Jharkhand University of Technology, Ranchi
B.Tech. (Civil Engineering)

Semester-III

S.No.	Course Code	Course Title	Hours per week				Cr	FM	Overall Pass Marks	Internal (CIE)	External (SEE)		Categorization
			L	T	P	J					FM	PM	
01	BSC301	Transformation Techniques and Complex Variable	3	1	0		4	100	35	30	70	21	BSC
02	CIV301	Fluid Mechanics	3	0	0		3	100	35	30	70	21	CIV
03	CIV302	Mechanics of Solids	3	0	0		3	100	35	30	70	21	CIV
04	CIV303	Surveying	3	0	0		3	100	35	30	70	21	CIV
05	CIV304	Concrete Technology	3	0	0		3	100	35	30	70	21	CIV
Total			**15**	**1**	**0**		**16**	**500**	--	--	--		--
Practical			**L**	**T**	**P**		**Cr**	**FM**	**Overall Pass Marks**	**Internal**	**External**		**Categorization**
											FM	**PM**	
06	BSC301P	Introduction to Computational Science (Numerical Methods)	0	0	2		1	50	25	30	20	10	BSC
07	CIV301P	Fluid Mechanics lab	0	0	2	6	1	50	25	30	20	10	CIV
08	CIV302P	Mechanics of Solids	0	0	2		1	50	25	30	20	10	CIV
09	CIV303P	Field Surveying	0	0	4		2	50	25	30	20	10	CIV
Total			**0**	**0**	**10**		**5**	**200**	--	--	--		--
Audit Course			**L**	**T**	**P**		**Cr**	**FM**	**Overall Pass Marks**	**Internal**	**External**		**Categorization**
											FM	**PM**	
10	AUC301	Professional Skills	3	0	0		--	100	35	30	70	21	AUC
11	AUC302P	Sports/NCC/NSS/YOGA/Painting/Music/ Classical Dance	6				Student shall participate actively in one of the activities and for Passing of the semester "Participation Certificate" in activity will be mandatory. Student participation shall be monitored and participation record shall be maintained at institute level.						
Total			**3**	**0**	**0**		--	--	--	--	--		--
Grand Total			**18**	**1**	**10**	**6**	**21**	**800**	--	--	--		--

***BSC: Basic Science, CIV- Civil : - AUC- Audit Course; L: Lecture, T: Tutorial, P: Practice.**

J- Self learning hours shall not be reflected in the Time table. Self-learning includes micro project/ assignment/ other activities as mentioned in earlier semester.

Jharkhand University of Technology, Ranchi
B.Tech. (Civil Engineering)

Semester-IV

S.No.	Course Code	Course Title	L	T	P	J	Cr	FM	Overall Pass Marks	Internal (CIE)	External (SEE)		Categorization
			Hours per week								FM	PM	
01	CIV401	Transportation Engineering	3	0	0		3	100	35	30	70	21	CIV
02	CIV402	Machine Learning Techniques for Civil Engineers	3	0	0		3	100	35	30	70	21	CIV
03	CIV403	Theory of Structures	3	0	0		3	100	35	30	70	21	CIV
04	CIV404	Geotechnical Engineering	3	0	0		3	100	35	30	70	21	CIV
05	CIV405	Building Planning, Design and Construction	3	0	0		3	100	35	30	70	21	CIV
Total			**15**	**0**	**0**		**15**	**500**	--	--	--		--
Practical			**L**	**T**	**P**		**Cr**	**FM**	**Overall Pass Marks**	**Internal**	**External**		**Categorization**
											FM	**PM**	
06	CIV401P	Transportation Engineering	0	0	2	6	1	50	25	30	20	10	CIV
07	CIV404P	Geotechnical Engineering	0	0	2		1	50	25	30	20	10	CIV
08	CIV405P	Building Planning, Design and Construction	0	0	4		2	50	25	30	20	10	CIV
Total			**0**	**0**	**8**		**4**	**150**	--	--	--	--	--
Audit Course			**L**	**T**	**P**		**Cr**	**FM**	**Overall Pass Marks**	**Internal**	**External**		**Categorization**
											FM	**PM**	
09	AUC401	Mastering Personal Finance (Basic to Advance Strategies)	3	0	0		--	100	35	30	70	21	AUC
10	AUC402P	Sports/NCC/NSS/YOGA/Painting/Music/ Classical Dance	6				Student shall participate actively in one of the activities and for Passing of the semester "Participation Certificate" in activity will be mandatory. S tudent participation shall be monitored and participation record shall be maintained at institute level.						
11	INT401P	Summer Internship	6-8 Weeks				2	--	--	1/0	--		INT
Total			**3**	**0**	**0**		**2**	**100**	--	--	--		--
Grand Total			**18**	**0**	**8**	**6**	**21**	**750**	--	--	--		--

