

Course Title	COMPLEX ANALYSIS, PROBABILITY AND SAMPLING THEORY	Semester	IV
Course Code	MVJ20MCV41	CIE	50
Total No. of Contact Hours	40 L : T : P :: 2 : 2 : 0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hours

Course Objective is to: The purpose of this course is to make students well conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering.

Module-1

L1,L2 & L3

8 Hours

Complex Variables-I: Review of a function of a complex variable, limits, continuity, and differentiability. Analytic functions-Cauchy-Riemann equations in Cartesian and polar forms. Properties and construction of analytic functions. Complex line integrals-Cauchy's theorem and Cauchy's integral theorem. Conformal transformations-Discussion of transformations: $w=z^2$, $w=e^z$, $w=z+(1/z)$ ($z \neq 0$)

Applications: It is useful in many branches of mathematics, including algebraic geometry, applied mathematics; including the branches of hydrodynamics, thermodynamics, and particularly quantum mechanics.

Module-2

L1,L2 & L3

8 Hours

Statistical Methods: Introduction, Correlation and coefficient of correlation, Regression, line of regression problems.

Curve Fitting: Curve fitting by the method of least squares- fitting of the curves of the form,

$$y = ax + b, y = ax^2 + bx + c \text{ and } y = ae^{bx}.$$

Applications: Correlation and Regression is used to see whether two variables are associated, without necessarily inferring a cause-and-effect relationship. Another important application is to estimate the value of one variable corresponding to a particular value of the other variable. Curve Fittings such as parabola and hyperbola are used in architecture to design arches in buildings.

Module-3

L1,L2 & L3

8 Hours

Probability Distributions: Random variables (discrete and continuous), probability mass/density functions. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems.

Applications: Few of the application areas include in industries, quality control, in errors correction, medicine, agriculture, engineering, for analysis and interpretations of basic

data obtained from experiments.		
Module-4		L1,L2 & L3
<p>8 Hours</p> <p>Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance.</p> <p>Stochastic Process: Probability vector, Stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability – problems.</p> <p>Applications: Stochastic processes are widely used as mathematical models of systems and phenomena that appear to vary in a random manner.</p>		
Module-5		L1,L2 & L3
<p>8 Hours</p> <p>Sampling Theory and Statistical Inference: Sampling, Sampling Distributions, Type I and Type II errors, standard error, Z – test, student’s t- distribution , test of hypothesis for means, test for hypothesis for proportions, confidence limits for means, Chi-square distribution as a test of goodness of fit.</p> <p>Applications: A large number of analyses for process control, product quality control for consumer safety, and environmental control purposes are using Sampling Theory..</p>		
Course outcomes:		
CO1	State and prove Cauchy - Riemann equation with its consequences and demonstrate Con-formal Transformation.	
CO2	Illustrate Complex Integration using Cauchy’s Integral theorem, Cauchy’s Integral formula and Cauchy’s Residue theorem.	
CO3	Use Method of Least Square for appropriate Curves. And Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data.	
CO4	Develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, information theory and design engineering	
CO5	Demonstrate testing of hypothesis of sampling distributions and illustrate examples related to discrete parameters.	
Text Books:		
1	B.S. Grewal, “Higher Engineering Mathematics” Khanna Publishers, 43 rd Edition 2013.	
2	Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley-India publishers, 10th edition,2014.	
Reference Books:		
1	Ramana B. V., “Higher Engineering Mathematics”, Tata Mc Graw-Hill, 2006.	
2	Bali N. P. & Manish Goyal, “A text book of Engineering Mathematics”, Laxmi	

	Publications, 8 th Edition
3	Jain R. K. & Iyengar S.R.K., Advanced Engineering Mathematics, Narosa Publishing House, 2002.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (10 marks)
- Assignments (10 Marks)

SEE Assessment:

- i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
- ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
- iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	3	0	0	0	0	0	0	0	1
CO2	3	3	0	3	0	0	0	0	0	0	0	1
CO3	3	2	0	1	0	0	0	0	0	0	0	1
CO4	3	3	0	3	0	0	0	0	0	0	0	1
CO5	2	3	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Course Title	ANALYSIS OF DETERMINATE STRUCTURES	Semester	IV
Course Code	MVJ20CV42	CIE	50
Total No. of Contact Hours	50 L : T : P :: 3: 2 :0	SEE	50
No. of Contact Hours/week	5	Total	100
Credits	4	Exam. Duration	3 Hrs.

Course objective is to:

- Analyze different forms of structural systems.
- Use concept of ILD and moving loads.
- Impart principles of elastic structural analysis and behaviour of determinate structures.
- Impart knowledge about various methods involved in the analysis of determinate structures.
- Apply the methods for analyzing the structures to evaluate the response of structures.

Module-1

L3, L4

10 Hrs.

Introduction: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic Indeterminacy of structural systems.

Analysis of Plane Trusses: Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.

Laboratory Sessions/ Experimental learning: (Self Study)

- Experiments on truss using Virtual labs
- Analysis of trusses by method of sections
- Formulation of Excel Sheet program for Method of joint to analyze simple truss

Applications: (Self Study)

- Behaviour of determinate structures.
- Determination of axial forces in truss.

Video link / Additional online information: (Self Study)

- <https://nptel.ac.in/courses/112103108/3>
- <https://nptel.ac.in/courses/105105108/33>
- <https://nptel.ac.in/courses/105105166/32>

Module-2

L3, L4

10 Hrs.

Influence Lines: Concepts of influence lines- ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses and numerical problems.

Moving Loads: Reactions, BM and SF in determinate beams, axial forces in determinate

trusses for rolling loads using ILD (Max. values and absolute max. values for beams subjected to multiple loads).

