

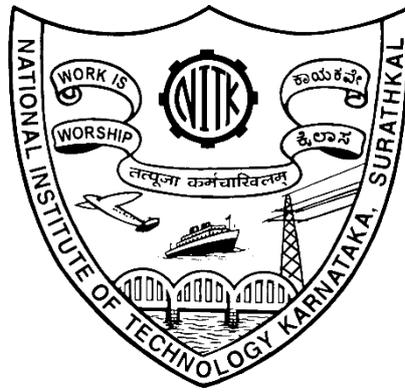
# **COURSE CURRICULUM**

*for*

## **Bachelor of Technology**

*in*

## **Civil Engineering**



**2020**



**Department of Civil Engineering  
NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA  
Mangalore 575025, D.K. District, Karnataka, INDIA**



## ABOUT THE DEPARTMENT

The Department of Civil Engineering, established in the year 1960, is one of the oldest departments of the Institute. The Department offers an undergraduate programme in Civil Engineering; five postgraduate programmes in Construction Technology and Management, Environmental Engineering, Geotechnical Engineering, Structural Engineering, and Transportation Engineering; research programmes for Master and Doctoral degrees. The Department has well-experienced faculty, skilled technical staff and well-equipped laboratories. It is a recognised QIP centre for the training of faculty from other engineering colleges and polytechnics. The Department has always been at the forefront of R&D initiatives and Industrial Consultancy assignments.

## VISION AND MISSION OF THE DEPARTMENT

### Vision

To produce Civil Engineers with the necessary knowledge, skills and attitudes, who can be entrusted by the society to lead a sustainable world with enhanced quality of life.

### Mission

To effectively train our students as Civil Engineers who can serve the society competently, collaboratively and ethically as

- Planners, designers, constructors and operators of the built environment
- Leaders of the natural environment and its resources
- Innovators and integrators of ideas and technologies across the public, private and academic sectors
- Managers of risk and uncertainty caused by natural events, accidents and other threats.
- Leaders in discussions and decisions; shaping public, environmental and infrastructure policies.

## PROGRAM EDUCATIONAL OBJECTIVES

**PEO1:** To prepare graduates for successful careers in various domains of Civil Engineering Profession by providing a strong foundation in mathematical analysis, scientific reasoning and sound engineering fundamentals necessary to solve practical problems.

**PEO2:** To expose graduates to emerging issues, and approaches to problem-solving, in order to meet the changing needs of the society, and the Indian industry in areas related to civil engineering design, planning, and construction.

**PEO3:** To inculcate team-spirit, and leadership capabilities among graduates through group-based activities and projects with emphasis on planning of experiments, use of software, development of skills for interpreting results of analyses, and writing of effective technical reports.

**PEO4:** To familiarize graduates with professional issues in civil engineering including: professional ethics, issues related to the global economy; emerging technologies; and fostering of job-related skills with emphasis on improved communication skills.

**PEO5:** To imbibe a spirit of inquiry among graduates in order to promote keen interest in pursuing higher studies and engineering-research.



## PROGRAM OUTCOMES

- PO1 Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2 Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3 Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4 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.
- PO5 Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO6 The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7 Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8 Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9 Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10 Communication:** Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11 Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12 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 OUTCOMES

- PSO1:** An ability to find solutions to civil engineering problems using mathematical and scientific knowledge.
- PSO2:** An ability to plan, and design civil engineering systems, components or processes as per relevant codes of practice, user requirements and constraints.
- PSO3:** An ability to develop attitudes, techniques and skills to succeed in a competitive professional environment including higher studies in a global context.
- PSO4:** An ability to develop the spirit of innovation and entrepreneurial leadership focused towards the design and implementation of sustainable civil engineering systems.



## COURSE STRUCTURE

### Degree Requirements:

Category of Courses	Minimum Credits to be Earned
	Year of Admission
	2019
<u>Foundation Courses</u> Basic Science Core (BSC) Engineering Science Core (ESC) Humanities and Social Science Core (HSC)	16 17 <u>09</u> Total 42
Programme Core (PC)	65
<u>Electives</u> Programme Specific Electives (PSE) and Open Electives	39
<u>Major Projects</u>	6
Mandatory Learning Courses (MLC)	5
<b>Total</b>	<b>157</b>

### Suggested Plan of Study

Number of Courses	Semester							
	I	II	III	IV	V	VI	VII	VIII
1	MA110	MA111	CV201	CV251	CV301	CV351	CV401	CV499
2	PH110	CY110	CV202	CV252	CV316	CV366	CV417	Elective
3	PH111	CY111	CV216	CV253	SM302	CV367	CV440	Elective
4	EC100	CS110	WO200	CV254	Elective	SM300	CV449	
5	EE110	CS111	WO216	CV265	Elective	CV390	Elective	
6	ME110	WO110	WO218	CV266	Elective	Elective	Elective	
7	ME111	CV100	WO219	CV267	Elective	Elective	Elective	
8	SM110	CV110	MA207	WO260	Mini Project*	Elective	Elective	
9	SM111					Mini Project*		



**List of Courses || B.Tech. in Civil Engineering || Department of Civil Engineering (CV) || NITK Surathkal**

<b>Basic Science Core (BSC)– 16 Credits</b>			CV386	Rock Mechanics	(3-0-0)3
MA110	Engineering Mathematics - I	(3-0-0)3	CV387	Applied Geology	(3-0-0)3
PH110	Physics	(3-1-0)4	CV388	Advanced Surveying	(3-0-2) 4
PH111	Physics Lab	(0-0-2)1	CV389	Advanced Structural Analysis	(3-0-0)3
MA111	Engineering Mathematics - II	(3-0-0)3	CV421	Bridge Engineering	(3-0-0)3
CY110	Chemistry	(3-0-0)3	CV422	Advanced Design Structures - I	(3-0-0)3
CY111	Chemistry Lab	(0-0-3)2	CV423	Design of Foundation, Earth and Earth retaining	(3-0-0)3
<b>Engineering Science Core (ESC) - 17 Credits</b>			CV424	Advanced Environmental Engineering	(3-0-0)3
EC100	Elements of Electronics and	(2-0-0)2	CV425	Computer Aided design and applications in civil	(2-0-3) 4
WO110	Engineering mechanics	(3-0-0)3	CV426	Solid waste Management	(3-0-0)3
ME110	Elements of Mechanical Engineering	(2-0-0)2	CV427	Structural Dynamics and Wind Engineering	(3-0-0)3
ME111	Engineering Graphics	(1-0-3)3	CV471	Advanced design of Structures - II	(3-0-0)3
EE110	Elements of Electrical Engineering	(2-0-0)2	CV472	Ground Improvement Techniques	(3-0-0)3
CS110	Computer Programming	(3-1-0)4	CV473	FEM applications in Civil Engineering	(3-0-0)3
CS111	Computer Programming Lab	(0-0-2)1	CV474	Elements of Earthquake Engineering	(3-0-0)3
<b>Humanities and Social Science core(HSC)- 9 credits</b>			CV475	Oil and Natural Gas Explosion	(3-0-0)3
SM110	Professional Communication	(3-0-0)3	CV476	Disaster Management and Mitigation	(3-0-0)3
SM300	Engineering economics	(3-0-0)3	CV477	Seismo resistant Concrete Structures	(3-0-0)3
SM302	Principle of Management	(3-0-0)3	CV485	Air pollution and Noise Pollution	(3-0-0)3
<b>Programme Core (PC)- 65 Credits</b>			CV486	Environmental Impact Assessment	(3-0-0)3
WO200	Mechanics of materials	(3-0-0)3	CV487	Construction project management	(3-0-0)3
WO216	Strength of materials lab	(0-0-3)2	CV488	Ground water Development and management	(3-0-0)3
WO218	Mechanics of fluids	(3-0-0)3	CV489	Retrofitting and rehabilitation of structures	(3-0-0)3
WO219	Hydraulics lab	(0-0-3)2	CV490	Non-destructive testing and evaluation for concrete	(3-0-0)3
WO260	Water resources Engineering	(3-0-0)3	CV491	Bituminous materials, mixtures and pavements	(3-0-0)3
CV100	Civil Engineering materials and	(3-1-0)4	AM371	Open channel flow and sediment transport	(3-0-0)3
CV201	Elements of surveying	(3-0-0)3	AM372	Civil Engineering systems	(3-0-0)3
CV202	Engineering Geology	(3-0-0)3	AM400	Geographic Information Systems	(3-0-0)3
CV216	Civil Engineering Materials Lab	(0-0-3)2	AM401	Satellite Digital Image Analysis	(3-0-0)3
CV251	Design of RCC structures	(3-0-0)3	AM402	Introduction to Geospatial Technology and application	(3-0-0)3
CV252	Soil Mechanics Lab	(0-0-3)2	AM403	Global Positioning systems	(3-0-0)3
CV253	Structural Analysis	(3-0-0)3	AM421	Design and Drawing of Hydraulic systems	(1-0-3) 3
CV254	Highway and Traffic Engineering	(3-0-0)3	AM422	Fundamentals of Coastal Engineering	(3-0-0)3
CV265	Surveying Practice	(0-0-3)2	AM423	Basics of OffShore Engineering	(3-0-0)3
CV266	Geology Lab	(0-0-3)2	AM424	Coastal Erosion and its mitigation	(3-0-0)3
CV267	Soil Mechanics Lab	(0-0-3)2	AM445	Fundamentals of Finite Element method	(3-0-0)3
CV301	Environmental Engineering	(3-0-0)3	AM455	Engineering Optimization	(3-0-0)3
CV316	Building Design and Drawing	(1-0-3)3	AM473	Water Resources Excess Management	(3-0-0)3
CV351	Design of Steel Structures	(3-0-0)3	AM474	Computational methods in Hydrology	(3-0-0)3
CV366	Highway Materials and Concrete	(0-0-3)2	AM475	Groundwater Engineering	(3-0-0)3
CV367	Environmental Engineering Lab	(0-0-3)2	AM477	Open source Virtual Instrumentation	(3-0-0)3
CV401	Estimation Costing and Specifications	(3-0-0)3	AM478	Theory of Isotropic Elasticity	(3-0-0)3
CV417	Structural Design and Drawing	(1-0-3)3	AM380	Mini Project I	(0-0-3)2
MA207	Numerical Methods	(3-0-0)3	AM381	Mini Project II	(0-0-3)2
<b>Programme Specific Electives (PSE)</b>			CV380	Mini Project I	(0-0-3)2
CV268	Advanced Mining Geology	(3-0-0)3	CV381	Mini Project II	(0-0-3)2
CV321	Applied Soil Engineering	(3-0-0)3	<b>Major and Mini Projects (MP)- 6 credits</b>		
CV322	Concrete Technology	(3-0-0)3	CV449	Major Project I	(0-0-3)2
CV323	Architecture and Town Planning	(3-0-0)3	CV499	Major Project II	(0-0-6)4
CV324	Analysis of Indeterminate structures	(3-0-0)3	<b>Mandatory Learning Courses(MLC)- 5 credits</b>		
CV371	Railways, Tunnels, Harbors and Airports	(3-0-0)3	CV110	Environmental Studies	(1-0-0)1
CV372	Design of PSC Structures	(3-0-0)3	SM111	Professional Ethics and Human values	(1-0-0)1
CV373	Probability methods in Civil Engineering	(3-0-0)3	CV390	Seminar	(0-0-2)1
CV385	Geoinformatics	(3-0-0)3	CV440	Practical Training	(0-0-3)2



**Applicable only to other Department UG students opting for Minors in Civil Engineering**

<b>Minor Courses (Mn) – Any Five to be selected by the student</b>		
W200M	Mechanics of Materials/	(3-0-0)3
CV201	Elements of Surveying	(3-0-0)3
CV252M	Soil Mechanics	(3-0-0)3
CV301M	Environmental Engineering	(3-0-0)3
CV254M	Highway and Traffic Engineering	(3-0-0)3
CV401M	Estimation, Costing and Specification	(3-0-0)3

**Applicable to Honors Programme students**

As per of this B.Tech Honors Programme, the Department of Civil Engineering proposes that the student is required to earn additional credits by registering for any five designated core courses of M.Tech Level to be offered in the E-slots for the 5th, 6th and 7th semester B.Tech based on the recommendation of the DFC from time to time in the Department of Civil Engineering and the Department of Applied Mechanics and Hydraulics. Such courses will not be offered at the 3rd and 4th semester due to prerequisites of the courses. See explanation given below:

- In B.Tech fifth semester, the students registering for honors are required to select 2 subjects from a set of 5 designated core PG subjects.
- Similarly, in B.Tech sixth semester, the students registering for Honors are required to select 2 subjects from another set of 5 designated core PG subjects.
- Also, in B.Tech seventh semester, the students registering for Honors are required to select 1 subject from another set of 5 designated core PG subjects.