Note-

1. **CIV- CIVIL; AUC- Audit Course; L: Lecture, T: Tutorial, P: Practice, CIE- Continuous Internal Evaluation, SEE- Semester End Evaluation.**
2. **INT- Internship (Completion of internship will be marked as-1; Non-completion of internship will be marked as-0 by the institution; The submitted write up & presentation record shall be kept safely by the institution).**
3. **J- Self learning hours shall not be reflected in the Time table. Self-learning includes micro project/ assignment/ other activities as mentioned in earlier semester.**

Jharkhand University of Technology
Ranchi, 834010

TENTETIVE SYLLABUS

For B.Tech. Program in

Civil Engineering

(Effective from 2024-25)

DEPARTMENT OF CIVIL ENGINEERING

(3rd – SEMESTER)

Transformation Techniques and Complex Variable

BSC301

Course Outcomes:

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

CO1	Introduce the application of Laplace Transform and solution of engineering problems in the form of differential equations.
CO2	Develop the understanding of transform the signal from time domain into frequency domain using Fourier Transform
CO3	Introduce z-transform and its application in the solution of difference Equation
CO4	Analyze engineering problems of fluid mechanics, Thermodynamics and electric field involving complex functions.
CO5	Understand the conceptual knowledge of integration over contour having complex variables.

Syllabus Unit Wise, Teaching Hours

Unit 1 **(10 hours)**

Laplace Transform

Laplace Transform and Its Properties, Transform of Derivatives, Transform of Integrals, Inverse Laplace transform, Convolution Theorem, Unit Step Function, Unit Impulse Function, Solution of ODE by Laplace Transform.

Unit 2 **(7 hours)**

Fourier transform

Fourier Integrals, Fourier Transform and Properties, Fourier Sine Transform, Fourier Cosine Transform, Inverse Fourier Transform, Inverse Fourier Sine and Cosine Transform.

Unit 3 **(8 hours)**

Z- Transform

Z-transform, Properties of Z-Transform, Initial and Final value Theorem, Convolution Theorem, Inverse Z-Transform, Solution of Difference Equation using Z-transform.

Unit 4 **(9 hours)**

Complex Variable: Differentiation

Derivative of Complex Functions, Analytic Function, Cauchy-Riemann Equation, C-R Equation in Polar form, Harmonic Function, Milne-Thomson's Method, Harmonic Conjugate, Conformal Mapping, Bilinear Mapping, Mobius Tranformation and their Properties.

Unit 5 **(8 hours)**

Complex Variable: Integration

Contour Integral, Cauchy's Integral Theorem, Cauchy's Integral Formula, Taylor's Series, Laurent's Series, Zeros and singularity of Analytic Function, Poles and Residues, Cauchy's Residue Theorem and Evaluation of Integrals.

Materials and access:

Textbooks:

1. Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley Eastern Ltd.

2. The Laplace Transform: Theory and Application, Joel L. Schiff.

3. N.P. Bali And Manish Goyal, A Text Book Of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Reference Books:

1. J. W. Brown And R. V. Churchill, Complex Variables And Applications, 7th Edition, Mc- Graw Hill, 2004.

2.M. J. Ablowitz and A. S. Fokas, Complex Variables- Introduction and Applications, Cambridge University Press, 1998 (Indian Edition).

3. G.B. Thomas and R. L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint, 2002.

4. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition.