Laboratory Sessions/ Experimental learning: (Self Study)

- Computation of Loads using a model making
- Computation of Deflection for determinate beams using Excel Sheet

Applications: (Self Study)

- Calculation of Forces in Design of Bridges

Video link / Additional online information: (Self Study)

- <https://nptel.ac.in/courses/112103108/3>
- <https://nptel.ac.in/courses/105105108/33>
- <https://nptel.ac.in/courses/105105166/32>

Module-3	L3, L4	10 Hrs.
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Deflection of Beams: Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts. Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections

Laboratory Sessions/ Experimental learning: (Self Study) Using Virtual Lab,

- Single Span Beams Experiment
- Continuous Beams Experiment

Deflection check at different points

Applications: (Self Study)

- Knowledge on Behaviour of determinate structure

Video link / Additional online information: (Self Study)

- <https://nptel.ac.in/courses/112103108/3>
- <https://nptel.ac.in/courses/105105108/33>
- <https://nptel.ac.in/courses/105105166/32>

Module-4	L3, L4	10 Hrs.
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Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the point of application of single load, Castigliano's theorems and its application to estimate the deflections of trusses, bent frames, Special applications-Dummy unit load method.

Laboratory Sessions/ Experimental learning: (Self Study)

- Strain energy charts: for different materials
- Computation of Deflection for determinate beams using Excel Sheet

Applications: (Self Study)

- Knowledge about the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames.

Video link / Additional online information: (Self Study)

- <https://nptel.ac.in/courses/112103108/3>
- <https://nptel.ac.in/courses/105105108/33>
- <https://nptel.ac.in/courses/105105166/32>

Module-5	L3, L4	10 Hrs.
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Arches and Cable Structures: Three hinged parabolic and circular arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.

Laboratory Sessions/ Experimental learning: (Self Study)

- Computation of forces in Arches and Cables using Excel sheet.
- Analysis of problems using model making

Applications: (Self Study)

- Knowledge about the analysis of Arches and Cables.

Course outcomes: On completion of the course, students would be able to	
CO1	Calculate the member forces in trusses by method of joints and method of sections.
CO2	Restate the concept of Principle of Virtual Work
CO3	Describe the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames.
CO4	Determine the moment in determinate beams and frames having variable moment of inertia
CO5	Construct the shear force and bending moment in Arches and Cables.
CIE Assessment:	
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests	
- Quizzes/mini tests (10 marks)	

Assignments (10 Marks)	
SEE Assessment:	
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.	
ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.	
iii. One question must be set from each unit. The duration of examination is 3 hours.	
Textbooks:	
1.	Bhavikatti, Structural Analysis, VikasPublishing House Pvt. Ltd, New Delhi, 4 th edition, 2002.
2.	Reddy C S, "Basic Structural Analysis" , Tata McGraw-Hill Publishing CompanyLtd.,3 rd edition, 2010.

Reference Books:	
1.	L S Negi and R S Jangid, "Structural Analysis", Tata McGraw-Hill Publishing Company Ltd.,6 th edition,2004
2.	Muthu K U. etal, Basic Structural Analysis, 2 nd edition, IK International Pvt. Ltd., New Delhi, 2015.
3	Hibbeler R C, Structural Analysis, Prentice Hall, 6th edition (2005)
4.	Devadas Menon, Structural Analysis, Narosa Publishing House, New Delhi, 2 nd edition, 2008.
5.	Kenneth Leet, Chia-Ming Uang, Anne M. Gilbert, "Fundamentals of Structural Analysis", (2008)

CO-PO Mapping												
CO/P O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	1	1	-	1
CO2	3	3	-	1	-	-	-	-	1	1	-	1
CO3	3	3	-	1	-	-	-	-	1	1	-	1
CO4	3	3	1	2	1	-	-	-	1	1	-	1
CO5	3	3	1	2	1	-	-	-	1	1	-	1

High-3, Medium-2, Low-1

Course Title	APPLIED HYDRAULICS	Semester	IV
Course Code	MVJ20CV43	CIE	50
Total No. of Contact Hours	40 L : T : P :: 3 : 0 : 0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hrs.

Course objective is to:

- State the Principles of dimensional analysis and design hydraulic models.
- Design of open channels of different cross sections through concept of economical sections.
- Develop Water surface profiles at different bed slope condition using Energy concepts of fluid in open channel.
- Make student to Explain on working principles of the hydraulic machines and analyzing the performance of turbines under design condition.
- Gain the knowledge on working principles of Pumps

Module-1

L1, L2, L3

8 Hrs

Prerequisites: Knowledge on units and dimensions

Dimensional analysis: Dimensional analysis and similitude: Dimensional homogeneity, non-dimensional parameter (Online Mode), Rayleigh methods and Buckingham π theorem, dimensional analysis, choice of variables, examples on various applications.

Model analysis: Model analysis, similitude, types of similarities, force ratios, similarity laws, model classification (Online Mode), Reynolds model, Froude's model, Euler's Model, Weber's model, Mach model, scale effects, Distorted models. Numerical problems on Reynold's, and Froude's Model.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Model making and comparison between different classified models
- Formulation of Excel Sheet program for Reynold's and Frude's Model analysis

Applications: (Self Learning)

- Dynamic Characteristics of the System
- Design of alternative water resource design

Video link / Additional online information: (Self Learning)

- Hydraulics: <https://nptel.ac.in/courses/105103096/>
- Model Analysis: <https://nptel.ac.in/courses/105103021/>

