterway for drain, fluming of canal-uplift pressure on underside of barrel roof and at the floor of the culvert- design of bank connections. <span style="float: right;"><b>10 Hrs</b></span></p>					
<b>Module – III</b>					
<p>Reservoirs: Definitions. Investigation for reservoir sites. Storage zones. Determination of storage capacity and yield of a reservoir using mass curve. Diversion Works: Definition. Layout. Types of weirs, Tank sluices and canal drops. Design of Impermeable floors – Bligh’s and Lane’s theories – Simple design problems. <span style="float: right;"><b>10 Hrs</b></span></p>					
<b>Module – IV</b>					
<p>Dams: Introduction, Types of dams, Factors Affecting Selection of Dam, Classification criterion of dam type, Uses of dams, Failures of dams. Gravity dams: Definition. Forces acting on a Gravity dam. Modes of failures. Elementary and practical profile. Low and high gravity dams. Simple analysis problems, Principal stresses. Drainage galleries. <span style="float: right;"><b>10 Hrs</b></span></p>					

### Module – V

Earthen dams: Introduction. Types of earthen dams. Failure of earthen dams. Preliminary design. Drainage arrangements. Phreatic line. Spillways: Definition. Types of Spillways. Design Principles for an Ogee Spillway. Energy dissipaters: Types and introduction to IS Stilling basins (No design problems).10Hrs

#### Course Outcomes:

Students will be able to

- Explain the necessity, scope of irrigation and able to compute the water requirements of crop.
- Describe theories of Canal design and apply the concept to design lined and unlined canals and detail out the cross sections.
- Prepare planning, design and operational requirements of storage reservoir, gravity dams and analyse for its stability.
- Design the hydraulic structures on permeable foundation.

#### Text Books:

- B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, PandeBrijBasiLal, “Irrigation and Water Power Engineering”, Laxmi Publications, Sixteenth Edition (2016)
- Santosh Kumar Garg, “Water Resources Engineering Vol. II Irrigation Engineering & Hydraulic Structures”, Khanna Publishers, 24th Revised Edition (2011)
- K R Arora, Irrigation Water Power and Water Resource Engineering, Publisher: Standard Publishers Distributors, edition 2004.

#### Reference Books:

- P.N. Modi, “Irrigation Water Resources & Water Power”, Standard Book House. 9th Edition(2014)
- Pande B.B, Arun Kumar Jain, Ashok Kumar Jain, “Textbook of Irrigation Engineering and Hydraulic Structures”, Laxmi Publications , 16th Edition (2014)
- B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, PandeBrijBasiLal, “Irrigation and Water Power Engineering”, Laxmi Publications, New Delhi, 16th Edition, 2016

#### E-Resources:

- <https://nptel.ac.in/courses/105/105/105105110/>



<b>Geotechnical Engineering</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT45</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the basic concepts of soil mechanics to identify and classify the different soil types.</li> <li>• Comprehend basic engineering and mechanical properties of different types of soil.</li> <li>• Become familiar with geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering.</li> <li>• Assess the improvement in mechanical behaviour by densification of soil deposits using compaction.</li> <li>• Measure strength-deformation characteristics of soils.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Introduction:</b> Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phase relationships, definitions and their interrelationships.</p> <p><b>Determination of Index properties:</b> Specific gravity, water content, in-situ density, relative density, particle size analysis (sieve analysis). Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970).</p>					
<b>10 Hrs</b>					
<b>Module – II</b>					
<p><b>Soil Structure and Clay Mineralogy</b> Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering</p> <p><b>Compaction of Soils:</b> Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control- compactive effort &amp; method of compaction, Proctor's needle, Compacting equipment's and their suitability</p>					
<b>10 Hrs</b>					
<b>Module – III</b>					
<p><b>Flow through Soils:</b> Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena. Seepage Analysis: Laplace equation, assumptions and limitations.</p> <p><b>Flownets:</b> characteristics and applications. Flow nets for sheet piles and below the dam section. Unconfined flow, phreatic line (Casagrande's method-with toe filter). Effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.</p>					
<b>10 Hrs</b>					

#### Module – IV

**Shear Strength of Soil:** Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions

10 Hrs

#### Module – V

**Consolidation of Soil:** Definition, Mass-spring analogy, Terzaghi’s one dimensional consolidation theory-assumptions and limitations. Consolidation characteristics of soil ( $C_c$ ,  $a_v$ ,  $m_v$  and  $C_v$ ). Laboratory one dimensional consolidation test, characteristics of  $e$ -log ( $\sigma'$ ) curve, Pre-consolidation pressure and its determination by Casagrande’s method. Normally consolidated, under consolidated and over consolidated soils. Determination of consolidation characteristics of soils- compression index and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.

10 Hrs

#### Course Outcomes:

Students will be able to

- Plan and execute geotechnical site investigation program for different civil engineering projects
- Get knowledge of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
- Estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
- Determine bearing capacity in proportioning shallow isolated and combined footings for uniform bearing pressure
- Capable of estimating consolidation characteristics of soil.

#### Text Books:

- Punmia B.C. (2005), “Soil Mechanics and Foundation Engg.”, 16th Edition Laxmi Publications Co., New Delhi.
- Gopal Ranjan and Rao A.S.R. (2000), “ Basic and Applied Soil Mechanics”, New Age International (P) Ltd., New Delhi.
- Venkatramiah C., Geotechnical Engineering, New Age International (P) Ltd , Publishers, New Delhi, 2006.
- Dr. K.R.Arora, “Soil Mechanics & Foundation Engineering”, Standard Publishers & Distributors, New Delhi.
- Lambe and Whitman (1979), “Soil Mechanics” John Wiley & Sons, New York Terzaghi. K., and Peck. R.B. (1967) “Soil mechanics in Engineering practice”, 2nd Edition, John Wiley and Sons, New York.

#### Reference Books:

- Head K.H., (1986), “Manual of Soil Laboratory Testing”, Vol. I, II, III, Princeton Press, London.
- Bowles J.E. (1988), “Engineering Properties of Soil and Their Measurements”, McGraw Hill

Book Co. New York.

- Ramamurthy T.N. & Sitharam T.G.(2010), “Geotechnical Engineering”, S.Chand& Company, New Delhi.
- Alam Singh and Chowdhary G.R. (1994), “Soil Engineering in Theory and Practice” CBS Publishers and Distributors Ltd., New Delhi
- Braja M. Das (2002), Principles of Geotechnical Engineering, 5th Edition, Thomson Business Information India (P) Ltd., India

**E-Resources:**

- [http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/soil\\_mech/index.htm](http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/soil_mech/index.htm)
- <http://www.eng.fsu.edu/~tawfiq/soilmech/lecture.html>
- <http://aboutcivil.org/soil-mechanics/soil-mechanics-1-high.pdf>

<b>Environmental Engineering</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT46</b>	<b>3:0:0:0</b>	<b>3</b>	<b>50:50</b>	<b>3 Hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
This course will enable students to:					
<ul style="list-style-type: none"> <li>● Understand the basic concepts and principles of Collection and conveyance of water.</li> <li>● Identify the ill effects of water pollution.</li> <li>● Develop the Design for unit operations and Processes involved in water treatment and waste water.</li> <li>● Evaluate the performance of water and waste water treatment plants.</li> <li>● Estimate the different parameters of the water and wastewater quality</li> </ul>					
<b>Syllabus</b>					
<b>Module - I</b>					
Introduction: Requirement of water for various beneficial uses. Demand of Water: Types of water demands-domestic demand, institutional and commercial, public uses, fire demand. Per capita consumption-factors affecting per capita demand, population forecasting, different methods with merits and demerits-variations in demand of water. Fire demand by kuichling's formula, Freeman formula and national board of fire underwriters formula, peak factors, design period and factors governing the design periods. <b>10 Hrs</b>					
<b>Module – II</b>					
Quality of Water: Objectives of water quality management. Wholesomeness and palatability, Water quality parameters-physical, chemical, microbiological. Drinking water standards BIS and WHO guidelines. Water Treatment: Objectives- Treatment flow-chart. Sedimentation: Theory, settling tanks, types, design. Coagulant aided sedimentation, jar test. <b>10 Hrs</b>					
<b>Module – III</b>					
Aeration: Principles, types of Aerators. Filtration: Mechanism-theory of Filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design-excluding under drainage system-back washing of filters. Operational problems in filters. Disinfection: Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder. UV rays. Treatment of swimming pool water. Softening: definition methods of removal of hardness by lime soda process and zeolite process RO and membrane technique. <b>10 Hrs</b>					

#### Module – IV

Introduction to waste water: Necessity for sanitation, methods of domestic waste water disposal. Waste Water Characterization: Sampling, significance, techniques and frequency. Physical, chemical and biological characteristics, aerobic and anaerobic activities, CNS cycles. BOD and COD. Their significance and problems. **10 Hrs**

#### Module – V

Treatment of waste water: Flow diagram of municipal waste water treatment plant. Primary and Secondary waste water treatment: Screening, Primary sedimentation tank. Trickling filter, Activated sludge process and Anaerobic sludge digestion tanks including theory and design. E waste, Bio and medical waste treatment.

**10 Hrs**

**Course Outcomes:** On completion of this course, students will be able to:

- Recognize the importance of water to protect the water resources which is facing a continuous degradation in water quality.
- Demonstrate an ability to recognize the type of unit operations and processes involved in water and wastewater treatment plants.
- Design the individual unit operation in treatment of water and wastewater.
- Analyze the various water and wastewater quality parameters.

#### Text Books:

- Garg S.K.: “Environmental Engineering”, Vols. I and II, (Chapters 1,2,8,9 and Chapters 2-8), 12th Edition, Khanna Publishers, New Delhi, 2001, ISBN: 81-7409-120-3.
- B.C.Punmia: “Water Supply Engineering“, (Chapters 1,5,6,8,9), Arihant Publications, ISBN: 81-7008-092-4.
- Metcalf and Eddy Inc.: “Waste water Treatment, Disposal and Reuse”, (Chapters 1-9), Tata McGraw Hill Publications, ISBN: 9780070495395.

#### Reference Book:

- Rangwala: “Water supply and sanitary engineering”, (Chapters 1,2,5-10,17- 20,27-30), ISBN: 81-85594-59-7.

#### E-Resources:

- <https://ecommons.cornell.edu>
- <https://doi.org/10.1016/j.enbsoft>

## Surveying Practice

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
19CVL47	1-0-2-0	2	50:50	3 hours	PCC

### Course Objectives:

The students will be able to:

- Impart the practical knowledge of different surveying instruments.
- Gain the knowledge of Theodolite and use it.
- Conduct a profile levelling to calculate the volume of earthwork for different Civil Engineering works.
- Expose the students to different curves and methods of setting them in field.
- Study the use of total station and its applications in various fields of surveying.

### Syllabus

#### List of Experiments

Sl No.	Name of the Experiment
1.	To measure distance between two points using direct and indirect ranging.
2.	Open traverse at various points using Chain, tape, cross staff and optical square.
3.	Closed traverse using tape /chain, compass and its corrections.
4.	To determine difference in elevation between two points using simple and differential leveling technique using both HI and Rise and Fall methods.
5.	To determine difference in elevation between two points using fly leveling technique and to conduct fly back leveling using both HI and Rise and Fall methods.
6.	To conduct profile leveling for water supply /sewage line and to draw the longitudinal section to determine the depth of cut and depth of filling for a given formation level.
7.	Measurement of horizontal angles with method of repetition using theodolite.
8.	Measurement of vertical angles using theodolite.
9.	To set out simple curves using linear methods – perpendicular offsets from long Chord.
10.	To set out simple curves using Rankine's deflection angles method.
11.	Traverse survey using total Station.

### Course Outcomes:

Students will be able to

- Apply the concept of basic mathematics and its application in surveying.
- Determine ground profile by different methods of levelling.
- Recognize the importance of theodolite in the field of surveying.
- Construct the simple curves using different linear methods.
- Illustrate the use of Total Station in the different fields of surveying.

### Text Books:

- Dr B C Punmia, "Surveying Volume I", Lakshmi Publications Pvt Ltd, 6<sup>th</sup> Edition, 2005, ISBN 978-81-700-8853-0
- Dr B C Punmia, "Surveying Volume II", Lakshmi Publications Pvt Ltd, 6<sup>th</sup> Edition, 2005,

ISBN 978-81-700-8853-0.

- Kanetkar T P and S V Kulkarni , Surveying and Leveling Part I, Pune Vidyarthi Griha Prakashan,1988, ISBN-10 : 8185825009

**Reference Books:**

- C Venkatramaiah, “Text Book of Surveying”, Universities Press (India) Pvt. Ltd, 5th edition, 1996.
- S.K. Roy, “Fundamentals of Surveying”, (Chapter 1, 3& 19),Prentice-Hall Of India Pvt. Limited, 2004,2<sup>nd</sup> Edition, ISBN: 81-20-312-60-0.
- R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi, ISBN 10: 0198085427

**E-Resources:**

- [http://lib.uniten.edu.my/libsite/index.php?option=com\\_joomd&view=item&layout=detail&typid=2&id=202&Itemid=790](http://lib.uniten.edu.my/libsite/index.php?option=com_joomd&view=item&layout=detail&typid=2&id=202&Itemid=790)
- <http://ascelibrary.org/journal/jsued2>
- [www.survivorlibrary.com/.../engineers\\_surveying\\_instruments\\_1892.pdf](http://www.survivorlibrary.com/.../engineers_surveying_instruments_1892.pdf)

Fluid Mechanics and Machinery Laboratory					
Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
19CVL48	1-0-2-0	2	50:50	3 hours	PCC
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• Find hydraulic coefficients of flow measuring devices</li> <li>• Characterize the performance of hydraulics machines</li> <li>• Understand the selection of flow measuring devices</li> </ul>					
<b>Syllabus</b>					
<p><b>Cycle 1</b></p> <ol style="list-style-type: none"> <li>1. Calibration of V- Notch</li> <li>2. Calibration of Rectangular Notch</li> <li>3. Calibration of Broad Crested Weir and Ogee Weir</li> </ol> <p><b>Cycle 2</b></p> <ol style="list-style-type: none"> <li>4. To determine hydraulic coefficient of Orifice/mouth piece</li> <li>5. Calibration of Venturi meter</li> <li>6. To determine loss coefficient for flow through pipes</li> <li>7. To determine darcy's friction factor for flow through pipes</li> </ol> <p><b>Cycle 3</b></p> <ol style="list-style-type: none"> <li>8. To determine Impact of jet on curved, flat and inclined vanes</li> <li>9. To determine performance characteristics for varying speed with constant head for a given Centrifugal pump</li> <li>11. To determine performance characteristics for varying speed with constant head for a given Pelton wheel turbine</li> <li>12. To determine performance characteristics for varying speed with constant head for a given Kaplan Turbine</li> </ol>					
<b>Course Outcomes:</b>					
<p>Students will be able to</p> <ul style="list-style-type: none"> <li>• Properties of fluids and the use of various instruments for fluid flow measurement.</li> <li>• To measure the discharge using various measuring devices</li> <li>• Working of hydraulic machines under various conditions of working and their characteristics.</li> </ul>					
<b>Text Books:</b>					
<ul style="list-style-type: none"> <li>• P.N. Modi &amp; S.M. Seth, "Hydraulics and Fluid Mechanics", Standard Book House</li> <li>• Madan Mohan Das, "Fluid Mechanics and Turbo Machines", PHI Learning Pvt. Ltd. 2011</li> </ul>					
<b>Reference Books:</b>					
<ul style="list-style-type: none"> <li>• Sarbjit Singh , Experiments in Fluid Mechanics - PHI Pvt. Ltd.- New Delhi</li> <li>• Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press</li> </ul>					
<b>E-Resources:</b>					
<ul style="list-style-type: none"> <li>• <a href="http://nptel.ac.in/courses/105107059/">http://nptel.ac.in/courses/105107059/</a></li> </ul>					



**Aadalitha Kannada and Vyavaharika Kannada**

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
19CVH49	1-0-0-0	1	50:50	3 hours	HSMC

**ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು**

- ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡಿಸುವುದು.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

**ಪರಿವಿಡಿ (ಪಠ್ಯಪುಸ್ತಕದಲ್ಲಿರುವ ವಿಷಯಗಳ ಪಟ್ಟಿ)**

ಅಧ್ಯಾಯ - 1

ಕನ್ನಡಭಾಷೆ - ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ.

ಅಧ್ಯಾಯ - 2

ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ.

ಅಧ್ಯಾಯ - 3

ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ.

ಅಧ್ಯಾಯ - 4

ಪತ್ರ ವ್ಯವಹಾರ.

ಅಧ್ಯಾಯ - 5

ಆಡಳಿತ ಪತ್ರಗಳು.

ಅಧ್ಯಾಯ - 6

ಸರ್ಕಾರದ ಆದೇಶ ಪತ್ರಗಳು.

ಅಧ್ಯಾಯ - 7

ಸಂಕ್ಷಿಪ್ತ ಪ್ರಬಂಧ ರಚನೆ (ಪ್ರಿಸೈಸ್ ರೈಟಿಂಗ್), ಪ್ರಬಂಧ ಮತ್ತು ಭಾಷಾಂತರ.

ಅಧ್ಯಾಯ - 8

ಕನ್ನಡ ಶಬ್ದಸಂಗ್ರಹ.

### ಅಧ್ಯಾಯ - 9

ಕಂಪ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ.

### ಅಧ್ಯಾಯ - 10

ಪಾರಿಭಾಷಿಕ ಆಡಳಿತ ಕನ್ನಡ ಪದಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ / ಕಂಪ್ಯೂಟರ್ ಪಾರಿಭಾಷಿಕ ಪದಗಳು.

ಆಡಳಿತ ಕನ್ನಡ ಕಲಿಕೆಯ ಫಲಿತಾಂಶಗಳು

- ಆಡಳಿತ ಭಾಷೆ ಕನ್ನಡದ ಪರಿಚಯವಾಗುತ್ತದೆ.
- ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾ ರಚನೆಯಲ್ಲಿನ ನಿಯಮಗಳು ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.
- ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡುತ್ತದೆ.
- ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿ ಮೂಡುತ್ತದೆ.
- ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ್ತು ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳು ಪರಿಚಯಿಸಲ್ಪಡುತ್ತವೆ.

ಪರೀಕ್ಷೆಯ ವಿಧಾನ :

1. ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ - CIE (Continuous Internal Evaluation):
2. ಕಾಲೇಜು ಮಟ್ಟದಲ್ಲಿಯೇ ಆಂತರಿಕ ಪರೀಕ್ಷೆಯನ್ನು 100 ಅಂಕಗಳಿಗೆ ವಿಶ್ವವಿದ್ಯಾಲಯದ ನಿಯಮಗಳು ಮತ್ತು ನಿರ್ದೇಶನದಂತೆ ನಡೆಸತಕ್ಕದ್ದು.

ಪಠ್ಯಪುಸ್ತಕ :

1. ಆಡಳಿತ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕ (Kannada for Administration), ಸಂಪಾದಕರು : ಡಾ.ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ,

ಪ್ರಕಟಣೆ :

1. ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

## **Vyavaharika Kannada**

### **Course Objectives:**

- The course will enable the students to understand Kannada and communicate in Kannada language.

### **Syllabus**

#### **Module - 1**

Vyavaharika Kannada – Parichaya (Introduction to Vyavaharika Kannada).

#### **Module - 2**

Kannada Aksharamalehaagu uchcharane(Kannada Alpabets and Pronunciation).

#### **Module - 3**

Sambhashanegaagi Kannada Padagalu(Kannada Vocabulary for Communication).

#### **Module - 4**

Kannada Grammar in Conversations (Sambhashaneyalli Kannada Vyakarana).