FLUID MECHANICS

Subject Code – CIV301

BCLE202L	FLUID MECHANICS	L	T	P	C
		3	0	0	3
Pre-requisite	NIL	**Syllabus version**			
		v. xx.xx			

Course Objectives

The objectives of this course is to :

1. Provide fundamental knowledge of fluid properties and apply the principle of mass and momentum in fluid flows.
2. Determine the losses in a flow system.
3. Acquire knowledge on open channel flow concepts and importance of dimensional analysis.

Course Outcomes

Upon completion of this course, the student will be able to :

1. Analyse various hydraulic systems by applying the laws of statics and resolve fluid flow governing equations by taking appropriate constraints and assumptions.
2. Measure the pipe flow discharge and major and minor losses.
3. Analyse the practical significance of open channel flows.
4. Solve the fluid problems through dimensional analysis.
5. Predict the boundary layer aspects of laminar and turbulent flows.

Module: 1	**Introduction to Fluid Properties**	**5 hours**
Scope of Fluid Mechanics-Control Volume, Dimensions and units-Fluid continuum-Fluid properties-Classification of fluids.		
Module: 2	**Fluid Statics and Buoyancy**	**6 hours**
Basic equation of fluid statics-Manometers-Hydrostatic forces on plane, vertical, inclined and curved submerged surfaces-Buoyancy and stability.		
Module: 3	**Fluid Dynamics**	**8 hours**
Types of flows, Reynold's Transport theorem-Continuity equation-Stream function and Velocity potential function-Laplace's equation-Euler's equation-Bernoulli's equation and its applications-Momentum equations-Application of momentum equation-Navier-Stokes Equation.		
Module: 4	**Flow through pipes**	**6 hours**
Major losses-Friction factor-Minor losses-Solution to pipe flow problems-single path and multi path systems-Fully developed Laminar flow in pipe-Laminar flow between parallel plates when both plates at rest-Laminar flow between parallel plates when upper plate moving with constant speed-Turbulent flow–shear stress distribution and velocity profiles.		
Module: 5	**Open channel flows**	**6 hours**
Types of open channel flows-Specific energy-Critical depth-Flow over bump-Hydraulic jump-Discharge measurement using weirs.		
Module: 6	**Dimensional analysis and similitude**	**6 hours**
Dimensional homogeneity-Buckingham Pi theorem-Dimensionless numbers-Flow similarity and model studies-Incomplete similarity studies.		
Module: 7	**Boundary layer flow**	**6 hours**
Boundary layer, Boundary layer thickness, Laminar flat plate boundary layer-Momentum integral equation-Laminar flow and turbulent flow-Drag-Lift-Streamlining of body shapes.		
Module: 8	**Contemporary Issues**	**2 hours**
Guest lecture from industry and R & D organisations.		
Total Lecture Hours		**45 hours**

FLUID MECHANICS LAB

Subject Code – CIV301P

Course Objectives		
The objectives of this course is to : 1. Estimate the discharge in tanks and open channels. 2. Able to understand major loss and minor loss in pipe flow. 3. Classify the fluid motion and estimate the flow rate in pipes.		
Course Outcomes		
Upon completion of this course, the student will be able to : 1. Perform experiments and determine discharge in open and closed conduit. 2. Determine friction factor in flow through pipes. 3. Classify the type of flow and determine discharge.		
List of Experiments		
1.	Assessment of discharge from a given tank using Orifice (Constant Head Method).	
2.	Evaluation of discharge from a given tank using Mouth piece (Falling Head Method).	
3.	Verification of conservation of energy principle for a given flow system using Bernoulli's Theorem.	
4.	Determination of discharge in an open channel using Rectangular / Triangular Notch.	
5.	Assessments of discharge of a given pipe flow using Venturi Meter.	
6.	Evaluation of discharge of a given pipe flows using Orifice Meter.	
7.	Determination of friction factor for a given flow system.	
8.	Determination of minor losses for a given pipe.	
9.	Determination of state of flow in a closed conduit using Reynold's experiment.	
10.	(i) Determination of flow rate in a pipeline using Water Meter. (ii) Calibration of a Pitot-Static Tube.	
Total Laboratory Hours		**30 hours**

SURVEYING

Subject Code – CIV303

Pre-Requisites: None

Course Outcomes:

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

CO1 Apply the basic principles of Surveying

CO2 Operate and use different instruments and techniques to determine the positions