Module-2	L1, L2, L3	8 Hrs
<p>Buoyancy and Floatation: Buoyancy, Force and Centre of Buoyancy, Metacenter and Metacentric height, Stability of submerged and floating bodies (Online Mode), Determination of Metacentric height, Experimental and theoretical method, Numerical problems.</p> <p>Open Channel Flow Hydraulics (Uniform Flow): Introduction, Classification of flow through channels (Online Mode), Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems.</p> <p>Laboratory Sessions/ Experimental learning: (Self Learning)</p> <ul style="list-style-type: none"> • Determination of Metacentric height to check the stability of partially submerged boat • Formulation of Excel Sheet program for Chezy's and Manning's method <p>Applications: (Self Learning)</p> <ul style="list-style-type: none"> • Stability Analysis of Submarine • Arrive the optimum weight of Hot-Air Balloon • Measure Relative density by Hydrometer <p>Video link / Additional online information: (Self Learning)</p> <ul style="list-style-type: none"> • Buoyancy, Metacenter, Stability and Rigid body motion: https://nptel.ac.in/courses/105103192/ • Open Channel Flow: https://nptel.ac.in/courses/105107059/ 		
Module-3	L1, L2, L3	8 Hrs.
<p>Open Channel Flow Hydraulics (Non-Uniform Flow): Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Metering flumes (Online Mode), Numerical Problems. Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems. Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems.</p> <p>Laboratory Sessions/ Experimental learning: (Self Learning)</p> <ul style="list-style-type: none"> • Computation of Gradually Varied Flow profiles for a given slope pattern • Model Making of Hydraulic Jump under different Froude Number • Calculation of Critical depth and energy using Excel sheet 		

Applications: (Self Learning)

- Flow Measuring into a reservoir
- Hydraulic Critical Zones

Video link / Additional online information: (Self Learning)

- Open Channel Flow: <https://nptel.ac.in/courses/105107059/>
- Free Surface flow: <https://nptel.ac.in/courses/105106114/>

Module-4

L3

8 Hrs.

Hydraulic Machines:

Introduction, Impulse-Momentum equation. Direct impact of a jet on stationary and moving curved vanes (Online Mode), Introduction to concept of velocity triangles, impact of jet on a series of curved vanes- Problems.

Turbines – Impulse Turbines:

Introduction to turbines, General lay out of a hydro-electric plant, Heads and Efficiencies, classification of turbines (Online Mode). Pelton wheel-components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Determination of impact force on a curved vane by jet of water (APPLIED HYDRAULICS LABORATORY_MVJ19CVL47_Expt. No. 7)
- Model making of hydro-electric power plant in Indira Sagar Dam
- Formulation of Excel Sheet program for performance analysis

of turbine Applications: (Self Learning)

- Flow through bend pipes
- Jet Propulsion and propellers
- Hydraulic Jump in open channel

Video link / Additional online information: (Self Learning)

- Momentum Equation: <https://nptel.ac.in/courses/112105269/>
- Power Plant Engineering: <https://nptel.ac.in/courses/112107291/>

Module-5

L3

8 Hrs.

Reaction Turbines: Radial flow reaction turbines: Francis turbine- Descriptions, working proportions and design (Online Mode), Numerical problems. Kaplan turbine- Descriptions, working proportions and design, Numerical problems. Draft tube theory and unit quantities. (No problems)

Centrifugal pumps: Components and Working of centrifugal pumps, Types of centrifugal pumps (Online Mode), Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, multi-stage pumps.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Development of Operational Curves for Single Stage Centrifugal Pump (APPLIED HYDRAULICS LABORATORY_MVJ19CVL47_Expt. No. 9)
- Development of Operational Curves for Impulse and Reaction Turbines (APPLIED HYDRAULICS LABORATORY_MVJ19CVL47_Expt. No. 10 & 13)
- Formulation of Excel Sheet program for performance analysis of

centrifugal pump Applications: (Self Learning)

- Power Plant to generate electricity
- Wastewater Processing Plants
- Fire protection Sprinkler System

Video link / Additional online information: (Self Learning)

- Turbines: <https://nptel.ac.in/courses/112104117/>
- Pumps: <https://nptel.ac.in/courses/112105206/>

Course outcomes: On completion of the course, students would be able to

CO1	Create mathematical model of hydraulics variables using dimensional analysis
CO2	Analyze the relationship between dependent and independent model parameters
CO3	Apply the Energy concepts to compute the flow in open channel sections
CO4	Draw the water surface profiles at different bed slope conditions
CO5	Design turbines for the given data with their operation characteristics

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (10 marks)
- Assignments (10 Marks)

SEE Assessment:

- Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
- Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
- One question must be set from each unit. The duration of examination is 3 hours.

Textbooks:

1.	P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi.
2.	R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2010

Reference Books:

1	S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi. 2006
2.	J.B. Evett, and C. Liu, "Fluid Mechanics and Hydraulics", McGraw-Hill Book Company.- 2009.
3.	K Subramanya, "Flow in Open Channels", McGraw Hill Publishing Co. Ltd. 4 th Edition 2015.
4.	Jagdish Lal , "Hydraulic Machines (Including Fluidics)", Metropolitan Book Co Pvt Ltd, 1994

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	BASIC GEOTECHNICAL ENGINEERING	Semester	IV
Course Code	MVJ20CV44	CIE	50
Total No. of Contact Hours	40 L : T : P :: 3 : 0 : 0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hrs.

Course objective is to:

- Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering.
- Determine the improvement in mechanical behavior by densification of soil deposits using compaction.
- Familiar broadly with geotechnical engineering problems such as, foundation engineering, flow of water through soil medium and terminologies associated with geotechnical engineering.
- Know the basic engineering properties and the mechanical behavior of different types of soil. This includes strength-deformation characteristics under shearing stresses. Also, consolidation properties of clayey soils.