#### **Module - 5**

Activities in Kannada.

### **Course Outcomes:**

- At the end of the course, the student will be able to understand Kannada and communicate in Kannada language.

***FIFTH SEMESTER***

<b>Design and Drawing of RCC Structures</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT51</b>	<b>3:2:0:0</b>	<b>4</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
The students will be able to:					
<ul style="list-style-type: none"> <li>● Identify, formulate and solve engineering problems of RC elements subjected to different kinds of Loading.</li> <li>● Follow a procedural knowledge in designing various structural RC elements.</li> <li>● Impart the usage of codes for strength, serviceability and durability.</li> <li>● Provide knowledge in analysis and design of RC elements.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
Objective of structural design-Steps in RCC Structural Design Process- Type of Loads on Structures and Load combinations- Code of practices and Specifications – Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC – Stress strain behavior of Concrete and Reinforcing Steel – Analysis and Design of Singly reinforced Rectangular beams by working stress method – Limit State philosophy as detailed in IS code – Advantages of Limit State Method over other methods – Analysis and design of singly and doubly reinforced rectangular beams by Limit State Method.					
<b>10 Hrs</b>					
<b>Module – II</b>					
<b>Design of Beams</b>					
Design procedures for critical sections - Behavior of RC members in Shear, Bond and Anchorage Slenderness limits for beams to ensure lateral stability, - Design of RC members for combined Bending, Shear and Torsion. Design examples Drawings.					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>DESIGN OF SLABS</b>					
Types of slabs - Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams-Two-way slab- Design using IS code - coefficients- Flat slab design methods. Drawings.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Design of Columns:</b> Effective length of column, Slenderness ratio for columns, Minimum eccentricity, Design of short axially loaded columns, Design of column subject to combined axial load and uni-axial and bi-axial moment using SP – 16 charts - Drawing					
<b>Design of Staircases :</b> General features; types of staircase, Design of Dog legged and Open well staircases. Drawing.					
<b>10 Hrs</b>					
<b>Module – V</b>					
<b>Design of Footings:</b> Introduction, Types of footings – selection – Design of isolated rectangular footing for axial load – Design of combined and raft footings. Plinth beam design - Drawing					
<b>Flexure and Serviceability Limit States:</b> General aspects of serviceability, Deflection limits in IS:456–2000, Calculation of deflections and crack width.					
Ductile detailing requirements of RC members based on IS 13920 code.					
<b>10 Hrs</b>					

**Course Outcomes:**

Students will be able to

- Understand the design philosophy and principles.
- Solve engineering problems of RC elements subjected to flexure, shear.
- Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
- Design structures for serviceability.
- Prepare Reinforcement drawings of structural elements

**Text Books:**

- Pillai and Menon, Reinforced Concrete Design-, McGraw Hill Education, 3rd edition (2017)
- N Krishnaraju, Design of Reinforced Concrete Structures: IS:456-2000, CBS Publishers & Distributors, 4th Edition (2016)
- S.S. Bhavikatti: “Design of RCC Structural Elements Vol-I”, New Age International Publications, New Delhi, ISBN:978-8122416930.

**Reference Books:**

- Neelam Sharma, “R.C.C Design& Drawing”, S.K. Kataria& Sons, Reprint edition (2013)
- P.C. Varghese, “Limit State Design of Reinforced Concrete”, PHI Learning Private Limited, 2nd Edition (2008)
- V. L. Karve& Late S. R. Shaha, “Limit State Theory & Design of Reinforced Concrete (I.S. 456 - 2000)”, Structures Publications (2014)
- S.N.Shinha: “Reinforced concrete Design” TMH Education Private Limited, ISBN: 978-9351342472.

**E-Resources:**

- <http://nptel.ac.in/courses/105105105/14>
- [https://youtu.be/pIdaC\\_I6H\\_M](https://youtu.be/pIdaC_I6H_M)
- <https://youtu.be/zVKf6hZfrhA>
- <https://youtu.be/DjT5G6Klf1M>
- <https://youtu.be/0fTvE8aSsiE>
- <https://youtu.be/JwiHgkC-6Ic>
- <https://youtu.be/WaAWYM6HDWs>
- <https://youtu.be/AyRgeA65oI0>
- <https://youtu.be/aTGeCoGkh3M>
- <https://youtu.be/AfHmpWlcqq4>
- <https://youtu.be/PDJPcQq3PZE>
- <https://youtu.be/wJWt0dcgafs>
- <https://youtu.be/8ATp13mOhvg>
- <https://youtu.be/hxakW1miEcM>

<b>Structural Analysis-II</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT52</b>	<b>2-2-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>Analyse the indeterminate beams and frames by method of moment distribution.</li> <li>Evaluate the bending moment and shear force by kanis method.</li> <li>Understand the matrix method of analysis for beams and frames</li> <li>Perform the analysis of continuous beam and rigid beam.</li> <li>Adopt concept of influence line diagrams for moving load.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Moment Distribution Method:</b> Introduction, Definition of terms- Distribution factor, Carry over factor, Development of method and Analysis of beams and orthogonal rigid jointed plane frames with kinematic redundancy less than/equal to three. <p style="text-align: right;"><b>10 Hours</b></p>					
<b>Module – II</b>					
<b>Kani’s Method:</b> Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway. Analysis of rigid jointed non-sway plane frames. <p style="text-align: right;"><b>10 Hours</b></p>					
<b>Module – III</b>					
<b>Matrix Method of Analysis ( Flexibility Method) :</b> Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy $\leq 3$ <p><b>10 Hours</b></p>					
<b>Module – IV</b>					
<b>Matrix Method of Analysis (Stiffness Method):</b> Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy $\leq 3$ <p><b>10 Hours</b></p>					
<b>Module-V</b>					
<b>Rolling Load and Influence Lines:</b> Rolling load analysis for simply supported beams for several point loads and UDL, Influence line diagram for reaction, SF and BM at a given section for the cases mentioned above. <p style="text-align: right;"><b>10 Hours</b></p>					
<b>Course Outcomes:</b>					
Students will be able to <ul style="list-style-type: none"> <li>Determine the moment in indeterminate beams and frames of sway and non-sway using moment distribution method.</li> <li>Compute bending moment and shear force for beams and frames by Kanis method.</li> <li>Analyse the beams and indeterminate frames by system stiffness method.</li> <li>Construct the bending moment diagram for beams and frames using flexibility.</li> <li>Apply the concept of influence lines and construct the ILD diagram for the moving loads.</li> </ul>					

**Text Books:**

- S SBhavikatti: “StructuralAnalysis-Vol.I”,(Chapters1,7,8,12),VikasPublishing House, 4thEdition, 2009, ISBN:9788125927907.
- S Ramamrutham and R Narayan: “Theory of Structures”, (Chapters 1,4,6,9), DhanpatRai Publishing Company Private Limited, New Delhi, 9thEdition, 2014, ISBN:978-9384378103.

**Reference Books:**

- V. N Vazirani: “Analysis Of Structures Vol. 1: Analysis, Design And Details Of Structures”, (Chapters 1,6,9), International Student Edition, Mcgraw Hill Book Co., New York, 2008, ISBN:978-8174091406.
- ReddyC.S:“BasicStructuralAnalysis”,(Chapters1,6,8),TataMcGrawHill,New Delhi, 3rdEdition, 2010, ISBN:9780070702769.

**E-Resources:**

- <http://elearning.vtu.ac.in/elcmys/13/enotes/eceem/gr.pdf>
- [http://elearning.vtu.ac.in/elcmys/e-con/stru\\_ana/ch5/html/0004.htm](http://elearning.vtu.ac.in/elcmys/e-con/stru_ana/ch5/html/0004.htm)
- [http://elearning.vtu.ac.in/elcmys/p2/cv42/Chapters\\_05/html/0004.htm](http://elearning.vtu.ac.in/elcmys/p2/cv42/Chapters_05/html/0004.htm)
- <http://elearning.vtu.ac.in/elcmys/struana.html>



<b>HIGHWAY ENGINEERING AND CONSTRUCTION</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT53</b>	<b>2:2:0:0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b> This course will enable students to :					
<ul style="list-style-type: none"> <li>• Study the importance and characteristics of road transport with various road classification patterns and road development programs in India.</li> <li>• Understand the requirements of Ideal alignment and various Surveys with basic road construction materials.</li> <li>• Analyze principles of geometric design for highways.</li> <li>• Gain the knowledge of pavement construction and to know appropriate equipments required for construction.</li> <li>• Know the Design of pavements and identify the importance of Highway Drainage system.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Principles of Transportation Engineering:</b> Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport, Jayakar committee recommendations and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute.</p> <p><b>Highway Development and Planning:</b> Road types and classification, road patterns, planning surveys, saturation system of road planning, phasing road development in India, Present scenario of road development in India (NHDP and PMGSY) and in Karnataka (KSHIP), Road development plan - vision 2021. <span style="float: right;"><b>10 Hrs</b></span></p>					
<b>Module – II</b>					
<p><b>Highway Alignment and Surveys:</b> Ideal Alignment, Factors affecting the alignment, engineering surveys-Map study, Reconnaissance, Preliminary and Final location &amp; detailed survey, Reports and drawings for new and re-aligned projects.</p> <p><b>Pavement materials:</b> Desirable properties of Sub grade soil, HRB soil classification, determination of CBR &amp; examples, Aggregates-Desirable properties, List-Tests on Aggregates, Bituminous Materials – Desirable properties, List-Tests on bituminous materials. <span style="float: right;"><b>10 Hrs</b></span></p>					
<b>Module – III</b>					
<p><b>Highway Geometric Design – I:</b> Importance, Terrain classification, Design speed, Factors affecting geometric design, Cross sectional elements-Camber, width of pavement, Shoulders, Width of formation. Right of way, Typical cross sections.</p> <p><b>Highway Geometric Design – II:</b> Sight Distance, Restrictions to sight distance, PIEV theory, Stopping sight distance, Overtaking sight distance, overtaking zones- Examples. Sight distance at intersections, Horizontal Alignment-Radius of Curve, Superelevation, Extra widening, Transition curve and its length, Examples, Vertical Alignment-Gradient-summit and valley curves. <span style="float: right;"><b>10 Hrs</b></span></p>					
<b>Module – IV</b>					
<p><b>Pavement Components and Construction:</b> Pavement types, component parts of flexible and rigid pavements and their functions. Preparation of subgrade, Specification and construction of Granular Sub base, WBM Base, WMM base, Bituminous Macadam, Dense Bituminous Macadam Bituminous Concrete, Dry Lean Concrete sub base, PQC and Joints in Concrete roads.</p> <p><b>Equipments in Highway Construction:</b> Various types of equipment for excavation, grading and compaction- advantages. List- Special equipment for bituminous and cement concrete pavements.</p>					

**10 Hrs**

**Module – V**

**PAVEMENT DESIGN:** Design factors, ESWL and its determination-Examples, **Flexible pavement**-Design of flexible pavements as per IRC; 37-2012-Examples, **Rigid pavement**-Westergaard's equations for load and temperature stresses- Examples- Design of slab thickness only as per IRC: 58- 2015. Introduction to white topping – design factors and equipments in use – quality control. Condition assessment of existing pavements.

**Highway Drainage:** Significance and requirements, Surface drainage system and design- Examples, sub surface drainage system.

**10 Hrs**

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

- Describe the importance of road transportation in infrastructural development of a Nation.
- Analyze factors influencing road alignment and identify good pavement materials.
- Design the geometric elements for the proposed alignment.
- Construct the various pavements as per standards using various equipments.
- Design Flexible and Rigid pavement as per IRC codes with good drainage system.

**Text Books:**

- Dr. S.K. Khanna, Dr. C.E.G Justo, A. Veraraghvan, “Highway Engineering” Revised 10th Edition, Nem Chand & Sons (2017)
- L.R. Kadiyali, “Principles And Practices Of Highway Engineering”(Including Expressways And Airport Engineering), Khanna Publishers(2005)
- Transportation Engineering, K P Subramaniam, ISBN:978-8174092205 2nd edition, 2011, Scitech Publications, Chennai
- Introduction to Transportation Engineering, James H Banks, ISBN-13: 978-0070702462 2nd edition, 2004, Mc. Graw. Hill Pub. New Delhi
- Construction Equipment and its Management- S.C. Sharma,

(Chapters 1,2,3,4,6,7) SBN:9788174092281 8174092285 xvi+893 Yr. of Pub.2013 Paper Back English Khanna Publishers, Delhi.

**Reference Books:**

- IRC Codes, Indian Road Congress Publications
- “Specifications for Roads and Bridges”-MoRT&H Specifications, Indian Road Congress Publications(2013)
- C. JotinKhisty, B. Kent lal, “Transportation Engineering, PHI Learning Pvt. Ltd”, 3rd Edition(2002)
- E.J. Yoder, M.W. Witzak, “Road materials & Pavement Design”, Wiley India Pvt Ltd; 2nd edition (2011)
- James H Banks, “Introduction to Transportation Engineering”, McGraw. Hill Publicatons(2010)

**E-Resources:**

- <https://www.fhwa.dot.gov/environment/publications/flexibility/ch01.cfm>
- <https://www.railectrica.com/traction-mechanics/train-grade-curve-and-acceleration-resistance-2/>
- <http://nptel.ac.in/courses/105104098/TransportationII/lecture6/7slide.htm/>

- <http://www.aboutcivil.org/highway-drainage-design-guidelines-structures.html>
- <http://nptel.ac.in/courses/105104098/45>
- <https://www.youtube.com/watch?v=qbO7ZMfCDWI>

<b>Construction Quality Management System (QA/QC)</b>				
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Course Type</b>
<b>19 CVT 54</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>PEC</b>
<b>Course Objectives:</b>				
The students will be able to: <ul style="list-style-type: none"> <li>• Learn the importance of quality assurance and control</li> <li>• Know the ISO standards for construction and QC/QA plan</li> <li>• Provide the performance monitoring requirements for QC/QA</li> <li>• Study the construction deficiencies, documentation, field changes and reporting</li> <li>• Apply the above concepts for life project.</li> </ul>				
<b>Syllabus</b>				
<b>Module – I</b>				
<b>Introduction:</b> Construction Quality, Definition of quality as given by Deming, Juran, Crosby, Inspection and Testing, Quality aspects in every phase in the life cycle of Construction project, Quality control, Quality Assurance, difference between Quality control, Quality Assurance (QA/QC). PDCA Cycle. <b>10 Hrs</b>				
<b>Module – II</b>				
<b>Quality Systems:</b> Study of ISO 9000 - Quality System Standards, Purpose of ISO Standards - project setting construction QC/QA plan - contracts description - objectives of this construction quality assurance plan (CQAP) - organization <b>Project QC/QA organization-</b> responsibilities and authorities of organizations- environmental protection agency - structure of QC/QA organization - responsibilities and authorities of key personnel - contractor's quality control personnel - QC systems manager <b>10 Hrs</b>				
<b>Module – III</b>				
<b>Performance monitoring requirements</b> - quality of life performance standards - pollution prevention - reporting <b>Inspection and verification activities</b> - general construction inspection and verification requirements - control, verification and acceptance testing plan – inspections - preparatory inspection - initial inspection - follow-up inspection - completion inspection - QC testing - QA testing - construction acceptance criteria - construction audits - compliance with handling, storage, packaging, - preservation, and delivery requirements - material identification and traceability . <b>10 Hrs</b>				
<b>Module – IV</b>				
<b>Construction deficiencies</b> - deficiency identification - contractor qc deficiency identification and control - non-conformance report - contractor QC deficiency correction - preventive actions <b>Documentation</b> - daily record keeping - daily construction report - inspection and testing report forms - record drawings - control of quality records <b>Environmental requirement approvals</b> (environmental protection agency) - required submittals – CQAP - work completion report - EPA approval <b>Field changes</b> - CQAP changes - QC changes <b>Final reporting:</b> As-built drawings and specification – QA/QC report <b>10 Hrs</b>				
<b>Module – V</b>				
<b>Project Base Learning</b> Quality plan for a small residential building including documentation using templates. <b>10 Hrs</b>				

**Course Outcomes:**

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

- Gain the knowledge of different aspects of quality
- Implementation of ISO standards and QC/QA plan
- Perform monitoring requirements for QC/QA
- Identify construction deficiencies, documentation, field changes and reporting for site
- Evaluate the QA/QC plan for life project.

**Text Books:**

- N. Logothetis, "Management for Total Quality", 8<sup>th</sup> Edition, Prentice Hall New Delhi, 2003.
- D S Rajendra Prasad, "Quality Management System in Civil Engineering", Sapna Book House, Bangalore. 2000

**References:**

- Robert (QMP) "Bench Marking", "The search for industry Best Practices that led to superior performance" American Society of Quality 1995.
- Break Joseph and Susan Joseph "Total Quality Management", Excel Books , New Delhi, 1995.
- Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", Tata McGraw Hill 2002.
- Ishikawa, K. (2006). Introduction to quality control. Productivity Press, Chennai.
- Mathur, P. (2003). Implementing ISO 9001:2000. Vikas Publishing House, New Delhi.
- Mitra, A. (2001). Fundamentals of quality control and improvement. Pearson Education Asia, New Delhi.
- Mohanty R., Lakhe R. (2002). Total quality management. Jaico Publication House, Mumbai

**E-Resouces:**

- <https://nptel.ac.in/courses/110/104/110104080/>

Foundation Engineering					
Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
19CVT55	2-2-0-0	3	50:50	3 hours	PCC
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Become familiar with foundation engineering terminology and estimate internal stresses developed in the soil mass.</li> <li>● Study about assessing stability of slopes and earth pressure on rigid retaining structures.</li> <li>● Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations.</li> <li>● Estimate of settlement and load carrying capacity of pile foundation.</li> <li>● Understand the forces acting on well foundations</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Stress in Soils:</b> Introduction, Boussinesq’s and Westergaard’s theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark’s chart.</p> <p><b>Foundation Settlement:</b> Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).</p>					
<b>10 Hrs</b>					
<b>Module – II</b>					
<p><b>Lateral Earth Pressure:</b> Active, Passive and earth pressure at rest, Rankine’s theory for cohesionless and cohesive soils, Coulomb’s theory, Rebhann’s and Culmann’s graphical construction.</p> <p><b>Stability of Slopes:</b> Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-Ø (Method of slices) soils, Taylor’s stability number.</p>					
<b>10 Hrs</b>					
<b>Module – III</b>					
<p><b>Bearing Capacity of Shallow Foundation:</b> Types of foundations, Determination of bearing capacity by Terzaghi’s and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test</p>					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<p><b>Pile Foundations:</b> Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation).</p>					
<b>10 Hrs</b>					
<b>Module – V</b>					
<p><b>Well Foundations:</b> Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and Remedies of tilts and shifts. <b>Drilled Piers &amp; Caissons:</b> Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and Disadvantages of floating caissons.</p>					

**Course Outcomes:**

Students will be able to

- Understanding of stress distribution and Estimate factor of safety against failure of slopes.
- Compute lateral pressure distribution behind earth retaining structures.
- Determine bearing capacity of soil and also settlement beneath the loaded footings on sand and clayey soils.
- Capable of estimating load carrying capacity of single and group of piles.
- Determine forces acting on well foundations & design different caissons.

**Text Books:**

- Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
- K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publisher Distributors, New Delhi.\
- P C Varghese, Foundation Engineering, PHI India Learning Private Limited, New Delhi.
- Punmia B C, Soil Mechanics and Foundation Engineering-(2017), 16thEdition, Laxmi Publications co., New Delhi
- Bowles J E , Foundation analysis and design, McGraw- Hill Publications, New York.