CO3 Prepare maps/plans from the collected field data

CO4 Apply the techniques for setting out curves and other layouts etc

CO5 Demonstrate advanced equipment in preparing maps

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1	3	3	3	3	1	1	1	1	-	3	-
CO2	3	2	3	3	2	2	2	1	1	2	3	2	1	-	1	-
CO3	3	1	2	1	1	3	1	1	2	3	2	2	2	2	-	2
CO4	3	3	2	2	3	2	3	2	3	2	3	2	2	-	2	-
CO5	3	2	2	3	3	3	3	3	3	2	3	2	3	-	2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction to Surveying: Surveying objectives, plane surveying principles and classification, scales, Errors and Mistakes, Types of tapes and chains, offsets, Errors and Corrections

Compass Surveying: Measurement of directions and angles, types of compass, meridians and bearings, local attraction, magnetic declination, traversing, plotting of traverse, adjustmentof closing error

Plane Table Surveying: Principle and instruments used in plane table surveying, working operations, methods of plane table surveying

Levelling and Contouring: Description of a point (position) on the earth's surface, instruments for leveling, principle and classification of leveling, bench marks, leveling staff, readings and booking of levels, field work, longitudinal section and cross section, plotting the profile, height (level) computations, contours, characteristics of contours, methods of contouring, interpolation, contour gradient, contour maps, calculation of areas of a closed traverse,measurements from cross sections, earth work calculations

Theodolite and Tacheometric Surveying: Principle of theodolite survey, Theodolite component parts, observations, Traversing, traverse computations, Trigonometrical Surveying, Tacheometry, principle of tacheometry, methods of tacheometry

Curve Settting: Types of curves, elements of a curve, setting out a simple curve, setting out acompound curve, checks on field work, reverse curve, transition curves, super elevation, deflection angles, transition curves, characteristics of transition curves, method of setting out acompound curve, types of vertical curves, setting out vertical curves

Advanced Surveying: Principle of EDM, Features and Functions of Total Station, GNSS – Segments, IRNSS,GAGAN

FIELD SURVEYING LAB

Subject Code – CIV303P

1. Measurement of a line using a chain taking offsets on both sides
2. Traversing using compass.
3. Measurement of horizontal angle using Theodolite by Repetition/ Reiteration method.
4. Differential Levelling.
5. Profile Levelling and Cross sectioning.
6. Grid Contouring
7. Plane table traversing
8. Direct contouring using plane tabling
9. Setting out simple curve using theodolite.
10. Introduction to Total Station.
11. Total station traversing.
12. Introduction to GPS

MECHANICS OF SOLIDS

Subject Code – CIV302

Course Objectives

The objectives of this course is to :

1. Provide the basic concepts and principles of deformable bodies.
2. Achieve an ability to calculate stresses and deformation of members under external loading.
3. Gain knowledge on application of solid mechanics on engineering applications and design problems.

Course Outcomes

Upon completion of this course, the student will be able to

1. Understand the fundamental concept of stress and strain of deformable bodies.
2. Evaluate the problems related to pure and uniform bending of beams and other simple structures.
3. Apply the bending concepts to calculate the deflection of beams under various loading conditions.
4. Determine the effect of torsion of shafts and buckling of columns
5. Analyse the structural elements using Energy methods.