Module-1

L3

08 Hrs.

Prerequisite: Integration and Differentiation

Introduction: Introduction, origin and formation of soil, Phase Diagram, phase relationships, definitions and their inter relationships (Online Mode). Determination of Index Properties-Specific gravity, water content, in-situ density and particle size analysis (sieve and sedimentation analysis) Atterberg's Limits, consistency indices, relative density, BIS soil classification, Plasticity Chart.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Determination of Index properties of soil sample
- Solution to problems on three phase system using EXCEL

Video link: (Self Learning)

- <https://nptel.ac.in/courses/105101201/>

Module-2

L3

08 Hrs.

Soil Structure and Clay Mineralogy: Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Common clay minerals in soil and their structures Kaolinite, Illite and Montmorillonite

Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control (Online Mode) - Compactive effort & method of

compaction, Proctor's needle, Compacting equipment and their suitability.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Standard and Modified Proctor test
- Solution to problems on Permeability and compaction of soils using Excel

software. **Applications: (Self Learning)**

- Model Making of Compacting equipment.

Video link: (Self Learning) :

<https://nptel.ac.in/courses/105101201>

Module-3	L3	08 Hrs.
<p>Flow through Soils: Darcy's law- assumption and validity, Coefficient of permeability (Online Mode) and its determination (laboratory method only), factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and Coefficient of percolation.</p> <p>Seepage Analysis: Laplace equation, assumptions, limitations and its derivation. Flow nets- characteristics and applications (Online Mode). Flow nets for sheet piles, dam section., phreatic line (Casagrande's method –with toe filter only),</p> <p>Effective Stress Analysis: Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress (Online Mode), quick sand phenomena.</p> <p>Laboratory Sessions: (Self Learning)</p> <ul style="list-style-type: none"> • Case study on Flow net by making a working model • Drawing Flow net using software's like SEEP2D. <p>Applications: (Self Learning)</p> <ul style="list-style-type: none"> • Earthen dam • Sheet pile <p>Video link: (Self Learning)</p> <ul style="list-style-type: none"> • https://nptel.ac.in/courses/105101201/ 		
Module-4	L3	08 Hrs.
<p>Consolidation of Soil: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory - assumption and limitations (Online Mode). Governing differential Equation Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils. Consolidation characteristics of soil (C_c, a_v, m_v and C_v. Laboratory one dimensional consolidation test, characteristics of e-log (σ') curve, Primary and secondary consolidation.</p> <p>Determination of consolidation characteristics of soils compression index (Online Mode) and coefficient of consolidation (square root of time fitting method, logarithmic time fitting method).</p>		

Laboratory Sessions/ Experimental learning: (Self Learning)

- One dimensional consolidation test
- Determination of Consolidation characteristics of soil using Excel software

Applications: (Self Learning)

- Foundation settlement

Video link: (Self Learning)

- <https://nptel.ac.in/courses/105101201/>

Module-5

L3

08 Hrs.

Shear Strength of Soil: Concept of shear strength, Mohr–Coulomb Failure Criterion, Concept of pore pressure, Total and effective shear strength parameters, factors affecting shear strength of soils (Online Mode). Thixotropy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, Triaxial compression test and field Vane shear test, Classification of shear tests based on drainage conditions.

Laboratory Sessions: (Self Learning)

- Shear parameters of soil

Video link: (Self Learning)

- <https://nptel.ac.in/courses/105101201/>

Course outcomes: On completion of the course, students would be able to

CO1	Acquire an understanding of the procedures to determine index properties of any type of soil, classify the soil based on its index properties
CO2	Determine compaction characteristics of soil and apply that knowledge to assess field compaction procedures
CO3	Determine permeability property of soils and acquires conceptual knowledge about stresses due to seepage and effective stress; Also acquire ability to estimate seepage losses across hydraulic structures.
CO4	Solve practical problems related to estimation of consolidation settlement of soil deposits also time required for the same.
CO5	Estimate shear strength parameters of different types of soils using the data of different shear tests and comprehend Mohr-Coulomb failure theory.

CIE Assessment:

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marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (10 marks)
- Assignments (10 Marks)

SEE Assessment:

- i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
- ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
- iii. One question must be set from each unit. The duration of examination is 3 hours.

Text Books:

1.	Punmia B C, Soil Mechanics and Foundation Engineering- (2012), Laxmi Publications.
2.	Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics- (2000), New Age International (P) Ltd., Newe Delhi.

Reference Books:

1.	Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering- (1996), 4 th Edition, UBS Publishers and Distributors, New Delhi.
2.	Braja, M. Das, Geotechnical Engineering; (2002), Fifth Edition, Thomson Business Information India (P) Ltd., India
3.	Narasimha Rao A. V. & Venkatrahmaiah C, Numerical Problems, Examples and objective questions in Geotechnical Engineering-. (2000), Universities Press., Hyderabad.

CO-PO Mapping

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CO1	3	2	3	2	-	-	-	1	1	-	1	1
CO2	2	2	1	2	2	-	-	1	1	1	1	1
CO3	2	2	1	1	2	-	1	1	1	-	1	1
CO4	2	3	1	1	-	-	-	-	-	-	1	1
CO5	3	3	2	1	2	-	-	1	1	1	1	1

High-3, Medium-2, Low-1

Course Title	ENGINEERING GEOLOGY & LABORATORY	Semester	IV
Course Code	MVJ20CV45	CIE	50
Total No. of Contact Hours	40 L : T : P :: 2 : 0 : 2	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hrs

Course objective is to:

- To understand the internal structure and composition of the earth and learn about geo-morphological agents such as river, wind, sea waves, and their implications in implementing civil engineering projects by the application of Topographic maps, remote sensing and GIS
- To comprehend the properties, occurrence, uses of minerals and rocks in various industries
- To gain knowledge about the structures of the rocks and their considerations in the selection of site for dams, tunnels, bridges and highways

Module-1

L1, L2, L3

15 Hrs.

Prerequisites: Basic knowledge on geography & Remote sensing techniques

Introduction to Geology, Geomorphology and Seismology:

Introduction: Geology in civil engineering, branches of geology; Understanding the earth, internal structure and composition and Introduction to Plate tectonics

Landforms – Classification, Rock weathering, types and its effects on Civil Engineering Projects. Study of Geo-morphological aspects in the selection of sites for Dams, Reservoirs, Tunnels, Highways and Bridges; Watershed management, Floods and their control, River valley, Drainage pattern – parameters and development; Coastlines and their engineering considerations.