**SYLLABUS [from 3<sup>rd</sup> Sem onwards]**

**CV100 CIVIL ENGINEERING MATERIALS AND CONSTRUCTION**

**(3-1-0) 4(PC)**

Traditional materials: stone, brick, tiles-roofing and flooring, steel, timber, lime, cement, their manufacture, properties and codal requirements. Mortar, cement concrete, properties, specifications and tests for quality control. Reinforced concrete, fibre reinforced concrete and ferrocement applications. Paints, enamels, varnishes, tar, bitumen, asphalt, properties and use. Modern materials: plastics, rubber, polymer, fiber reinforced plastics, manufacture, properties and use. Introduction to composites and smart materials. Building Construction: Foundations; Stone Masonry - Random rubble and Ashlar,; Brick Masonry -Rules for bonding, stretcher and header bonds and English Bond for 1 and 1 V brick thickness,; Doors and Windows; RCC Stairs and design of a dog-legged stair; Pitched Roofs and Simple Trusses; RC Constructions - Lintels and sunshades, beams and one- way and two-way slabs.

**References**

S.K. Duggal, *Building Materials*, Oxford & IBH publishing Co. Ltd., New Delhi, 2000  
M.S. Shetty, *Cement Technology, Theory and Practice*, S.C. Chand & Co. Ltd., 2002  
B.C.Punmia, *Building Construction*

**CV110 ENVIRONMENTAL STUDIES**

**(1-0-0) 1 [MLC]**

Definition, scope and importance of Environmental Studies, Need for public awareness. Natural Resources Renewable and Non-renewable Resources. Natural resources and associated problems. Concept of an ecosystem: Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains and ecological pyramids, Biodiversity and Its Conservation, Environmental Pollution: Definition, Causes, effects and control measures. Pollution case studies. Disaster management, Social Issues and the Environment, Environmental ethics, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation, Consumerism and waste products, Acts related to Environment Protection, Issues involved in enforcement of environmental legislation, Human Population and the Environment, Field work equal to 5 lecture hours. R. Rajagopalan, *Environmental Studies*, Oxford IBH Pub,2011.

**References**

Benny Joseph, *Environmental Studies*, McGraw Hill Pub,2008.  
Erach Bharucha, *Textbook for Environmental Studies*, Pub., UGC,2004.  
Masters, Gilbert M. *Introduction to Environmental Engineering and Sciences*, Prentice Hall India,2008.

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**CV201 ELEMENTS OF SURVEYING**

**(3-0-0) 3 (PC)**

Introduction to Surveying, Chain Surveying, Compass Surveying, Errors, Accuracy and precision. Introduction to plane table surveying. Levelling, contouring, Theodolite traverse. Introduction to tacheometric surveying and Trigonometric leveling. Horizontal curves. Introduction to vertical curves. Electronic distance measurements - Introduction. Minor Instruments, Digital Theodolite and total Station.

**Course Outcomes:**

1. To develop an understanding of the basic concepts of surveying.
2. To apply various surveying techniques and equipments for real life problems.
3. To conceptualize how to use a set of survey techniques and equipments in an optimal way.
4. To get acquainted with modern surveying equipments to improve the quality of surveys.

**References**

B.C. Punmia, *Surveying Vol. I and II -STD*  
K. R. Arora, *Surveying Vol-I &II- STD Book*, New Delhi.  
S.K. Roy, *Fundamentals of surveying -Prentice - Hall of India*, New Delhi.

**CV202 ENGINEERING GEOLOGY**

**(3-0-0) 3 (PC)**

General Geology, Physical Geology, Mineralogy, Petrology. Study of Igneous, Sedimentary, Metamorphic rocks, Physico - mechanical properties of rocks. Structural geology: Study of folds, faults, Joints, unconformities: resource



engg., remote sensing applications, Hydrogeology : Aquifers, geophysical exploration, selection of dam sites, tunnels, landslide control measures, environmental geology.

**Course Outcome:**

1. Students will understand the dynamic nature of earth, the associated surface and subsurface processes and appreciate the importance of geology in civil engineering projects.
2. Students will develop basic knowledge about different minerals, various rocks and their classification schemes and their engineering properties with their significance in civil engineering.
3. Students will be able to appreciate the process involved in rock deformation and formation of various geological structures such as folds, faults, joints unconformities and their critical aspects in stability of civil engineering structures.
4. Students will be able to apprehend various geological concepts in planning, designing and construction of various civil projects and make critical decisions and strategies to mitigate the impact of geohazards on stability of civil structures.

**References**

Parbin Singh, *Engineering and General Geology*, Katson Pub., Delhi, Sixth edition 2001. Blyth. F.G.H & De Freitas M.H. *Engineering Geology*, ELBS, 7th Edition, 1984  
D.V.Reddy, *Engineering Geology for Civil Engineers*, Oxford IBH Publishers, 1995, 1997.

**CV216 CIVIL ENGINEERING MATERIALS LAB**

**(0-0-3) 2 (PC)**

Sampling and testing of materials as per BIS specifications and codal requirements. Cement, fine and coarse aggregates, bricks, roofing and flooring tiles.

**References**

V.V. Sastry & M.L.Gambhir, *Laboratory Manual of Concrete Testing (Part - I)*, Dhanpat Rai & Sons.  
Relevant BIS codes for testing of materials.

**CV251 DESIGN OF RCC STRUCTURES**

**(3-0-0) 3 (PC)**

Strength properties and behaviour of concrete and reinforcing steel. Basic principles of working stress design. Limit state design concepts. Designing of members subjected to flexure, shear, torsion, axial forces and combinations, uniaxial and biaxial bending of columns. Design of simply supported and continuous beams and slabs; two-way slabs, isolated and combined footings. Computation of deflection and crack width.

**Course Outcomes:**

1. The students will be well aware of the basic design philosophies of Working Stress Design and Limit State Design of RCC Structures.
2. The students will be able to design RCC beams –Singly and doubly reinforced rectangular beams, Flanged beams, based on specifications in IS 456-2000.
3. The students will be able to design one- and two-way slabs; continuous beams and slabs, based on specifications in IS 456-2000.
4. The students will be able to design RCC columns – Axially loaded columns, Short columns under axial load and moments, Slender columns, based on specifications in IS 456-2000

**References**

Ashok K Jain, *Reinforced Limit State Design*, Nem Chand & Bros. Roorkee.  
Unnikrishnapillai and Devadas Menon, *Reinforced Concrete Design*, Tata- McGrawhill.

**CV252 SOIL MECHANICS**

**(3-0-0) 3(PC)**

Soil formation, Three-phase system, Index properties of soils, Soil classification, Hydraulics of soils, Stress distribution in soils, Soil compaction, One dimensional consolidation, Effective stress and pore water pressure, Shear strength of soils.

**Course Outcomes:**



1. Understand the basic principles of soil mechanics and apply them to real field problems.
2. Determine soil grain proficiency for evaluation of index properties.
3. Evaluate engineering properties of soils and classify different types of soils.
4. Determine the shear strength and bearing capacity of soils which will be useful in designing a foundation system for civil engineering constructions.

### References

*T.W.Lambe and R.V.Whitman, Soil Mechanics, John Wiley and Sons, Inc, New York.*  
*V.N.S.Murthy, Soil Mechanics and Foundation Engineering, Dhanpat Roy and Sons, New-Delhi.*  
*Relevant IS Codes(Latest editions).*

### CV253 STRUCTURAL ANALYSIS

(3-0-0) 3 (PC)

Conditions of equilibrium, degrees of freedom, determinate and indeterminate structures, Linear and non-linear structural systems. Deflection of beams: Moment area method and conjugate beam method, the first theorem of Castigliano, Betti's law, Clark Maxwell's Theorem of reciprocal deflection, strain energy method and unit load method. Redundant Structures: The second theorem of Castigliano, Consistent deformation method, slope deflection method. Rolling loads and influence lines: Statically determinate beams and bridge trusses, series of loads and uniformly distributed loads, criteria for maximum and absolute maximum moments and shears. Three-hinged arches, influence lines, Cables and suspension bridges, suspension bridge with three hinged stiffening girders and influence line diagrams.

### Course Outcomes:

1. To introduce basic concepts of structural analysis.
2. To analyse the behaviour of structures for displacement responses.
3. To introduce various methods to analyse statically indeterminate structures.
4. To understand the concepts of rolling loads and influence line diagrams.

### References

*Norris and Wilber, Elementary structural analysis.*  
*C.K. Wang, Statically indeterminate structures*

### CV254 HIGHWAY AND TRAFFIC ENGINEERING

(3-0-0) 3 (PC)

Introduction: Initial recommendations for highway planning in India, saturation system, Third 20-year road development plan and fundamentals of transportation systems, planning on trip generation, distribution, assignment and modal split. Traffic Engineering: Vehicular and road user characteristics, traffic studies, junctions and signals, traffic control devices Highway alignment and geometric design: Highway alignment, cross-sectional elements, horizontal alignment and vertical alignment Highway design and construction: design of flexible and rigid pavements, WBM and bituminous concrete roads and highway maintenance.

### Course Outcomes:

1. To introduce the Fundamental Principles of Transportation Engineering.
2. To study the importance of Road Geometry.
3. Introduction of Traffic Engineering and Design and Analysis of Traffic Problems.
4. Introduction of Pavement Design. Analysis and Design of Pavements and Highway Economics and Design of Drainage System.

### References

*S.K. Khanna and C.E.G. Justo, Highway Engineering, Nemchand Bros., Roorkee*  
*L.R. Kadiyali, Traffic and Transport Planning, Khanna Publishers, New Delhi*

### CV265 SURVEYING PRACTICE

(0-0-3) 2(PC)

Chain, Compass, Plane table leveling theodolite and tacheometric surveying, curve Setting, Demonstration of Total Station.



**Course Outcomes:**

1. Use the surveying equipments to conduct field surveys for design and construction of engineering projects.
2. Analyze and synthesize survey data.
3. Work effectively as a team member in completing the various tasks involved in the field surveying.