Module: 1	**Concept of Stress and Strain**	**4 hours**
Statically determinate structures-Stress and strain under general loading condition-Stress on Oblique Plane under axial loading-Principle of Superposition-Saint Venant's Principle.		
Module: 2	**Stresses and Strains on Deformable Bodies**	**8 hours**
Hooke's Law-Stress under Tension, Compression and Shear-Relation between elastic constants-Poisson's Ratio-Bulk Modulus-Generalized Hooke's Law-Mohr's Circle-Principal stresses and strains-Stress tensor-Stresses in Thin-walled Pressure Vessels-Failure Theories.		
Module: 3	**Shear Force and Bending Moment- Simple Bending**	**8 hours**
Bending of Beams-Types of loading and support conditions-Shear force and bending moment of Statically Determinate Beams-Simple bending theory- Bending stresses and shear stresses.		
Module: 4	**Deflection of Beams**	**8 hours**
Slope and Deflection of Statically Determinate Beams-Macaulay's Method-Moment Area Method-Conjugate Beam Method.		
Module: 5	**Torsion of shaft**	**4 hours**
Circular shaft in torsion-Torsional rigidity-Design of transmission shaft-Torsion of non-circular shaft.		
Module: 6	**Theory of Columns**	**5 hours**
Long and short column-Stability of columns-Euler's formula-Rankine's formula-Secant formula.		
Module: 7	**Energy Methods**	**6 hours**
Strain Energy-Strain Energy for general stress state-Castigliano's Theorems-Unit Load Method-Maxwell-Betti Theorem.		
Module: 8	**Contemporary Issues**	**2 hours**
Guest lecture from industry and R & D organisations.		
Total Lecture Hours		**45 hours**

MECHANICS OF SOLID LAB Subject Code – CIV302P

Course Objectives	
The objectives of this course is to : 1. Provide physical insight on deformation of bodies. 2. Study the stress and strains developed in bodies under the action of various loads. 3. Calculate the material properties of deformable bodies by means of various tests.	
Course Outcomes	
Upon completion of this course, the student will be able to : 1. Calculate the shear and tensile properties of steel 2. Apply bending principles to evaluate the flexural behaviour of steel and wooden beam 3. Understand the fundamental principles of stability.	
List of Experiments	
1.	Tension test on mild steel bar.
2.	Construction of Mohr's Circle graphically using principal stress values.
3.	Double shear test.
4.	Bending moment and shear force variation in beams subjected to three point loading.
5	Bending moment and shear force variation in beams subjected to four point loading
6.	Calculation of bending stress of wooden beam.
7.	Deflection of simply supported steel beam.
8.	Deflection of Cantilever steel beam.
9.	Determination of rigidity modulus of a steel bar.
10.	Load carrying capacity of long and short columns.
Total Laboratory Hours	**30 hours**

CONCRETE TECHNOLOGY

Subject Code – CIV304

Pre-Requisites: None

Course Outcomes:

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

CO1 Identify Quality Control tests on concrete making materials

CO2 Comprehend the behaviour of fresh and hardened concrete

CO3 Design concrete mixes as per IS and ACI codes

CO4 Determine the durability properties of concrete

CO5 Explore special concretes for construction

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	3	-	-	-	2	-	2	-	-	2	-	-	3	2	-
CO2	-	3	2	-	-	2	-	2	-	-	2	-	-	2	3	-
CO3	-	-	3	2	-	2	-	2	-	-	2	-	-	2	3	-
CO4	-	3	2	3	-	2	-	2	-	-	1	-	-	2	3	2
CO5	-	2	2	2	-	2	-	2	-	-	1	-	-	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Concrete Making Materials: Cement, Fine Aggregate, Coarse aggregate, Water, Chemical & Mineral admixtures.

Hydration of Cement: Bogue's compounds, Hydration, Gel formation, Types of cement,pore& capillary water.

Quality tests on cement: Different test on cement as per Indian standards

Aggregates: Tests on aggregates as per Indian standards, Bulking of sand, Sieve analysis –Grading.

Fresh concrete: Properties of fresh concrete- Workability – different tests of workability-Factors influencing workability compaction, finishing, curing.

Hardened concrete: Tests on hardened concrete as per IS codes – Relationship betweendifferent strengths – factors influencing strength, NDE Techniques.

Durability: Factors influencing durability – Chemical effects on concrete- Carbonation,Sulphate attack, Chloride attack.

Concrete Mix design: Different methods of mix design – factors affecting mix design –exercises.

Special concrete: Heavy density concrete, underwater concrete, self-compacting concrete,light weight concrete etc.

(4th – SEMESTER)

TRANSPORTATION ENGINEERING

Subject Code – CIV401

Pre-requisites: NoneCourse

Outcomes:

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

CO1 Plan highway networks.

CO2 Design highway geometrics.

CO3 Determine the characteristics of traffic flow.

CO4 Characterize the pavement materials and design a bituminous mix.

CO5 Analyze and design flexible pavements and rigid pavements.