**Reference Books:**

- Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
- Shashi K. Gulathi& Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications
- Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.
- Braja M. Das (2002), Principles of Geotechnical Engineering, 5th Edition, Thomson Business Information India (P) Ltd., India

**E-Resources:**

- [www.sciencedirect.com/science/book/9780124080768](http://www.sciencedirect.com/science/book/9780124080768)
- [https://www.bauer.de/bma/info\\_80\\_e](https://www.bauer.de/bma/info_80_e)
- [thecounstructor.org/geotechnical/latest-trends-in-ground-improvement-techniques/1836/](http://thecounstructor.org/geotechnical/latest-trends-in-ground-improvement-techniques/1836/)
- [https:// www.nptel.ac.in/courses/105104034](https://www.nptel.ac.in/courses/105104034)

<b>Basics of Structural Dynamics and Earthquake Resistant Design</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT561</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PEC</b>
<b>Course Objectives:</b>					
The students will be able to learn:					
<ul style="list-style-type: none"> <li>● Fundamentals of engineering seismology</li> <li>● Fundamental of structural dynamics</li> <li>● Irregularities in building which are detrimental to its earthquake performance</li> <li>● Different methods of computation seismic lateral forces for framed and masonry structures</li> <li>● Earthquake resistant design requirements for RCC and Masonry structures</li> <li>● Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Engineering Seismology:</b> Terminologies (Focus, Focal depth, Epicentre, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicentre, Magnitude of earthquake).					
<b>10 Hrs</b>					
<b>Module – II</b>					
<b>Response Spectrum:</b> Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>Seismic Performance of Buildings and Over View of IS-1893:</b> Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modelling; Code based seismic design methods.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Determination of Design Lateral Forces:</b> Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).					
<b>10 Hrs</b>					
<b>Module – V</b>					
<b>Earthquake Resistant Analysis and Design of RC Buildings:</b> Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings.					
<b>Earthquake Resistant Design of Masonry Buildings:</b> Performance of Unreinforced, Reinforced,					



Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

**10 Hrs**

**Course Outcomes:**

Students will be able to:

- Acquire basic knowledge of engineering seismology.
- Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
- Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios.
- Analyse multi-storied structures modelled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
- Comprehend planning and design requirements of earthquake resistant features of RCC structures thorough exposure to different IS-codes of practices.

**Text Books:**

- Pankaj Agarwal and Manish Shrikande, “Earthquake resistant design of structures”, PHI India.
- S.K. Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press
- Anil K. Chopra, “Dynamics of Structures: Theory and Applications to Earthquake Engineering”, Pearson Education, Inc.
- T. K. Datta, “Seismic Analysis of Structures”, John Wiley & Sons (Asia) Ltd.

**Reference Books:**

- David Dowrick, “Earthquake resistant design and risk reduction”, John Wiley and Sons Ltd.
- C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, “Some Concepts in Earthquake Behaviour of Buildings”, Published by Gujarat State Disaster Management Authority, Government of Gujarat.
- IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi.
- IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi.
- IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
- IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
- IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

<b>Air Pollution Controlling and Monitoring</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT562</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>EE</b>
<b>Course Objectives:</b>					
The students will be able to:					
<ul style="list-style-type: none"> <li>❖ Understand the fundamentals of air pollution and standards.</li> <li>❖ Assess major air pollutants, their sources and its effects.</li> <li>❖ Analyze different air quality models.</li> <li>❖ Study Different air quality monitoring equipments.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Introduction:</b> Definition – Classification and Characterization of Air Pollutants, Emission Sources, Behaviour and Fate of air pollutants, Chemical Reactions in the Atmosphere, Photo-chemical Smog, Coal-induced Smog.					
Effects of Air Pollution: On Human Health, Animals, Plants and Materials – Major Environmental Air Pollution Episodes–London Smog, Los Angeles Smog and Bhopal Gas Tragedy.					
<b>10Hrs</b>					
<b>Module – II</b>					
<b>Meteorology:</b> Introduction – Meteorological Variables, Primary and Secondary Lapse Rate, Inversions, Stability Conditions, Windrose, General Characteristics of Stack Plumes, Meteorological Models. Factors to be considered in Industrial Plant Location and Planning, Noise pollution sources, measurement units, effects and control.					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>Sampling, Analysis and Control:</b> Sampling and Measurement of Gaseous and Particulate matter, Stack Sampling, Analysis of Air Pollutants, Smoke and Smoke Measurement.					
Air Pollution Control Methods: Particulate, Emission Control, Gravitational Settling Chambers, Cyclone Separators, Fabric Filters, Electrostatic Precipitators, Wet Scrubbers, Selection of a Particulate Collecting Equipment.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
Control of Gaseous Emissions, Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their control.					
Air Pollution due to Automobiles: Air Pollution due to Gasoline Driven and Diesel Driven Engines, Effects, Direct and Indirect Methods of control.					
<b>10 Hrs</b>					
<b>Module – V</b>					
<b>Burning Environmental Issues:</b> Acid Rain, Global Warming, Ozone Depletion in Stratosphere, Indoor Air Pollution.					
<b>Environmental Legislation:</b> Environmental Policy, Environmental Acts, Water, Air and Noise Pollution Standards. Guide lines Environmental impact assessments.					
<b>10Hrs</b>					
<b>Course Outcomes:</b>					
Students will be able to					
<ul style="list-style-type: none"> <li>❖ Examine emission standards for industrial and other sources.</li> <li>❖ Identify air pollution concentrations as a function of emission in the environment.</li> <li>❖ Discuss impact of air pollution on health of humans, animals, plants and materials.</li> </ul>					

- ❖ Identify different equipments for air quality monitoring and control.
- ❖ Distinguish between global and local effects of air pollution as well to recognize the legal aspects associated with air pollution.

**Text Books:**

- Rao M.N. and Rao H.V.N: "Air Pollution", (Chapters 1-6), Tata- McGraw- Hill Publishing Company Ltd., New Delhi, India, 2011, ISBN 13:978-0074518717.
- Anjaneyulu Y: "Air Pollution and control Technologies", (Chapters 2-5), Allied Publishers, Delhi, 2012, ISBN- 13: 9788177641844.
- Rao C.S: "Environmental Pollution Control Engineering", (Chapters 2-6), New age International Publishers, New Delhi, 2nd Edition, 2013, ISBN- 13: 978- 8122418354.

**Reference Books:**

- Gilbert M Masters: "Introduction To Environmental Engineering and Science", (Chapters 1-4), Pearson Education, 3<sup>rd</sup> Edition, 2007, ISBN-13:978-0131481930.
- Mahajan.S.P: "Pollution Control in Process Industries", (Chapters 1-5), Tata Mc- Graw Hill Publishing Co., New Delhi, 2010, ISBN-13:978-0074517727

**E-Resources:**

- <http://nptel.ac.in/courses/105102089/>
- <http://nptel.ac.in/courses/105104099/>
- [3. nptel.ac.in/courses/103107084/module1/lecture1/lecture1.pdf](http://nptel.ac.in/courses/103107084/module1/lecture1/lecture1.pdf)

<b>Design of Masonry Structures</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT563</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PEC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>● Understand the concept of masonry construction.</li> <li>● Recognize the strength and stability aspects along with defects in masonry.</li> <li>● Study the behaviour of masonry under compression.</li> <li>● Compute flexural and shear bond strengths.</li> <li>● Design the load bearing masonry building as per BIS codal provisions.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Masonry Construction:</b> Brick, stone and block masonry units – strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars, selection of mortars. <b>10 Hrs</b>					
<b>Module – II</b>					
<b>Stability:</b> Strength and stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking, methods of avoiding cracks. <b>10 Hrs</b>					
<b>Module – III</b>					
<b>Strength of Masonry in Compression:</b> Behaviour of Masonry under compression, strength and Young's modulus, influence of mortar and masonry unit, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context. Effects of slenderness and eccentricity on compressive strength. <b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Flexural and shear bond:</b> Bond between mortar and masonry unit, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength. <b>10 Hrs</b>					
<b>Module – V</b>					
<b>Permissible Stresses, Design Considerations and Load Considerations for Masonry:</b> Permissible stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses. Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels. Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings, freestanding wall. <b>Design of Load Bearing Masonry Buildings:</b> Design of load bearing masonry for building up to 3 storey using IS : 1905 and SP : 20 procedure. <b>10 Hrs</b>					
<b>Course Outcomes:</b>					
Students will be able to <ul style="list-style-type: none"> <li>● Classify and describe the characteristics of brick, stone, clay block, concrete block.</li> <li>● Comprehend the factors affecting the strength and stability of masonry.</li> <li>● Describe the behavior of masonry under compression, strength and elastic properties.</li> <li>● Calculate masonry flexural, shear bond strength of and permissible compressive stress.</li> </ul>					

- Analyze and design the load bearing masonry building.

**Text Books:**

- Hendry A.W , “Structural masonry”, Macmillan Education Ltd., 2nd edition,ISBN-13: 978-0333733097
- Sinha B.P & Davis S.R. “Design of Masonry structures”, E. & F. N. Spon, 2004.
- Jagadish K. S, Venkatarama Reddy B. V and Nanjunda Rao K. S, “Alternative building materials & technologies”, New age International, New Delhi & Bangalore, 2007.

**Reference Books:**

- Dayaratnam P, “Brick & Reinforced Brick structures”, Oxford & IHB.ISBN-13: 978-8120402492, 2017.
- Sven Sahlin, “Structural Masonry”, Prentice Hall,ISBN-13: 978-0138539375, 1971.
- IS 4326: Code of practice for earthquake resistant design and construction of buildings.
- IS 1905: Code Of Practice for Structural Use of Unreinforced Masonry.
- SP 20: Handbook on Masonry Design and Construction.

**E-Resources:**

- <https://nptel.ac.in/courses/105/106/105106197/>

<b>Environmental Engineering Lab</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVL 57</b>	<b>1-0-2-0</b>	<b>2</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Understand how to classify and analyse various quality parameters of raw water.</li> <li>● Prepare water quality assessment report.</li> <li>● Suggest required type of treatment to purify water and wastewater.</li> <li>● Analyse different quality requirements for industrial waters and domestic waters.</li> </ul>					
<b>Syllabus</b>					
1. Determination of pH and Electrical conductivity.					
2. Determination of Acidity, Alkalinity.					
3. Determination of Calcium, magnesium and Total hardness.					
4. Determination of Solids in sewage: Total solids, suspended solids,					
5. Dissolved solids and settle able solids.					
6. Determination of Chlorides.					
7. Determination of Dissolved oxygen and BOD.					
8. Determination of COD.					
9. Determination of Optimum Dosage of Alum using Jar Test Apparatus,					
<b>Course Outcomes:</b>					
<p>Students will be able to</p> <ul style="list-style-type: none"> <li>● Conduct experiments and determine the physical and chemical characteristics of water and wastewater.</li> <li>● Compare the experimental results with standards and deliberate based on the purpose of analysis.</li> <li>● Determine type and degree of treatment, for water and wastewater.</li> <li>● Relate the significance of experimental results in environmental engineering practices.</li> </ul>					
<b>Text Books:</b>					
<ul style="list-style-type: none"> <li>● Garg S.K.: “Environmental Engineering”, Vols. I and II, (Chapters 1,2,8,9 and Chapters 2-8), 12th Edition, Khanna Publishers, New Delhi, 2001, ISBN: 81-7409-120-3.</li> <li>● B.C.Punmia: “Water Supply Engineering“, (Chapters 1,5,6,8,9), Arihant Publications, ISBN: 81-7008-092-4.</li> <li>● Lab manual, ISO – 14001 Environmental management, Regulatory standards for drinking water and sewage disposal.</li> </ul>					
<b>Reference Books:</b>					
<ul style="list-style-type: none"> <li>● Clair sawyer and perry Mc Carty and Gene Parkin, “Chemistry for Environmental Engineering and Science”, McGraw – Hill Series in civil and Environmental Engineering.</li> </ul>					

- Guide manual: Water and wastewater analysis, Central pollution control board, Govt of India.
- APHA standard methods for the examination of water and wastewater – 20<sup>th</sup> edition.
- Water supply engineering S. K Garg – 30<sup>th</sup> Edition.

**E-Resources:**

- [www.neerivis.nic.in/pdf/](http://www.neerivis.nic.in/pdf/)
- [www.fao.org/](http://www.fao.org/)
- [www.gewater.com/applications](http://www.gewater.com/applications), [www.waterleau.com/en](http://www.waterleau.com/en)

<b>Construction Management And Entrepreneurship</b>				
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Course Type</b>
<b>19CVH58</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>HSMC</b>
<b>Course Objectives:</b>				
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Understand the fundamentals of construction and project management.</li> <li>● Learn the fundamentals of Resource management</li> <li>● Study the concepts of Construction economics</li> <li>● Get insight financial management and construction accounting</li> <li>● Inculcate the concepts of entrepreneurship</li> </ul>				
<b>Syllabus</b>				
<b>Module – I</b>				
<p><b>Management:</b> Characteristics of management, functions of management, importance and purpose of planning process, types of plans</p> <p><b>Construction Project Formulation and Planning:</b> Introduction to construction management, Projects as a business; Fundamentals; Project management- concepts; Project management triangle; Project management systems; Project planning- scope definition, work breakdown structure; Organization breakdown structure; project organization, management functions, management styles, types of project plans, , Grant Chart, preparation of network diagram- event and activity based and its critical path-critical path method, concept of activity on arrow and activity on node.</p> <p><b>10 Hrs</b></p>				
<b>Module – II</b>				
<p><b>Resource Management:</b> Basic concepts of resource management, class of labour, Wages &amp; statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.</p> <p><b>Construction Equipment Management:</b> Equipment-Selection, planning and financing, classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipment.</p> <p><b>Materials Management:</b> Importance, objectives and uses. Functions of materials management department and stores management</p> <p style="text-align: right;"><b>10 Hrs</b></p>				
<b>Module – III</b>				
<p><b>Introduction to engineering economy:</b> Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.</p> <p><b>Interest and time value :</b>concept of simple and compound interest, interest formula for: single payment, equal payment and uniform series. Nominal and effective interest rates,</p> <p><b>Comparison of alternatives:</b> Present worth, annual equivalent , capitalized and rate of return methods , analysis.</p> <p style="text-align: right;"><b>10 Hrs</b></p>				
<b>Module – IV</b>				
<p><b>Financial management–</b> Depreciation – methods of depreciation, Numerical on depreciation Taxation Inflation , Working capital management, Sources of finance, Long term and short term Finance, Construction accounting – Basic concepts and principles, Income statement, Financial statements – Profit and Loss, balance sheets.<b>10 Hrs</b></p>				
<b>Module – V</b>				
<p><b>Entrepreneurship:</b> Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions.</p> <p><b>Micro, Small &amp; Medium Enterprises (MSME):</b> definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC</p>				



**Business Planning Process:** Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities , entry into international business , exporting , direct foreign investment , venture capital. **10 Hrs**

**Course Outcomes:**

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

- Recognize the nature of construction industry and the importance of management.
- Balance the resources efficiently in construction.
- Apply the concepts of economics in constructions.
- Manage finance and accounts in construction
- Gain knowledge of entrepreneurship

**Text Books:**

- Chitkara K K, Construction Project Management, 10<sup>th</sup> Reprint, Tata McGraw Hill, 2006. ISBN-13: 978-9339205447.
- Courtland A. Collier and William B. Ledbetter,” Engineering Economics and Cost Analysis”, Harper & Row.2005.ISBN-13: 9780673983947.
- Dr. U.K. Shrivastava “Construction Planning and Management”, Galgotia publications Pvt. Ltd. New Delhi.

**References:**

- Poornima M. Charantimath , “Entrepreneurship Development and Small Business Enterprise”, Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education
- S.C Sharma –“Construction Equipments and its management” – Khanna publishers
- Srinath L.S, “PERT and CPM”, 3<sup>rd</sup> Edition, East West Press Pvt. Ltd. New Delhi. 2001. ISBN-13: 978-8185336206
- Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, “Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
- Harold Koontz, Heinz Weihrich, “Essentials of Management: An International, Innovation, and Leadership perspective”, T.M.H. Edition, New Delhi
- Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “ Modern Construction Management”, Wiley-Blackwell.

**Eresources:**

- <https://nptel.ac.in/courses/110/107/110107081/>

ENVIRONMENTAL STUDIES					
Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
19CVH59	1:0:0:0	1	CIE:50 SEE:50	1 Hours	HSMC
<b>Course Objectives:</b> To recognize major concepts in environmental sciences and demonstrate in-depth understanding of the environment. The industrial revolution and development have led to the stress on environment in the form of pollution. Checking of the pollution in all fronts at local and global level encompassing the issues of carbon credit, ozone level depletion, global warming, desertification and polar ice cap melting. The main objectives of the course is to expose to students to the problems and mitigation measures concerned to the environmental components like resources, air, water and land.					
<b>Syllabus</b>					
<b>Module 1:</b>					
<b>Ecosystems</b> (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake. <b>Biodiversity:</b> Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.					
<b>3 Hour</b>					
<b>Module 2:</b>					
<b>Advances in Energy Systems</b> (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind. <b>Natural Resource Management</b> (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.					
<b>4 Hour</b>					
<b>Module 3:</b>					
<b>Environmental Pollution</b> (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. <b>Waste Management &amp; Public Health Aspects:</b> Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.					
<b>4 Hour</b>					
<b>Module 4:</b>					
<b>Global Environmental Concerns</b> (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.					
<b>3 Hour</b>					
<b>Module 5:</b>					
<b>Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):</b> G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs. <b>Field work:</b> Visit to an Environmental Engineering Laboratory or Green Building; Visit to a local area to document environment assets river / forest / grassland / hill / mountain. Visit to a local polluted site-urban/rural/industrial/agricultural/Water Treatment Plant/ Waste water treatment Plant. Study of					

common plants, insects, birds. Study of simple ecosystems-pond, river, hills slopes; etc (field work equal to 2 lecture works) ought to be Followed by understanding of process and its brief documentation.

**4 Hour**

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

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale, ·
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Sl. No	Name of the Textbook/s	Title of the Book Author/s	Name of the Publisher	Edition and Year
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2 <sup>nd</sup> Edition, 2012
2	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3 <sup>rd</sup> Edition, 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
4.	Environmental Studies	R. Geetha Balakrishna, K. G. Lakshminarayana Bhatta	SM Publications.	2016
<b>Reference Books</b>				
1	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning, Singapur.	2 <sup>nd</sup> Edition, 2005
2	Environmental Science – working with the Earth	G. Tyler Miller Jr.	Thomson Brooks /Cole,	11 <sup>th</sup> Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, Anoop Singh & Piyush Malaviya	Acme Learning Pvt. Ltd. New Delhi.	1 <sup>st</sup> Edition

# ***SIXTH SEMESTER***

<b>Design of Steel Structures</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT61</b>	<b>3:2:0:0</b>	<b>4</b>	<b>50:50</b>	<b>3 Hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>● Learn the Limit State Design concept and plastic behavior of structural steel members.</li> <li>● Analyze the behavior of different connections used in steel structures.</li> <li>● Understand the procedure of designing a steel structural tensile component.</li> <li>● Identify, formulate and solve engineering problems in Design of compression Members.</li> <li>● Design flexural members and column foundation bases.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Introduction:</b> Advantages and Disadvantages of Steel structures, loads, load combination, Failure criteria for steel, Codes, Specifications and section classification.					
<b>Plastic Behavior of Structural Steel:</b> Introduction, Plastic theory, Plastic hinge concept, conditions of plastic analysis, Theorem of Plastic collapse and Plastic analysis of continuous beams. <b>10 Hrs</b>					
<b>Module – II</b>					
<b>Bolted Connections:</b> Advantages and Limitations of bolted joints, Design strength of ordinary Black Bolts and High Strength Friction Grip bolts (HSFG), Design of Simple Connections, Moment resistant connections.					
<b>Welded Connections:</b> Advantages of Welding, Types and Properties of Welds, Weld specifications, Design of welds, Simple joints and Moment resistant connections. Design and drawing of Beam to Beam connection. <b>10 Hrs</b>					
<b>Module – III</b>					
<b>Design of Tension Members:</b> Introduction, Types of tension members, Design of strands, behavior of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension, Other sections, Design of tension member, Lug angles, Splices, Gussets. <b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Design of Compression Members:</b> Introduction, Failure modes, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members with batten and lacings Effective length of compression members, Design of compression members, Built up compression members. <b>10 Hrs</b>					
<b>Module – V</b>					
<b>Flexural Members:</b> Introduction, Beam types, slenderness ratio, lateral stability of beams, factors affecting lateral stability, Design of laterally supported and laterally unsupported beams.					
<b>Bases:</b> Design of simple slab base and gusseted base. <b>10 Hrs</b>					
<b>Course Outcomes:</b>					
Students will be able to: <ul style="list-style-type: none"> <li>● Apply the concept of Limit State Design of steel structures.</li> </ul>					

- Analyze and design steel structural beams subjected to plastic behavior.
- Capable of design various steel components using bolted and welded connections.
- Apply Indian Standard codal provisions for the design of tension and compression members.
- Understand and Design flexural members and bases.