**References**

*P.C. Punmia, Surveying Vol. I and II -STD*  
*K. R. Arora, Surveying Vol-I &II- STD Book, New Delhi.*

**CV266 GEOLOGY LAB**

**(0-0-3) 2(PC)**

Mineralogy: Identification and description of important rock -forming and ore minerals. Petrology: Identification and description of Igneous, Sedimentary, Metamorphic rocks.

Structural Geology: Interpretation of geological and Structural geological maps, Solving Dip and strike problems.

**Course Outcomes:**

1. Will be able to appreciate the importance of various geological structures, to reconstruct them along particular profile and assess their significance in critical civil structures.
2. Able to recognize various rock forming minerals, their important physical properties able to be recognized using macroscopic observation.
3. Able to identify various rocks, remember their classification schemes, their formation mechanism and infer their important properties in macroscopic investigation.
4. Able to estimate the critical aspects of geological structures such as dip, strike, thickness of strata under different field conditions.

**References**

*K.M. Gurappa, Structural geology Manual*  
*B.S. Sathya Narayanaswamy Engineering Geology Laboratory Manual, Eurasia pub.*

**CV267 SOIL MECHANICS LAB**

**(0-0-3) 2 (PC)**

Identification of soils, Index properties of soils, Soil permeability, Light compaction test, Coefficient of consolidation, Direct shear test, Unconfined comp. Test, Triaxial comp. Test and Vane shear test, CBR test. T.W.Lambe, Soil Testing for Engineers, John Wiley and Sons, Inc, New York.

**Course Outcomes:**

1. Understand the basic principles of soil mechanics and apply them to real field problems.
2. Determine soil grain proficiency for evaluation of index properties.
3. Evaluate engineering properties of soils and classify different types of soils.
4. Determine the shear strength and bearing capacity of soils which will be useful in designing a foundation system for civil engineering constructions.

*SP36 Part 1 and Part 2 (Latest editions).*

**CV301 ENVIRONMENTAL ENGINEERING**

**(3-0-0) 3 (PC)**

Essentials of water and wastewater engineering systems, quantities, sources, water distribution systems, planning and analysis. Wastewater collection. House drainage. Water and wastewater characteristics.

Drinking water standards. Unit operations and processes of water and wastewater treatment. Design of treatment units.

**Course Outcomes:**

1. Analyze the water and wastewater quality parameters.
2. Assess water demand and design distribution systems.
3. Assess wastewater generation and collection systems.
4. Plan and design water and wastewater treatment units.



### References

Fair & Geyer, *Water Supply and Waste water disposal*, John Wiley Publications  
B.C. Punmia & Ashok Jain, *Water supply Engineering & Wastewater Engineering*, Arihant Publications

### CV316 BUILDING DESIGN AND DRAWING

(1-0-3) 3 (PC)

Foundations; Doors and Windows; Stairs - proportioning and designing of different types of staircases for residential and commercial buildings; Different types of roofs and trusses. Functional design of buildings: To draw the line-diagram, plan, elevation and section and line-sketches of different types of buildings (school, hospital, hostel, residential, office etc.). Introduction to AutoCAD.

#### Course Outcomes:

1. To develop an appreciation for understanding the essence of Building Design and Drawing, and its importance in Civil Engineering.
2. To apply basic skills acquired in Civil Engineering in the design of building components as part of Building Design and Drawing.
3. To develop capabilities for design of structural plans for the benefit of the community.
4. To develop capabilities for generating various types of building plans using AutoCAD.

### References

Shah and Kale, *Principles of Building Drawing*  
Sharma and Kaul, *Building construction*  
B.C. Punmia, *Building construction*

### CV351 DESIGN OF STEEL STRUCTURES

(3-0-0) 3 (PC)

General principles of elastic method of design of steel structures. Bolted and welded connections, Tension and compression members, laterally supported and unsupported beams, unsymmetrical bending, built up beams, plate girders, members subjected to axial force and uniaxial and biaxial moments. Introduction to the limit state design philosophy of steel structures.

#### Course Outcomes:

1. To understand and shall be able to design structural fasteners namely riveted, bolted or welded connections.
2. Able to design tension members and their connections.
3. Able to design compression members and their connections.
4. Able to design beams and built-up beams and their connections.

### References

A.S. Arya and J.L. Ajmani, *Design of steel structures*, Nem Chand Bros, Roorkee.  
Ramachandra, Vol I & II, *Design of steel structures*, Standard Book House, New Delhi.  
S.K. Duggal, *Design of Steel Structures*, Tata McGraw Hill, Publishing Co. Ltd., New Delhi.  
*Related IS Codes*

### CV366 HIGHWAY MATERIALS AND CONCRETE TESTING LAB

(0-0-3) 2 (PC)

Tests on highway materials, aggregates and bituminous materials; tests on fresh concrete; workability tests; tests on hardened concrete; strength tests; destructive and non-destructive testing; tests on R.C. beams and columns.

#### Course Outcomes:

1. Summarize the characteristics, test methods, and specifications required for assessing the suitability of materials used for highway construction.
2. Perform tests on aggregate, bitumen, fresh concrete, and hardened concrete as per relevant standards
3. Design concrete mixes for a specified strength based on the properties of the ingredients.
4. Articulate the findings of laboratory tests and prepare a sound test report.

### References



S.K. Khanna and C.E.G. Justo, *Highway materials Testing - Nem Chand Bros, Roorkee*  
V.V. Sastry and M.L. Gambir, *Laboratory manual on concrete testing (Part II)*.

### CV367 ENVIRONMENTAL ENGINEERING LAB

(0-0-3) 2 (PC)

pH, colour, turbidity; Solids - suspended, dissolved, settleable and volatile; Dissolved oxygen, BOD, COD; Determination of fluorides and iron; hardness, chlorides; Nitrite-Nitrogen and Ammonical - nitrogen; Available chlorine in bleaching powder, residual chlorine in water and chlorine demand; Bacteriological quality of water- presumptive test, confirmation test and determination of MPN; Jar test.

#### Course Outcomes:

1. Apply different analysis techniques for the measurement of physical and chemical qualities of water and wastewater.
2. Quantify the pollutant concentration in water and wastewater.
3. Recommend the degree of treatment required for the water and wastewater.
4. Assess the microbial contamination in water.

#### References

Kotaiah B. and Kumaraswamy N, "Environmental Engineering Laboratory Manual", Charitor Publishing House, India.  
APHA, "Standard Methods for testing of water and wastewater, 21st Edition, American Public Health Association, Washington, D. C.  
BIS-10500: Indian Standards Code for Water  
BIS-3025: Indian Standards Code for Testing of Water

### CV401 ESTIMATION, COSTING AND SPECIFICATIONS

(3-0-0) 3 (PC)

Methods of estimating, measurements, taking out quantities, typical estimates for buildings, and Civil Engineering works, Specifications for all types of building items. Analysis of rates, data for various building items, Earthwork calculations. Introduction to Departmental procedures, tender, contracts, arbitration, valuation of buildings.

#### Course Outcomes:

1. Shall be able to work out the quantities of various items of work, by both Long walls and Short walls method and method of centerline.
2. Able to write detailed specifications for important items of works.
3. To perform rate analysis for various items of works.
4. Able to value land and property of Civil Engineering projects.

#### References

B.N. Dutta, *Estimating and Costing in Civil Engineering Theory and Practice*.  
M. Chakroborti, *Estimating, Costing & Specifications in Civil Engineering*.  
S.C. Rangawala - *Valuation of Real Properties*, Charotar Publishing House.

### CV417 STRUCTURAL DESIGN AND DRAWING

PREREQ: CV251, CV351 (1-0-3) 3 (PC)

R.C. design- R.C. staircases, retaining walls - Cantilever and Counterfort type, Water tank- rectangular and circular tanks, underground and resting on ground. Framed structures.  
Steel design - Connections: Column splices, column bases, beam - columns, Steel purlins and roof trusses, connection between roof truss and supporting column, bracing systems.

#### Course Outcomes:

1. Design and detail structural elements in steel structures like simple riveted plate connections, riveted/ welded bracket connection, back-to-back connected angle section tension member, laced/ battened built-up columns, splice, bearing plate and base plate (gusseted/ non-gusseted) design.
2. Understand the mechanical behavior of structures like flat slabs, staircases, retaining walls and water tanks. Compute the design forces and moments.
3. Design the reinforced concrete structures like retaining walls, water tanks, flat slabs and staircases as per relevant IS codes (IS 456 - 2000).
4. Incorporate detailing aspects of steel reinforcement in the design drawing of flat slabs, staircases, retaining walls and water tanks as per relevant IS codes (IS456 - 2000).



### References

N. Krishna Raju, *Structural Design and Drawing - R.C. and Steel*, University Press, Hyderabad.  
D. Krishna Murthy, *Structural Design & Drawing, Vol II&III*, C.B.S.Publishing Co., New Delhi.

### MA207 NUMERICAL METHODS

(3-0-0) 3

Root finding of polynomials (zeros of a function) and transcendental functions (nonlinear equation), bracketing, bisection, secant, and Newton-Raphson methods. Interpolation, splines, polynomial fits, Chebyshev approximation. Numerical Integration and Differentiation: Evaluation of integrals, elementary analytical methods, trapezoidal and Simpson's rules, Romberg integration, Gaussian quadrature and orthogonal polynomials, multiple integrals, improper integrals, summation of series, Euler-Maclaurin summation formula, numerical differentiation and estimation of errors. Linear system of equations, LU factorization, Special types of Matrices, Iterative Methods – Jacobi, Gauss-Siedel, SOR methods.

### References

Richard L. Burden and J. Douglas Faires, *Numerical Analysis: Theory and Applications, India Edition*, Cengage Brooks-Cole Publishers, 2010.  
W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, *Numerical Recipes in C/FORTRAN*, Prentice Hall of India, New Delhi, 1994.  
Jaan Kiusalaas, *Numerical Methods in Engineering with MATLAB, 2nd Edition*, Cambridge University Press, 2009.

### WO200 MECHANICS OF MATERIALS

(3-0-0) 3 PREREQ: WO110 [PC]

Simple flexure theory, Bending stress and shearing stress distribution across sections. Deflection of beams, Macaulay's method for deflection of statically determinate beams. Compound stresses - analytical method, graphical method - Mohr's circle of stresses. Torsion, Transmission of power through hollow and solid shafts. Beams of uniform strength, springs, Combined bending and torsion, Strain energy, Theories of failure, Columns & struts, Thick and thin pressure vessels.

### References

Singer, F.L. *Strength of Materials, 3rd Edition*, Harper and Row Publishers, New York, 1980.  
Hearn, E.J., *Mechanics of Materials*, Pergaman Press, England, 1972.  
Beer and Johnston E. R. *Mechanics of Materials, 3rd Edition*, Tata McGraw Hill, New-Delhi, 2007.

### WO216 STRENGTH OF MATERIALS LAB

(0-0-3) 2 [PC]

Tension test on mild steel and cast iron, Compression test on mild steel and cast iron, Torsion test on mild steel rod, Rockwell and Brinell hardness tests, Impact test (Charpy and Izod) on mild steel, Bending test on mild steel rod and wood, Shear test on mild steel plate and rod, tests on leaf and helical spring. Demonstration on fatigue test.

