Course Structure
for Degree Programme
B. Tech. in Civil Engineering

with effect from AY 2018-19

Dr. Babasaheb Ambedkar Technological University
Lonere 402 103, Dist- Raigad, Maharashtra, INDIA
Program Objectives

Goal of the Civil engineering with a specialization in Structural Engineering (SE) at Dr. Babasaheb Ambedkar technological University, Lonere (BATU) is to provide students with preparation to become worthy of professional careers in the field and to be motivated for lifelong learning. All prescribed courses have definite objectives and outcomes. Program objectives are expected qualities of engineers as under:

a) **Preparation:** To prepare students to excel in various educational programmes or to succeed in industry / technical profession through further education/training;

b) **Core Competence:** To provide students with a solid foundation in mathematical, scientific fundamentals required to solve Structural problems;

c) **Breadth:** To train students with a breadth of scientific knowledge to comprehend, analyze, design & create novel products and solutions for real life problems;

d) **Professionalism:** To inculcate in students professional/ethical attitude, effective team work skills, multidisciplinary approach and to relate engineering issues to a broader context;

e) **Learning Environment:** To provide students with academic environment of excellence, leadership, ethical guidelines and life-long learning needed for a long / productive career.

In addition to above DBATU graduate is expected to be

1. Taking pride in their profession and have commitment to highest standards of ethical practices and related technical disciplines;

2. Able to design structural system that is safe, economical and efficient;

3. Capable of using modern tools efficiently in all aspects of professional practices;

4. Dealing successfully with real life civil engineering problems and achieve practical solutions based on a sound science and engineering knowledge;

5. Shall be engage in continuous research, development and exchange of knowledge for professional development;

6. Be honest in their control and performing their duties and promote effective use of resources through open, honest and impartial services to the public;

7. Act in such a manner which will uphold the honour, integrity, or dignity of the engineering profession, and avoid knowingly engaging in business or professional practices of a fraudulent, dishonest or unethical nature;

8. Recognize that the lives, safety, health and welfare of the general public are dependent upon engineering, decision and practices;

9. Continue their professional development throughout their careers and provide opportunities for the professional development;
Course Structure

1) Subjects with code CV belong to Civil Engineering
2) Subjects with code CVE indicate Civil Engineering Elective Course
3) Elective Subject Codes suffixed as OS indicate an Open Subject. Students willing to register for such courses shall contact Course Coordinator for information on prerequisites
4) Subjects with code CVL indicate Civil Engineering Laboratory
5) Code CVP indicate Civil Engineering Project work
6) Code CVF indicate Civil Engineering Fieldwork related
7) Subjects with code CVA indicate Civil Engineering Audit Course which may be an Open Subject

Semester- III

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Total 30 22

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#### Theory

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<td>CVE2-502 OS</td>
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<td>CVE2-503</td>
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<td>CVE3-504 OS</td>
<td>Business Communication &amp; Presentation Skills</td>
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### Semester- VI

$: Students should register for the CVF 705 in Semester VI to undergo training during vacation after semester VI and appear at examination in Semester VII. Result shall appear in Grade-sheet of Semester VII.
## Semester – I

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Sub-Total **14** | **3** | **11**

### Elective III

- CVE3-401 Waste Water Treatment
- CVE3-402 OS Operations Research
- CVE3-403 Geographic Data Analysis and Applications
- CVE3-404 Advanced Engineering Geology

Total **28** | **19**

## Semester – VII

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### Elective IV

- CVE4-701 Plastic Analysis and Design
- CVE4-702 OS Machine Foundations
- CVE4-703 Modern Surveying Techniques
- CVE4-704 OS Engineering Economics
- CVE4-705 Ground Improvement Techniques

Total **26** | **22**

### Elective V

- CVE5-701 Advanced Structural Mechanics
- CVE5-702 Town and Urban Planning
- CVE5-703 Construction Economics & Finance
- CVE5-703 Intelligent Transportation Systems

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<td>Repair &amp; Rehabilitation of Structures</td>
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**Overall Total**

|                  | 50+168 = 218                                            | 125           |

## Detailed Syllabus

### Semester III

#### Semester- III

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<td>CV 302</td>
<td>Mechanics of Solids</td>
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<td>CV 303</td>
<td>Hydraulics I</td>
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<td>1</td>
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<td>CV 304</td>
<td>Surveying I</td>
<td>2</td>
<td>1</td>
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</table>
MA 301 Mathematics – III

Pre Requisites: Mathematics - I and Mathematics – II

Course Contents

Module 1: Laplace Transform
Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by \( t^n \), scale change property, transforms of functions divided by \( t \), transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

Module 2: Inverse Laplace Transform
Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

Module 3: Fourier Transform
Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms; Parseval’s identity for Fourier Transforms.

Module 4: Partial Differential Equations and Their Applications:
Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange’s linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation

\[
\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}
\]

and two dimensional heat flow equation (i.e. Laplace equation:

\[
\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0
\]

Module 5: Functions of Complex Variables (Differential calculus)
Limit and continuity of \( f(z) \); Derivative of \( f(z) \); Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection, bilinear transformation; Conformal mapping.