**Text Books:**

- N Subramanian: “Design of Steel structures”, Oxford University Press, 11<sup>th</sup> Edition, 2013, ISBN:9780195676815.
- K S Duggal: “Limit State Design of Steel Structures”, Tata McgrawHill, Edition, 2010, ISBN:9781259083785.
- S. Ramamrutham: “Design of Steel structures”, Dhanpat Rai Publishing Company, Edition, 2018, ISBN-10: 8187433361; ISBN-13: 978-8187433361.

**Reference Books:**

- S.S Bhavikatti: “Design of Steel Structures”, IK International Pvt. Ltd., 2009, ISBN:9789380026619.
- Dr. B C Punmia, Dr. A K Jain: “Comprehensive Design of Steel Structures”, Firewall Media, 1998, ISBN:9788170080930.
- P Dayaratnam “Design of Steel Structures”, 2<sup>nd</sup> Edition, S chand Publication, 2012, ISBN-13: 978-8121923200.

**E-Resources:**

- <http://nptel.ac.in/courses/105106112/>
- [http://nptel.ac.in/courses/IITMADRAS/Design\\_Steel\\_Structures\\_I/index.php](http://nptel.ac.in/courses/IITMADRAS/Design_Steel_Structures_I/index.php).

<b>Estimation and Quantity Surveying in Construction (QS)</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT62</b>	<b>2-2-0-0</b>	3	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Gain the knowledge of estimating the different types of buildings.</li> <li>● Estimate the quantities of work and develop the bill of quantities and arrive at the Cost of Civil Engineering Project.</li> <li>● Identify the specifications of different items of works</li> <li>● Analyse the rates of different building components of works according to standard schedule of rates.</li> <li>● Understand, Apply and Create the Tender and Contract document.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Introduction:</b> Unit of measurements, Method of taking quantities - Study of various drawings. Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential, building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc.</p>					
<b>10 Hrs</b>					
<b>Module – II</b>					
<p>Estimation of septic tank, soak pit – sanitary and water supply installations – water supply pipe line – sewer line – tube well – open well – estimate of bituminous and cement concrete roads – estimation of retaining walls – culverts – estimation of irrigation works, estimation of road works</p>					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>SPECIFICATION AND TENDERS</b>					
<p>Data – Schedule of rates – Analysis of rates – Specifications – sources – Detailed and general specifications – Tenders – Contracts – Types of contracts – M-Book Measurement - Preparation of bills – Preparation of BOQ (Bill of Quantity).</p>					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>VALUATION</b>					
<p>Necessity – Basics of value engineering – Capitalized value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease Arbitration and legal requirements. Current rate of construction materials.</p>					
<b>10 Hrs</b>					
<b>Module – V</b>					
<p><b>Contract Management:</b> Types of contract- essentials of contract agreement- legal aspects, penal provisions on breach of contract.</p> <p><b>Tender and its Process:</b> Invitation to tender, Prequalification, administrative approval &amp; Technical sanction. Bid submission and Evaluation process. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC). Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture.</p>					
<b>10 Hrs</b>					

**Course Outcomes:**

Students will be able to

- Taking out quantities and work out the cost and preparation of abstract for the estimated cost for various civil engineering works.
- Estimate the cost of different sanitary works.
- Prepare the specifications as per standard schedule of rates.
- Analyze the rates for various items of work.
- Assess contract and tender documents for various construction works.

**Text Books:**

- B.N.Dutta: "Estimating and costing", UBS publishers Distributors Ltd., India, 27<sup>th</sup> Edition, ISBN-13:978-8174767295.
- P.L.Basin: "Quantity Surveying", 3<sup>rd</sup> Revised Edition, S.Chand and company, New Delhi, ISBN-10:8121900859.
- S.C. Rangwala: "Estimating and Specification", 16<sup>th</sup> Edition, Charotar publishing house, 2014, ISBN:978-93-80358-97-0.

**Reference Books:**

- G.S. Birde: "Text book of Estimating and Costing", 6<sup>th</sup> Edition, Dhanpath Rai and sons, New Delhi, ISBN:9789384378134.
- D.D. Kohli, R.C. Kohli: "A text book on Estimating, Costing and Accounts", 2<sup>nd</sup> Edition, S. Chand, New Delhi, ISBN-10:8121903327.
- Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.

**E-Resources:**

- <https://www.schandpublishing.com/books/...textbook-estimating-costing>.
- [nfra.eresourceerp.com/estimation.html](https://nfra.eresourceerp.com/estimation.html)
- [nfra.eresourceerp.com/Project-estimation.html](https://nfra.eresourceerp.com/Project-estimation.html)
- <https://www.mynewsdesk.com/in/view/pressrelease/job-costing-estimation>.



<b>CONSTRUCTION PLANNING TECHNIQUES</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT63</b>	<b>3-2-0-0</b>	<b>4</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>● Inculcate the principles of construction project management</li> <li>● Learn the elements of construction planning and scheduling</li> <li>● Study different scheduling methods</li> <li>● Understand the evaluation of the project strategies and optimizing the characteristics of project.</li> <li>● Get insight information on resource management system</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Introduction:</b> Basic Concepts - Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships Among Activities - Estimating Activity Duration. Estimating Resource Requirements for Work Activities -Coding Systems, Work Breakdown Structure (WBS), Defining Project Activities <b>10 Hrs</b>					
<b>Module – II</b>					
<b>Construction Planning and scheduling Techniques:</b> Planning and Scheduling ,needs of Planning and Scheduling, Steps in Planning and Scheduling, Advantages of Planning and Scheduling, Time Management Function Details– Planning, Scheduling and Project Control. <b>10 Hrs</b>					
<b>Module – III</b>					
<b>CPM and PERT:</b> Introduction to Critical Path Method (CPM), its applications, Network fundamentals, Numerical on Fulkerson’s rule. Program Evaluation Review technique (PERT) and its uses and importance, Numerical on Time estimates.  <b>Precedence Diagram Method (PDM)</b> - four types of relationships and three types for lag, network design (PDM calculation) and analysis. <b>10 Hrs</b>					
<b>Module – IV</b>					
<b>LOB:</b> Introduction to Line of Balance (LOB) Scheduling, construction and prepare of LOB, Line of balance (LOB) technique Need and methods, Numerical on LOB, linear programming chart (LPC); Links, lead/lags, types of schedule constraints and effect.  <b>Cost &amp; Network:</b> Time-Cost Trade-off, Direct cost, Indirect cost, Total project cost, Cost optimization, Cost Control in Construction, Numerical on crashing of network. <b>10 Hrs</b>					
<b>Module – V</b>					
<b>Resource Allocation:</b> Introduction, Resource usage profiles, Project updating, Planning, levelling and Allocation, Numerical on Resource allocation, Monitoring and control, progress monitoring, records, reports, assessment and review; Updation and revision of project plan.  <b>Earned value Analysis:</b> Introduction to earned value analysis, and Components - Budgeted Cost of Work Scheduled (BCWS) Budgeted Cost of Work Performed (BCWP) Actual Cost of Work					

Performed (ACWP), Schedule Variance (SV): Schedule Performance Index, Cost Variance (CV): Cost Performance Index, Estimate to Complete (ETC) budget at completion (BAC), Estimate at Completion (EAC).

**10 Hrs**

**Course Outcomes:**

Students will be able to

- Gain insight on principles of construction project management
- Apply knowledge on preparing project plans, schedule of construction, and project organization.
- Formulate and solve problems on construction network and time estimates.
- Identify and apply time cost tradeoff principles and cost control in construction.
- Design information system on resources and perform earned value analysis

**Text Books:**

- Chitkara K K, Construction Project Management, 10<sup>th</sup> Reprint, Tata McGraw Hill, 2006., ISBN-13: 978-9339205447.
- Callaghan, M.T., Quackenbush, D.G. and Rowings, J.E. (1992) “Construction Project Scheduling”, McGraw-Hill.
- Harris, R.B. (1978) “Precedence and Arrow Network Techniques for Construction”, John Wiley and Sons.

**Reference Books:**

- Poornima M. Charantimath , “Entrepreneurship Development and Small Business Enterprise”, Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education
- Dr. U.K. Shrivastava “Construction Planning and Management”, Galgotia publications Pvt. Ltd. New Delhi.
- S.C Sharma –“Construction Equipment and its management” – Khanna publishers
- Srinath L.S, “PERT and CPM”, 3<sup>rd</sup> Edition, East West Press Pvt. Ltd. New Delhi. 2001, ISBN-13: 978-8185336206
- Robert L Peurifoy, Clifford J. Schexnayder, Aviad Shapira, Robert Schmitt, “Construction Planning, Equipment, and Methods (Civil Engineering), McGraw-Hill Education
- Harold Koontz, Heinz Weihrich, “Essentials of Management: An International, Innovation, and Leadership perspective”, T.M.H. Edition, New Delhi
- Frank Harris, Ronald McCaffer with Francis Edum-Fotwe, “ Modern Construction Management”, Wiley-Blackwell.

**E-Resources:**

- <https://nptel.ac.in/courses/110/107/110107081/>

<b>Traffic Engineering and Management</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT641</b>	<b>3:0:0:0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PEC</b>
<p><b>Course Objectives:</b> This course will enable students to :</p> <ul style="list-style-type: none"> <li>• Understand scope of traffic engineering and traffic characteristics.</li> <li>• Demonstrate various traffic engineering studies.</li> <li>• Analyze the Interpretation of the traffic study and traffic flow theory.</li> <li>• Know the various intersections and its applications.</li> <li>• Gain the Knowledge of ITS, traffic regulation and its control</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Introduction to Traffic Engineering:</b> Definition, objectives of Traffic Engineering and scope of Traffic Engineering.</p> <p><b>Traffic Characteristics:</b> Road user characteristics, Vehicular characteristics – static and dynamic characteristics, Power performance of vehicles, Resistance to the motion of vehicles – Reaction time of driver – Problems. <b>10 Hrs</b></p>					
<b>Module – II</b>					
<p><b>Traffic Studies and Interpretation</b> – Types, Objectives, Data collection, analysis and interpretation of traffic results. Spot speed, speed and delay, origin and destination, Parking studies, Accident- causes, analysis of individual accidents, measures to reduce accident. Problems. <b>10 Hrs</b></p>					
<b>Module – III</b>					
<p><b>Traffic Flow Characteristics:</b> Traffic flow variables, speed – flow – density relationship, PCU values, correlation and regression analysis (linear only) – Queuing theory, Poisson’s distribution and Normal Distribution application to traffic engineering and relevant problems on Normal Distribution. Traffic Forecast and Simulation technique. <b>10 Hrs</b></p>					
<b>Module – IV</b>					
<p><b>Intersection Design:</b> Principle At grade and Grade separated junctions – Types – channelization –Features of channelizing Island – median opening – Gap in median at junction.</p> <p><b>Rotary Intersection:</b> Elements – Advantages – Disadvantages – Design guide lines Three legged inter section – Diamond inter change – Half clover leaf – Clover leaf- Advantages- Disadvantages only. <b>10 Hrs</b></p>					
<b>Module – V</b>					
<p><b>Traffic Regulation and Control:</b> Driver, vehicle and road controls – Traffic regulations, Traffic markings, Traffic signs, Traffic signals – Signals co-ordination. Webster’s and IRC method of signal design-Examples, Street lighting.</p> <p><b>Intelligent Transport System:</b> Definition, Necessities, Application in the present traffic scenario. Area Traffic Management System, Traffic System Management (TSM), Travel Demand Management (TDM). <b>10 Hrs.</b></p>					

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

- Illustrate the objective and scope of traffic engineering and traffic characteristics.
- Interpret the traffic study and traffic flow theory.
- Conduct traffic studies and analyze traffic data.
- Determine the capacity of highways and Design traffic signal systems.
- Demonstrate traffic regulation and control methods and understand the basic knowledge of ITS.

**Text Books:**

- L.R. Kadiyali: “Traffic Engineering and Transport Planning”, Khanna Publishers, (Chapters, 1-6,8-11,13-17), ISBN-10: 817409220X,ISBN-13: 978-8174092205.
- Khanna, Justo: “Highway Engineering”, Nemchand and Bros, Roorkee, (Chapter 5), ISBN: 978-81-85240-80-0.
- Nicholas J. Garber, Traffic & Highway Engineering, Cengage Learning India Private Limited

**Reference Books:**

- Salter RJ and Hounsell NB: “Highway, Traffic Analysis and Design”- Macmillan Press Ltd., London, (Chapters 1-4), ISBN: 9780333609033.
- Matson T M, Smith W S, Hurd F W: “Traffic Engineering, McGraw Hill Book Co, NY, USA, ISBN 10: 0071761136 ISBN 13: 9780071761130.
- Drew D R,” Traffic Flow Theory and Control”, McGraw Hill Book Co, NY, USA, ISBN: 978-3-642-02604-1.
- Wohl, Martin: “Traffic System Analysis of Engineers and Planners”, McGraw Hill Book Co., New York, USA, ISBN-10: 0070712743, ISBN-13: 9780070712744.
- Pignataro: “ Traffic Engineering”, John wiley and sons, ISBN: 978-1-118-76230-1
- IRC: SP:41-1994, IRC SP:31-1992, IRC 43-1994, Indian Roads Congress.
- MORTH: “Type Designs for Intersections on National Highways”, Indian Roads Congress.
- Congress.
- MORTH: “Manual for Road Safety in Road Design”, Indian Roads Congress.

**E-Resources:**

- [https://en.wikipedia.org/wiki/Traffic\\_engineering\(transportation\)](https://en.wikipedia.org/wiki/Traffic_engineering(transportation))
- [http://www.faadooengineers.com/threads/7094-Traffic-Engineering-Ebooks-](http://www.faadooengineers.com/threads/7094-Traffic-Engineering-Ebooks-notes-pdf-ppt-download)
- notes-pdf-ppt-download
- <http://nptel.ac.in/downloads/105101008/>
- <http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=4114883>

<b>Remote Sensing and GIS</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT642</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be learning:</p> <ul style="list-style-type: none"> <li>• About the principles of remote sensing and spectral signatures.</li> <li>• About satellites, types of remote sensing, enhancement and information extraction and digital image processing</li> <li>• About GIS mapping and analysis Techniques.</li> <li>• Application of RS and GIS is various domains including Watershed management, Irrigation management, Drought and Flood monitoring, Environment and ecology.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p>Principles of Remote Sensing: Introduction to remote sensing &amp; system. Electromagnetic spectrum, Black body Atmospheric windows, Spectral characteristics of earth's surface, Range of sensing system. Active &amp; Passive Microwave Remote Sensing: Basics–physics of RADAR waves, spectral characteristics of RADAR waves, microwave radiometers, passive microwave scanners and sensors.</p>					
<b>10 Hrs</b>					
<b>Module – II</b>					
<p>Platforms, Sensors and Data Products: Introduction - Ground aircraft, space aircraft platforms- photographic sensors, scanners, radiometers, and Mission planning. Data types and format, Scale and Legend., platforms- Indian satellite IRS and Land sat specifications, Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal) Basic elements in Image interpretation.</p>					
<b>10 Hrs</b>					
<b>Module – III</b>					
<p>Geographic Information System: Introduction, history of GIS, comparisons with CAD, Necessity of GIS, components of GIS, GIS Architecture-data input, data manipulation, data output, Operation-processes and capabilities, different types of GIS, GIS data- spatial and non-spatial, data models with advantages and disadvantages. Drone survey and its application</p>					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<p>Hyper-spectral Remote Sensing: spectral concepts, Imaging and data collection systems- calibration techniques, data processing techniques; preprocessing, N dimensional scatter-plots, Special angle mapping, Spectral mixture analysis, Spectral Matching, Classification techniques, airborne and space-borne hyper- spectral sensors, applications. High-resolution hyper-spectral satellite systems: Sensors, orbit characteristics, description of satellite systems, data processing aspects, applications. GNSS, IRNSS, GPS and its application.</p>					
<b>10 Hrs</b>					
<b>Module – V</b>					
<p>Applications of RS and GIS in Civil Engineering: Water resource management, Ground water studies, Agriculture, Earthquake hazardous studies, Urban Development Planning, Flood monitoring, Draught monitoring, Transportation engineering, Watershed management, Irrigation management, Site selection for Dams, Bridges and Reservoirs.</p>					
<b>10 Hrs</b>					

**Course Outcomes:**

Students will be able to

- Demonstrate the concepts of Electro Magnetic energy, spectrum and spectral signature curves.
- Apply the concepts of satellite and sensor parameters and characteristics of different platforms.
- Prepare spatial Maps in GIS and able to Interpret GISMaps.
- Design the Hyper spectral remotesensingsystems.
- Solve complex Civilengineering Problems using RSandGIS techniques.

**Text Books:**

- Lillesand T.Mand R.W.Kiefer: “Remotesensingandimageinterpretation”, (Chapters 1-8), 4<sup>th</sup> Edition, John Wiley and Sons, 2000, ISBN: 9780470052457.
- Jensen J.R: “Introductory digital image processing, a remote sensing perspective”, (Chapters 1-4), 2<sup>nd</sup> Edition Prentice Hall, 1996, ISBN: 9780132058407.
- Richards J.A., and X.Jia: “Remotesensingdigitalimageanalysis:anintroduction”, (Chapters 1-3), 3<sup>rd</sup> Edition, Springer, 2006, ISBN: 9783540297116.
- Mikhail E., J.Bethel, and J.C.McGlone: “Introduction to modern photogrammetry”, (Chapters 5-9), Wiley, 2001, ISBN: 9780471309246.

**Reference Books:**

- Ravi P Gupta: “Remote sensing Geology”, (Chapters 1-8), Springer Verilog, New York, ISBN: 9783662052839
- Mather P.M.: “Computer processing of remotely-sensed images, an introduction”, ISBN: 9781119956419.