### References

Hearn, E.J., *Mechanics of Materials*, Pergaman Press, England, 1972.  
Beer and Johnston E. R. *Mechanics of Materials, 3rd Edition*, Tata McGraw Hill, New-Delhi, 2007.

### WO217 MECHANICS OF SOLIDS LAB

(0-0-2) 1 [PC]

Tension tests on mild steel and cast iron, Compression tests on mild steel and cast iron, Shear tests, Bending test on mild steel, Torsion test, Hardness test and Impact test. Demonstration on fatigue test and springs

### References

Hearn, E.J., *Mechanics of Materials*, Pergaman Press, England, 1972.  
Beer and Johnston E. R. *Mechanics of Materials, 3rd Edition*, Tata McGraw Hill, New-Delhi, 2007.

### WO218 MECHANICS OF FLUIDS

(3-0-0) 3 [PC]



Properties and classification of fluids. Basic equation of fluid statics. Manometers. Buoyant force. Kinematics of fluid flow. Continuity equation. Bernoulli's equation. Momentum equation. Flow measurements: Brief introduction. Dimensional analysis. Model law. Basics of pipe flow. Hagen-Poiseuille equation. Darcy-Weisbach equation. Moody's diagram. Uniform flow in open channels.

### References

Modi, P.N and Seth, S.M., *Hydraulics and Fluid Mechanics*, Standard Book House, Delhi, 2010.  
Streeter. V.L and Wylie. E.B., *Fluid Mechanics*, McGraw Hill Book Company, New York, 1997.  
Ven Te Chow, *Open Channel Hydraulics*, McGraw Hill, New York 1959.

### WO219 HYDRAULICS LAB

(0-0-3) 2 PREREQ: WO218 [PC]

Calibration of V notch, Rectangular Notch; Venturimeter, Orifice meter, Water meter. Friction factor of pipes. Impact of jet on vanes. Tests on centrifugal pump, reciprocating pump, Pelton wheel turbine, Francis turbine. Hydraulics jump, Syphons, Demonstration experiments (pressure gauge, Pitot tube, Kaplan turbine)

### References

Modi, P.N and Seth, S.M., *Hydraulics and Fluid Mechanics*, Standard Book House, Delhi, 2010

### WO260 WATER RESOURCES ENGINEERING

(3-0-0) 3 PREREQ: WO218 [PC]

Hydrology: Hydrologic cycle, Water budget, Catchment. Precipitation: types, measurement, intensity, duration, temporal and spatial analysis. Infiltration, soil moisture, evaporation, transpiration, Groundwater. Runoff: components, factors, hydrographs, unit hydrograph, flood estimation. Irrigation: objectives, methods, irrigation water requirements. Components of irrigation system and design principles. Water Power Engineering: Basic principles, types of schemes

### References

Subramanya K, *Engineering Hydrology*, Tata McGraw Hill, 3rd Edition, 2008.  
Garg S. K, *Irrigation Engineering and Hydraulic Structures*, Khanna Publishers, 2008.  
Ven Te Chow, LW Mays and DR Maidment., *Applied Hydrology*, McGraw Hill, 1988

## Programme Specific Electives [ PSE]

### CV268 ADVANCED MINING GEOLOGY

(3-0-0) 3 [ PSE]

Structural Geology; Dip and Strike, study of folds, faults, Joints, unconformities, Economic Geology; Magmatic, Hydrothermal, Sedimentary, Metamorphic deposits, oxidation and supergene enrichment, study of Gold, Iron, copper, lead, Zinc Chromite, manganese, bauxite, mica, asbestos, magnetite, borytes deposits. Exploration Geology; Principles, Stage of mineral exploration, Geological, Geophysical, geochemical and remote sensing methods of exploration. Applied Geology; Sampling, guides for locating ore deposits, geological mapping, Hydrogeology.

### References

Arogya Swamy, *Courses in Mining Geology*, Oxford & IBH, 1988  
Bateman A.M., *Economic mineral deposits*, John Wiley & Sons  
Billings, *Structural Geology*

### CV321 APPLIED SOIL ENGINEERING

PREREQ: CV 252 (3-0-0) 3 [PSE]

Soil exploration, Earth pressure and its determination, Bearing capacity - Theoretical methods and In-situ tests, Stability of slopes by various approaches, Load carrying capacity of single and group of piles. Ground improvement methods. Introduction to soil dynamics.

### References

B.M. Das, *Principles of Geotechnical Engineering*, The PWS Series in Civil Engg.  
V.N.S. Murthy, *Soil Mechanics and Foundation Engineering*, Dhanpat Rai & Sons, New Delhi.



### **CV322 CONCRETE TECHNOLOGY**

**(3-0-0) 3 [PSE]**

Concrete making materials - Manufacture of Cements, types of cements and aggregates, properties and testing, Water, admixtures. Fresh concrete, workability, Compaction, Curing. Strength of Concrete, elasticity, shrinkage and creep. Durability of Concrete. Testing of hardened concrete, destructive and non-destructive testing methods, Concrete mix design, Quality Control and acceptance Criteria. Special Concretes, Concrete chemicals.

#### **References**

*A.M. Neville, Properties of Concrete, The English Language Book Society and Pitman Publishing Co. London, U.K.*  
*M.S. Shetty, Concrete Technology - Theory and Practice, S. Chand & Co. Ltd., New Delhi.*

### **CV323 ARCHITECTURE AND TOWN PLANNING**

**(3-0-0) 3 [PSE]**

Town Planning and Architecture: An overview of ancient human settlements; Indus Valley, Manasura's classification of villages, Dantaka Village, Slums, Housing Bye-laws, Neighbourhood units, objectives and principles of town planning, Master-Plan, Zoning, Aesthetics and Principles of Architectural Composition.

#### **References**

*S.C.Rangawala, Principles of Town Planning*  
*Sir. Banister Fletcher, Comparative Architecture*  
*Talbot Hamlin, Forms and Functions of Twentieth Century Architecture; Vol II*

### **CV324 ANALYSIS OF INDETERMINATE STRUCTURES**

**(3-0-0) 3 [PSE]**

Analysis of statically indeterminate Structures, Moment distribution Method, Kani's Method, Matrix method: introduction to flexibility and stiffness methods, two hinged arches, influence lines for indeterminate beams and arches, analysis of multistory frames by approximate methods, substitute frame, portal and cantilever methods, plastic analysis of simple beams and portal frames.

#### **References**

*S.P. Timoshenko, Theory of structures*  
*M.B. Kanchi, Matrix method of structural analysis*

### **CV371 RAILWAYS, TUNNELS, HARBOURS AND AIRPORTS**

**(3-0-0) 3 [PSE]**

Railways: Rail gauges; coning; adzing; railway track components, functions, requirements, and width of formation; creep; tractive resistance; geometric design; points and crossings; stations and yards; signaling and interlocking. Docks & Harbors: Types of harbors, tides, wind and waves, breakwaters, docks, quays, Transit sheds, warehouses, navigational aids

Tunnels: Introduction to tunneling, tunneling through soils, soft and hard rocks, tunnel ventilation Airports: Introduction to airport planning and development, Airport design standards, airport planning

#### **References**

*S.P. Arora & S.C. Saxena, A text Book of Railway Engineering Srinivasan, Docks, Harbors and Tunnels.*  
*S.K. Khanna, M.G. Arora and S.S. Jain, Airport Planning and Design*

### **CV372 DESIGN OF P.S.C. STRUCTURES**

**(3-0-0) 3 [PSE]**

Materials- Pre and post tensioning methods; losses in pre-stressing; stresses in concrete due to pre-stress and loads; prediction of long term and short term deflections; limit state of collapse in flexure and shear -Limit state of serviceability; transmission length; anchorage zone stresses; design of end-block; design of pre and post-tensioned beams; analysis of continuous beams; concordant cable profiles; analysis of composite beams; determination of stress distribution in a composite sections.

#### **References**

*N. Krishna Raju, Pre-stressed concrete, Tata-McGraw Hill, New Delhi.*



T. Y. Lin and N. H. Burns, *Design of pre-stressed concrete structures*, John Wiley and Sons, New York.

### CV373 PROBABILITY METHODS IN CIVIL ENGINEERING

(3-0-0) 3 [PSE]

Role of probability in civil engineering problems; Definition of basic random events; Application of set theory in definition of composite event operations; Probability of events and definition of probability axioms; Random variables; Probability definitions; Moments and expectations; Functions of random variables; Common probability models; Statistics and sampling; Regression and correlation analyses; Estimation of distribution parameters from statistics; Hypothesis testing and significance; Bayesian updating of distributions; Uncertainty quantification; Probabilistic analysis; Methods of structural reliability; Applications to design of civil engineering systems.

#### References

A.H-S. Ang & W.H. Tang, *Probability Concepts in Engineering: Emphasis on Applications to Civil and Environmental Engineering*, Wiley, 2006

A. Haldar & S. Mahadevan, *Probability, Reliability, and Statistical Methods in Engineering Design*, Wiley, 1999

### CV 380 MINI PROJECT - I

(0-0-3)2 [PSE]

Experimental work either in the field or in the laboratory or design task of relatively smaller magnitude compared to Major project and in line with the guidelines formulated by the DUGC.

### CV381 MINI PROJECT - II

(0-0-3)2 [PSE]

Experimental work either in the field or in the laboratory or design task of relatively smaller magnitude, as compared to a Major project and in-line with the guidelines formulated by the DUGC.

### CV385 GEOINFORMATICS

(3-0-0) 3 [PSE]

Introduction to geoinformatics: Principles of Remote sensing Satellites and Sensors, Aerial photography, elements of photo-grammetry, Satellite data products, Visual interpretation, Digital interpretations. Introduction to GIS principles, Generation of thematic maps, Georeferencing, Digitization, overlay analyses, Map projections: Global positioning system: Application of RS and GIS in mining; Geological mapping, geomorphological mapping, oil and mineral exploration, Ground water and surface water potential mapping, Natural hazard and disaster (Earthquakes, volcanic eruptions, Landslides, Avalanches, flood, drought etc.) Zone mapping, Forecasting, estimation of losses and management, monitoring ocean productivity and coastal zone management, computer applications in mining.

#### References

Lillesand, Thomas and Kiefer, *Remote Sensing and image interpretation*, John Wiley and Sons.

Burrough and Mc Dennell, *principles of Geographical information systems*, Oxford University Press.

### CV386 ROCK MECHANICS

(3-0-0) 3[PSE]

Introduction to rock mechanics, Engineering classification of rocks, Engineering properties of intact rocks, Determination of in situ properties - shear strength, deformation, in situ stress, strength of jointed rocks, application to rock slopes, rock blasting, ground improvement techniques in rocks and bearing capacity.

#### References

Jaegar and Cook, *Foundation of rock masses*.