Earthquake – Causes and Effects, Seismic waves, Engineering problems related to Earthquakes, Earthquake intensity, Richter Scale, Seismograph, Seismic zones- World and India, Tsunami – causes and effects. Early warning system. Reservoir Induced Seismicity; Landslides – causes and their control.

Laboratory Sessions:

Following Experiments are to be carried out for identification of suitable site selection for civil engineering structures

- Interpretation of Toposheets for Civil Engineering Projects
- Interpretation of geological maps Civil Engineering Projects

- Electrical resistivity curves drawing and its interpretation for Geotechnical and Aquifer investigations.

Module-2

L1, L2, L3 & L5

15 Hrs.

Mineralogy and Petrology:

Prerequisites: Physiographical divisions & mineral wealth of India

Minerals: Properties that affect the strength of minerals. Physical properties and chemical

composition of following minerals - **Quartz, Feldspars** (orthoclase and plagioclase), **Micas** (biotite and muscovite), **Amphibole** (hornblende), **Pyroxene** (augite and hypersthene), **Gypsum, Calcite, Clay minerals** (kaolinite) and their chemical formulae.

Introduction to petrology: Rock Cycle, broad classification of rocks. **Igneous Petrology:** Plutonic, Hypabyssal and Volcanic rocks, Structure, Texture and Classification of Igneous rocks. Study of common rock types prescribed in practical work and their engineering applications. **Sedimentary Petrology:** Rock weathering, Genetic classification of secondary rocks and grain size classification and Textures, Sedimentary Structures, Diagenesis Process. Study of common rock types prescribed in practical work and their engineering applications. **Metamorphic Petrology:** Agents, Types of metamorphism, Texture and structures. Study of common rock types prescribed in practical work and their engineering applications.

Laboratory Sessions:

Following Experiments are to be carried out under Digital Image Processing

- Identification of physical properties - Quartz group of minerals
- Identification of physical properties – Feldspar group of minerals
- Identification of physical properties – Mica group of minerals
- Identification of physical properties – Carbonate group of minerals
- Identification of physical properties – Economic minerals
- Identification of Important rock types – Igneous rocks
- Identification of Important rock types – Metamorphic rocks
- Identification of Important rock types – Sedimentary rocks

Module-3

L1, L2, L3 & L5

10 Hrs.

Structural and Engineering Geology:

Prerequisites: Formation, classification of minerals and rocks

Outcrop, stratification, dip and strike relation, Unconformity, joints their types and genesis Faults and folds with their types and causes, Engineering consideration of joints, folds and faults

Geotechnical investigations for civil engineering projects: Study of toposheets and geological maps, importance of lithological and structural features studies for the

construction of Dams, Reservoirs, Tunnels, Bridges and Highways

Laboratory Sessions:

Following Experimental Studies are performed

- Calculation of Vertical, True thickness and width of the outcrops
- Dip and Strike problems: Determination of dip and strike direction in Civil Engineering projects (Railway lines, tunnels, dams, reservoirs) – graphical or any other method.
- Geological cross section and study of geological map

Course outcomes: On completion of the course, students would be able to

CO1	Students will able to apply the knowledge of geology and its role in Civil Engineering
CO2	The students will know the significance of geological investigations for civil engineering projects and site selection as well as for the preparation of feasibility reports and others
CO3	Students will effectively utilize earth's materials such as mineral, rocks and water in civil engineering practices
CO4	Assess various structural features and geological tools in ground water exploration, Natural resource estimation and solving civil engineering problems
CO5	Apply and asses use of building materials in construction and assess their properties

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (10 marks)

Assignments (10 Marks)

SEE Assessment:

- Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
- Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
- One question must be set from each unit. The duration of examination is 3 hours.

Text Books:	
1.	P.K. Mukerjee, "A Text Book of Geology", World Press Pvt., Ltd. Kolkatta.
2.	Parbin Singh, "Text Book of Engineering and General Geology", Published by S.K.Kataria and Sons, New Dehli

Reference Books:	
1.	D. Venkata Reddy, "Engineering Geology", New Age International Publications, New Delhi
2.	S.K Duggal, H.K Pandey and N Rawal, "Engineering Geology", McGraw Hill Education (India) Pvt, Ltd. New Delhi.
3.	M.P Billings, "Structural Geology", CBS Publishers and Distributors, New Delhi.

Web Link and Video Lectures:	
1.	http://nptel.iitm.ac.in/video.php?subjectId=105105106
2.	http://nptel.iitm.ac.in/courses.php?branch=Civil
3.	http://nptel.iitm.ac.in/video.php?courseId=1055&p=1
4.	http://nptel.iitm.ac.in/video.php?courseId=1055&p=3
5.	http://nptel.iitm.ac.in/video.php?courseId=1055&p=4

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	2	1	1	1	-	2	-	1	1
CO2	1	2	1	2	2	1	1	-	2	-	2	2
CO3	2	2	2	2	1	1	1	-	2	-	2	2
CO4	2	2	2	2	-	1	1	-	2	-	2	2
CO5	2	2	2	2	2	1	1	-	2	-	2	3

High-3, Medium-2, Low-1

Course Title	CONCRETE TECHNOLOGY	Semester	IV
Course Code	MVJ20CV46	CIE	50
Total No. of Contact Hours	40 L : T : P :: 3 : 0 : 0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	3	Exam. Duration	3 Hrs.

Course objective is to:

- Recognize the importance of material characteristics and their contributions to strength development in Concrete
- Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
- Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

Module-1

L3

08 Hrs.

Cement – Cement manufacturing process flow chart, steps to reduce carbon footprint, chemical composition and their importance (Online Mode), hydration of cement, Effect of heat of hydration during mass concreting at project sites, Testing of cement.