**E-Resources:**

- <http://www.set.ait.ac.th/page.php?fol=rsgisandpage=rsgis>
- [http://geology.wlu.edu/harbor/geol260/lecture\\_notes/notes.html](http://geology.wlu.edu/harbor/geol260/lecture_notes/notes.html)
- <http://www.rejinpaul.com/2014/10/vtu-civil-notes-vtu-civil-enigneering-1st-2nd-3rd-4th-5th-6th-7th-8th-semester-lecture-notes-download-load.html>
- <http://www.rejinpaul.com/2013/12/civil-2nd-4th-6th-8th-semester-notes-an-na-university-civil-notes.html>

<b>Subsurface Exploration and Ground Improvement Techniques</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT643</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PEC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>● Access ground condition through multidisciplinary sources and Implement various exploration methods to determine soil properties which helps in design</li> <li>● Understand the dewatering techniques based on environmental context</li> <li>● Select and apply appropriate techniques for ground improvement</li> <li>● Suggest/propose suitable chemical stabilizers for ground improvement, through engineering practice and environmental context</li> <li>● Apply the contextual knowledge to choose suitable type of geosynthetics for ground improvement and filtration.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>SUBSURFACE EXPLORATION:</b> Introduction, Importance of exploration, Methods of exploration: Boring, sounding tests. Soil samples-undisturbed, disturbed and representative samples, Soil samplers and sampling, Number and disposition of trial pits and boring, Depth of exploration, Field tests: SPT, SCPT, DCPT, plate load test, Geo-physical methods, Borehole logs, Site investigation report.					
<b>10 Hrs</b>					
<b>Module – II</b>					
<b>GROUND IMPROVEMENT:</b> Introduction, Need and objectives for ground improvement, Classification of improvement techniques, suitability and feasibility. Engineering properties of weak and compressible deposits.					
<b>HYDRAULIC MODIFICATIONS:</b> Objectives, Techniques, Dewatering methods. Drains, different types of drains. Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading.					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>MECHANICAL MODIFICATION:</b> Introduction, Principles of densification, Compaction- Shallow and deep compaction, compaction quality control. Effect of compaction on engineering properties - compressibility, permeability, and liquefaction potential.					
<b>DYNAMIC MODIFICATIONS:</b> Introduction, Need and objectives, Dynamic Consolidation, Compaction by blasting, vibratory probe, Vibroflotation.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>CHEMICAL MODIFICATION:</b> Introduction, Methods of Chemical stabilization, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and deformation characteristics. Criteria for cement stabilization, Stabilization using Fly ash.					
Lime stabilization – suitability, process, criteria for lime stabilization. Other chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Bitumen, tar or asphalt in stabilization.					
<b>10 Hrs</b>					

### Module – V

**GROUTING:** Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.

**GEOSYNTHETICS:** Introduction, Geosynthetic types, properties of Geosynthetics – materials and fiber properties, Hydraulic properties, Durability; Applications of Geosynthetics – Reinforcement, Separation, Filtration and Fluid Transmission.

**10 Hrs**

#### Course Outcomes:

Students will be able to,

- Apply the knowledge of exploration methods to interpret field and laboratory data.
- Identify dewatering techniques based on field conditions
- Conduct investigations on problems and suitable techniques in stabilization
- Suggest/propose suitable chemical stabilizers based on site condition
- Choose suitable type of geosynthetics for ground improvement and filtration process.

#### Text Books:

- Peter.G.Nicholson,“Soil improvement and ground modification methods”,Butterworth-Heinemann Ltd, 1<sup>st</sup> Edition-22 Aug 2014 ,ISBN: 978-0-12-408076-8
- 2. Dr. P.Purushotham Raju ,“Ground Improvement techniques”, Laxmi Publications,2000, ISBN: 978-8131808573
- 3. Manfred R. Hausmann,“ Engineering principles of ground modification”, McGraw-Hill Publishing Co.1990, ISBN: 978-0071007405
- 4. Nihar Ranjan Patra,“Ground Improvement techniques”,S.Chand (G/L) & Company Ltd,2012,ISBN:978-9325960015.

#### Reference Books:

- JieHan,“Principles and Praticce of Ground Improvement”,John Wiley & Sons,edition-28 july 2015, ISBN: 978-1118259917
- Ingles. O.G and Metcalf J.B.,’Soilstabilisation –Principles and Practice”,Butterworths. London 1972, ISBN: 978-0409482157
- M.C.Alfaro,“Improvement Techniques of Soft Ground in Subsiding &Lowland”,CRC Press,1994,ISBN: 978-9054101536
- J.M.Galvin,“Groung Engineering “, Springer,2016 ,ISBN: 978-3319250038

#### E-Resources:

- [www.sciencedirect.com/science/book/9780124080768](http://www.sciencedirect.com/science/book/9780124080768)
- [https://www.bauer.de/bma/info\\_80\\_e](https://www.bauer.de/bma/info_80_e)
- [thecounstructor.org/geotechnical/latest-trends-in-ground-improvement-techniques/1836/](http://thecounstructor.org/geotechnical/latest-trends-in-ground-improvement-techniques/1836/)
- [https:// www.nptel.ac.in/courses/105104034](https://www.nptel.ac.in/courses/105104034)



<b>REPAIR AND REHABILITATION OF STRUCTURES</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT651</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PEC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>• The objectives of this course is to make students to investigate the cause of deterioration of concrete structures,</li> <li>• Strategies different repair and rehabilitation of structures.</li> <li>• Evaluate the performance of the materials for repair and rehabilitation.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>General:</b> Introduction 3R, Cause of deterioration of concrete structures includes Fire attack, frost attack, abrasion, erosion etc., Condition survey of affected structure, Diagnostic methods, interpretation & assessment out of preliminary investigations, experimental investigations using NDT & PDT/load testing, Types of reinforcement, assessing the quality of steel , corrosion parameter mapping, core drilling and other instrumental methods Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Introduction to Forensic science & Law.					
					<b>10 Hours</b>
<b>Module – II</b>					
<b>Influence on Serviceability and Durability:</b> Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion and carbonation mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection, and introduction to service life estimation.					
					<b>10</b>
<b>Hours</b>					
<b>Module – III</b>					
<b>Materials for Repair:</b> Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete. Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shot Crete, Epoxy injection, shoring and underpinning.					
					<b>10</b>
<b>Hours</b>					
<b>Module – IV</b>					
<b>Maintenance and Repair Strategies:</b> Definitions: Maintenance-Methods of maintenance, necessitation of maintenance, Process of maintenance. Facets of Maintenance, importance and Maintenance Preventive measures on various aspects. Repair of cracks- Crack measurements, Factors affecting cracks, Methods of crack repair. Structural repairs of prestress concrete systems, Inspection. Repair strategies.					
					<b>10 Hours</b>
<b>Module – V</b>					
<b>Case Studies of Rehabilitated Structures:</b> Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques and types for dilapidated structures, external strengthening of girders. Points to remember during repair work.					

**Course Outcomes:**

Students will be able to

- Achieve Knowledge of design and development of problem solving skills.
- Analyse the cause of deterioration of concrete structures.
- Design and develop analytical skills.
- Summarize the principles of repair and rehabilitation of structures
- Utilize the concept of Serviceability and Durability.

**Text Books:**

- Dr B Vidivelli “Rehabilitation of Concrete Structures”. 1st edition. Standard Publisher Distributors., 2009.
- Sidney, M. Johnson “Deterioration, Maintenance and Repair of Structures”. Krieger Publishing Co. 1980.
- Denison Campbell, Allen & Harold Roper, “Concrete Structures – Materials, Maintenance and Repair”- Longman Scientific and Technical. 1991.

**Reference Books:**

- R.T. Allen, S.C. Edwards and D N Shaw, “Repair of Concrete Structures”-Blakie and Sons, CRC Press, 1992.
- Raiker R.N., “Learning for failure from Deficiencies in Design, Construction and service”- R&D Center (SDCPL)., 1987.

**E-Resources:**

- <http://linlpringer.com>
- <http://crcnetbase.com>

<b>Advanced Design Of Temporary Structure</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19 CVT 652</b>	<b>3:0:0:0</b>	<b>3</b>	<b>50:50</b>	<b>3 Hours</b>	<b>PEC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Evaluate the importance of different types of false-work and formwork.</li> <li>● Analyze different loading conditions on the temporary structure</li> <li>● Appraise alternative solutions to formwork design and materials.</li> <li>● Recognize the inter-relationship and interdependence of various areas in construction.</li> <li>● Comprehend the operations, technology &amp; structure, management, economics safety aspects.in the area of temporary structure.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Introduction</b>					
Temporary Structure & Recent Developments/Formwork Materials -Types of temporary structure, Uniform Traffic Control and Devices- temporary road and bridge installations for construction projects - soil erosion and sediment control plan - codes & standards pertaining to scaffolding, stairways and ladders, Modular formwork systems used in construction - Lifting plant and materials					
<b>10 Hrs</b>					
<b>Module – II</b>					
<b>False work design</b>					
Procedures, materials and components, forces applied to false work, analysis of false work structure, foundations to false work - design using scaffold tube and fittings, standard solutions and other considerations affecting certain design solutions.					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>Design considerations</b>					
Live loads and Wind pressure -Concrete pressure on form work- concrete density -Height of discharge -Temperature -Rate of Placing -Consistency of concrete - Vibration - Hydrostatic pressure and pressure distribution –Design Examples -Adjustment for non-standard conditions- Basic simplification - Beam forms -Slab forms- Column forms -Wall forms –Allowable stresses - Check for deflection, bending and lateral stability - Codal provisions Examples on form designs.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Techniques</b>					
Building erection of formwork, - formwork for concrete structures, including the basics of formwork layout - temporary guying, and bracing of steel structures – Using the forms involving the temporary installation of retaining walls, sheet piling, and cofferdams -subsurface excavation work. Construction dewatering, Earth retaining structures/shoring/sheeting Soil compaction and stabilization, Access roads, hauling and decking Shoring & Re-shoring & Test-Problems - Slip forms and jump forms					
<b>10 Hrs</b>					

## Module – V

### Formwork cost

Economics/planning, Form estimating - Safe work method statements procedures (MSP) - Emergency procedures for slip forms or jump forms – Safety procedure document for adjacent buildings or structures.

**10 Hrs**

### Course Outcomes:

Students will be able to

- Differentiate types of false-work and formwork.
- Use different loading conditions on the temporary structure for the design.
- Manage alternative solutions to formwork design and materials.
- Give solution through inter-relationship and interdependence of various areas in construction.
- Execute the operations through technology & structure, management, economics and safety aspects in the area of temporary structure.

### Text Books:

- Formwork for concrete structures, Kumar Neeraj Jha, McGraw Hill Education, 2017.
- Formwork For Concrete Structures, Robert L. Peurifoy and Garold D. Oberlender, McGraw - Hill
- Slipform Techniques, Tudor Dinescu and Constantin Radulescu, Abacus Press, Turn Bridge Wells, Kent

### Reference Books:

- Formwork for Concrete, Austin, C.K., Cleaver - Hume Press Ltd., London, 1996.
- Formwork for Concrete, Special Publication No.4, American Concrete Institute, Hurd, M. K., Detroit,
- Concrete Formwork Systems -Awad. Hanna - University of Wisconsin –Copyright Marcel Dekkel Inc.
- A guide to Good Practice – Formwork –Concrete Society –U.K 2nd Edition 1995.
- Illingworth J.R (1987) Temporary Works: Their Role in Construction, London: Thomas TelfordLabour Department (1995) Code of Practice for Scaffolding Safety
- Chudley, R (1999) Advanced Construction Technology, 3rd ed. revised by Roger Grano, Longman.
- Illingworth, J.R. (2000) Construction Methods and Planning, 2nd ed., E & FN Spon

### E-Resources:

- <http://d2l.kennesaw.edu>

<b>Solid Waste Management</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT653</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PEC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Characterize the waste and apply the knowledge of laws for municipal solid waste management and disposal of biomedical wastes and plastic wastes.</li> <li>● Apply the knowledge of mathematics, science, and engineering for effective solid wastes collection systems, waste collection route optimization and processing of solid waste.</li> <li>● Understand composting systems, maintenance and operation of aerobic and anaerobic composting processes for effective organic waste recycling.</li> <li>● Know construction and operations of landfill facilities, energy recovery systems and management of leachate systems.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p>Definition of solid wastes, Land Pollution-scope and importance of solid waste management, functional elements of solid waste management. Sources: Classification and characteristics of solid wastes, Municipal Solid Waste, Commercial and Industrial. Method of quantification. Biomedical Waste Handling Rules and Recycled Plastic usage Rules.</p>					
<b>10 Hrs</b>					
<b>Module – II</b>					
<p>Collection of solid waste: Systems of collection of solid wastes, transfer stations-bailing and compacting, collection equipment's, garbage chutes, route optimization techniques and numerical problems on route optimization. Incineration: Incineration process-3 T's, factors affecting incineration process, incinerators-types, prevention of air pollution, pyrolysis, design criteria for incineration.</p>					
<b>10 Hrs</b>					
<b>Module – III</b>					
<p>Composting: Composting, factors affecting composting process, aerobic and anaerobic composting, Indore and Bangalore method of composting, mechanical composting process, vermi-composting.</p>					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<p>Landfills: Sanitary land filling –Different types, trench method, area method, ramp method and pit method. Factors considered for a landfill site selection, Prevention of site pollution. Cell design, leachate collection systems, control of gas movement and gas recovery systems. Geo-synthetic fabrics in sanitary landfills.</p>					
<b>10 Hrs</b>					
<b>Module – V</b>					
<p>Disposal Methods: Open dumping-selection of site, ocean disposal, feeding to hogs, incineration, pyrolysis, composting, sanitary land filling, merits and demerits, plastic waste, Biomedical waste and its impact on Human health.</p>					
<b>10 Hrs</b>					
<b>Course Outcomes:</b>					

Students will be able to

- Explain Components of solid waste management and the laws governing it.
- Describe the solid waste collection systems, route optimization techniques and processing of solid wastes.
- Design, operation and maintenance of landfills and composting units.
- Discuss the importance and techniques of all major and minor methods of disposal considering plastic and biomedical waste.

**Text Books:**

- Howard S.Peavy et.al: “Environmental Engineering”, (Chapters 10-13), Mc-Graw- Hill Book Company, New York, 2012, ISBN: 978-0071002318.
- George Tchobanoglous et.al.: “Integrated Solid Waste Management”, (Chapters 1-5), Mc-Graw-Hill Inc., New York, 2013, ISBN: 9780070632370.

**Reference Books:**

- K Sasikumar: “Solid Waste management”, PHI Learning Pvt. Limited, New Delhi, 1<sup>3th</sup> Edition, ISBN: 9788120338692.
- S.K Garg: “Environmental Engineering (Vol II)”, Khanna Publishers, New Delhi, 2009, ISBN: 9788174092304.

**E-Resources:**

- <https://ecommons.cornell.edu>
- <https://doi.org/10.1016/j.enbsoft>

<b>Construction Joints And Water Proofing</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19 CVT 661</b>	<b>3:0:0:0</b>	<b>3</b>	<b>50:50</b>	<b>3 Hours</b>	<b>IEC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>● Understand construction joints and sealants</li> <li>● Acquire knowledge in water proofing principles</li> <li>● Study the materials and design for a water proofing system</li> <li>● Distinguish different industrial standard and inspection methods.</li> <li>● Get in-depth details about asphalt and its modifications</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Construction Joints:</b> Introduction - Types of joint – Concrete Contraction Joints - Expansion Joints - necessity for joint sealant – failure of sealant - common problems – Defect identification and remedial measures -method of joint sealant application – pre surface preparation – Post preparation - Types of Sealants Used for Joints in Buildings – Properties and Uses - Design and workmanship – Durability and maintenance <b>10 Hrs</b>					
<b>Module – II</b>					
<b>Waterproofing Principles</b> - Below-Grade Waterproofing - Above-Grade Waterproofing - Residential Waterproofing - Admixtures - Remedial Waterproofing - Mold - The Building Envelope - Life Cycles - Envelope Testing - Leak Investigation and Detection - Safety - Guide Specifications - Resources <b>10 Hrs</b>					
<b>Module – III</b>					
<b>Materials:</b> Introduction - waterproofing materials identification - selection process - Difference between waterproofing and damp proofing - waterproofing system applications - below-grade systems - above-grade waterproofing – water proofing membranes. <b>Design</b> - design above-grade and below-grade waterproofing systems - performance - various calculations - detailing - geotechnical conditions - various drainage systems <b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Industry Standards</b> - safety hazards associated with waterproofing systems - Product Safety and Safe Use – examples - standards and codes <b>Testing and Investigation</b> - various test and investigative methods for existing waterproofing - testing methods related to new or replacement waterproofing installations <b>10 Hrs</b>					
<b>Module – V</b>					
<b>Asphalt</b> - Petroleum Asphalt - Components and Structure - Technical Properties - Technical Standards - selection of the petroleum asphalt - Mineral Filler Modification - Polymer Modification - Other Kinds of Modification - Waterproof Asphalt Paint - Architectural Waterproof Asphalt Jointing Ointment - New Waterproof Membrane - New Waterproof Paint - New Building Sealing Material <b>10 Hrs</b>					

**Course Outcomes:**

Students will be able to

- Understand construction joints and sealants
- Acquire knowledge in water proofing principles
- Study the materials and design for a water proofing system
- Distinguish different industrial standard and inspection methods.
- Get in-depth details about asphalt and its modifications

**Text Books:**

- Michael T Kubal, Construction water proofing hand book, Tata Mc Graw Hill publications
- CPWD Specifications (VOL. 2) 2009, published by, Director General of works, CPWD, Nirman Bhawan, New Delhi
- P.C.Varghese, Building Materials, Prentice-Hall India, 2005

**Reference Books:**

- IS 6509: Code of practice for installation of joints in concrete pavements
- IS 13143: Joints in concrete lining of canals - sealing compound
- M. N. Bussell, R. Cather, Thomas Telford, 1995 - Technology & Engineering
- Farhana M. et al “Expansion joint treatment: material & techniques” conference on “Trends and Challenges of Civil Engineering in Today’s Transforming World” 1 29th March, 2014,. Available from: <https://www.researchgate.net/publication/270894738>
- Biswajit Roy Aminul Islam Laskar, Construction joints in substandard beam–column connections subjected to cyclic loading, Magazine of Concrete Research, ISSN 0024-9831 | E-ISSN 1751-763X Volume 72 Issue 8, April, 2020, pp. 379-391
- Study guide For the Registered waterproofing consultant, by International Institute of Building Enclosure Consultants, 1500 Sunday Drive, Suite 204, Raleigh, NC 27607

**E-Resources:**

- <https://www.researchgate.net/publication/270894738>



<b>CONSTRUCTION SAFETY AND INDUSTRIAL POLICIES</b>				
<b>Course Code</b>	<b>L:T:P</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>
<b>19CVT662</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>
<b>Course Objectives:</b>				
The students will be able to: <ul style="list-style-type: none"> <li>● Understand concept of safety management and its implications</li> <li>● Study construction accidents, safety programmes, and contractual obligations</li> <li>● Gain proficiency and to comply with all statutory requirements for construction projects and sites</li> <li>● Familiarize design for safety in construction.</li> <li>● Get insight the occupational health and safety and legal Provisions.</li> </ul>				
<b>Syllabus</b>				
<b>Module – I</b>				
<b>Introduction:</b> Construction Safety-meaning and scope, Safety in construction- Technological aspects, organizational aspects and behavioral aspects, Safety in Project management, Education and training conditions on safety in Civil Engineering projects, Introduction to environment and environmental impacts associated with projects.				
<b>10 Hrs</b>				
<b>Module – II</b>				
<b>Safety in construction:</b> Causes, classification, cost and measurement of an accident, accident report. Safety information systems, safety programme for construction, PPE, Human Factors in Construction Safety – Costs of Construction Injuries – Occupational and Safety Hazard Assessment –. Safety Culture – Safe Workers, Contractual obligations Safety in Construction Contracts – Substance Abuse – Safety Record Keeping, Safety legislation and Standards, Legal Implications of accident				
<b>10 Hrs</b>				
<b>Module – III</b>				
<b>Safety in critical operations;</b> Storage of materials. Safety for Material handling at site; Excavation and earthwork, drilling and blasting, piping and foundations, concreting, erection, demolition, hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation, Safety for specialized structures- tunnels, dams, power plants, and oil and gas or coal transportation.				
<b>10 Hrs</b>				
<b>Module – IV</b>				
<b>Designing for safety and Owners’ and Designers’ Outlook :-</b> Safety and First Line Supervisors – Safety and Middle Managers, Top Management Practices, Company Activities and Safety – Safety Personnel – Sub-contractual Obligation – Project Coordination and Safety Procedures				
<b>10 Hrs</b>				
<b>Module – V</b>				
<b>Occupational Safety and Health Administration:</b> Definition and Context of OHS, Objectives and Principles of OHS, Workplace and Health Occupational Health, Hygiene and Ergonomics. Introduction to OHSAS - 18001				
<b>Socio-Economic aspects of Occupational Health and Safety:</b> Women’s occupational and health safety, Child labour issues in occupational health and safety, Health issues in the unorganized sector.				
<b>Legal Provisions on Occupational Health and Safety:</b> Overview of existing OHS Legislations in India, The Factories Act, The Mines Act, The Workmen’s Compensation Act, The Employee’s State Insurance Act				
<b>10 Hrs</b>				
<b>Course Outcomes:</b>				
On completion of this course, students will be able to: <ul style="list-style-type: none"> <li>● Acquire working knowledge of various safety, health and environment policies and systems</li> <li>● Gain the knowledge of different aspects of safety management</li> </ul>				

- Know the safety precaution in critical operations
- Design of safety and Owners' and Designers' Outlook
- Develop the ability to know the occupational health and safety and legal Provisions on Occupational Health and Safety.