Goodman, *Introduction to rock mechanics*, Wiley international

### CV387 APPLIED GEOLOGY

PREREQ: CV202 (3-0-0) 3 [PSE]

Introduction, interior of the earth, Geological process, Geological hazards, Natural resources; Minerals, rocks, water, soil; Engineering properties of rocks, Structural geology, stratigraphy, Hydrogeology; artificial recharge structures, rain water harvesting, ground water exploration, geophysical exploration, Remote sensing and GIS applications. Economic



Geology, process of formation of mineral deposits, ore genesis, ore dressing, Indian mineral deposits, Environmental geology, Application of geology in Civil Engg. projects like Dams, tunnels, bridges etc.,

### References

Blyth, F.G.H & De Freitas M.H., *Engineering Geology, ELBS, 7th Edition, 1984.*  
Robert F. Legget, *Geology and Engineering, McGraw Hill*

### CV388 ADVANCED SURVEYING

PREREQ CV201 (3-0-2) 4 [PSE]

Introduction to tacheometric surveying, tacheometric levelling and errors in tacheometric levelling; Fundamentals of geodetic surveying; theory of errors and triangulation adjustments; Electronic distance measurement; Hydrographic surveying including three-point problems; photogrammetric surveying including aerial photogrammetry; fundamentals on the use of digital theodolites and total stations.

### References

B.C. Punmia, *Surveying Vol. 2 and 3*  
T.P. Kanetkar & Kulkarni, *Surveying and leveling Vol. 2*  
S.K. Roy, *Fundamentals of surveying*  
David Clark, *Plane and geodetic surveying Vol.2*

### CV389 ADVANCED STRUCTURAL ANALYSIS

(3-0-0) 3[PSE]

Matrix method of structural analysis: flexibility and stiffness formulation - Direct stiffness method. Analysis of Beams of non-uniform cross-section. Unsymmetrical bending of beams. Analysis of beams curved in plan. Introduction to analysis of shell roofs.

### References

Genaro, *Advanced Structural Analysis.*  
G.S. Ramaswamy, *Design and Construction of shell roofs.*

### CV390 SEMINAR

(0-0-2) 1[MLC]

This course is a 1 credit course to be completed during 6th semester. The student will make presentations on topics of academic interest.

### CV421 BRIDGE ENGINEERING

PREREQ: CV251 (3-0-0) 3[PSE]

Bridge site investigation and planning, bridge hydrology, Standards of loading for highway and railway bridges, Culverts, bridge superstructures, Design of R.C.C. beam and slab bridges, load distribution methods, Bearings, Design of bridge substructures and foundations, Design principles of prestressed concrete, steel and composite bridges, Introduction to cable-stayed and suspension bridges, flyovers, temporary and movable bridges, construction and maintenance of bridges and flyovers.

### References

D.J. Victor, *Essentials of Bridge Engineering, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.*  
N. Krishna Raju, *Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.*

### CV422 ADVANCED DESIGN OF STRUCTURES – I

PREREQ: CV251 (3-0-0) 3 [PSE]

Design of R.C.flat slabs, continuous beams and portal frames, redistribution of moments. Yieldline analysis of slabs, Deep beams, Curved beams, Elevated water tanks and supporting structures, Chimneys, Silos and Bunkers.

### References

N. Krishna Raju, *Advanced Reinforced Concrete Design, C.B.S. Publishers and Distributors, Delhi.*  
P.C. Varghese, *Advanced Reinforced Concrete Design, Prentice - Hall of India, Pvt. Ltd., New Delhi.*

### CV423 DESIGN OF FOUNDATIONS, EARTH AND EARTH RETAINING STRUCTURES



**PREREQ: CV252, CV321 (3-0-0)3 [PSE]**

Loads for foundation design, Depth of foundation, proportioning of footings, Geotechnical and structural design of isolated, combined and raft foundations. Analysis of pile groups. Design of piles and pile cap. Design of cantilever, counterfort and soil reinforced retaining walls.

**References**

Swami Saran, *Design of Substructures*, Oxford and IBH Publishers.  
J.E. Bowles, *Analysis & Design of Foundations*, Mc Graw Hill. Relevant IS Codes.

**CV424 ADVANCED ENVIRONMENTAL ENGINEERING**

**PREREQ: CV350 (3-0-0) 3[PSE]**

Water-pollution control: Effluent standards. Disposal of wastewater. Stream sanitation. Water quality indices; Solid waste management: Characteristics, treatment disposal; Air Pollution Control: Sources and Characteristics, effects, Control; Noise Pollution Control, measurement & analysis; Hazardous solid waste: Classified wastes, Disposal of hospital wastes; EIA: Introduction, case studies.

**References**

Metcalf & Eddy, *Waste Water Engineering Treatment, Disposal & Reuse*, Tata Mcgraw Hill Publishers Sincero & Sincero, *Environmental Engineering*, Prentice Hall Inc.

**CV425 COMPUTER AIDED DESIGN & APPLICATIONS IN CIVIL ENGINEERING**

**(2-0-3) 4[PSE]**

Object oriented programming, Application programs to solve problems in structural analysis, surveying, soil mechanics, transportation engineering and numerical analysis. Design of structural elements and programming concepts. Programs for the design of beams, slabs and columns by Limit state theory.

**References**

E. Balaguruswamy, *Object oriented programming in C++*, McGraw Hill Publishers.  
V.L.Shah, *Computer aided design in reinforced concrete*, Structures publishers.

**CV426 SOLID WASTE MANAGEMENT**

**(3-0-0) 3[PSE]**

Characterization of Municipal wastes; Waste Collection, Disposal and Management-Laws and guidelines; Utilization of municipal wastes for bio-gasification and manure; landfill; Recent technological advances in composting and thermal gasification; utilization and management of nonhazardous and hazardous waste; Case studies.

**References**

George Tchobanoglous, Frank Kreith, *Handbook of Solid Waste Management*, McGraw-Hill, 2002. CPHEEO Manual on Solid Waste Management, 2000.  
Asian Productivity Organization Report on Solid-Waste Management: Issues and Challenges in Asia, Environmental Management Centre, 2005  
Thomas H. Christensen, *Solid Waste Technology & Management: Volume 1 & 2*, A John Wiley & Sons, 2010 Michael D. LaGrega, Phillip L. Buckingham, Jeffrey C. Evans. *Hazardous Waste Management*, Waveland Press Inc., 2010

**CV427 STRUCTURAL DYNAMICS AND WIND ENGINEERING**

**(3-0-0) 3[PSE]**

Vibration of SDOF systems - Free and Forced vibrations, effect of damping, response spectrum, MDOF systems - Natural frequencies and modes, Eigenvalue problem, mode superposition method, Wind effects- Mean Wind speed, turbulence, spectrum of turbulence, Aerodynamic instabilities, Aerodynamic damping, Along - wind and Across - wind responses.

**References**

Clough and Penzien, *Dynamics of Structures*, McGraw Hill, New York.  
J.W. Simth, *Vibration of Structures*, Chapman and Hall Ltd., New York. Scanlan and Sachi, *Wind Engineering*

**CV440 PRACTICAL TRAINING**

**(0-0-2)1 [MLC]**



This course is a 1 credit course. A student may complete the training before the beginning of 7th semester (or as stipulated by DUGC) and register for it in the 7th semester. The duration and the details shall be decided by the faculty advisor, with approval from DUGC.

#### **CV471 ADVANCED DESIGN OF STRUCTURES – II**

**PREREQ: CV251 (3-0-0) 3 [PSE]**

R.C. domes and shell roofs, membrane and beam method of analysis, Multistoried building systems; Grid floors, Composite steel and in-situ concrete beams & slabs. Communication and transmission line steel towers. P. Dayaratnam, Design of Reinforced concrete structures, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.  
P. Dayaratnam, Design of Steel Structures, A.H. Wheeler & Co. Ltd. Allahabad.  
N. Krishna Raju, Advanced Reinforced Concrete Design, C.B.S. Pub. and Distributors, New Delhi.

#### **CV472 GROUND IMPROVEMENT TECHNIQUES**

**PREREQ; CV252, CV321 (3 0-0) 3 [PSE]**

Need and Objectives, Mechanical Modification-Compaction control, Vibro flotation, Hydraulic modification - Dewatering methods, Electro-Osmosis, Vertical drains, Physical and chemical modification - grouting, shortcreting, ground freezing. Modification by inclusions and Confinement. Stone columns, lime columns, Sand drains and Compaction piles.

#### **References**

*M.R. Hausmann(1990) Engineering Principles of Ground Modifications, McGraw Hill Publishing Co.*  
*Purushotham Raj, Ground Improvement Techniques, Laxmi Publications, New Delhi.*

#### **CV473 FEM APPLICATIONS IN CIVIL ENGG.**

**(3 0-0) 3 [PSE]**

Types of elements - Boundary value and initial value problems - Approximate methods - Principles and steps in Finite Element Analysis - Generalized and natural coordinates - Direct stiffness approach- Analysis of 2D Trusses, beams, and Plane frames. Introduction to continuum problems - Triangular elements for plane stress problems - Numerical Integration.

#### **References**

*T.R. Chandrupatla& Ashok D. Belegundu , Introduction to Finite Elements in Engg. - Prentice Hall.*  
*O. C. Zienkiewicz and K Morgan, Finite Elements & Approximation, John Wiley & Sons.*

#### **CV474 ELEMENTS OF EARTHQUAKE ENGINEERING**

**(3 0-0) 3 [PSE]**

Engineering seismology - Plate tectonics, Earthquake mechanism, Seismic zoning map of India, seismic waves, earthquake magnitude and intensity, seismic vulnerability, hazard and risk, Introduction to the theory of vibrations - simple SDOF systems, response spectra, Performance of structures, Lessons from past earthquakes, causes of failure and damage Aseismic design of structures - Philosophy & Principles of earthquake resistant design, building forms and architectural design concepts, Introduction to seismic codes, Calculation of equivalent static earthquake forces. Restoration and retrofitting of existing structures.

#### **References**

*A.K.Chopra, Dynamics of Structures, Prentice Hall, 2002 IITKanpur, Earthquake Tips, www.nicee.org*

#### **CV475 OIL AND NATURAL GAS EXPLORATION**

**(3-0-0) 3 [PSE]**

Geology of oil and Natural gas fields: Introduction to petroleum, Economic Importance, Geological factors, Reservoir Sedimentology and Sequence Stratigraphy of oil and natural, Structural Geology and Basin Development, oil and natural gas deposit distribution in India, Gas hydrated deposits in India and in the world. Exploration of oil and natural gas deposits: Remote Sensing, GIS, GPS, geological, geophysical and geochemical methods of exploration of oil and natural gas deposits.

Reservoir Engineering; Drilling and Production Engineering (drilling Methods of oil and natural gas wells, drilling technologies for deep water areas); Refining Engineering.



Safety and Environmental Engineering: Safety norms and regulations; Environmental norms and regulations; safety auditing; environmental auditing; carbon credits; preparation of EIA reports; principles of developing green belt around petroleum installations to minimize carbon footprints.

### References

- A. I. Levorsen, 1967, *Geology of Petroleum*  
Reddy D V, 2010, *Engineering Geology*, Vikas Publishers.  
Azar J J, Samuel G R, 2007, *Drilling Engineering*. Pennwell Corporation.  
Edwin S. Robinson and Cahit Coruh, 1988, *Basic Exploration Geophysics*, John Wiley and Sons.