Fine aggregate: Functions, requirement (Online Mode), alternatives to River sand, M-sand introduction and manufacturing.

Coarse aggregate: Importance of size, shape and texture (Online Mode). Grading and blending of aggregate. Recycled aggregates. Water – qualities of water.

Chemical admixtures – plasticizers, superplasticizers, accelerators, retarders and air entraining agents.

Mineral admixtures – Fly ash, GGBS, silica fumes, Metakaolin and rice husk ash.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Conduct field tests on cement.
- Conduct soundness test on cement.
- Determine zone of fine aggregate (CONCRETE TECHNOLOGY LABORATORY_MVJ19CVL48_Expt. No. 2d)
- Determine flakiness index and elongation index of aggregate.
- Classify aggregates according to shapes.

Applications: (Self Learning)

- Assess quality of materials for using in concrete

Video link / Additional online information: (Self Learning)		
<ul style="list-style-type: none"> • https://nptel.ac.in/courses/105/102/105102012/ • https://nptel.ac.in/courses/105104030/ 		
Module-2	L3	08 Hrs.
<p>Workability–factors affecting workability (Online Mode). Measurement of workability– slump, Compaction factor, Vee-Bee Consistometer tests and flow tests. Segregation and bleeding.</p> <p>Process of manufacturing of concrete– Batching, Mixing, Transporting, Placing and Compaction (Online Mode). Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete.</p> <p>Applications: (Self Learning)</p> <ul style="list-style-type: none"> • Assess quality of fresh concrete before laying (CONCRETE TECHNOLOGY LABORATORY_MVJ19CVL48_Expt. No. 4a(ii)) <p>Video link / Additional online information: (Self Learning)</p> <ul style="list-style-type: none"> • https://nptel.ac.in/courses/105/102/105102012/ • https://nptel.ac.in/courses/105104030/ 		
Module-3	L3	08 Hrs.
<p>Concept of Mix Design with and without admixtures, Selection criteria of ingredients used for mix design (Online Mode), Procedure of mix proportioning using IS10262 and current American (ACI)/ British (BS) methods. Numerical Examples of Mix Proportioning using IS-10262.</p> <p>Laboratory Sessions/ Experimental learning: (Self Learning)</p> <ul style="list-style-type: none"> • Create excel sheet for mix design <p>Applications: (Self Learning)</p> <ul style="list-style-type: none"> • Design concrete mix of required strength. <p>Video link / Additional online information: (Self Learning)</p> <ul style="list-style-type: none"> • https://nptel.ac.in/courses/105/102/105102012/ • https://nptel.ac.in/courses/105104030/ • https://nptel.ac.in/courses/105106176/ 		
Module-4	L3	08 Hrs.
<p>Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –factors affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage (Online Mode).</p>		

Definition and significance of durability.

Internal and external factors influencing durability, Thermal conductivity, thermal diffusivity, specific heat. Alkali Aggregate Reaction, Mechanisms- Sulphate attack – chloride attack, carbonation, efflorescence, freezing and thawing. Corrosion, Durability requirements as per IS-456.

Laboratory Sessions/ Experimental learning: (Self Learning)

- Create excel sheet for durability

study Applications: (Self Learning)

- Design concrete mix of required strength.

Video link / Additional online information: (Self Learning)

- <https://nptel.ac.in/courses/105/102/105102012/>
- <https://nptel.ac.in/courses/105104030/>
- <https://nptel.ac.in/courses/105106176/>

Module-5

L3

08 Hrs.

RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages, quality control (Online Mode), Self Compacting concrete – concept, materials, tests, properties, application, typical mix and quality control. Fiber reinforced concrete - Fibers types, properties, application of FRC.

Light weight concrete - material properties and types. Typical light weight concrete mix and applications. (Online Mode)

In-situ testing of concrete- penetration and pull out test. Rebound hammer test, ultrasonic pulse velocity, core extraction- principal, application and limitations.

Laboratory Sessions/ Experimental learning: (Self Learning)

- RMC site visit and preparing

layout. Applications: (Self Learning)

- Design special concrete.

Video link / Additional online information: (Self Learning)

- <https://nptel.ac.in/courses/105/102/105102012/>
- <https://nptel.ac.in/courses/105104030/>

Course outcomes: On completion of the course, students would be able to

CO1	Select suitable materials for making concrete
CO2	Distinguish concrete behaviour based on its fresh and hardened properties.
CO3	Illustrate proportioning of different types of concrete mixes for required fresh and

	hardened properties using professional codes.
CO4	Measure workability and strength of concrete for using in real time structures.
CO5	Evaluate the strength of existing structures using nondestructive tests.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests <ul style="list-style-type: none"> - Quizzes/mini tests (10 marks) - Assignments (10 Marks)
SEE Assessment:
<ul style="list-style-type: none"> i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

Text Books:	
1.	M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
2.	M L Gambir, "Concrete Technology", McGraw Hill Education, 2014.
Reference Books:	
1.	Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014
2.	Neville A.M. "Properties of Concrete"-4th Ed., Long man.
3.	A.R. Santha Kumar, "Concrete Technology", Oxford University Press, New Delhi (New Edition)

CO-PO Mapping												
CO/P O	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	2	-	-	-
CO2	3	2	-	-	-	-	-	-	2	-	-	-
CO3	3	2	-	-	-	-	-	-	2	-	-	-
CO4	3	2	2	-	-	-	-	-	2	1	-	-
CO5	3	2	2	2	-	-	-	-	2	1	-	-

High-3, Medium-2, Low-1

Course Title	APPLIED HYDRAULICS LABORATORY	Semester	IV
Course Code	MVJ20CVL47	CIE	50
Total No. of Contact Hours	L : T : P :: 0 : 2 : 2	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	2	Exam. Duration	3 Hrs

Course objective is to:

- Demonstrate the Bernoulli's theorem and applications
- Measure the open channel flow using notches and weirs
- Determine the head losses in pipelines
- Calculate the efficiency of the pumps
- Compare the performance of the Pelton wheel, Francis and Kaplan Turbine

Prerequisites: Bernoulli's theorem, Discharge of the flow, Volumetric method for calculating the flow discharge, Pressure, Working principle of Pump and Turbine.