**Text Books:**

- David Gold Smith, "Safety Management in construction and Industry", McGraw Hill Publishers.
- K N Vaid, "Construction Safety Management", NICMAR, Bombay.
- The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, Universal Law Publishing Co. Pvt. Ltd.

**References:**

- NICMAR. (1998). *Safety management in the construction industry - A manual for project managers*. NICMAR, Mumbai.
- Woodside, G., Kourek, D. (1997). *Environmental safety and health engineering*. John Wiley & Sons, New Jersey
- Grimaldi, J., Simonds, R. (2003). *Safety management*. AITBS, Delhi.
- Colling, D. (1990). *Industrial safety management and technology*. Prentice-Hall, New Jersey.
- Davies V., Thomasin, K. (1996). *Construction safety handbook*. Thomas Telford, London.
- Deb, S. (2003). *Environmental management*. Jaico Publication House, Mumbai.
- Jimmy W. Hinze, *Construction Safety*, Prentice Hall Inc., 1997.

<b>Natural Disaster Mitigation And Management</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT663</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>IEC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Understand about types of Natural Disasters and Disaster Management Cycle.</li> <li>● Develop skills in various stages of preparedness, mitigation and Management of Natural Hazards.</li> <li>● Obtain Complete Knowledge on the Water and Weather related Disaster Management.</li> <li>● Apply knowledge of Space Technologies and Early warning systems in Disaster Management.</li> <li>● Demonstrate the knowledge of Various Organization and Stakeholders Working on Disaster Management.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Natural Disasters – Overview:</b> Introduction- Natural Disasters around the world-Natural Disaster Risk Assessment- Earth and its characteristics Human Dimensions of Global environment Change - Disaster mitigation, preparedness, response and recovery comprehensive emergency management Early warning systems and Disaster Preparedness– Rehabilitation, Vulnerable Populations - Logistics and Services, Food, Nutrition and Shelter -Role of UN Red cross and NGOs.</p>					
<b>10 Hrs</b>					
<b>Module – II</b>					
<p><b>Climate system aspects and Processes:</b> Oceanic, Atmospheric and Hydrologic cycles Severe Weather and Tornadoes , Cyclones, Floods and Droughts - Global Patterns - Mitigation and Preparation – Drought – Famine- nature and dimensions – Drought Assessment and Monitoring.</p>					
<b>10 Hrs</b>					
<b>Module – III</b>					
<p><b>Natural Hazards:</b> Introduction and Review - Natural Disasters - Principles, Elements,and Systems- Geological-Geomorphological aspects, Earthquake- Geology, Seismology, Characteristics and dimensions – Landslides - Human impact on the mountainous terrain and its relationship with Rainfall, liquefaction etc.- Tsunami - Nature and characteristics.</p>					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<p><b>Natural Disaster Communication:</b> Mapping - Modeling, risk analysis and lossestimation – Natural disaster risk analysis - prevention and mitigation - Applications of Space Technology (Satellite Communications, GPS, GIS and Remote Sensing and Information / Communication Technologies (ICT) in Early warning Systems - Disaster Monitoring and Support Centre– Information Dissemination, mobile communication system – Modern systems.</p>					
<b>10 Hrs</b>					
<b>Module – V</b>					
<p><b>Administrative mechanisms:</b> Structure of rescue system, Community and Social organizations –Education and Training – Establishment of capacity building among various stake holders – Government - Educational institutions – Use of Multi-media knowledge products for self-education.</p>					
<b>10 Hrs</b>					
<b>Course Outcomes:</b>					
<p>Students will be able to</p> <ul style="list-style-type: none"> <li>● Develop organizational and Administrative strategies for managing Natural Hazards.</li> <li>● Adopt methodologies for disaster risk assessment w.r.t Water and Climate related disasters.</li> </ul>					

- Apply tools like GPS, GIS, Remote sensing, information technologies, etc. for managing the disasters.
- Specify key roles of capacity building to face disaster among government bodies, institutions, NGO's, etc.

**Text Books:**

- Kovach, Robert L.: “Earth’s Fury: An Introduction to Natural Hazards and Disasters”, Englewood Cliffs, N.J., Prentice Hall, 1995.
- B.Narayan: “Disaster Management”, S.B.Nangia, A P H publishing corporation, Delhi-2014
- Siddhartha Gautam, K Leelakrishna Rao: “Natural disaster Management”, 3<sup>rd</sup> Edition, 2012, ISBN: 9381604320.

**Reference Books:**

- Arul Jothi, D L Balaji: “Safety and Disaster Management Education In Schools”, 1<sup>st</sup> Edition, Anmol Publications, 2009, ISBN: 9380252609.
- R B Singh “Natural Hazards and Disaster Management: Vulnerability and Mitigation” Rawat Publication 2006, ISBN : 8131600335, 9788131600337.

**E-Resources:**

- <https://www.ndma.gov.in/en/>
- <https://www.ksndmc.org/Default.as>
- [www.nrdms.gov.in/natural\\_disaster.asp](http://www.nrdms.gov.in/natural_disaster.asp)

## Concrete and Highway Engineering Lab

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
<b>19CVL67</b>	<b>1-0-2-0</b>	<b>2</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>

### Course Objectives:

The students will be able to:

- Characterize cement properties by conducting various tests on cement.
- Design concrete mixes based on properties of material and evaluate the workability of fresh concrete.
- Describe mechanical behavior of hardened concrete.
- Characterize aggregates based on mechanical properties.
- Evaluate bitumen properties for its suitability for various conditions.
- Design bituminous mix based on Marshall mix properties.

### Syllabus

#### Tests on Cement & Concrete

1. Test on Specific gravity and fineness of cement
2. Test on Normal consistency and initial and final setting time of cement.
3. Test on Soundness of cement
4. Test on compressive strength of mortar.
5. Mix design of concrete-Fresh concrete: Slump, compaction factor, vee-bee test, flow table test.
6. Properties of hardened concrete-Compressive strength and flexural strength, Split tensile strength, relation between them and codal provision.
7. Non-destructive test on hardened concrete using rebound hammer
8. Non-destructive test on hardened concrete using Ultrasonic pulse velocity.
9. Permeability and water absorption test on concrete.

#### Tests on Aggregates

1. Aggregate Crushing Value Test
2. Los Angeles Abrasion Test
3. Aggregate Impact Test
4. Shape tests (Flaky, Elongation,)

#### Tests on Bituminous Materials and Mixes:

1. Specific Gravity Test,
2. Penetration Test,
3. Ductility Test,
4. Softening point Test,
5. Flash and fire point Tests,
6. Viscosity Test
7. Marshall Stability tests

#### Course Outcomes: Students will be able to

- Determine the properties of cement by conducting basic test.
- Define the workability of fresh concrete.

- Estimate the strength of hardened Concrete by destructive and non destructive test.
- Examine the strength of aggregate material as per codal provisions
- Measure the physical properties and stability of bituminous materials and mixes by conducting tests.

**Text Books:**

- M.S Shetty, “Concrete Technology “, S. Chand & Co. Ltd, New Delhi.
- Mehta P.K, “Properties of Concrete”, Tata McGraw Hill Publications, New Delhi.
- S.K Khanna, C.E.G.Justo, and A.Veeraragavan, “Highway Material and Pavement Testing

**Reference Books:**

- Neville AM, “Properties of Concrete”, ELBS Publications, London.
- Relevant BIS codes, Relevant IS Codes and IRC Codes.
- IS: 2386 – Methods of tests for aggregate for concrete.
- IS: 383 – Specifications for fine & coarse aggregate from natural sources for concrete
- IS: 516BXB JWJS– Methods of test for strength of concrete.

**E-Resources:**

- <http://elearning.vtu.ac.in>
- [www.sginstitute.in/downloads/civil.../manual\\_ConcreteTech](http://www.sginstitute.in/downloads/civil.../manual_ConcreteTech)

<b>Extensive Survey Camp</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVP68</b>	<b>1-0-2-0</b>	<b>2</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>● Understand the practical applications of Surveying.</li> <li>● Use Total station in different projects.</li> <li>● Develop communication skills, team work and use modern tool usage in the field of civil engineering.</li> </ul>					
<b>Syllabus</b>					
An extensive survey training involving investigation and design of the following projects is to be conducted for 2 weeks (14 days). The student shall submit a project report consisting of designs and drawings.					
<b>General instructions:</b> Reconnaissance of the sites and fly leveling to establish bench marks.					
<ol style="list-style-type: none"> <li>1. <b>New Tank Projects:</b> The work shall consist of <ol style="list-style-type: none"> <li>a. Alignment of center line of the proposed bund, Longitudinal and cross sections of the centerline.</li> <li>b. Capacity surveys.</li> <li>c. Details at surplus weir and sluice points.</li> <li>d. Canal alignment.</li> </ol> </li> <li>2. <b>Restoration of an Existing Tank:</b> The work shall consist of: <ol style="list-style-type: none"> <li>a. Alignment of centre line of the existing bund, Longitudinal and Crosssections along the centre line.</li> <li>b. Capacity surveys, Details at sluice and surplusweir.</li> </ol> </li> <li>3. <b>Water Supply and Sanitary Project:</b> 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 tanks underground drainage system surveys for laying the sewers.</li> <li>4. <b>Highway Project:</b> 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).</li> <li>5. <b>TOWN/HOUSING / LAYOUT PLANNING:</b> The work shall consist of; <ol style="list-style-type: none"> <li>a) Reconnaissance survey for selection of site and conceptualization of project.</li> <li>b) Detailed survey required for project execution like contour surveys</li> <li>c) Preparation of layout plans as per regulations.</li> <li>d) Centerline marking-transfer of centre lines from plan to ground</li> <li>e) Design of all elements and preparation of drawing with report as per regulations.</li> </ol> </li> </ol>					

**Course Outcomes:**

Students will be able to

- Understand of the principles and operation of the Global Positioning System for locating salient features by Total Station.
- Measure differences in elevation, draw and utilize contour plots, and calculate volumes for earthwork for civil engineering projects.
- Apply the need for licensed surveyors to establish positioning information for property and structures.
- Prepare layout plans as per the specifications of the local bodies.
- Develop communication skills and team work in any project.

**Text Books:**

- Dr. B C Punmia: “Surveying Volume I”, Lakshmi Publications Pvt. Ltd, 6<sup>th</sup> Edition, 2005, ISBN:978-81-700-8853-0.
- Dr. B C Punmia: “Surveying Volume II”, (Chapters 1-4, 6, 7, and 15), Lakshmi Publications Pvt Ltd, 6<sup>th</sup> Edition, 2005, ISBN:978-81-700-8853-0..
- A. M. Chandra , ‘Plane Surveying’ – New age international ( P) Ltd, (2015) ISBN-10: 8122438806

**Reference Books:**

- Chandra, A.M.: “Higher Surveying”, New Age International Publishers, 2002, ISBN: 9788122438123.
- Punmia P.C.: “Surveying”, Volume 3, 15<sup>th</sup> Edition, Laxmi publications, 2004, ISBN:81-7008-825-9.
- Lab manual provided by Dept. of Civil Engg., NCET.
- A Text-Book of Plane Surveying, William Galt Raymond (Author), Charles Winthrop Crockett, Nabu Press, (2010), ISBN-10: 1146996349.



## ***SEVENTH SEMESTER***

<b>Bridge Engineering</b>					
<b>Course Code</b>	<b>L:T:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19 CVT71</b>	<b>2-2-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>This course will enable students to:</p> <ul style="list-style-type: none"> <li>● Formulate and solve engineering problems design of bridges.</li> <li>● Know components of bridge, Classification of Bridges, Survey and data collection for a bridge site selection.</li> <li>● Design a system, component or process as per specifications</li> <li>● To imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design and detailing of bridges for strength and durability.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>INTRODUCTION:</b> Introduction to bridges, classification, selection of bridge site and preliminary and detailed survey work computation of discharge, linear waterway, economic span, afflux, scour depth. Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.</p> <p><b>10 Hrs</b></p>					
<b>Module – II</b>					
<p><b>SPECIFICATIONS OF ROAD BRIDGES:</b> Indian road Congress Bridge code, carriageway, clearance, Forces on bridge, Review of IRC loadings, applications of loads on bridge such as dead load, live load, impact effectetc.</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module –III</b>					
<p><b>RCSLABCULVERT:</b> RC Slab culvert, dead load BM&amp;SF, BM&amp;SF For IRC Class AA Tracked Vehicle, BM&amp;SF For IR C Class AA Wheeled Vehicle, BM&amp;SF For IRC Class A Loading, Structural Design and drawing of Slab Culvert.</p> <p><b>10 Hrs</b></p>					
<b>Module-IV</b>					
<p><b>Design Parameters:</b> Proportioning of Components, Analysis of Slab Using IRC Class AA Tracked Vehicle, Structural Design of Slab, Analysis of Cross Girder for Dead Load &amp; IRC Class AA Tracked Vehicle, Structural Design of Cross Girder, Analysis of Main Girder Using COURBON’S Method, Calculation of Dead load BM and SF, Calculation of Live load B M &amp;S F using IRC Class AA Tracked vehicle. Structural design and drawing of main Girder.</p> <p><b>10 Hrs</b></p>					
<b>Module – V</b>					
<p><b>SUB STRUCTURE:</b></p> <p>Definition of pier and abutment, Design and drawing of pier and abutments, Scourat abutments and pier, types of foundations, pile, welland pneumatic caissons. Importance of bridge bearings, sketches of different types of bearings.</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Course Outcomes:</b>					
<p>Students will be able to</p> <ul style="list-style-type: none"> <li>● Identify, formulate and do hydraulic design of bridges like afflux, scouring depth and calculate the most economical span among the given alternatives</li> <li>● Identify different loadings coming on bridge structures in the form of DL, wind loads,</li> </ul>					

earthquake loads and IRC 6 live loadings.

- Demonstrate the procedural knowledge to design a system, component or process as per needs and specifications of slab culvert subjected to various load combinations with different boundary conditions subjected to various load combinations with different boundary conditions.
- Demonstrate the procedural knowledge to design a system, component or process as per needs and specifications of T beam bridges subjected to various load combinations with different boundary conditions subjected to various load combinations with different boundary conditions.
  - Will understand details of other important components of bridges like substructure, foundations, bearings joints and appurtenances.

**TEXT BOOKS :**

- Essentials of Bridge Engineering by Dr D Johnson Victor, Oxford & IBH Publishing Co New Delhi
- Design of Bridges by Dr N Krishna Raju, Oxford & IBH Publishing Co New Delhi
- Design of Bridges by Jagadish and Dr M A Jayaram

**Reference Books:**

- Principles and Practice of Bridge Engineering by S P Bindra, Dhanpat Rai & Sons New Delhi
- IRC 6 – 2017 Standard Specifications And Code Of Practice For Road Bridges Section II Loads and Stresses, The Indian Road Congress New Delhi
- IRC 112 -2019 Standard Specifications And Code Of Practice For Road Bridges Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
- IS 456 - 2000 Indian Standard Plain and Reinforced Concrete Code of Practice (Fourth Revision) BIS New Delhi
- IS 1343 - 2019 Indian Standard Prestressed Concrete Code of Practice BIS New Delhi.

<b>Pre-Stressed Concrete Structures</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT72</b>	<b>2-2-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the concept of pre-stressing, devices for pre and post-tensioning.</li> <li>• Identify different stress distribution due to pre stress and the imposed load.</li> <li>• Calculate loss of pre stress and deflection in PSC members.</li> <li>• Study the limit state of PSC beams in flexure and shear, anchorage zone (End block) stress.</li> <li>• Design of pre-tensioned, post tensioned simple PSC beams, continues and cantilever beam.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Introduction:</b> Definition and scope of pre stressed concrete, its applications, Types of pre-stressing system, High strength concrete and steel, Stress-Strain characteristics and properties.</p> <p>Basic Principles of Pre-stressing: Fundamentals, Load balancing concept, Stress concept, centre of Thrust. Pre-tensioning and post-tensioning devices, tensioning methods and end anchorages. Ram pressure, extension and proof stress calculation during stressing operation.</p> <p><b>Analysis of Sections for Flexure:</b> Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles.</p>					
<b>10Hrs</b>					
<b>Module – II</b>					
<p><b>Losses of Pre-Stressing:</b> Various losses encountered in pre-tensioning and post-tensioning methods, determination of jacking force.</p> <p><b>Deflections:</b> Deflection of a pre-stressed member – Short term and long term deflections, Elastic deflections under transfer of loads and due to different cable profiles. Deflection limits as per IS 1343. Effect of creep and deflection, load verses deflection curve, methods of reducing deflection.</p>					
<b>10Hrs</b>					
<b>Module – III</b>					
<p><b>Design of beam:</b> Flexure -IS Code recommendations –Ultimate flexural strength of sections Shear, shear resistance of sections, shear reinforcement. Limit state of serviceability control of deflections and cracking. Design of pre-tensioned and post-tensioned sections. Design of post tensioned slabs (PT Slab).</p>					
<b>10Hrs</b>					
<b>Module – IV</b>					
<p><b>Design of End Block:</b> Transmission of pre-stress in pre-tensioned member, transmission length, anchorage stress in post-tensioned members. Bearing stress and bursting tensile force, stresses in end block, IS code method, design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.</p>					
<b>10Hrs</b>					
<b>Module – V</b>					
<p><b>Cantilever Beams and Continuous Beams:</b> Analysis and design of cantilever beams – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.</p>					
<b>10Hrs</b>					

**Course Outcomes:**

Students will be able to

- Identify different pre-stressing techniques and apply principles of pre-stressing to field problem.
- Evaluate the nature of stresses in the flexural member and calculate different losses in PSC members.
- Compute the deflection of PSC members.
- Design the pre-tensioned and post-tensioned beams.
- Analyze composite and continuous beam.