Module 6: Functions of Complex Variables (Integral calculus)
Cauchy’s integral theorem; Cauchy’s integral formula; Residues; Cauchy’s residue theorem (All theorems without proofs).

Text Books

Reference Books
Course Outcomes: On completion of the course, student will be able to formulate and solve mathematical model of civil engineering phenomena in field of structures, survey, fluid mechanics and soil mechanics.

CV 302 Mechanics of Solids

Pre Requisites: Engineering Mechanics (EM02)

Course Contents

Module 1: Stress and Strain
Simple stress - Analysis of internal forces, simple stress, shearing stress, bearing stress, diaphragm or skin stresses in thin walled vessels, statically indeterminate members, thermal stresses
Simple strains - Stress strain diagram for different engineering materials and its importance for elastic and plastic analysis, Hooke's law: axial and shearing deformations, Poisson’s ratio: biaxial and triaxial deformations, strain measurement devices basis of sensors, working principles and operation, data acquisition

Module 2: Axial Force, Shear Force and Moment in Beams
Axial force, shear force and moment in beams – concept of unbalanced forces at a transverse section, axial forces, shear forces and moment – interaction of these, relations among load shear and moment, introduction to moving loads
Stresses in beams: Derivation of flexural formula, economic sections, floor framing, unsymmetrical beams, analysis of flexure action derivation of formula for horizontal shearing stress, design for flexure and shear
Torsion - Assumptions, derivation of torsion formulae, torsion of circular shafts, power transmission, stresses and deformation in determinate solid/hollow homogeneous/composite shafts

Module 3: Combined Stresses
Combined axial and flexural loads, Kern of a section; load applied off the axes of symmetry, variation of stress with inclination of element, relationship between modulus of rigidity and modulus of elasticity, variation of stress at a point: analytical derivation, Mohr's circle, absolute maximum shearing stress, application of Mohr's circle to combined loadings (principal stresses), state of simple shear, transformations of strain components, strain rosette

Module 4: Beam Deflections
Calculations of deflection for determinate beams by double integration, Macaulay’s method, moment area method, moment diagram by parts, conjugate beam method, deflection by method of superposition, introduction to energy methods

Module 5: Columns and Struts
Concept of short and long columns, formulae by Euler and Rankin, limitation of Euler's formula, equivalent length, eccentrically loaded short compression members

Module 6: Theories of Failure
Concept of failure in strength and failure in deformation, statement and application of maximum principal stress theory, maximum principal strain theory, maximum strain energy theory, maximum shear stress theory, maximum shear strain theory

Text Books
Course Outcomes: On completion of the course, the students will be able to:

CO1: Perform the stress-strain analysis.
CO2: Draw force distribution diagrams for members and determinate beams.
CO3: Find deflections in determinant beams.
CO4: Visualize force deformation behavior of bodies.

CV 303 Hydraulics I

Pre Requisites: Engineering Mechanics (EM02)

Course Contents

Module 1: Fundamental Concepts
Definition of fluids, fluid properties-density, specific weight, specific volume, specific gravity, viscosity, compressibility, surface tension, capillarity, vapor pressure, types of fluids - Newtonian and non-Newtonian fluid, continuum, fluid pressure

Module 2: Fluid Statics
Forces on fluid elements, fundamental equation, manometers, hydrostatic thrust on submerged surfaces, buoyancy, stability of unconstrained bodies, fluids in rigid body motion

Module 3: Fluid Kinematics
Types of flow, continuity equation, derivation and applications of momentum equation, Euler's equation, Bernoulli's equation, velocity potential and stream function, concept of flow net

Module 4: Laminar Flow
Fully developed laminar flow between infinite parallel plates, both plates stationary, upper plate moving with constant speed, fully developed laminar flow in pipe.

Turbulent flow: Shear stress distribution and turbulent velocity profiles in fully developed pipe flow, velocity distribution and shear stresses in turbulent flow, Prandtl mixing length theory, Nikuradse's experiment, Introduction to Boundary Layer Theory

Module 5: Dimensional Analysis and Similitude
Nature of dimensional analysis, Rayleigh's Method, Buckingham pi theorem, dimensionless groups and their physical significance, flow similarity and model studies, Scale Effects, Distorted and Undistorted Models

Module 6: Flow Measurement
Direct methods, restriction flow meters, linear flow meters, traversing methods, measurements in open channel flow

Flow Through Pipes: Loss of energy in pipes, pipe discharging from a reservoir, pipe connecting two reservoirs in series and parallel, siphon, transmission of power through nozzle, water hammer in pipes- rigid and elastic water column theory, surge tanks - function, calculation of head loss, introduction to Moody's chart, nomograms and other pipe diagrams

Text Books
Course Outcomes: On completion of the course, the students will be able to:

CO1: Calibrate the various flow measuring devices.
CO2: Determine the properties of fluid and pressure and their measurement.
CO3: Understand fundamentals of pipe flow, losses in pipe and analysis of pipe network.
CO4: Visualize fluid flow phenomena observed in Civil Engineering systems.