CO6 Select appropriate pavement construction techniques and maintenance options.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	3	2	-	-	-	-	-	-	2	2	3	1
CO2	3	2	2	3	1	1	-	-	-	-	-	-	2	1	2	-
CO3	2	2	2	3	2	1	-	-	-	-	-	-	2	-	3	2
CO4	3	2	2	2	2	2	-	-	-	-	-	-	2	1	2	-
CO5	3	3	3	2	2	2	-	-	-	-	-	-	2	1	-	-
CO6	3	3	2	1	1	2	-	-	-	-	-	-	3	1	-	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Highway Network Planning: Different modes of transportation, the role of highway transportation, classification, network patterns, planning surveys, preparation of plans, final report, master plan, evaluation by saturation system, 20-year road development plans, salient features, determination of road lengths, introduction to highway economics.

Highway Alignment and Geometric Design: Principles of highway alignment, requirements, controlling factors, engineering surveys, the importance of geometric design, design controls and criteria, cross-section elements, pavement surface characteristics, camber, carriageway, Krebs, road margins, formation, right of way, typical cross-sections, sight distance, stopping sight distance, overtaking sight distance, sight distance at intersections, design of horizontal alignment, super elevation, transition curves, design of vertical alignment, gradients, vertical curves.

Traffic Engineering Principles: Traffic characteristics; components of traffic stream: flow- speed-Density, measurement and analysis, q-k-v relationships, hourly design volume, the concept of EPCU, capacity, level of service, parking studies and road safety, types of intersections, and designs.

Pavement Materials and Mix Design: Types of pavement structures, functions of pavement component layers, materials used in pavements, basic soil properties relevant to pavement applications, properties of aggregate, blending of aggregates, tests on bitumen, grading of bitumen, bituminous mix design using Marshall method.

Design of Pavements: Stresses in flexible pavements: layered system concepts, stress solution for one, two, and three-layered systems, fundamental design concepts; variables considered in pavement design: axle types, standard and legal axle loads, ESWL, EWLF,

vehicle damage factor, ADT, AADT, growth factor, lane distribution factor, directional distribution factor, tire pressure, contact pressure, design life; design of flexible pavement using IRC method; stresses in rigid pavements: Westergaard's theory and assumptions, stresses due to curling, stresses and deflections due to loading, frictional stresses, design of joints; design of rigid pavement using IRC method.

Pavement Construction and Maintenance: Construction of subgrade, subbase, base layers, bituminous courses and MoRTH specifications, routine maintenance, periodic maintenance, special repairs, responsive maintenance program, reconstruction, and treatment strategies.

MACHINE LEARNING TECHNIQUES FOR CIVIL ENGINEERS

Subject Code – CIV402

Pre-Requisite(s): Probability & Statistics, Introduction to Computing, Foundation of Data Science

Course Objectives

- To understand the basics of machine learning and its need for Civil Engineering.
- To learn the concept of supervised learning, unsupervised learning with reinforcement learning.
- To be able to apply the techniques to build models for different applications in Civil Engineering.

Course Outcome

CO1: Understanding the basics of machine learning and its real-world applications.

CO2: Understanding the concept of supervised learning, unsupervised learning with reinforcement learning

CO3: Apply the techniques to build models for different applications in Civil Engineering.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2					1						1	
CO2	1	2	2					1						2	
CO3	2	3	3					2						3	

Syllabus

Unit 1

Introduction of Machine Learning (ML), Historical context, Necessities, ML in modern civil engineering, Real-world application examples. Recapitulation of linear regression, Logistic regression, Model evaluation

Unit 2

Adaline, Backpropagation, Neural Networks Learning, Learning rate, Unsupervised Learning, Clustering, Reinforcement Learning, Overview of DL

Applications: Density-based clustering Rainfall-runoff modelling, Soil strength prediction.

Unit 3

Supervised Learning, Decision Tree, Bayes Classifier, Bayesian Networks, k-Nearest Neighbour, Support Vector Machines and

Kernel Machines.

Applications: Soil Classification, Gap acceptance characteristics of traffic, Forecasting.