**Text Books:**

- Krishna Raju N.: “Pre-stressed Concrete”, 5<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2007. ISBN:978-9387886209.
- Dayaratnam P.: “Pre-stressed Concrete Structures”, 7<sup>th</sup> edition, Oxford and IBH Publications, New Delhi, 1996. ISBN:978-9386479778.
- Lin T.Y., Ned. Burns H.: “Design of Pre-stressed Concrete Structures”, 3<sup>rd</sup> edition, John Wiley and Sons, New York, 1982. ISBN:978-9812531179.

**Reference Books:**

- Mallick S.K., Gupta A.P.: “Pre-stressed Concrete”, Oxford and IBH, New Delhi, 1983. ISBN: 978-9324527831.
- Natarajan V.: “Fundamentals of Pre-Stressed Concrete”, 1976, B.I Publications, Bombay. ISBN: 978-9367312602.
- Libby J.R.: “Modern Pre-stressed Concrete”, CBS Publishers, New Delhi, 1986. ISBN: 978-9376239543.
- IS: 1343-1980, Code of Practice For Prestressed Concrete, Bureau of Indian Standards, New Delhi, 1981.

**E-Resources:**

- <http://www.vtuupdates.com>>vtunotes
- <http://www.vidhayarthiplus.com>
- <http://www.iitg.ernet.in>>qip>cd\_cell>chapters

<b>Railways, Harbor, Airport and Tunnel Engineering</b>					
<b>Course Code</b>	<b>L:T:P:S</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT731</b>	<b>3:0:0:0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PEC</b>
<p><b>Course Objectives:</b> This course will enable students to :</p> <ul style="list-style-type: none"> <li>• Understand the importance of Railways and various components of railway track.</li> <li>• Analyze about the Tractive resistances &amp; super elevation involved for movement of train &amp; geometric elements of a track.</li> <li>• Know about the layout of an airport, site selection, aircraft characteristics and runway design.</li> <li>• Gain the knowledge on types of Tunnels &amp; methods of tunneling.</li> <li>• Study the importance of Harbors and Docks.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Introduction of Railways and its Components:</b> 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 and requirements. Calculation of quantity of materials required for laying a track-Examples. <b>10 Hrs</b></p>					
<b>Module – II</b>					
<p><b>Traction and Tractive Resistance:</b> Traction and Tractive resistance, Gradients, super elevation, cant deficiency, Negative super elevation, Points and crossings, Salient features of Metrotransit.</p> <p><b>Geometric Design of Railways:</b> Necessity, Safe speed on curves, Cant-cant deficiency- negative cant-safe speed based on various criteria, (both for normal and high speed tracks) Transition curve, Gradient and types, grade compensation, Examples on above. <b>10Hrs</b></p>					
<b>Module – III</b>					
<p><b>Airport Planning and Design:</b> Airport components and diagram, Aircraft characteristics, Site selection and ICAO stipulations. Runway Design- Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Elements of Taxiway Design, Runway and Taxiway Markings and lighting, Instrumental Landing System. <b>10Hrs</b></p>					
<b>Module – IV</b>					
<p><b>Tunnel Engineering:</b> Advantages and disadvantages, Different shapes of tunnels, Surveying-Transferring centre line, and gradient from surface to inside the tunnel working face, Tunneling in rocks-Drift method, Heading and benching method, Tunneling methods in soils-Needle beam, Liner plate, Tunnel lining, Tunnel ventilation, Pilot tunneling. <b>10Hrs</b></p>					
<b>Module – V</b>					
<p><b>Harbours:</b> Types, components, Natural phenomenon on affecting the design of harbours. Wind, wave and tides. Currents, Breakwaters - types, wharf and quays, Jetties and berths. Offshore Platforms.</p> <p><b>Docks:</b> Dry dock and wet docks, Slipways, Navigational aids, warehouse and transit-shed. <b>10 Hrs</b></p>					
<p><b>Course Outcomes:</b> After successful completion of the course, students will be able to,</p>					

- Identify the importance of Railway Engineering in transportation sector.
- Design the various Geometrics of railways..
- Analyze the components of Airport design.
- Demonstrate the different types of tunnels and methods of tunneling.
- Identify the importance of Harbour and dock construction.

**Text Books:**

- S.C.Saxena and S.PArora:“RailwayEngineering”,7<sup>th</sup>Edition, Dhanpat Rai Publications, New Delhi, ISBN:9788189928834.
- S.KKhanna,M.GArora,S.SJain-AirportPlanningandDesign,6<sup>th</sup> Edition, Nem Chand Bros - Roorkee, ISBN: 81-85240-68-10.
- R. Srinivasan:“Harbour, Dockand Tunnel Engineering”, Charaotar Publishing House, 28<sup>th</sup> Edition, 2016, ISBN:9789385039195.

**Reference Books:**

- J S Mundry: “Railway Track Engineering”, (Chapters 1-5), Tata McGraw-Hill Education, 4<sup>th</sup> Edition,2009.
- Hasmukh P. Oza, Gautam H. Oza “Dock and Harbour Engineering”, (Chapters 8-12,17,21), 7<sup>th</sup> Edition, Charotar Publishing house Pvt. Ltd., Gujarat, India,ISBN: 9789380358789.

**E-Resources:**

- <http://nptel.ac.in/courses/105107123/>
- <https://www.railelectrica.com/traction-mechanics/train-grade-curve-and-acceleration-resistance-2/>
- <http://www.faa.gov/airports/engineering/>
- <https://sites.google.com/a/venusict.org/dha/material>

<b>Advanced Concrete Technology</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT732</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PEC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>• Understand the importance of concrete making ingredients.</li> <li>• Comprehend the significance of admixtures in improving the engineering properties of concrete.</li> <li>• Recognize the importance durability and nondestructive tests.</li> <li>• Acquire the knowledge on special concrete.</li> <li>• Apprehend the principles of concrete mix design as per Indian standards.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Concrete Ingredients:</b> Cement – Chemical composition, hydration of cement, types of cement, manufacture of OPC with flow charts, Bogue’s compound and transition zone in cement paste. Tests on cement – field test, fineness, normal consistency, setting time, soundness and compressive strength. Quality of mixing water. Fine aggregate – grading of aggregates, sieve analysis, specific gravity, bulking, moisture content and deleterious materials. Coarse aggregate – importance of size, shape and texture, grading of aggregates, sieve analysis, specific gravity, flakiness and elongation index, crushing, impact and abrasion tests. Structure of aggregate phase, structure of hydrated cement paste, structure - property relationship in hydrated cement paste. <b>10 Hrs</b>					
<b>Module – II</b>					
<b>Admixtures and Rheology of Fresh Concrete:</b> Chemical admixtures – plasticizers, accelerator, retarders and air entraining agents. Mineral admixtures – fly ash, blast furnace slag, metakaolin, Silica fume and rice husk ash. Workability – definition, factors affecting workability, measurement of workability by slump, compaction factor, vee-bee and flow tests. Segregation and bleeding. Process of manufacture of concrete – batching, mixing, transporting, placing, compaction and curing of concrete. <b>10 Hrs</b>					
<b>Module – III</b>					
<b>Hardened Concrete:</b> Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, effect of aggregate properties, compressive strength, tensile strength, bond strength, modulus of rupture, modulus of elasticity, poisson ratio and the relationship between these parameters. Shrinkage and creep. Durability of concrete – permeability, chemical attack, sulphate attack, alkali aggregate reaction, corrosion and carbonation of concrete. Nondestructive testing of concrete – Introduction, testing methods, advantages and applications. <b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Special Concrete:</b> Light Weight Concrete, High Density Concrete, Fibre Reinforced Concrete, Ferro cement, High strength concrete, High Performance concrete, Self-compacting Concrete, Polymer concrete, Geopolymer concrete, Reactive powder concrete, Bacterial concrete, Roller Compacted concrete, Pervious concrete and Nano concrete. <b>10 Hrs</b>					



### Module – V

**Concrete Mix Design:** Concept of mix design, variables in proportioning, exposure conditions, procedure of mix design as per IS 10262-2019 and numerical examples of mix design.

**10 Hrs**

#### Course Outcomes:

Students will be able to

- Acquire the knowledge on concrete ingredients.
- Relate admixtures and their influence on engineering properties.
- Comprehend the concepts of durability along with nondestructive testing of concrete.
- Understand the conceptions of special concrete and applications.
- Design and conceptualize concrete mixes for structural components.

#### Text Books:

- M. S Shetty, “Concrete Technology Theory and Practice”, S. Chand & Co Ltd., New Delhi, 2007.
- M. L Gambhir, “Concrete Technology”, 4th edition, McGraw-Hill, 2009.
- Kumar Mehta. P and Paulo J.M. Monteiro “Concrete-Microstructure, Property and Materials”, 4th Edition, McGraw Hill Education, 2014.
- A. R Santhakumar, “Concrete Technology”- Oxford University Press, New Delhi, 2007.

#### Reference Books:

- Job Thomas, “Concrete Technology”, CENGAGE Learning, 2015.
- N. V. Nayak, A. K. Jain Handbook on “Advanced Concrete Technology”, ISBN: 978-81-8487-186-9.
- Neville A. M, “Properties of concrete”, 4th edition, Pearson Education, Inc. and Dorling Kindersley Publishing Inc., 1995.
- IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete] Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC.
- IS 10262:2019, Indian standard. Concrete Mix Proportioning – Guidelines.
- Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House.

#### E-Resources:

- <https://nptel.ac.in/courses/105/102/105102012/>
- <https://nptel.ac.in/courses/105/106/105106176/>
- <https://nptel.ac.in/courses/105/102/105102012/>

<b>Energy Efficient And Green Buildings</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT733</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>PEC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• Expose to climatic factors and requirements for health.</li> <li>• Understand the fundamentals of passive heating and cooling, lighting and thermal comfort.</li> <li>• Learn the green concepts and expose to both national and international rating systems</li> <li>• Provide the importance and utilization of solar energy in building construction.</li> <li>• Obtain knowledge on green composite and zero discharge concepts.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Introduction: Introduction:</b> Climatic factors, Classification of tropical climates, site climate, micro climate of human settlements, ventilation requirements for health, mechanisms. Estimation of natural ventilation, airflow patterns in building. Human Comfort for the noise level</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module – II</b>					
<p><b>Passive solar heating and cooling:</b> Introduction to thermal comfort, Heat control and ventilation, Thermal comfort factors, thermal indices, thermal quantities, heat exchange in buildings, periodic heat flow, mechanical and structural means of thermal control. Principles of day lighting in buildings</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module – III</b>					
<p><b>Green buildings:</b> Green building definition, needs of green building. green building concepts, Energy efficient materials and Technologies, types of rating systems, Globally and in India, Case studies <b>10 Hrs</b></p>					
<p><b>Solar buildings:</b> Latest development in solar cell system, Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. <b>08Hrs</b></p>					
<b>Module – V</b>					
<p><b>Green Composites:</b> Concepts of Green Composites. Zero discharge concepts. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage Urban Environment and Green Buildings. Green Cover and Built Environment. <b>10 Hrs</b></p>					
<b>Course Outcomes:</b>					
<p>Students will be able to</p> <ul style="list-style-type: none"> <li>• Know about climatic factors and requirements for health and mechanisms.</li> <li>• Assess the fundamentals of passive solar heating and cooling.</li> <li>• Apply the green rating systems concepts</li> <li>• Assess the fundamentals of solar energy</li> </ul>					

- Design zero discharge green composites.

**Text Books:**

- O H Koenigsberger, “Manual of Tropical Housing and Building- Climatic Design”, Orient Longman, Chani 1975
- Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2002McGraw-Hill.
- Osman Attmann: “Green Architecture Advanced Technologies and Materials”, (Chapters 2,4,6-9) McGraw Hill, 2010, ISBN: 9780071625012.

**Reference Books:**

- SP:41- Functional Requirements for Buildings, BIS, New Delhi
- Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi,2007.
- Jerry Yudelson: “Green building Through Integrated Design”, (Chapters 5-7) Mc- Graw Hill, 2009, ISBN: 9780071546010.
- Walker, B, W. Steffen: “Global change and terrestrial ecosystems”, International geosphere-biosphere programme book series, Cambridge University Press, 1996, ISBN-13: 9780521578103.

**E-Resources:**

- [www.greenresourcecouncil.org/green-resources/reference-linksenergy.gov/eere/buildings](http://www.greenresourcecouncil.org/green-resources/reference-linksenergy.gov/eere/buildings)
- [www.michigan.gov/documents/CIS\\_EO\\_Inside\\_ChurchManual..energy.gov/energysaver/led-lighting](http://www.michigan.gov/documents/CIS_EO_Inside_ChurchManual..energy.gov/energysaver/led-lighting)

## ANALYSIS AND DESIGN OF TALL STRUCTURES

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
<b>19CVT741</b>	<b>3:0:0:0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>IEC</b>

### Course Objectives:

The students will be able to:

- Understand basic design philosophy and Loading of Tall structures.
- Analyze the static and dynamic load combination of Tall structures.
- Learn the behavior and forms of Structural Systems on tall buildings.
- Determine the Modeling for approximate analysis of structures.
- Understand the performance of tall structures for strength and stability.

### Syllabus

#### Module – I

**Design Criteria:** Design philosophy, loading, sequential loading, and materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading.

**10 Hrs**

#### Module – II

**Lateral loads and analysis:** static and dynamic approach, Analytical and wind tunnel experimentation method. Equivalent lateral force, modal analysis, combinations of loading, Design of different types of bracings.

**10 Hrs**

#### Module – III

**Behavior of Various Structural Systems:** Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, Design of shear walls, coupled shear walls, wall-frames, tubular, cores. **10 Hrs**

#### Module – IV

**Design:** Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift and twist, computerized general three-dimensional analyses.

**10 Hrs**

#### Module – V

**Stability of Tall Buildings:** Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Delta analysis, Transnational, Torsional instability, out of plumb effects, Differential movement, creep and shrinkage effects, temperature effects and fire.

**10 Hrs**

### Course Outcomes:

Students will be able to:

- Achieve Knowledge of design, different types of loads and their influence on tall buildings and development of problem-solving skills.
- Understand the concept of lateral loads and their influence on tall buildings.

- Summarize the behavior of various structural systems.
- Design and develop analytical skills.
- Describe the concepts of P-Delta analysis.

**Text Books:**

- Taranath B.S, “Structural Analysis and Design of Tall Buildings”- 2<sup>nd</sup> Edition, McGraw Hill.
- Wilf gang Schuller, “High rise building structures”- John Wiley, 1977.
- Bryan Stafford Smith and Alexcoull, “Tall building structures Analysis and Design”-2<sup>nd</sup> Edition, John Wiley.

**Reference Books:**

- T.Y Lin & D. Stotes Burry, “Structural concepts and system for Architects and Engineers”-3<sup>rd</sup> Edition, John Wiley.
- Lynn S. Beedle, “Advances in Tall Buildings”-3<sup>rd</sup> Edition, CBS Publishers and Distributors.
- Dr. Y.P. Gupta – Editor, “Proceedings National Seminar on High Rise Structures- Design and Construction practices for middle level cities”- 1<sup>st</sup> Edition, New Age International Limit.

**E-Resources:**

- <http://publications.lib.chalmers.se/records/fulltext/3785.pdf>.
- <http://www.scribd.com/doc/149804560/Analysis-and-Design-of-Tall-Buildings-Bungale-S-Taranath#scribd>.

<b>Computational Structural Mechanics</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT742</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>FE</b>
<b>Course Objectives:</b>					
The students will be able to:					
<ul style="list-style-type: none"> <li>● Understand basic concepts of Matrix Methods of Structural Analysis.</li> <li>● Analyze the behaviour of plane trusses, continuous beams, and portal Frames.</li> <li>● Adopt flexibility and stiffness matrices method to solve problems in beams, frames and trusses.</li> <li>● Gain knowledge of direct stiffness method to solve problems in beams, frames and trusses.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Basic concepts:</b>					
Introduction, Types of framed structures, Static and Kinematic Indeterminacy, Equilibrium equations, Compatibility conditions, Principle of superposition, Energy principles, Equivalent joint loads, Methods of solving linear simultaneous equations- Gauss elimination method, Cholesky method and Gauss-Siedal method.					
<b>10Hrs</b>					
<b>Module – II</b>					
<b>Flexibility and Stiffness Methods:</b>					
Concepts of stiffness and flexibility, Local and Global coordinates, Development of element flexibility and element stiffness matrices for truss, beam and grid elements. Force-transformation matrix, Development of global flexibility matrix for continuous beams, plane trusses and rigid plane frames, Displacement-transformation matrix, Development of global stiffness matrix for continuous beams, plane trusses and rigid plane frames					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>Flexibility Method:</b> Continuous beams, plane trusses and rigid plane frames.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Analysis using Stiffness Method (including secondary effects):</b> Continuous beams, plane trusses and rigid plane frames.					
<b>10 Hrs</b>					
<b>Module – V</b>					
<b>Direct Stiffness Method:</b> Stiffness matrix for truss element in local and global coordinates, Analysis of plane trusses, Stiffness matrix for beam element, Analysis of continuous beams and orthogonal frames.					
<b>10Hrs</b>					
<b>Course Outcomes:</b>					
Students will be able to					
<ul style="list-style-type: none"> <li>● Formulate force displacement relation by flexibility and stiffness method.</li> <li>● Evaluate the structural systems to application of concepts of flexibility and stiffness matrices.</li> <li>● Analyze the plane trusses, continuous beams and portal frames by transformation approach.</li> </ul>					

- Analyse the structures by direct stiffness method.

**Text Books:**

- Weaver W and Gere J H, “Matrix Analysis of Framed Structures”, CBS publications, New Delhi.
- Rajasekaran S, “Computational Structural Mechanics”, PHI, New Delhi.
- Madhujit Mukhopadhyay and Abdul Hamid Sheikh, “Matrix and Finite Element Analysis of Structures”, Ane Books Pvt. Ltd.

**Reference Books:**

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

**E-Resources:**

- <https://vtu.ac.in/pdf/cbcs/pg/2018/msesyll.pdf>
- <https://www.vturesource.com/vtu-question-papers/CSE/2018/18CSE11/Computational-Structural-Mechanics->
- [https://vm.civeng.unsw.edu.au/courseprofiles/2017/2017-S1\\_CVEN9820x10339.pdf](https://vm.civeng.unsw.edu.au/courseprofiles/2017/2017-S1_CVEN9820x10339.pdf)

<b>Advanced Design of Steel Structures</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19 CVT 743</b>	<b>3:0:0:0</b>	<b>3</b>	<b>50:50</b>	<b>3 Hours</b>	<b>IEC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand different types of steel bridges.</li> <li>• Make analysis and design plate girder and gantry girder.</li> <li>• Find solutions and design for Industrial structural components.</li> <li>• Recognize the inter-relationship of various concepts used for special structures.</li> <li>• Comprehend the operations, technology &amp; structure, management, economics safety aspects.in the area of advanced steel structure.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Steel Bridges</b>					
Introduction – Historical development of bridge - Classification of steel bridges – Movable bridges – Comparison of movable and fixed bridges – Selection of type of bridges – Execution methods of bridges – Economical span length – Clearance - Width of roadway and footway – Dimension of rolling stock.					
<b>10 Hrs</b>					
<b>Module – II</b>					
<b>Plate Girder</b>					
Analysis and design of Plate girders using IS800-2007 - curtailment of flange plates –stiffeners – Introduction to hybrid girders - analysis and design of gantry girder – Problems with welded and bolted connections					
<b>10 Hrs</b>					
<b>Module – III</b>					
<b>Industrial Structure</b>					
Design of industrial building - roofing, cladding and wall material - structural components and framing - types of roof trusses - components - wind load estimation for different type of structures for various zones. Approximate analysis of industrial bents/PEB - design of purlins and wall girts using Channel and Angle sections; cold formed steel purlin.					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Special Structures</b>					
Transmission Towers – Introduction – loads on towers – analysis – design of members and foundation. Light gauge members – Light gauge sections – design considerations – allowable stresses – buckling, design of compression members, tension members and laterally supported beams – connections.					
<b>10 Hrs</b>					



## Module – V

### Mini-projects

1. The first project is a literature survey and/or case studies
2. A real time design/computer project.

### Guide line for QP setting

- Question relevant to literature survey and case studies related to
  - i. Steel Bridges
  - ii. Plate girder
  - iii. Industrial structure
  - iv. Special structures
- The real time design / project can be considered as AIT II

**10 Hrs**

### Course Outcomes:

Students will be able to:

- Select optimum type of steel bridge for the design.
- Analyze and design plate girder and gantry girder as a structural component.
- Design Industrial structural components.
- Utilize various concepts in design and erection of special structures.
- Manage design and operations through technology & structure, management, economics safety aspects.