CV 304 Surveying - I

Pre Requisites: Basic Civil Engineering (BCE06)

Course Contents

Module 1: Chain Surveying
Definition, principles, classification, fields and office work, scales, conventional signs, survey instruments, their care and adjustment, ranging and chaining, reciprocal ranging, setting perpendiculars, well-conditioned triangles, traversing, plotting, enlarging and reducing figures

Module 2: Compass Surveying
Prismatic compass, surveyor's compass, bearing systems and conversions, local attraction, magnetic declination, dip traversing, adjustment of errors

Module 3: Plane Table Surveying
Plane table instruments and accessories, merits and demerits, methods: radiation, intersection, resection, traversing

Module 4: Leveling and Applications

Module 5: Theodolite Surveying
Theodolite - Vernier and micro-optic - Description and uses - temporary and permanent adjustments of vernier transit - Horizontal angles - Vertical angles - Heights and Distances - Traversing - Closing error and distribution - Gales's tables - Omitted measurements

Module 6: Engineering Surveys
Reconnaissance, Preliminary and location surveys for engineering projects, Layout, Setting out works, Route Surveys for highways, railways and waterways, introduction to curve ranging, Mine Surveying - Instruments – Tunnels: correlation of underground and surface surveys, shafts
Text Books

Reference Books
• Kahmen Heribert and Faig Wolfgang, “Surveying”, Walter de Gruyter, 1995

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

CO1: Perform measurements in linear/angular methods.
CO2: Perform plane table surveying in general terrain.
CO3: Know the basics of leveling and theodolite survey in elevation and angular measurements.

CV 305 Building Construction

Pre Requisites: Engineering Graphics (EGP04), Basic Civil Engineering (BCE06)

Course Contents

Module 1: Masonry Construction
Stone masonry: Random rubble, un-coursed rubble, coursed rubble & ashlar brickwork & brick bonds - english, flemish, principles to be observed during construction composite masonry, various partition walls, brick, aluminum & timber, solid concrete blocks, hollow concrete blocks and light weight blocks (aerated autoclaved), soil stabilized blocks, fly ash blocks, cement concrete walls

Module 2: Concrete for Construction
Introduction and properties of ingredients, importance of admixture materials such as pozzolona, fly ash, specific purpose chemical admixtures, Properties of fresh and hardened concrete

Module 3: Arches and Lintels
Arches and their stability, technical terms in arches, types of arches, methods of construction; Lintel: Necessity, materials: wood, stone, brick, steel, R.C.C. and reinforced brick lintels, beams: types according to material, layout such as primary and secondary, continuous beams, formwork for RCC elements: function, requirements

Module 4: Means of Lateral Communication
Doors and windows
Doors - classification based on parameters such as material, geometry, fixtures and fastening
Windows - classification based on parameters such as material, geometry, fixtures and fastening
Use of composite materials for doors and window frames and shutters, laying out of passages

Stairs: Terminology, requirements of a good stair, various types, uses and limitations

Ramps: Requirements and types, planning aspects for physically handicapped persons

Elevators: Types and their Use

Module 5: Flooring Roofs and Types
Flooring: Types, factors for selections of floorings, flooring in ground and upper floors, various types of tiled flooring: natural, composite, synthetic, and special purpose flooring, concrete flooring for industrial purpose: tremix flooring
**Roof coverings**: Terms used, roof and their selection, pitched roofs and their types, roof coverings and their selection. Natural, composite, synthetic, and special purpose roof coverings, timber trusses (King Post and Queen Post), steel trusses types and their suitability

**Module 6: Precast and Pre-engineered Buildings**
Principles- advantages and disadvantages, types of prefabricate, standardization, basic, nominal and actual dimensions, tolerances, joints production, transportation and erection

**Text Books**

**Reference Books**
- Chudley R., ”Construction Technology”, Vol.1, 2, 3 and 4 ELBS Publisher
- SP 7- National Building Code Group 1 to 5, B.I.S. New Delhi
- I.S. 962 - 1989 Code for Practice for Architectural and Building Drawings, B.I.S. New Delhi
- Sikka V. B., “A Course in Civil Engineering Drawing”, S. K. Katariya and Sons
- Catalogues. Information Brochures, Trade Literature by material or product manufacturers
- Mehta, Scarborough, Armpriest, “Building Construction”, Pearson Education

**Course Outcomes**: On completion of the course, students will be able to:
- CO1: Understand types of masonry structures.
- CO2: Understand composition of concrete and effect of various parameters affecting strength.
- CO3: Comprehend components of building and there purposes.
- CO4: Comprehend the precast and pre-engineered building construction techniques.

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**CV 306 Engineering Geology**

**Pre Requisites**: Basic Civil Engineering (BCE06)

**Course Contents**

**Module 1: Introduction and Physical Geology**
Definition, Scope and subdivisions, applications of Geology in Civil Engineering, Major features of the Earth’s structure, internal structure of earth, and Geological work of river: features of erosion, deposition and transportation, Civil Engineering Significance, Geological work of wind: Processes and features of erosion, deposition and transportation, Civil Engineering Significance. Volcano: Central and Fissure types, Products of volcano, Mountain: Origin and formation, types, examples