S.NO	Experiments	L3,L4
1	Calibration of Venturi meter (FLUID MECHANICS_MVJ19CV33_Module 1&3)	
2	Calibration of rectangular and triangular notches. (FLUID MECHANICS_MVJ19CV33_Module 4)	
3	Determination of Friction Factor of the Pipe Materials (Major losses). (FLUID MECHANICS_MVJ19CV33_Module 1)	
4	Determination of head losses for different pipe fittings (Minor losses: Sudden Enlargement, Bends and Contraction Only). (FLUID MECHANICS_MVJ19CV33_Module 1)	
5	Measurement of Flow through Orifice (FLUID MECHANICS_MVJ19CV33_Module 4)	
6	Calibration of Ogee and Broad crested weir	
7	Experimental determination of force exerted by a jet on flat and curved plates (APPLIED HYDRAULICS_MVJ19CV43_Module 4)	
8	Determination of Cd for Venturi flume	
9	Performance characteristics of centrifugal pump. (APPLIED HYDRAULICS_MVJ19CV43_Module 5)	
10	Performance characteristics of Pelton wheel. (APPLIED HYDRAULICS_MVJ19CV43_Module 5)	

11	Performance characteristics of Francis turbine.
12	Demo experiment on Verification of Bernoulli's theorem
13	Demo experiment on Performance characteristics of Kaplan turbine (APPLIED HYDRAULICS_MVJ19CV43_Module 5)
14	Demo experiment on Multistage centrifugal pump, Metacentric height Apparatus (APPLIED HYDRAULICS_MVJ19CV43_Module 2)
Video link / Additional online information:	
<ul style="list-style-type: none"> • http://eerc03-iith.vlabs.ac.in/List%20of%20experiments.html?domain=Civil%20Engineering • http://fm-nitk.vlabs.ac.in/ 	
Course outcomes: On completion of the course, students would be able to	
CO 1	Verify the Bernoulli's Theorem
CO 2	Calibrate the flow measuring devices, Determine the losses for different pipes and fittings Verify the Bernoulli's Theorem
CO 3	Measure the flow through pipe and open channel
CO 4	Calculate and draw the characteristic curves of the Hydraulic Machines

Scheme of Evaluation

Regular Lab work and Writing Lab records	(20+15) = 35 marks
Lab test and Viva-voce at the end of the semester	(10+5) = 15 marks
Total	50 marks

Textbooks:

1. Modi, P.N & Seth, S.M Hydraulics and Fluid Mechanics' Standard Book House- New Delhi, 2009 Edition

Reference Books:

1. Sarbjit Singh, Experiments in Fluid Mechanics - PHI Pvt. Ltd.- New Delhi, 2009
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press, 2015

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	CONCRETE TECHNOLOGY LABORATORY	Semester	IV
Course Code	MVJ20CVL48	CIE	50
Total No. of Contact Hours	L : T : P :: 0 : 2 : 2	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	2	Exam. Duration	3 Hrs

Course objectives is to:

- Assess quality and suitability of materials used for making concrete.
- Proportion ingredients of Concrete.
- Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

S.NO	Experiments	L3, L4
1	Tests on Cement: a. Determination of Normal Consistency of Cement b. Determination of Setting time of Cement c. Estimation of Compressive strength of Cement d. Determination of fineness of Cement e. Determination of specific gravity of Cement	
2	Tests on Fine aggregate: a. Determination of Moisture content of fine aggregate b. Determination of Specific gravity of fine aggregate c. Determination of Bulk density of fine aggregate d. Determination of Sieve analysis of fine aggregate (CONCRETE TECHNOLOGY_MVJ19CV46_Module 1) e. Determination of Bulking of fine aggregate	
3	Tests on Coarse aggregate: a. Determination of Absorption of Coarse aggregate b. Determination of Moisture content of Coarse aggregate c. Determination of specific gravity of Coarse aggregate d. Determination of Bulk density of Coarse aggregate e. Determination of Sieve analysis of Coarse aggregate	

4	<p>Tests on Concrete:</p> <p>a. Tests on fresh concrete:</p> <p>i. Determination of Slump of fresh concrete (CONCRETE TECHNOLOGY_MVJ19CV46_Module 2)</p> <p>ii. Determination of compaction factor of fresh concrete</p> <p>iii. Determination of consistency of fresh concrete by Vee Bee test</p>
	<p>b. Tests on hardened concrete:</p> <p>i. Determination of compressive strength of hardened concrete</p> <p>ii. Determination of split tensile strength of hardened concrete</p> <p>iii. Determination of flexural strength of hardened concrete</p> <p>c. NDT tests</p> <p>i. Estimation of elastic property of concrete by Re bound hammer test</p> <p>ii. Evaluate the quality and homogeneity of concrete by pulse velocity test</p>
5	<p>Tests on Self Compacting Concrete:</p> <p>a. Design of self-compacting concrete as per IS 10262:2019</p> <p>b. Conducting slump flow test to determine the workability of self-compacting concrete</p> <p>c. Conducting V-funnel test to determine the flow time of self-compacting concrete</p> <p>d. Conducting J-Ring test to determine the passing ability of self-compacting concrete</p> <p>e. Conducting U Box test to determine the filling ability of self-compacting concrete</p> <p>f. Conducting L Box test to determine the filling and passing ability of self-compacting concrete</p>
<p>Video link / Additional online information:</p> <ul style="list-style-type: none"> • https://nptel.ac.in/courses/105102012/ • https://nptel.ac.in/courses/105104030/ • https://nptel.ac.in/courses/105106176/ 	
<p>Course outcomes: On completion of the course, students would be able to</p>	
CO 1	Assess quality of materials used for making concrete
CO 2	Distinguish concrete behavior based on its fresh properties.
CO 3	Determine strength and quality of concrete
CO 4	Evaluate the strength of structural elements using nondestructive tests.
CO 5	Design appropriate concrete mix

Textbooks:	
1.	M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi. 2010
2.	M L Gambir, "Concrete Technology", McGraw Hill Education, 2014.