### CV487 CONSTRUCTION AND PROJECT MANAGEMENT

(3-0-0) 3 [PSE]

Introduction: project forms, management objectives and functions; organizational chart of a construction company; manager's duties and responsibilities; public relations; Leadership and team - work; ethics, morale, delegation and accountability. Man and Machine: Man-power planning, training, recruitment, motivation, welfare measures and safety laws; machinery for Civil Engg., earth movers and hauling costs, factors affecting purchase, rent, and lease of equipment, and cost-benefit estimation. Planning, scheduling and Project Management: Planning stages, construction schedules project specification, monitoring and evaluation; Bar-chart, CPM, PERT, network- formulation and time computation. Departmental Procedures: specifications, tendering, contracting and arbitration Lionel Stebling, Project and Quality Management

### References

- P.P. Dharwadkar, *Management in Construction Industry*, Oxford IBH, New Delhi  
J.O.Brien, *Construction Management*, McGraw Hill  
J.M.Antill & R.W. Woodhead, *Critical Path Methods in Construction*, Wiley  
B.C. Punmia & K.K.Khandelwal, *Project Planning and control with PERT and CPM, PWD Codes A and D*

### CV476 DISASTER MANAGEMENT & MITIGATION

(3-0-0)3 [PSE]

Concepts of disaster; Types of disasters - natural and manmade: Cyclone, flood, landslide, land subsidence, fire and earthquake, tsunami, coastal erosion, river erosion, chemical spills, nuclear disasters, mine disasters etc.; Psychological and Social Dimensions in Disasters, Trauma and Stress. Techniques of monitoring and design against disasters; forecasting and early warning; communications & IT Tools; disaster risk reduction through prevention, preparedness, mitigation, response, recovery, rehabilitation and reconstruction. Management issues related to disaster, national Policy on disaster management, legislative responsibilities; mitigation through capacity building, disaster mapping, assessment, pre-disaster risk & vulnerability reduction, post disaster recovery & rehabilitation; Participation by voluntary Agencies & Community at various stages of disaster management; disaster related infrastructure development.

### References

- <http://ndma.gov.in/> (Home page of National Disaster Management Authority). <http://www.ndmindia.nic.in/> (National Disaster Management in India, Ministry of Home Affairs).  
Pradeep Sahni, 2004, *Disaster Risk Reduction in South Asia*, Prentice Hall.  
Singh B.K., 2008, *Handbook of Disaster Management: techniques & Guidelines*, Rajat Publication. Ghosh G.K., 2006, *Disaster Management*, APH Publishing Corporation.

### CV477 SEISMORESISTANT CONCRETE STRUCTURES

(3-0-0)3 [PSE]

Introduction to dynamic response of structures- Dynamic equilibrium, SDOF and MDOF. Earthquake ground motion and response spectra- Characteristics of ground motion, earthquake response spectra. Seismo-resistant architecture, IS 1893(Part1):2002 codal provisions, Simplified modal response spectrum analysis- Example problems. Earthquake resistant design of RC elements, Shear walls - Response of concrete and steel to monotonic cyclic loading, Codal provisions of IS 13920:1993. Design example of a multi-storey building. Seismic retrofitting strategies – considerations, classification, case studies. (IS 13935:1993) Base isolation-Isolation system components, Isolator design procedures.(Mini project on analysis and design of a multi storey building)

### References

- The Seismic Design Handbook.*, Farzad Naeim, International code council, Kluwar Academic publishers (USA), 2001  
George. G. Penelis and Andreas J. Kappos, *Earthquake resistant concrete structures*, E & FN Spon Chapman, Hall London, 1997



FarzadNaeim and James M Kelley, *Design of seismic isolated structures*, John Wiley and sons Inc. 1999 IS codes: IS 1893(Part1):2002, IS 13920:1993, IS 13935:1993

A.K. Chopra, *Dynamics of structures - Theory and applications to earthquake engineering*, Pearson Education, 2001

Pankaj Agarwal, Manish Shrikhande *Earthquake Resistant Design of Structures*, Prentice- Hall India, 2006

### **CV485 AIR POLLUTION AND NOISE POLLUTION**

**(3-0-0) 3 [PSE]**

Natural and man-made air pollution, sources, effects, control. Noise pollution - sources, measurement, mitigation.

#### **References**

Wark Kenneth and Warner C.F., *Air Pollution its Origin and Control*, Harper and Row, Publ.

Sincero A.P. and Sincero G.A. *Environmental Engineering*. Prentice Hall.

### **CV486 ENVIRONMENTAL IMPACT ASSESSMENT**

**(3-0-0) 3 [PSE]**

Introduction of EIA - Environmental impact Statement (EIS) and Environmental Impact Analysis (EIA) - Meaning and objective of EIA; Environmental Impact Prediction - Planning and Management of Impact Studies - ISO 14000 Series - Environmental monitoring and mitigation measures.

#### **References**

Canter, R.L., *Environmental Impact Assessment*, McGraw Hill Inc.,

John G.Rau and David C. Wooten (Ed)., *Environmental Impact Analysis Handbook*, McGraw Hill Book, 1980.

Peter Wathern (Ed)., *Environmental Impact Assessment, Theory and Practice*, Unwin Hyman Ltd., London, 1988.

Munn, R.E., (Ed)., *Environmental Impact Assessment, Principles and Procedures*, Published on behalf of Scope, Unwin Brothers Ltd., Surrey, London, 1979.

### **CV488 GROUND WATER DEVELOPMENT AND MANAGEMENT**

**(3-0-0) 3 [PSE]**

Hydrological cycle, Hydrological properties of rocks, Distribution of groundwater, Ground water movement-Darcy's law, Flow nets. Aquifer parameters, Parameter estimation, pump test and recovery test-Thei's, Theim's, Jacob's equations. Ground water exploration-Geophysical techniques RS, GIS, GPS, Construction of wells, Springs. Ground water recharge, Rain Water harvesting, Water conservation techniques. Ground water quality, Ground water pollution, Environmental issues. Ground water budget, Ground water management. Ground water legislation

#### **References**

Todd D. K, *Ground water hydrology*, 3rd edition, Wiley, 2008.

Walton, W. C., *Ground water resource evaluation*. McGraw Hill, 1970. Raghunath, H. M, *Ground water*, New Age International, 3rd edition, 1998.

Karanth, K. *Groundwater Assessment and Management*, Tata McGraw Hill, 2007.

### **CV489 RETROFITTING AND REHABILITATION OF STRUCTURES**

**(3-0-0) 3 [PSE]**

Introduction, Causes of Deterioration, Deterioration process, Planning, Investigation and diagnosis, Assessment of distress structures, Assessment procedure for evaluation of structures and demolition procedures, Testing techniques, Interpretation of results, Repair and renovation Repair materials, techniques, Surface coatings, Protection, Seismic retrofitting.

#### **References**

Allen, R.T.L. and Edwards, S.C., 'The repair of concrete structures' Key, T., 'Assessment and renovation of concrete structures'

Emmons, P.H., 'Concrete repair and maintenance illustrated'

### **CV490 NON-DESTRUCTIVE TESTING & EVALUATION FOR CONCRETE STRUCTURES**

**(3-0-0)3 [PSE]**

Fundamentals and basic concepts of Non-Destructive Testing and Evaluation. Principle and applications of different Non-Destructive Evaluation tools viz., Ultrasonics, radiography, electromagnetic methods, acoustic emission, thermography for testing and evaluation of concrete structures.



### References

Guidebook on nondestructive testing of concrete structures-International Atomic Energy Agency, Vienna.  
Nondestructive Evaluation –Theory Techniques and Applications by P.J Shull Marcell Decker Inc.,  
Nondestructive Testing and Evaluation of Materials Tata McGraw Hill Education Private Limited  
Acoustic Emission testing –Basic for Research-Applications in Civil Engineering, Chriastan U Grosse,  
Masayasu Ohtsu , Springer:2008

### CV491 BITUMINOUS MATERIALS, MIXTURES, AND PAVEMENTS

(3-0-0)3 [PSE]

Introduction to bituminous materials, processing of petroleum crude. Bituminous binders - types, characteristics, test protocols, and recent developments in binder modifications. Aggregates - production, properties, test methods, grading, and blending. Bituminous mixtures - types, characteristics, mix design methods, and tests. Bituminous pavement construction - mixture production, transportation, placement, compaction and finishing operation. Bituminous Pavements - different bituminous layers, and specifications.

### References

Hot Mix Asphalt Materials, Mixture Design and Construction, Third Edition, National Asphalt Pavement Association, Research and Education Foundation, Lanham, Maryland, 2009.  
Bituminous Road Construction in India, by P.S.Kandhal, PHI Learning Private Limited; Revised edition, 2016.  
Relevant Standards and Guidelines published by the Bureau of Indian Standards (BIS) and the American Standard for Testing and Materials (ASTM) International.

### MAJOR PROJECT

#### CV449 MAJOR PROJECT-I

(0-0-3) 2 [MP]

The students, in groups of 1-4, will select a project work based on a topic of interest under the supervision of project guide and work on the said topic for two semesters. The work under the Project will be evaluated first at the end of 7<sup>th</sup> semester. The evaluation is based on the work completed during the semester, quality of work, report made by the group, relative contributions by each individual student to the project (as ascertained by the project guide) and individual performance in the semester-end viva –voce.

#### CV499 MAJOR PROJECT - II

(0-0-6) 4 [MP]

Extension and completion of Major Project-I initiated in the VII semester under the supervision of the same guide. The total project work will be evaluated at the end of the VIII<sup>th</sup> semester. Evaluation parameters are the same as in VII semester.

### WO110 ENGINEERING MECHANICS

(3-0-0) 3

Fundamentals of force system, Concept of Rigid body and deformable bodies, Free body diagrams. Support Reactions- Determinate and Indeterminate structures. Analysis of Trusses, Frames and Machines. Centroid and Moment of Inertia of plane areas. Shear Force and Bending Moment Diagrams. Simple stress and strain, Hooke's Law, Mechanical properties of materials, Elastic Constants.

### References

Merian, J.L, Kraige, L.G. Engineering Mechanics – Statics, 5th Edition, Wiley Publishers, New-Delhi, 2007. Beer & Johnston, Mechanics for Engineers, 4th Edition, McGraw – Hill, New Delhi, 1987.  
Timoshenko, S.P., Young, D.H., Rao, J.V. Engineering Machines, 4th Edition, McGraw-Hill, Singapore, 1956. Singer, F.L. Strength of Materials, Third Edition, Harper and Row Publishers, New York, 1980.  
Hearn, E.J., Mechanics of Materials, Pergaman Press, England, 1972.  
Beer and Johnston E. R. Mechanics of Materials, 3rd Edition, Tata McGraw Hill, New Delhi, 2007.

### WO200 MECHANICS OF MATERIALS

PREREQ: WO110 (3-0-0) 3

Simple flexure theory, Bending stress and shearing stress distribution across sections. Deflection of beams, Macaulay's method for deflection of statically determinate beams. Compound stresses - analytical method, graphical method - Mohr's circle of stresses. Torsion, Transmission of power through hollow and solid shafts. Beams of uniform strength,



springs, Combined bending and torsion, Strain energy, Theories of failure, Columns & struts, thick and thin pressure vessels.

### References

Singer, F.L. *Strength of Materials, 3rd Edition, Harper and Row Publishers, New York, 1980.* Hearn, E.J., *Mechanics of Materials, Pergaman Press, England, 1972.*  
Beer and Johnston E. R. *Mechanics of Materials, 3rd Edition, Tata McGraw Hill, New-Delhi, 2007.*

### WO216 STRENGTH OF MATERIALS LAB

(0-0-3) 2 [PC]

Tension test on mild steel and cast iron, Compression test on mild steel and cast iron, Torsion test on mild steel rod, Rockwell and Brinell hardness tests, Impact test (Charpy and Izod) on mild steel, Bending test on mild steel rod and wood, Shear test on mild steel plate and rod, tests on leaf and helical spring. Demonstration on fatigue test.