**Module 2: Mineralogy and Petrology**
Mineralogy: Physical properties of mineral, Classification of minerals, Petrology: Definition, rock cycle, Igneous rocks: Origin, Textures and Structures, Classification, Concordant and Dis-concordant Intrusions, Civil Engineering significance,
Secondary rocks: Formation, Classification, Residual deposits: Soil, Laterite and Bauxite and their importance, Sedimentary deposits: Formation, Textures, Classification and Structures, Civil Engineering significance, Chemical and organic deposits, Metamorphic rocks: Agents and Types of Metamorphism, Stress and anti-stress Minerals, Structures, Products of metamorphism

**Module 3: Structural Geology**
Outcrop, Strike and Dip, Unconformity-Types, Outliers and Inliers, Overlap Fold and Fault: Parameters, Classification, Causes, Civil Engineering significance Joint: Types, Civil Engineering considerations

**Module 4: Building Stones**
Properties of rocks, Requirement of good building stone, Building stones of India

**Groundwater:** Sources of groundwater, water table, Zones of groundwater, Porosity and permeability

**Module 5: Geology of Dams and Reservoirs, Tunnels and Bridges**
Preliminary geological survey, Influence of geological conditions on location, alignment, Design and Type of a dam, geological considerations in site selection for dams, Site improvement techniques, dams on carbonate rocks, sedimentary rocks, folded strata and Deccan traps, favorable and unfavorable geological conditions for reservoir site

**Tunnels and Bridges:** Influence of geological conditions on tunneling, difficulties during tunneling, tunnel lining, tunneling in folded strata, sedimentary rocks and Deccan traps, dependence of types of bridges on geological conditions

**Module 6: Preliminary Geological Investigations**
Steps in geological investigations, consideration of structural features exploratory drilling: Observations, Preservation of cores, Core logging, Core recovery, Graphical representation of core log, Limitation of exploratory drilling method

**Text Books**
- Singh Prabin, “Engineering and General Geology”, S. K. Katariya and sons, Delhi
- Subinoy Gangopadhyay , “Engineering Geology ”,oxford university

**Reference Books**
- Read H. H., “Rultey’s Elements of Mineralogy”, CBS Publishers & Distributors, Delhi

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

- CO1: Recognize the different land forms which are formed by various geological agents.
- CO2: Identify the origin, texture and structure of various rocks and physical properties of mineral.
- CO3: Emphasize distinct geological structures which have influence on the civil engineering structure.
- CO4: Understand how the various geological conditions affect the design parameters of structures.

**CVA 301 Soft Skills Development**

**Program Educational Objectives:**
1) To build the skills like team building so that they can work efficiently in groups.
2) To provide knowledge of conflict management while working in large organizations.
3) To develop management skills required in routine work environment.
4) To polish the personality of the learners in order to make them good leaders and employees.
5) To imbibe qualities like manners & etiquettes co-ordination, mutual understanding while working in a group.

**Module 1: Development of Proficiency in English**: Speaking skills, Feedback & questioning technique, Objectivity in argument (Both one on one and in groups), 5 Ws & 1 H & 7 Cs for effective Communication, Imbibing Etiquettes and manners, Study of different pictorial expressions of non-verbal communication and their analysis

**Module 2: Self-Management**: Self Evaluation, Self-discipline, Self-criticism, Recognition of one’s own limits and deficiencies, dependency, etc., Self-Awareness, Self-Management, Identifying one’s strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride, Leadership & Team Dynamics

**Module 3: Time Management Techniques**: Practice by game playing and other learning strategies to achieve the set targets Time Management Concept, Attendance, Discipline & Punctuality, Acting in time, Quality /Productive time

**Module 4: Motivation/ Inspiration**: Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation

**Motivation techniques**: Motivation techniques based on needs and field situations

**Module 5: Interpersonal Skills Development**: Positive Relationship, Positive Attitudes, Empathise: comprehending others’ opinions, points of views, and face them with understanding Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonal skills

**Module 6: Effective Computing Skills**: Designing an effective Presentation, Contents, appearance, themes in a presentation, Tone and Language in a presentation, Role and Importance of different tools for effective presentation

**Reference Books**
3) Covey, Stephen R., “Seven Habits of Highly Effective People: Powerful Lessons in Personal Change”

**Program Educational Outcomes**
1) Learners will acquire interpersonal communication skills.
2) Learners will develop the ability to work independently.
3) Learners will develop the qualities like self-discipline, self-criticism and self-management.
4) Learners will have the qualities of time management and discipline.
5) Learners would be able to present themselves as an inspiration for others.

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**CVL 301 Hydraulic Engineering Laboratory I**

**Practical**: 2 hours / week

Practical Work consists of at least eight performances from list below and detailed reporting in form of journal. Practical examination shall be based on above.

1) Measurement of Viscosity of various fluids
2) Demonstration of working of different types of valves and pipe fittings
3) Measurement of pressure Piezometer, manometers, Pressure gauges
4) Measurement of discharge - Calibration of measuring tank, Use of hook or point gauge.
5) Verification of Bernoulli's Theorem
6) Determination of metacenteric height.
7) Calibration of an orifice / mouthpiece / venturimeter / orifice meter
8) Study of factors affecting coefficient of friction for pipe flow (for two different materials and two different diameters)
9) Determination of loss of head due to Pipe Fittings

Use of computer programs such as MS Excel is desirable for post-processing of results.