Text Book(s)

1. Kevin Murphy, Machine Learning: A probablistic perspective, MIT Press, 2012

2. Trevorhastie, Robert Tibshirani, Jerome Ffriedman, The Elements of Statistical Learning, Springer 2009 (freely available online)

Reference(s)

1. Murad, Yasmin, Husam, Abu Hajar and Iftikhar Azim, eds. Machine learning applications in Civil Engineering, Vol 16648714.Frontiers Media SA, 2022

THEORY OF STRUCTURES

Subject Code – CIV403

Pre-Requisites: Mechanics of MaterialsCourse

Outcomes:

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

CO1 Formulate Equilibrium and Compatibility equations for structural members

CO2 Analyze one dimensional indeterminate problems using classical methods

CO3 Analyze Indeterminate structures using energy methods

CO4 Analyze structures for gravity loads and moving loads

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	3	-	-	-	1	-	-	-	-	-	-	1	-
CO2	3	-	-	3	-	-	-	1	-	-	-	-	-	-	1	-
CO3	3	-	-	3	-	-	-	1	-	-	-	-	-	-	1	-
CO4	3	-	-	3	-	-	-	1	-	-	-	-	-	-	1	-

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus

Indeterminate beams: - Propped cantilever, Fixed and Continuous beams - Analysis for shear force and bending moment - Clapeyron's theorem of three moments - Slope and deflection - effect of sinking of supports.

Column Analogy Method: Application to fixed beams - Application to non-prismatic members - stiffness coefficients.

Slope - Deflection Method: Analysis and application to continuous beams - portal frames (single bay - Single storey).

Moment-Distribution Method: Analysis of continuous beams and portal frames (single storey - single bay).

Kani's method: Application to continuous beams and portal frames (Single Bay two storey)

Approximate methods of analysis: Portal method - Cantilever method – Substitute frame method

Moving Loads: Maximum bending moment and shear force diagrams for simply supported spans traversed by single point load - two concentrated loads - Uniformly distributed load, shorter and longer than the span - enveloping parabola and equivalent uniformly distributed load, determination of maximum bending moment and shear force for a system of concentratedloads on simply supported girders - focal length of a girder - counter bracing.

Influence Lines: Influence lines for reaction bending moment and shear force diagrams for simply supported beams - stresses in members of statically determinate pin jointed plane framesdue to moving loads.

GEOTECHNICAL ENGINEERING

Subject Code – CIV404

Pre-requisites: None

Course Outcomes:

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

CO1 Characterize and classify the soils.

CO2 Calculate the stress distribution and effective stress under various field conditions and estimate the consolidation settlements.

CO3 Select the suitable shear strength parameters for different field conditions and carryout the stability of slopes.

CO4 Determine the compaction parameters and exercise field compaction control. Understand the principles of compaction and its control.

CO5 Carryout the laboratory testing on soil samples to determine their index and engineering properties.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	3	-	-	-	1	-	-	-	-	1	3	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	2	-	-	-	-	2	2	-	-	1	3	-	-

1 - Slightly;2 - Moderately;3 Substantially

Syllabus:

Introduction: Soil formation- Development of soil mechanics- Importance of soil engineering- Major soil deposits of India.

Basic Definitions and Relationships: 3-phase soil system, Volumetric relationships and weight -volume relationships.

Determination of Index Properties: Water content, Specific gravity, Grain size distributionby sieve and hydrometer analysis, Relative density, Atterberg limits and indices.

Classification of Soils: Classification of soil systems – Particle size classification, Textural classification, AASHTO classification, Unified soil classification and Indian soil classification- Field identification of soils, Relative suitability of soils for engineering works based on soil classification.

Soil Water: Types of soil water, Capillarity in soils, Permeability of soils, Darcy's law,

Determination of permeability of soils, Permeability of stratified soils, Field permeability determination, Seepage velocity, Absolute coefficient of permeability, Factors affecting permeability- Effective stress principle- Effective stress under different field conditions- Seepage pressure-Quick sand condition.

Compaction of Soils: Definition and importance of compaction – Standard Proctor compaction test, Modified compaction test- Factors affecting compaction- Influence of compaction on soil properties – Field compaction and its control, Relative compaction.