### Text Books:

- Design of Steel Structures II, Prof. S. R. Satish Kumar & Prof. A. R. Santha Kumar, IIT Madras Civil Engineering Course Material,
- Design of Steel Structures by Arya and Ajmani, Nem Chand & Brothers.
- Design of Steel Structures by N. Subramanian, Oxford University Press
- Dr Ramchandra, “ Design of steel structures – II”, published by Standard book house, Rajsons Publications Pvt Ltd., 1705, NaiSarak, Delhi-110006, PB No.1074.

### Reference Books:

- S Ramamrutham, “Design of steel structures “, published by Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
- Indian Code of Practice IS 800 2007
- Indian Code of Practice I.S. 875 Part-I to IV
- Indian Code of Practice I.S 1893-2002

### E-Resources:

- [www.rejinpaul.com](http://www.rejinpaul.com)
- [easyengineering.net/design-of-steel-structures](http://easyengineering.net/design-of-steel-structures)

<b>Alternative Building Materials and Technologies</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT751</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>IEC</b>
<b>Course Objectives:</b>					
The students will be able to: <ul style="list-style-type: none"> <li>● Understand the concept of environmental friendly and cost effective building technologies.</li> <li>● Acquire the knowledge on alternative building materials.</li> <li>● Scrutinize the properties and applications of industrial by-products and mine wastes in composite materials.</li> <li>● Acquire the knowledge on structural members constructed by employing alternative building technologies.</li> <li>● Design of masonry compression elements.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<b>Introduction:</b> Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, Environmental friendly and cost effective building technologies, Requirements for building of different climatic regions, Traditional building methods and vernacular architecture. <b>10 Hrs</b>					
<b>Module – II</b>					
<b>Alternative Building Materials:</b> Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks, Concrete blocks, Stabilized blocks : mud blocks, steam cured blocks, Fal-G Blocks stone masonry block. Recycling of Construction demolition waste (CDW) and CDW management. <b>10 Hrs</b>					
<b>Module – III</b>					
<b>Lime-pozzolana cements:</b> Raw materials, Manufacturing process, Properties and uses, Fibre reinforced concretes, Matrix materials, Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications, Field quality control test methods. <b>10 Hrs</b>					
<b>Module – IV</b>					
<b>Alternative Building Technologies:</b> Alternative for wall construction, Types, Construction method, Masonry mortars, Types, Preparation, Properties, Ferrocement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications, Alternative roofing systems, Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes. <b>10 Hrs</b>					
<b>Module – V</b>					
<b>Structural Masonry:</b> Compressive strength of masonry elements, Factors affecting compressive strength, Strength of units, prisms / wallettes and walls, Effect of brick work bond on strength, Bond strength of masonry : Flexure and shear, Elastic properties of masonry materials and masonry, IS Code provisions, Design of masonry compression elements, Concepts in lateral load resistance. <b>10 Hrs</b>					
<b>Course Outcomes:</b>					
Students will be able to <ul style="list-style-type: none"> <li>● Comprehend the concepts of environmental issues concerned to building materials.</li> <li>● Classify and describe different types of bricks and blocks used in construction.</li> <li>● Understand the conceptions of lime-pozzolana cements.</li> </ul>					

- Apprehend the concepts of construction of building components by employing alternative building technologies.
- Analyze and design of masonry compression elements as per BIS.

**Text Books:**

- Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, “Alternative Building Materials and Technologies”- New Age International, New Delhi & Bangalore, 2007.
- M. S Shetty, “Concrete Technology Theory and Practice”, S. Chand & Co Ltd., New Delhi, 2007.
- A. W. Hendry , B. P. Sinha and S. R. Davies “Structural Masonry”, 3rd edition, E. & F. N. Spon, 2004.

**Reference Books:**

- IS 1905, BIS, New Delhi.
- SP20(S&T), New Delhi.
- IS 4326, BIS, New Delhi.
- Proceedings of workshop on Alternative Building Materials and Technologies.
- A. R Santhakumar, “Concrete Technology”- Oxford University Press, New Delhi, 2007.

**E-Resources:**

- <https://nptel.ac.in/courses/105/102/105102195/>
- <http://www.vtuboss.in/2018/07/vtu-civil-engineering-6th-sem-cbcs.html>

<b>Industrial Wastewater Treatment</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT752</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>IEC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Identify, formulate, and solve various types of industrial pollution problems.</li> <li>● Function on multi-disciplinary teams in the areas of different types of industries to reduce, recycle and reuse the waste from industries.</li> <li>● Apply knowledge of mathematics, science, and engineering in industrial wastewater treatment, like planning, analysis and designing of treatment units including details of statutory rules and regulations.</li> <li>● Design a system, components, or processes to meet desired needs in industrial wastewater treatment. Identify, various types of industrial wastes and suitable treatment techniques.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p>Industrial scenario in India - Industrial activity and Environment - Uses of Water by industry - Difference between domestic and industrial wastewater- Parameters of pollution and their effects receiving streams- Classification of streams based on the mixing of effluents-Self-purification of streams - Oxygen sag curve- Derivation of Streeter – Phelps equation – Numerical problems.</p>					
<b>10 Hrs</b>					
<b>Module – II</b>					
<p>Environmental standards for industrial effluents - Effluent sampling – grab and composite sampling, Treatment methods of industrial effluent – pre-treatment of waste - Equalization – Neutralization- Flotation-Volume reduction and strength reduction.</p>					
<b>10 Hrs</b>					
<b>Module – III</b>					
<p>Introduction to Secondary treatment of industrial effluents – Design of an aeration unit – design of a trickling filter – design of an oxidation pond - Introduction and feasibility of combined treatment municipal waste and industrial waste -volume ratio-Rental charges and economics.</p>					
<b>10 Hrs</b>					
<b>Module – IV</b>					
<p>Manufacturing process flow sheet with source of wastewater, Characteristics of waste, effects of untreated waste on streams or on land and the treatment of the following industrial effluents Cotton textile Industry, Dairy industry and sugar mill.</p>					
<b>10 Hrs</b>					
<b>Module – V</b>					
<p>Manufacturing process flow sheet with source of wastewater, Characteristics of waste, effects of untreated waste on streams or on land and the treatment of the following industrial effluents Paper and pulp Industry, Distillery industry, Food Processing industry. Processing industry.</p>					
<b>10 Hrs</b>					
<b>Course Outcomes:</b>					
<p>Students will be able to</p> <ul style="list-style-type: none"> <li>● Characterize the different types of industrial effluents.</li> <li>● Advise the regulating authority about the possible danger from specific industries.</li> </ul>					

- Develop planning skill in designing water pollution control systems in industries.
- Differentiate red category industries from green category industries.

**Text Books:**

- Nelson L Nemerow: “Liquid Waste of industry, Theories, Practices and Treatment”, Addison-Wesley, 1st Edition, 1971, ISBN-13: 978-0201052640.
- Rao M N, Dutta A.K: “Waste water treatment”, 3rd Edition, Oxford and IBH Publications Pvt. Ltd., New Delhi, 2008, ISBN: 9788120417120, 8120417127.

**Reference Books:**

- Mahajan S P.: “Pollution control in Process Industries”, Tata McGraw Hill Company, New Delhi, 1985, ISBN: 9780074517727, 0074517724.
- Eckenfelder: “Industrial Water pollution Control”, McGraw Hill Company, New Delhi American Chemical Society, Washington D.C., USA, 2000, ISBN: 9789339220433.

**E-Resources:**

- [www.neerienviis.nic.in/pdf/](http://www.neerienviis.nic.in/pdf/)
- [www.fao.org/](http://www.fao.org/)
- [www.gewater.com/applications](http://www.gewater.com/applications), [www.waterleau.com/en](http://www.waterleau.com/en)

<b>Rural Water Supply and Sanitation</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVT753</b>	<b>3-0-0-0</b>	<b>3</b>	<b>50:50</b>	<b>3 hours</b>	<b>IEC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Identify various source of water, water borne diseases, drinking water quality standards.</li> <li>● Design various Water treatment methods and to control contamination of water.</li> <li>● Understand the usage of pumps for various purposes.</li> <li>● Recognize the Refuse collection system and disposal systems.</li> <li>● Understand the Principles of rural sanitation and rain water harvesting.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p>Rural Water Supply: Introduction: Need for a protected water supply, Investigation and selection of water sources, water borne diseases, Protection of well waters, drinking water quality standards.</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module – II</b>					
<p>Types of Pumps: Supply systems viz., BWS, MWS, PWS, water treatment methods-disinfection, deflouridation, hardness and iron removal, ground water contamination and removal.</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module – III</b>					
<p>Rural Sanitation: Conservancy, public latrine, concept of eco-sanitation, trenching and composing methods, two pit latrines, aqua privy, W.C, septic tank, soak pit. Drainage Systems: Storm water and sullage disposal, rain water harvesting and uses.</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module – IV</b>					
<p>Communicable diseases: Terminology, Classifications, Methods of communication, general methods of Control Refuse Collection and disposal: Garbage, ash, rubbish, collection methods, transportation and disposal-salvaging, dumping, controlled tipping, incineration and composting, dung disposal-digester, biogas plant.</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Module – V</b>					
<p>Milk Sanitation: Essentials, Test for milk quality, pasteurization, quality control, cattle borne diseases, planning for a cow shed. Insect Control: House fly and mosquito-life cycle, diseases, transmission and control measures.</p> <p style="text-align: right;"><b>10 Hrs</b></p>					
<b>Course Outcomes:</b>					
<p>Students will be able to</p> <ul style="list-style-type: none"> <li>● Identify and select water supply systems for rural areas.</li> <li>● Distinguish between urban and rural water supply systems.</li> <li>● Categorize the different types of water borne and communicable diseases and apply the principles of rain water harvesting.</li> <li>● Explain overall management of rural water supply and other components like milk sanitation.</li> </ul>					

- Examine overall management of solid waste collection, disposal and other components like composting of waste to energy.

**Text Books:**

- S. K Garg: “Water Supply Engineering,” (Chapters 1-3), Khanna Publishers, Delhi, 26<sup>th</sup> Edition, 2012, ISBN: 978-8174091208.
- E. William: “Steel, Water Supply and Sewerage”, (Chapters 4,5), McGraw-Hill Publishers, Delhi, 28<sup>th</sup> Edition, 2011, ISBN: 978-0471523772.

**Reference Books:**

- K.Park: “Preventive and Social medicine”, (Chapters 4,5), Bhanot Publishers, Jabalpur (M.P,India), 2<sup>3rd</sup> Edition, 2015, ISBN: 978-9382219057.
- Joseph. A. Solveto: “Environmental Engineering and Sanitation”, (Chapters1-3), Wiley-Interscience Publishers, New Delhi, 4<sup>th</sup> Edition, 2012, ISBN: 978-0471523772.

**E-Resources:**

- <http://nptel.ac.in/courses/105105048/>
- <http://nptel.ac.in/courses/105104102/>

## Geotechnical Engineering Laboratory

Course Code	L-T-P-S (Hrs/week)	Credits	Exam marks	Exam Duration	Course Type
<b>19CVL76</b>	<b>1-0-2-0</b>	<b>2</b>	<b>50:50</b>	<b>3 hours</b>	<b>PCC</b>

### Course Objectives:

The students will be able to:

- Carry out laboratory tests and to identify soil as per IS code.
- Perform laboratory tests to determine index properties of soil.
- Perform tests to determine shear strength and consolidation characteristics of soil.
- Prepare the consolidated soil report.

### Syllabus

#### LIST OF EXPERIMENTS

1. Field Identification of soil; gravel type, sand type, silt type and clay types soils. Tests for determination of Specific gravity (for coarse and fine grained soils) and Water content (Oven drying method).
2. Grain size analysis of soil sample (sieve analysis).
3. In situ density by core cutter and sand replacement methods.
4. Consistency Limits – Liquid Limit (Casagrande’s and Cone Penetration Methods), plastic limit and shrinkage limit.
5. Standard Proctor Compaction Test and Modified Proctor Compaction Test.
6. Coefficient of permeability by constant head and variable head methods.
7. Strength Tests.
  - a. Unconfined Compression Test.
  - b. Direct Shear Test.
- c. Triaxial Compression Test (Unconsolidated undrained test).
  8. Determination of Consolidation Test.
  9. a) Demonstration of miscellaneous equipment’s such as Augers, Samplers, Rapid Moisture meter, Proctor’s needle.
  - b) Demonstration of Hydrometer Test and relative density of sands.
  - c) Demonstration of CBR value and Vane shear test.
10. Preparing a consolidated soil report of Index properties and Strength properties of soil.

### Course Outcomes:

Students will be able to

- Physical and index properties of the soil.
- Classify based on index properties and field identification.
- OMC and MDD, plan and assess field compaction program.
- Consolidation parameters to assess deformation characteristics.
- Strength characteristics and prepare a soil report.

### Text Books:

- Soil Mechanics and Foundation Engg.- Punmia B.C.(2005), 16th Edition Laxmi Publications Co., New Delhi.
- Soil Testing for Engineers- Lambe T.W., Wiley Eastern Ltd., New Delhi.
- Manual of Soil Laboratory Testing- Head K.H., (1986)- Vol.I, II, III, Princeton Press, London.
- Dr. K.R. Arora, “Soil Mechanics & Foundation Engineering”, Standard Publishers &



Distributors, New Delhi.

**Reference Books:**

- Engineering Properties of Soil and Their Measurements- Bowles J.E. (1988), - McGraw Hill Book Co. New York.
- BIS Codes of Practice: IS 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) –1986; IS 2720 (Part - 10) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) –1966, IS 2720 (Part-60) 1965

**E-Resources:**

- <http://www.eng.fsu.edu/~tawfiq/soilmech/lecture.html>
- <http://aboutcivil.org/soil-mechanics/soil-mechanics-1-high.pdf>

<b>SOFTWARE APPLICATION LABORATORY</b>					
<b>Course Code</b>	<b>L-T-P-S (Hrs/week)</b>	<b>Credits</b>	<b>Exam marks</b>	<b>Exam Duration</b>	<b>Course Type</b>
<b>19CVL77</b>	<b>0:0:2:0</b>	<b>2</b>	<b>50:50</b>	<b>3 Hours</b>	<b>PCC</b>
<b>Course Objectives:</b>					
<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>● Use industry standard software in a professional set up.</li> <li>● Understand the finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design.</li> <li>● Acquire basic knowledge and analysis of different components in the Structure.</li> <li>● Prepare work break down plan and estimate resources required in a construction project.</li> <li>● Implement resource allocation and levelling using MSP through software.</li> <li>● Understand the software principles of construction project management.</li> </ul>					
<b>Syllabus</b>					
<b>Module – I</b>					
<p><b>Use of civil Engineering software's:</b>  <b>Use of Structural Analysis software's (STAAD/ETABS) for:</b></p> <ol style="list-style-type: none"> <li>1. Analysis of plane trusses, continuous beams, portal frames.</li> <li>2. 3D analysis of multistoried frame structures.</li> </ol>					
<b>Module – II</b>					
<p><b>Project Management- Exercise on Project planning and scheduling of a building project using any project management software:</b></p> <ol style="list-style-type: none"> <li>a) Understanding basic features of Project management software.</li> <li>b) Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.</li> <li>c) Identification of Predecessor and Successor activities with constrain.</li> <li>d) Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Other non-Critical paths, Project duration, Floats.</li> <li>e) Study on various View options available.</li> <li>f) Basic understanding about Resource Creation and allocation.</li> <li>g) Understanding about Splitting the activity, linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project.</li> </ol>					
<b>Module – III</b>					
<p><b>Use of Excel In Civil Engineering Problems:</b>  Use of spread sheet for the following civil engineering problems:</p> <ol style="list-style-type: none"> <li>i. SFD and BMD for Cantilever and simply supported beam subjected to Point load, uniformly distributed and uniformly varying load acting throughout the span.</li> <li>ii. Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two-way slab.</li> </ol>					
<b>Course Outcomes:</b>					
<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>● Impart knowledge of FEM software for the analysis of structural elements.</li> <li>● Draw SFD and BMD for various kind of beam using Excel.</li> </ul>					

- Design RCC components using Excel.
- Use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work.
- Utilize the concept of construction project management in software.
- Analyze construction project techniques using PERT and CPM networks.

**Text Books:**

- Dr. M.N. Shesha Prakash, Dr. G.S.Suresh: “Computer Aided Design Laboratory”, Lakshmi Publications.
- M.A. Jayaram, D.S. Rajendra Prasad: “CAD Laboratory”, Sapna Publications Learning.
- Ramesh Bangia: “Excel”, Khanna Book Publishing Co. (P) Ltd., Microsoft, 2002, ISBN-10: 8187522577, ISBN-13: 978-8187522577.
- Krishnamoorthy, C.S., Rajeev, S.: “Computer Aided Design and Analytical Tools”, Narosa, 1993, 2<sup>nd</sup> Edition, ISBN: 978-81-7319-495-5.
- Peurifoy, R.L.: “Construction Planning, Equipment and Methods”, McGraw Hill, 8<sup>th</sup> Edition, ISBN-10: 0073401129.
- Chitkara K K: “Construction Project Management”, Tata McGraw Hill, 3<sup>rd</sup> Edition, ISBN: 9789339205454.
- Srinath L.S: “PERT and CPM”, East West Press Pvt. Ltd., New Delhi, ISBN-13: 978-8185336206.

● **Reference Books:**

- Vazirani V.N., Ratwani N.M.: “Strength of Materials”, Vol. II, Khanna Publishers, 1996.
- Ashok, Kumar Jain: “Reinforced Concrete Limit State Design”, Nem Chand Brothers, 1990.
- Harry G Harris and Gajanan M Sabnis: “Structural Modeling and Experimental Techniques”, 2<sup>nd</sup> Edition, ISBN: 0849324696
- Lab manual provided by Dept. of Civil Engg.

**E-Resources:**

- [https://www.researchgate.net/publication/273453659\\_CAD\\_in\\_Civil\\_Engineering\\_A\\_La](https://www.researchgate.net/publication/273453659_CAD_in_Civil_Engineering_A_La) .
- [www.sit.ac.in/department/mca/publication/jayaram.pdf](http://www.sit.ac.in/department/mca/publication/jayaram.pdf).
- [support.office.com/en-us/article/Set-the-general](http://support.office.com/en-us/article/Set-the-general).
- [www.wrike.com/blog/project-manager-calendar](http://www.wrike.com/blog/project-manager-calendar).
- [www.tacticalprojectmanagement.com/ms-project-export](http://www.tacticalprojectmanagement.com/ms-project-export).