**CVL 302 Surveying Laboratory - I**

**Practical:** 2 hours / week

Practical Work consists of performances among the list below and detailed reporting in form of field book, journal and drawing sheets. Practical examination shall be based on above practical course.

**Essential Practical**

1) Use of Dumpy Level, Auto Level and Tilting Level.
2) Sensitivity of Bubble Tube using Dumpy Level.
3) Evaluation of constant of Planimeter, and use of Digital Planimeter for measurement of areas.
4) Study of Theodolite.
5) Methods of Plane Table Survey
6) Study and use of Total Station

Among following any four shall be performed

1) Reciprocal Levelling.
2) Illustration of Permanent adjustment of Dumpy Level
3) Measurement of Horizontal Angle by Various Methods
4) Measurement of Magnetic Bearing and Vertical Angle by Theodolite
5) Two Point and Three Point Problems
6) Study and use of Minor Instruments

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

- CO1: Use the theodolite along with chain/tape, compass on the field.
- CO2: Apply geometric and trigonometric principles of basic surveying calculations.
- CO3: Plan a survey, taking accurate measurements, field booking, and adjustment of errors.
- CO4: Apply field procedures in basic types of surveys, as part of a surveying team.
- CO5: Employ drawing techniques in the development of a topographic map.

**CVL 303 Building Construction - Drawings Laboratory**

**Practical:** 2 hours / week

**List of Drawing Assignments**

1) Sketch Book consisting of free hand proportional scale sketches for items to be drawn on drawing sheets as mentioned below.
2) Drawing to scale on a half imperial drawing sheet covering following aspects.
   a) Lettering, Symbols, Types of lines and dimensioning as per IS 962.
b) Foundations: - Isolated, Combined Footings, Under Reamed Piles, Rafts.
c) Types of Stone Masonry: Elevation and Sectional Drawings.
d) Types of Brick masonry: Elevation and Sectional Drawings.
e) Types of Doors: Elevation and Sectional Drawings.
f) Types of Windows: Elevation and Sectional Drawings, Standard Aluminum Sections.
g) Types of Stairs: Plan and Sectional Drawings.
h) Trusses: Various types, various roof covering materials, sketches for sectional profiles
i) Typical plan for a single room and sectional views.
3) Site visit: To understand various building materials and their use.

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

- CO1: Draw plan, elevation and section of various structures.
- CO2: Apply the principles of planning and by laws used for building planning.
- CO3: Prepare detailed working drawing for doors and windows.

CVL 304 Engineering Geology Laboratory

Practical: 2 hours / Week

List of Experiments
Practical Work consists of study of relevant rock and mineral samples. Detailed report is expected.

- Megascopic study of Rock forming minerals
- Megascopic study of Ore forming minerals
- Megascopic study of Igneous rocks
- Megascopic study of Secondary rocks
- Megascopic study of Metamorphic rocks
- Cross-section Preparation and interpretation of geological maps
- Study of Structural Geological models
- Preparation of bore log /lithologs
- Interpretation of bore- hole data

Study tour to the places of Engineering Geological importance

A Journal containing record of above practical work shall be examined as Term Work. Practical examination shall be based on above practical course.

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

- CO1: Calculate the linear measurement on surface.
- CO2: Find out engineering properties of various geological materials.
- CO4: Identify minerals and rocks by studying physical properties.

CVF 301 Seminar on Topic of Field Visit to Foundation Work

Student shall visit to ongoing construction sites in field to witness and collect necessary information from works of foundation execution. It is desirable to collect basic information of geotechnical aspects of foundations, types and components of foundations, tools and plants, construction machinery, etc. Intention is to introduce students to process of collection and presentation of technical information. Report shall be submitted to cover above aspects as studied.
Semester- IV

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Practical / Drawing and/or Design

|         | CVL 401      | Hydraulics Laboratory II               | -  | -  | 2   | 1      |
|         | CVL 402      | Surveying Laboratory II                | -  | -  | 4   | 2      |
| 10      | CVL 403      | Mechanics of Solids Laboratory         | -  | -  | 2   | 1      |
| 11      | CVP 401      | Mini Project                           | -  | -  | 2   | 1      |
| 12      | CVF 402      | Seminar on Topic of Field Visit to works involving Superstructure Construction | -  | -  | 1   | AU     |

Sub-Total | 16 | 3 | 11 |
Total      | 30 | 21 |

Elective I

|         | CVE1 401     | Numerical Methods in Engineering Planning for Sustainable Development |
|         | CVE1 402 OS  | Instrumentation & Sensor Technologies for Civil Engineering Applications | 3  | -  | -   | 3      |

**CV 401 Hydraulics II**

**Pre Requisites:** Hydraulics - I

**Course Contents**

**Module 1: Uniform Flow in Open Channel**
Introduction, difference between pipe flow and open channel flow, types of open channels, types of flows in open channel, geometric elements, velocity distribution, measurement of velocity-(pitot lube, current meter) weir & spillway: sharp, broad & round crested weirs, calibration of weir, time of emptying tank with weir, profile of ogee spillway, flow below gates