Stress distribution in Soils: Importance of estimation of stresses in soils – Boussinesq's and Westergaard's theories for point loads, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along the vertical and horizontal planes – Newmark's influence chart, Contact pressure distribution in sands and clays.

Consolidation: Types of compressibility – Immediate settlement – Primary consolidation and secondary consolidation – Stress history of clay, Normally consolidated soil, Over consolidated soil and under consolidated soil- preconsolidation pressure and its determination- Consolidation test, Estimation of settlements -Terzaghi's 1-D consolidation theory – Coefficient of consolidation and its determination - Spring analogy.

Shear Strength: Definition and use of shear strength - Source of shear strength- Normal and Shear stresses on a plane – Mohr's stress circle- Mohr-Coulomb failure theory- Measurement of shear strength, Drainage conditions -Direct shear test, Triaxial shear test, Unconfined compression test and vane shear test – Factors affecting shear strength of granular soils and cohesive soils.

Stability of Soil Slopes: Types of slopes – Types of slope failures – Slip circle method, Determination of centre of most critical slip circle – Taylor's stability charts and their use. Stabilization of soil slopes.

BUILDING PLANNING, DRAWING ANDCONSTRUCTION

Subject Code – CIV405

Pre-requisites: None Course Outcomes:

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

CO1 Comprehend multiple factors to be considered in planning and construction of buildings

CO2 Identify various components of the building, their functionality, and construction techniques

CO3 Plan various service and safety requirements of the building, their functionality, and construction techniques

CO4 Create and draw the plan of different buildings in different views using computer aided graphic tools

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	-	-	3	3	2	-	2	2	2	2	-	1	2
CO2	1	1	2	-	-	3	2	-	-	2	1	1	1	1	1	1
CO3	1	1	2	-	-	3	2	-	-	2	2	2	1	1	2	2
CO4	1	1	2	-	2	3	2	2	2	2	2	2	2	-	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Functional planning of Buildings: Types of Buildings, Aspects and Principles of Building Planning, Building By-laws and Regulations, Site Selection criteria, Orientation of Building and its relation to surrounding environment, Sustainability and Green Buildings.

Components of Buildings: Foundation and its requirements, Soil characteristics, Construction of Foundation; Masonry construction and Materials used; Construction of Floors and Roofs; Functional requirements and planning of a stair case

Service and Safety requirements of Buildings: Damping causes, its effects, and Proofing techniques; Fire hazards, protection, and grading rules; Methods of thermal insulation and materials used.

TRANSPORTATION ENGINEERING LAB

Subject Code – CIV401P

A. Tests on Soil and Aggregate:

a. Atterberg limits, Proctor Tests, and California Bearing Ratio Test.

b. Aggregate Gradation, Shape Tests, Specific Gravity Test, and Water Absorption Test, Aggregate Impact Test, Aggregate Crushing Value Test, and Los Angeles Abrasion Test and

c. Introduction to Advanced types of equipment.

B. Field Tests:

a. Roughness using MERLIN and Pavement Layer Density using Sand ReplacementMethod.

C. Tests on Bitumen and Mixtures:

a. Penetration Test, Viscosity Test, Flash and Fire Point Tests, Ductility Test, Softening Point Test, Bituminous Mix Design using Marshall Stability Test, and Stripping Value of Aggregates.

D. Traffic Studies:

a. Traffic Volume Studies, Spot Speed Studies, Headway Studies and Parking Surveys.

Geotechnical Engineering Lab

Subject Code – CIV404P

1. Specific Gravity of soil particles.
2. Sieve Analysis.
3. Liquid Limit, Plastic Limit & Shrinkage Limit.
4. Proctor's Standard Compaction Test.
5. Determination of Field Density.
6. Constant Head Permeameter Test.
7. Variable Head Permeameter Test.
8. Unconfined Compression Test.
9. Triaxial Compression Test (U.U Test).
10. Consolidation Test.
11. Direct Shear Test.

BUILDING PLANNING, DRAWING ANDCONSTRUCTION Lab

Subject Code – CIV405P

- Planning a building according to the rules and requirementsDrawing the plan of the building
- Draw elevation and sectional views of the building
- Drawing various components of the building
- Bar bending schedule for steel and RCC
- Notations used in various civil engineering drawings