### References

Hearn, E.J., *Mechanics of Materials, Pergaman Press, England, 1972.*  
Beer and Johnston E. R. *Mechanics of Materials, 3rd Edition, Tata McGraw Hill, New-Delhi, 2007.*

### WO218 MECHANICS OF FLUIDS

(3-0-0) 3 [PC]

Properties and classification of fluids. Basic equation of fluid statics. Manometers. Buoyant force. Kinematics of fluid flow. Continuity equation. Bernoulli's equation. Momentum equation. Flow measurements: Brief introduction. Dimensional analysis. Model law. Basics of pipe flow. Hagen-Poiseuille equation. Darcy-Weisbach equation. Moody's diagram. Uniform flow in open channels.

### References

Modi, P.N and Seth, S.M., *Hydraulics and Fluid Mechanics, Standard Book House, Delhi, 2010.*  
Streeter. V.L and Wylie. E.B., *Fluid Mechanics, McGraw Hill Book Company, New York, 1997.*  
Ven Te Chow, *Open Channel Hydraulics, McGraw Hill, New York 1959.*

### WO260 WATER RESOURCES ENGINEERING

PREREQ: WO250 (3-0-0) 3 [PC]

Hydrology: Hydrologic cycle, Water budget, Catchment. Precipitation: types, measurement, intensity, duration, temporal and spatial analysis. Infiltration, soil moisture, evaporation, transpiration, Groundwater. Runoff: components, factors, hydrographs, unit hydrograph, flood estimation. Irrigation: objectives, methods, irrigation water requirements. Components of irrigation system and design principles. Water Power Engineering: Basic principles, types of schemes

### References

Subramanya K, *Engineering Hydrology, Tata McGraw Hill, 3rd Edition, 2008.*  
Garg S. K, *Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 2008.*  
Ven Te Chow, *LW Mays and DR Maidment., Applied Hydrology, McGraw Hill, 1988.*

### WO219 HYDRAULICS LAB

PREREQ: WO250 (0-0-3) 2 [PC]

Calibration of V notch, Rectangular Notch; Venturimeter, Orifice meter, Water meter. Friction factor of pipes. Impact of jet on vanes. Tests on centrifugal pump, reciprocating pump, Pelton wheel turbine, Francis turbine. Hydraulics jump, Syphons, Demonstration experiments (pressure gauge, Pitot tube, Kaplan turbine)

### References

Modi, P.N and Seth, S.M., *Hydraulics and Fluid Mechanics, Standard Book House, Delhi, 2010*

### ME100 INTRODUCTION TO DESIGN THINKING

(2-0-0) 2 [MLC]

Need and Definition of Design Thinking. Framework for Design Thinking. Engineering Design Process. Need Identification, Specification, Concept Generation, Product Architecture and Detailed Design. Prototyping – Virtual and Physical. Testing Methodology



### **References**

Christian Muller-Roterberg, "Handbook of Design Thinking", 2018

Eli Woolery, "Design Thinking Handbook" Invision Pub, 2019

Nigel Cross, "Design Thinking" Max Answell "Mastering Design Thinking", 2019

Karl T. Ulrich, Steven D. Eppinger and Maria C Yang, "Product Design and Development", McGraw Hill, 7ed, 2020

George e Dieter, Linda C Schmidt, "Engineering Design", Mc Graw Hill, 4ed, 2009

### Course Articulation Matrix (POs & PSOs)

Correlation levels 1, 2 or 3 as defined below:

*0- No Correlation; 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)*

**Academic Year 2020-21**

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
<b>CV201 Elements of Surveying</b>																	
CV201-CO.1	To develop an understanding on the basic concepts of surveying.	3	1	0	0	0	0	0	0	0	1	0	2	2	2	2	0
CV201-CO.2	To apply various surveying techniques and equipments for real life problems.	3	2	1	1	2	1	0	2	3	3	2	2	3	3	2	0
CV201-CO.3	To conceptualize how to use a set of survey techniques and equipments in an optimal way.	3	1	1	1	2	0	0	2	2	3	2	2	3	3	2	1
CV201-CO.4	To get acquainted with modern surveying equipments to improve the quality of surveys.	3	0	0	0	3	0	0	0	1	2	1	3	3	2	2	1
<b>CV201</b>		<b>3</b>	<b>1.3</b>	<b>1</b>	<b>1</b>	<b>2.3</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2.3</b>	<b>1.7</b>	<b>2.3</b>	<b>2.8</b>	<b>2.5</b>	<b>2</b>	<b>1</b>
<b>CV202 Engineering Geology</b>																	
CV202-CO.1	Students will understand the dynamic nature of earth, the associated surface and subsurface processes and appreciate the importance of geology in civil engineering projects	3	2	0	2	0	0	1	0	0	1	0	0	1	2	0	0
CV202-CO.2	Students will develop basic knowledge about different minerals, various rocks and their classification schemes and their engineering properties with their significance in civil engineering	2	0	0	0	0	0	1	0	0	1	0	0	0	2	0	0
CV202-CO.3	Students will be able to appreciate the process involved in rock deformation and formation of various geological structures such as folds, faults, joints unconformities and their critical aspects in stability of civil engineering structures	2	3	1	1	0	0	0	0	0	0	1	2	3	1	2	1
CV202-CO.4	Students will be able to apprehend various geological concepts in planning, designing and construction of various civil projects and make critical decision and strategies to mitigate the impact of geo-hazards on	2	1	0	1	0	0	1	0	0	0	0	0	1	2	1	0



CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	stability of civil structures																
<b>CV202</b>		<b>2.3</b>	<b>2</b>	<b>1</b>	<b>1.3</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1.7</b>	<b>1.8</b>	<b>1.5</b>	<b>1</b>
<b>CV216 Civil Engineering Materials Lab.</b>																	
CV216-CO.1	Will be able to experimentally determine the engineering properties like specific gravity, bulk density, porosity, etc., of fine aggregates	3	1	1	3	2	0	1	2	3	3	1	0	3	3	3	1
CV216-CO.2	Will be able to experimentally determine the engineering properties of coarse aggregate samples	3	1	1	3	2	0	1	2	3	3	1	0	3	3	3	1
CV216-CO.3	Will be able to experimentally determine the engineering properties the cement sample supplied	3	1	1	3	2	0	1	2	3	1	1	1	3	3	3	1
CV216-CO.4	Will be able to perform experiments for the determination of strength and water absorption characteristics of building bricks and tiles	3	1	1	3	2	0	1	2	3	3	1	3	3	3	3	1
<b>CV216</b>		<b>3</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2.5</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>
<b>CV217 Surveying Practice</b>																	
CV217-CO.1	Use the surveying equipments to conduct field surveys for design and construction of engineering projects.	3	2	1	1	2	1	0	2	2	3	2	2	3	3	2	1
CV217-CO.2	Analyze and synthesize survey data.	3	2	0	1	2	0	0	1	2	3	0	2	3	3	2	0
CV217-CO.3	Work effectively as a team member in completing the various tasks involved in the field surveying.	1	0	0	0	0	0	0	1	3	3	2	2	1	1	2	0
<b>CV217</b>		<b>2.3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>1.3</b>	<b>2.3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2.3</b>	<b>2.3</b>	<b>2</b>	<b>1</b>
<b>CV251 Design of RCC Structures</b>																	
CV251-CO.1	The students will be well aware of the basic design philosophies of Working Stress Design and Limit State Design of RCC Structures	1	0	1	1	1	0	0	1	0	2	1	1	1	1	1	2
CV251-CO.2	The students will be able to design RCC beams –Singly and doubly reinforced rectangular beams, Flanged beams, based on specifications in IS 456-2000	3	2	1	1	3	0	0	2	2	2	0	1	3	3	1	0



CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CV251-CO.3	The students will be able to design one- and two-way slabs; continuous beams and slabs, based on specifications in IS 456-2000	3	2	1	1	3	0	0	2	2	2	0	1	3	3	1	0
CV251-CO.4	The students will be able to design RCC columns – Axially loaded columns, Short columns under axial load and moments, Slender columns, based on specifications in IS 456-2000	3	2	1	1	3	0	0	2	2	2	1	3	3	3	3	3
<b>CV251</b>		<b>2.5</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2.5</b>	<b>0</b>	<b>0</b>	<b>1.8</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1.5</b>	<b>2.5</b>	<b>2.5</b>	<b>1.5</b>	<b>2.5</b>
<b>CV253 Structural Analysis</b>																	
CV253-CO.1	To introduce basic concepts of structural analysis	3	3	1	1	2	1	1	1	1	1	1	2	3	2	1	1
CV253-CO.2	To analyse the behaviour of structures for displacement responses	3	3	1	1	2	1	1	1	1	1	1	2	3	2	1	1
CV253-CO.3	To introduce various methods to analyse statically indeterminate structures	3	3	1	1	2	1	1	1	1	1	1	2	3	2	1	1
CV253-CO.4	To understand the concepts of rolling loads and influence line diagrams	3	3	1	1	2	1	1	1	1	1	1	2	3	2	1	1
<b>CV253</b>		<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>CV254 Highway and Traffic Engineering</b>																	
CV254-CO.1	To introduce the Fundamental Principles of Transportation Engineering	3	2	3	2	2	1	2	1	1	1	1	3	3	3	3	3
CV254-CO.2	To study the importance of Road Geometry	3	3	3	2	2	2	2	1	2	1	1	1	3	3	1	1
CV254-CO.3	Introduction of Traffic Engineering and Design and Analysis of Traffic Problems	3	3	3	2	2	2	2	1	2	1	1	1	3	3	1	1
CV254-CO.4	Introduction of Pavement Design. Analysis and Design of Pavements and Highway Economics and Design of Drainage System	3	3	3	2	2	2	2	1	2	3	1	3	3	3	3	3
<b>CV254</b>		<b>3</b>	<b>2.8</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1.8</b>	<b>2</b>	<b>1</b>	<b>1.8</b>	<b>1.5</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CV266 Geology Lab</b>																	



CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CV266-CO.1	Will be able to appreciate the importance of various geological structures, to reconstruct them along particular profile and assess their significance in critical civil structures	2	1	1	2	0	0	1	0	1	0	1	0	1	2	0	0
CV266-CO.2	Able to recognize various rock forming minerals, their important physical properties able to be recognized using macroscopic observation	2	1	0	0	0	0	1	0	0	0	0	0	1	2	0	0
CV266-CO.3	Able to identify various rocks, remember their classification schemes, their formation mechanism and infer their important properties in macroscopic investigation	2	2	2	2	1	0	0	0	0	2	0	1	2	2	0	0
CV266-CO.4	Able to estimate the critical aspects of geological structures such as dip, strike, thickness of strata under different field conditions	2	1	2	2	0	0	0	0	0	0	0	0	2	2	0	0
<b>CV266</b>		<b>2</b>	<b>1.3</b>	<b>1.7</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1.5</b>	<b>2</b>	<b>0</b>	<b>0</b>
<b>CV267 Soil Mechanics Lab</b>																	
CV267-CO.1	Understand the basic principles of soil mechanics and apply them to real field problems.	3	3	3	2	2	1	2	1	1	2	1	3	3	3	3	3
CV267-CO.2	Determine soil grain proficiency for evaluation of index properties.	3	3	3	2	2	1	1	1	1	1	1	1	3	3	1	1
CV267-CO.3	Evaluate engineering properties of soils and classify different types of soils	3	3	3	2	2	1	1	1	1	1	1	1	3	3	1	1
CV267-CO.4	Determine the shear strength and bearing capacity of soils which will be useful in designing a foundation system for civil engineering constructions.	3	3	3	2	2	1	1	1	1	3	1	3	3	3	3	3
<b>CV267</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1.3</b>	<b>1</b>	<b>1</b>	<b>1.8</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CV300 Structural Analysis II</b>																	
CV300-CO.1	Understand the basic principles of structural analysis	3	3	3	2	2	1	2	1	1	2	1	3	3	3	3	3
CV300-CO.2	Ability to formulate basic structural systems	3	3	3	2	2	1	1	1	1	2	1	2	3	3	1	1



CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CV300-CO.3	Ability to analyse basic structural systems	3	3	3	2	2	1	1	1	1	2	1	2	3	3	1	1
CV300-CO.4	Ability to apply the concepts to field problems	3	3	3	2	2	1	1	1	1	3	1	3	3	3	3	3
<b>CV300</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1.3</b>	<b>1</b>	<b>1</b>	<b>2.3</b>	<b>1</b>	<b>2.5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CV316 Building Design and Drawing</b>																	
CV316-CO.1	To develop an appreciation for understanding the essence of Building Design and Drawing, and its importance in Civil Engineering	3	2	2	1		2	1	1		1		3	1	3	2	2
CV316-CO.2	To apply basic skills acquired in Civil Engineering in the design of building components as part of Building Design and Drawing	3	3	3	2	2	2	2	1	1	2	1	2	2	3	1	1
CV316-CO.3	To develop capabilities for design of structural plans for the benefit of the community	3	3	3	3	3	3	3	1	1	2	2	3	2	3	2	1
CV316-CO.4	To develop capabilities for generating various types of building plans using AutoCAD	3	3	3	3	3	3	3	1	1	2	2	3	2	3	2	1
<b>CV316</b>		<b>3</b>	<b>2.75</b>	<b>2.75</b>	<b>2.25</b>	<b>2.7</b>	<b>2.5</b>	<b>2.25</b>	<b>1</b>	<b>1</b>	<b>1.75</b>	<b>1.67</b>	<b>2.75</b>	<b>1.75</b>	<b>3</b>	<b>1.75</b>	<b>1.25</b>
<b>CV350 Environmental Engineering</b>																	
CV350-CO.1	Analyze the water and wastewater quality parameters.	3	3	3	2	1	3	3	0	2	2	1	1	3	3	1	1
CV350-CO.2	Assess water demand and design distribution systems.	2	2	3	2	2	3	3	1	2	3	2	1	3	3	2	2
CV350-CO.3	Assess wastewater generation and collection systems.	3	2	3	3	2	3	3	1	2	2	2	1	3	3	2	2
CV350-CO.4	Plan and design water and wastewater treatment units.	3	2	3	3	2	3	3	1	2	3	2	1	3	3	2	3
<b>CV350</b>		<b>2.8</b>	<b>2.3</b>	<b>3</b>	<b>2.5</b>	<b>1.8</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2.5</b>	<b>1.8</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>1.8</b>	<b>2</b>
<b>CV351 Design of Steel Structures</b>																	
CV351-CO.1	To understand and shall be able to design structural fasteners namely riveted, bolted or welded connections.	3	3	3	0	0	0	0	0	1	2	0	1	3	3	0	0



CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CV351-CO.2	Able to design tension members and their connections.	3	3	3	0	1	1	1	2	1	2	0	1	3	3	0	0
CV351-CO.3	Able to design compression members, and their connections.	3	3	3	0	1	1	1	2	1	2	0	1	3	3	0	0
CV351-CO.4	Able to design beams and built-up beams and their connections.	3	3	3	0	1	1	1	2	1	2	0	1	3	3	0	0
<b>CV351</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>
<b>CV366 Environmental Engineering Lab</b>																	
CV366-CO.1	Apply different analysis techniques for the measurement of physical and chemical qualities of water and wastewater	3	3	3	2	1	3	3	1	2	2	1	1	3	3	1	1
CV366-CO.2	Quantify the pollutant concentration in water and wastewater	2	2	3	2	2	3	3	1	2	3	2	1	3	3	2	2
CV366-CO.3	Recommend the degree of treatment required for the water and wastewater	3	2	3	3	2	3	3	1	2	2	2	1	3	3	2	2
CV366-CO.4	Assess the microbial contamination in water	3	2	3	3	2	3	3	1	2	3	2	1	3	3	2	3
<b>CV366</b>		<b>2.8</b>	<b>2.3</b>	<b>3</b>	<b>2.5</b>	<b>1.8</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2.5</b>	<b>1.8</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>1.8</b>	<b>2</b>
<b>CV367 Highway Materials and Concrete Testing Lab</b>																	
CV367 - CO.1	Summarize the characteristics, test methods, and specifications required for assessing the suitability of materials used for highway construction	3	2	1	2	1	1	1	1	1	-	-	2	3	3	2	-
CV367 - CO.2	Perform tests on aggregate, bitumen, fresh concrete, and hardened concrete as per relevant standards	3	2	1	3	-	-	-	1	3	-	-	2	3	3	2	-
CV367 - CO.3	Design concrete mixes for a specified strength based on the properties of the ingredients	3	2	1	3	-	-	-	1	3	-	--	2	3	3	2	-
CV367-CO.4	Articulate the findings of laboratory tests and prepare a sound test report	2	2		3	-	1	-	2	1	3	-	2	1	1	2	-
<b>CV367</b>		<b>2.8</b>	<b>2</b>	<b>1</b>	<b>2.8</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1.3</b>	<b>2</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>2.5</b>	<b>2.5</b>	<b>2</b>	<b>0</b>
<b>CV400 Estimation Costing and Specifications</b>																	
CV400-CO.1	Shall be able to work out the quantities of various items of work, by both Long walls and Short walls method and method of centerline.	3	3	2	0	0	0	0	0	0	0	0	0	3	0	0	0



CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CV400-CO.2	Able to write detailed specifications for important items of works.	3	3	2	0	0	0	0	0	0	0	0	0	3	0	0	0
CV400-CO.3	To perform rate analysis for various items of works.	3	3	2	0	0	0	0	0	0	0	0	0	3	0	0	0
CV400-CO.4	Able to value land and property of Civil Engineering projects.	3	3	2	0	0	0	0	0	0	0	0	0	3	0	0	0
<b>CV400</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>CV417 Structural Design and Drawing</b>																	
CV417-CO.1	Design and detail structural elements in steel structures like simple riveted plate connections, riveted/ welded bracket connection, back to back connected angle section tension member, laced/ battened built-up columns, splice, bearing plate and base plate (gusseted/ non-gusseted) design	3	3	3	1	2	2	2	3	1	3	1	2	3	3	1	2
CV417-CO.2	Understand the mechanical behavior of structures like flat slabs, staircases, retaining walls and water tanks. Compute the design forces and moments.	3	3	3	1	2	3	2	2	1	2	1	1	3	3	1	2
CV417-CO.3	Design the reinforced concrete structures like retaining walls, water tanks, flat slabs and stair cases as per relevant IS codes (IS456 - 2000)	3	3	3	1	2	3	2	3	1	3	1	2	3	3	1	2
CV417-CO.4	Incorporate detailing aspects of steel reinforcement in the design drawing of flat slabs, staircases, retaining walls and water tanks as per relevant IS codes (IS456 - 2000)	2	2	3	1	3	3	1	3	2	3	1	2	2	3	1	1
<b>CV417</b>		<b>2.8</b>	<b>2.8</b>	<b>3</b>	<b>1</b>	<b>2.3</b>	<b>2.8</b>	<b>1.8</b>	<b>2.8</b>	<b>1.3</b>	<b>2.8</b>	<b>1</b>	<b>1.8</b>	<b>2.8</b>	<b>3</b>	<b>1</b>	<b>1.8</b>
<b>WO218 Mechanics of Fluid</b>																	
WO218-CO.1	Understand basic principle of fluid flow	3	3	1	3	1	2	3	1	3	3	2	3	3	3	3	3
WO218-CO.2	Perform the dimensional analysis	2	2	1	2	1	2	2	1	2	2	1	2	2	2	2	3
WO218-CO.3	Solve engineering problems related to hydraulics and fluid mechanics	3	3	1	3	1	1	3	1	2	3	2	3	3	3	3	3
WO218-CO.4	Obtain the basic understanding of the fluid mechanics	3	3	2	3	2	2	3	2	3	3	2	3	3	3	3	3



CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	WO218	2.8	2.8	1.3	2.8	1.3	1.8	2.8	1.3	2.5	2.8	1.8	2.8	2.8	2.8	2.8	3

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Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CV201	3	1.3	1	1	2.3	1	0	2	2	2.3	1.7	2.3	2.8	2.5	2	1
CV202	2.3	2	1	1.3	0	0	1	0	0	1	1	2	1.7	1.8	1.5	1
CV216	3	1	1	3	2	0	1	2	3	2.5	1	1	3	3	3	1
CV217	2.3	2	1	1	2	1	0	1.3	2.3	3	2	2	2.3	2.3	2	1
CV251	2.5	2	1	1	2.5	0	0	1.8	2	2	1	1.5	2.5	2.5	1.5	2.5
CV253	3	3	1	1	2	1	1	1	1	1	1	2	3	2	1	1
CV254	3	2.8	3	2	2	1.8	2	1	1.8	1.5	1	2	3	3	2	2
CV266	2	1.3	1.7	2	1	0	1	0	1	2	1	1	1.5	2	0	0
CV267	3	3	3	2	2	1	1.3	1	1	1.8	1	2	3	3	2	2
CV300	3	3	3	2	2	1	1.3	1	1	2.3	1	2.5	3	3	2	2
CV316	3	2.75	2.75	2.25	2.7	2.5	2.25	1	1	1.75	1.67	2.75	1.75	3	1.75	1.25
CV350	2.8	2.3	3	2.5	1.8	3	3	1	2	2.5	1.8	1	3	3	1.8	2
CV351	3	3	3	0	1	1	1	2	1	2	0	1	3	3	0	0
CV366	2.8	2.3	3	2.5	1.8	3	3	1	2	2.5	1.8	1	3	3	1.8	2
CV367	2.75	2	1	2.75	1	1	1	1.3	2	3	0	2	2.5	2.5	2	0
CV400	3	3	2	0	0	0	0	0	0	0	0	0	3	0	0	0



Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CV417	2.8	2.8	3	1	2.3	2.8	1.8	2.8	1.3	2.8	1	1.8	2.8	3	1	1.8
WO218	2.8	2.8	1.3	2.8	1.3	1.8	2.8	1.3	2.5	2.8	1.8	2.8	2.8	2.8	2.8	3
<b>Average</b>	<b>2.78</b>	<b>2.35</b>	<b>1.99</b>	<b>1.67</b>	<b>1.65</b>	<b>1.22</b>	<b>1.30</b>	<b>1.19</b>	<b>1.49</b>	<b>2.04</b>	<b>1.10</b>	<b>1.70</b>	<b>2.65</b>	<b>2.52</b>	<b>1.56</b>	<b>1.31</b>