**Module 2: Steady & Uniform Flow**
Chezy's & Manning's formula, Roughosity coefficient, uniform flow computations, hydraulically efficient section-considerations for rectangular, triangular, trapezoidal, circular sections
Specific energy: definition & diagram, concept of critical, sub-critical, super-critical flow, specific force, specific discharge derivation of relationships and numerical computations

**Module 3: Varied Flow**
Gradually (G.V.F): Definition, classification of channel Slopes, dynamic equation of G.V.F. (Assumption and derivation), classification of G.V.F. profiles-examples, direct step method of computation of G.V.F. profiles
Rapidly varied flow (R.V.F.): Definition, examples, hydraulic jump- phenomenon, relation of conjugate depths, parameters, uses, types of hydraulic jump

**Module 4: Impact of Jet**
Impulse momentum principle, impact of jet on Vanes-flat, curved (stationary and moving), inlet & outlet velocity triangles under various conditions, Series of flat, curved vanes mounted on wheel
Module 5: Hydraulic Machines

**Turbines:** Importance of hydro-power, classification of turbines, description, typical dimensions and working principle of Pelton, Francis & Kaplan turbine (detailed design need not to be dealt with), Module quantities, specific speed, performance characteristics, selection of type of turbine, description & function of draft tube, Thomas's cavitation number

**Pumps:** Classification, component parts, working of centrifugal pump, performance characteristics, selection of pump, common pump troubles & remedies, introduction to different types of pumps such as reciprocating, multi-stage, jet, air lift, submersible pump

**Module 6: Boundary Layer Theory:** Concept, Boundary layer along thin plate- Characteristics, Laminar, Turbulent Boundary Layer, laminar sub layer, Various Thicknesses- Nominal, displacement, Momentum, Energy. Hydraulically smooth and Rough boundaries, Separation of Boundary layer, control of Separation, Introduction to Drag and Lift on submerged bodies (like Flat plates, Sphere, Cylinder, aerofoil), Stokes law, Drag and Lift coefficients

**Text Books**

**Reference Books**

**Course Outcomes:** On completion of the course, the students will
- CO1: Design open channel sections in a most economical way.
- CO2: Know about the non uniform flows in open channel and the characteristics of hydraulic jump.
- CO3: Understand application of momentum principle of impact of jets on plane

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CV 402 Surveying – II

**Pre Requisites:** Survey-I (CV304), Engineering Mathematics

**Course Contents**

**Module 1: Tachometry**
Significance and systems, principle, constants, basic formulae and field work stadia method, auto reduction tachometer, tangential system

**Electronic Distance Measurement:** Importance, principles of electronic distance measuring (EDM) instruments, classification of EDM’s based on carrier waves used, study and use of total station

**Module 2: Triangulation**
Principle & classification, system, selection of station, base line measurement, correction and use of subtense bar, signals, satellite station, reduction to center, spherical excess, angular observations, tri-iteration

**Triangulation Adjustments:** Theory of errors, laws of weights, concept of most probable value
Module 3: Field Astronomy
Terms, co-ordinate systems, determination of latitude and true bearing by observation on the sun and pole star

Module 4: Curves
Horizontal and vertical curves, simple curves, setting with chain and tapes, tangential angles by theodolite, double theodolite, compound and reverse curves, transition curves, functions and requirements, setting out by offsets and angles, vertical curves, sight distance requirements

Module 5: Photogrammetry
Terms, types, vertical photographs, scale, ground coordinates, relief displacement, flight planning photomaps and mosaics, stereoscopy and photo interpretation

Module 6: Remote Sensing
Introduction, classification and principles, electromagnetic energy and its interaction with matter, idealized systems, sensors, platforms, and application in civil engineering, G.P.S & G.I.S. as surveying techniques – Overview, uses and applications

Text Books

Reference Books
- James M. Anderson and Edward M. Mikhail, “Introduction to Surveying”, McGraw Hill Book Company
- Agor, “Advanced Surveying”, Khanna Publications, Delhi
- Basak, “Surveying and Levelling”
- Gopi S., Satikumar R. and Madhu N., “Advanced Surveying”, Pearson Education,
- Chandra A. M., “Higher Surveying”, New Age International Publication

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

CO1: Understand basics different types of curves on roads and their preliminary survey.
CO2: Perform setting of curves, buildings, culverts and tunnels.
CO3: Comprehend different geodetic methods of survey such as triangulation, trigonometric leveling.
CO4: Comprehend modern advanced surveying techniques.

CV 403 Structural Mechanics - I

Pre Requisites: Engineering Mechanics (EM02), Solid Mechanics (CV302)

Course Contents

Module 1: Introduction
Different structural systems, concept of analysis, basic assumptions, indeterminacy, choice of unknowns, Castiglano's theorems

Module 2: Energy Principles
Strain energy and strain energy density, strain energy in traction, shear, flexure and torsion - Castiglano's and Engessor's energy theorems, principle of virtual work, application of energy theorems for computing deflections in beams and trusses, Maxwell's reciprocal theorem, Williot Mohr diagrams

**Module 3: Method of Consistent Deformation**

**Indeterminate Beams:** Analysis of indeterminate beams: Propped cantilever and fixed beams - fixed end moments and reactions for standard cases of loading – slopes and deflections in fixed beams - continuous beams - theorem of three moments - analysis of continuous beams - Shear Force and Bending Moment diagrams for continuous beams, settlement effects, thermal effect

**Frames up to Three Degree of Indeterminacy:** Analysis of pin jointed trusses, externally and internally redundant trusses, effects of settlement and pre-strains

**Module 4: Moment Distribution Method**
Analysis of continuous beams propped cantilevers, portal frames with and without sway

**Module 5: Slope Deflection Method**
Analysis of continuous beams, analysis of rigid frames, frames with sloping legs, gabled frames, frames without sway and with sway, settlement effects

**Module 6: Thin Cylinders**
Thin cylinders subjected to internal fluid pressure, wire wound thin cylinders, thin cylindrical shells, circumferential and hoop stresses, longitudinal stresses, maximum shear stress, concept of stresses in thick cylinders

**Text Books**
- Khurmi R.S., “Theory of Structures”, S Chand, Delhi
- Punmia B.C., “Structural Analysis”, Laxmi Publications

**Reference Books**
- Timoshenko and Young, “Theory of structures”, McGraw Hill

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

- CO1: Describe the concept of structural analysis, degree of indeterminacy.
- CO2: Calculate slopes and deflection at various locations for different types of beams.
- CO3: Identify determinate and indeterminate trusses and calculate forces in the members of trusses
- Perform the distribution of the moments in continuous beam and frame.

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**CV 404 Product Design Engineering**

**Course Contents**

**Module 1:** Creating Simple Products and Modules

**Module 2:** Document Creation and Knowledge Sharing

**Module 3:** Self and Work Management
Module 4: Team Work and Communication
Module 5: Managing Health and Safety
Module 6: Data and Information Management

Reference Books
• Model Curriculum for “Product Design Engineer –Mechanical”, NASSCOM (Ref. ID: SSC/Q4201, Ver 1.0, NSQF Level: 7)

CVE2 401 Numerical Methods in Engineering

Pre Requisites: Mathematics - I and Mathematics – II

Course Contents

Module 1
Basis of Computations, Matrix Operations on Computer, Multiplication and Inversion, Solution of Simultaneous Equations, Gauss Elimination Method, Cholesky Decomposition method, Gauss Jordan and Gauss Sceidal Methods

Module 2

Module 3
Interpolation with Newton's Divided Differences, Lagrange's Polynomial, Finite Difference Method, Central, Forward and Backward Differences, Least Square Polynomial Approximations Application in Deflection of Determinate Beams, Buckling Load of Long Columns

Module 4
Numerical Integration: Trapezoidal Rule, Simpon’s Rules, Gauss Quadrature Rules

Module 5
Statistical Analysis of Experimental Data, Mean, Median, Mode, Deviation, Measures of Dispersion, Least Square Method, Regression Analysis: Linear, Parabolic, Curve Fitting

Module 6
Implementation of above methods by algorithm development leading to programming in Fortran / C / C++

Text Books
• Scheid F, “Numerical Analysis (Schaum’s series)”, Tata Mc-Graw Hill
• Shantha Kumar M , “Computer Based Numerical Analysis”, Khanna Publication
• Sastry, S.S., "Introductory Methods of Numerical Analysis", Printice Hall of India, New Delhi

Reference Books
• Numerical Recipe , Oxford Publishing
CVE1- 402 OS Planning for Sustainable Development

Course Contents

Module 1:
Sustainable Development-explains and critically evaluates the concept of sustainable development, Environmental degradation and poverty. Sustainable development: its main principles, the evolution of ideas about sustainability.

Module 2:
Strategies for promoting sustainable development, resistances to the concept, and some alternative approaches. Examine some important current issues and areas of debate in relation to sustainable development.

Module 3:
Innovation for sustainable development- Environmental management and innovation strategies.

Module 4: Societal transformations. Institutional theory.

Module 5: Governance for sustainable development. Policy responses to environmental degradation.

Module 6: Capacity development for innovation. Research methods.

Text/Reference Books:
- Harris, J.M. (2204) Basic Principles for Sustainable Development, Global Development and Environment
%20Development.PDF

CVA- 402 Engineering Management

Course Contents

Module 1: Evolution of Management Thought
Scientific, human behavior, system approach, introduction to elements of systems – input, output, process restriction, feedback, contingency approach, contributions by Taylor, Frank and Lillion, Gilbreth, Henry Fayol, Elton Mayo, McGregor (theory X and theory Y), H. L. Gantt, Maslow

Module 2: Functions of Management
Planning – nature and purpose of planning, strategies and policies, management by objectives, formal and informal organization, centralization, decentralization, line, line and staff, functional organization, principles of site layout, leading and directing, controlling and coordination (introduction only), communication process, motivation

Module 3: Decision Making
Importance of decision making, steps in decision making, analysis of decision, decision under certainty, uncertainty and decision under risk, criterion of optimism and regret, sensitivity of criteria and decision under conflict, expected monetary value, decision tree, theory of games (dominance pure and mixed strategy).

Module 4: Operations Research
Linear programming, simple l-p model, simplex method - duality, sensitivity analysis, application of linear programming in transportation and assignment models

Module 5: Simulation Studies
Monte-Carlo simulation, queuing or waiting line theory (simple problems), dynamic programming, introduction to emerging optimization techniques

Module 6: Material Management
Material management – purchasing principles, stores, coding system function, responsibilities, record and accounting. Inventory control – an introduction, inventory cost, EOQ analysis, ABC analysis, safety stocks

Text Books
- Deshpande S. H., “Operation Research”
- Taha, “Operation Research”
- Banga and Sharma, “Engineering Management”

References
- Stoner, “Engineering Management”
- Davar, “Principles of Management”
- Koontz, Dounell and Weigrick, “Essentials of Management”
- Zhamb L.C., “Quantitative Techniques in Management”, Vol. I,
- Miller and Stars, “Executive Decisions & Operation Research”, Prentice Hall of India

Course Outcomes: On completion of the course, the students will be able to:
- CO1: Demonstrate the nuances of management functions.
- CO2: Analyze the framework of a business organization.
- CO3: Adopt an empirical approach toward business situations.
- CO4: Apply various Management techniques.

CVA 403 Basic Human Rights

Course Contents
Module 1: The Basic Concepts

Module 2: Fundamental Rights and Economic Program

Module 3: Workers and Human Rights

**Module 4: NGOs and Human Rights in India**
Land, Water, Forest issues.

**Module 5: Human Rights in Indian Constitution and Law**
v) Some other provisions

**Module 6: UDHR and Indian Constitution**
Universal declaration of human rights and provisions of India; Constitution and law; National human rights commission and state human rights commission.

**References**
2) C. J. Nirmal, “Human Rights in India: Historical, Social and Political Perspectives (Law in India)”, Oxford India.

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**CVL 401 Hydraulic Engineering Laboratory II**

**Practical:** 2 hours / week

Practical Work consists of at least three performances from groups listed below and detailed reporting in form of journal. Practical examination shall be based on above.

**Group (A)**
1) Calibration of V notch / Rectangular notch.
2) Calibration of Ogee Weir.
3) Study of hydraulic jump
   a) Verification of sequent depths,
   b) Determination of loss in jump.
   c) Study of parameters with respect to Fraud Number: i) Y2/Y1; ii) Length; iii) Energy loss
5) Velocity distribution in open channel in transverse direction of flow.

**Group (B)**
1) Impact of jet.
2) Study of Turbines (Demonstration).
3) Tests on Centrifugal Pump.
4) Study of Charts for Selection of Pumps

Use of computer programs such as MS Excel is desirable for post-processing of results.

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

- CO1: Understand various properties of fluids and measurement techniques.
- CO2: Carry out calibrations of various flow measuring devices.
- CO3: Understand mechanism of hydraulic jump, various jets and pumps.

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**CVL 402 Surveying Laboratory - II**
Practical: 2 hours / week

Practical Work consists of performing field practical from the list below and detailed reporting in form of journal. Practical examination shall be based on above.

1. Tacheometry
   a) Determination of tachometric constants,      b) Determination of grade of a line.
2. Use of subtense bar for distance measurement.
3. Setting out of curves
   a) Simple circular curves,      b) Transition curves
4. Study of topo sheets
5. Study of Aerial Photographs under Stereoscope
6. Traversing by Total Station.

Projects: 1) Road Project 2) Radial Contouring. 3) Block Contouring Project 4) Theodolite Traversing

Course Outcomes: On completion of the course, the students will be able to:
   CO1: Determine contour level of field.
   CO2: Determine the tachometric constants and grade of a line.
   CO3: Use sub tense bar for distance measurement.

CVL 403 Solid Mechanics Laboratory

Practical: 2 hours / week

Practical Work consists of performance of at least seven experiments from the list below (excluding the eleventh study) experiment: Detailed report is expected.

List of Experiments
1. Tension test on ferrous and non-ferrous alloys (mild steel / cast iron /aluminum etc.)
2. Compression test on mild steel, aluminum, concrete, and wood.
3. Shear test on mild steel and aluminum (single and double shear tests).
4. Torsion test on mild steel and cast iron solid bars and pipes.
5. Flexure test on timber and cast iron beams.
6. Deflection test on mild steel and wooden beam specimens.
8. Impact test on mild steel, brass, Aluminum, and cast iron specimens.
9. Experimental on thermal stresses.
10. Strain measurement involving strain gauges / rosettes.

Assignment involving computer programming for simple problems of stress, strain computations.

Course Outcomes: On completion of the course, the students will be able to:
   Evaluate Young Modulus, torsional strength, hardness and tensile strength of given specimens.
   Determine the strength of coarse aggregates.
   Find the compressive strength of concrete cubes and bricks.
   Determine physical properties of given coarse aggregates, fine aggregates and cement samples.

CVP 401 Mini Project

Practical: 2 hours / week
Students shall take up work leading to product development. Needs of community around may be of prime concern. Work may target at easing out conventional construction operation by improvement of traditional devices / tools or development of altogether new approach.

**CVF 402 Seminar on Topic of Field Visit to works involving Superstructure Construction**

Student shall visit to ongoing construction sites in field to witness and collect necessary information from works of execution of superstructure of buildings or other. It is desirable to collect basic information on components of superstructure, tools and plants, construction machinery, etc. Intention of the work is to introduce the student to the chronological order of execution of works and generate data on vocabulary of terms in field.