Reference Books:	
1.	Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014
2	Neville A.M. "Properties of Concrete"-4th Ed., Long man.2010
3	A.R. Santha Kumar, "Concrete Technology", Oxford University Press, New Delhi (New Edition), 2009
4	IS456:2000, IS10262:2009

Scheme of Evaluation

Regular Lab work and Writing Lab records	(20+15) = 35 marks
Lab test and Viva-voce at the end of the semester	(10+5) = 15 marks
Total	50 marks

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	1	-	-	2	-	-	-
CO2	3	2	-	-	-	1	-	-	2	-	-	-
CO3	3	2	-	-	-	1	-	-	2	-	-	-
CO4	3	2	2	-	2	1	-	-	2	1	-	-
CO5	3	2	2	2	-	1	-	-	2	1	-	-

High-3, Medium-2, Low-1

Course Title	CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW	Semester	IV
Course Code	MVJ20CPH49	CIE	50
Total No. of Contact Hours	15 L : T : P :: 1 : 0 : 0	SEE	50
No. of Contact Hours/week	1	Total	100
Credits	1	Exam. Duration	2 hrs

Course objective is :

- To know the fundamental political codes, structure, procedures, powers, and duties of Indian constitution, Indian government institutions, fundamental rights, directive principles and the duties of the citizens.
- To provide overall legal literacy to the young technocrats to manage complex societal issues in the present scenario.
- To understand engineering ethics & their responsibilities, identify their individual roles and ethical responsibilities towards society.

Module-1

L1,L2,L3

3 Hrs

Introduction to Indian Constitution

The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian Constitution, The Making of the Constitution, The role of the Constituent Assembly – Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and Limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and Significance in Nation Building.

Module – 2

L1,L2,L3

3 Hrs

Union Executive and State Executive

Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Article 370, 371, 371J) for some States.

Module – 3

L1,L2,L3

3 Hrs

Elections, Amendments and Emergency Provisions

Elections, Electoral Process, and Election Commission of India, Election Laws.

<p>Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44,61,73,74,75,86, and 91,94,95,100,101,118 and some important Case Studies. Recent Amendments with explanation. Important Judgements with Explanation and its impact on society (from the list of Supreme Court Judgements).</p> <p>Emergency Provisions, types of Emergencies and it's consequences.</p> <p>Constitutional Special Provisions: Special Constitutional Provisions for SC & ST, OBC, Special Provision for Women, Children & Backward Classes.</p>		
Module – 4	L1,L2,L3	3 Hrs
<p>Professional / Engineering Ethics Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India) : Profession, Professionalism, Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering - Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.</p>		
Module – 5	L1,L2,L3	3 Hrs
<p>Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship, Cybercrimes and enforcement agencies.</p>		

Scheme of valuation:		
Details		
Average of three Internal Assessment (IA) tests of 40 Marks each i.e., $\Sigma(\text{Marks obtained in each test})/3$	CIE (50)	40
Assignment / Case Studies / Quiz		10
Semester End Examination	SEE (50)	50
Total		100

Course Outcomes: On completion of this course, students will be able to	
CO1	Have constitutional knowledge and legal literacy
CO2	Understand Engineering and Professional ethics and responsibilities of Engineers.
CO3	Understand the cyber crimes and cyber laws for cyber safety measure.

Text Books:	
1.	Constitution of India and Professional Ethics, T.S. Anupama, Sunstar Publisher
Reference Books:	
1.	Durga Das Basu (DD Basu): "Introduction to the Constitution on India", (Students Edition.) Prentice –Hall EEE, 19 th /20 th Edn., (Latest Edition) or 2008.
2.	Shubham Singles, Charles E. Haries, and Et al : "Constitution of India and Professional Ethics" by Cengage Learning India Private Limited, Latest Edition – 2018.
3	M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice – Hall of India Pvt. Ltd. New Delhi, 2004.
4.	M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
5.	Latest Publications of NHRC - Indian Institute of Human Rights, New Delhi.

.CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	-	-	1	2	-
CO2	-	-	-	-	-	2	2	-	-	1	2	-
CO3	-	-	-	-	-	2	2	-	-	1	2	-

High-3, Medium-2, Low-1

Course Title	ADDITIONAL MATHEMATICS-II (Common to all branches)	Semester	IV
Course Code	MVJ20MATDIP41	CIE	50
Total No. of Contact Hours	40 L:T:P : : 2: 1 :0	SEE	50
No. of Contact Hours/week	3	Total	100
Credits	-	Exam. Duration	3 Hours

Course objective is to: This course viz., aims to prepare the students:

- To familiarize the important and basic concepts of Differential calculus and Differential Equation, ordinary/partial differential equations and Vector calculus and analyse the engineering problems.

Module-1	L1,L2	8Hrs.
<p>Linear Algebra: Introduction, Rank of a matrix-echelon form. Solution of system of linear equations – consistency. Gauss-elimination method and problems. Eigen values and Eigen vectors of square matrix and Problems.</p> <p>Video Link:</p> <ul style="list-style-type: none"> • https://www.math.ust.hk/~machas/matrix-algebra-for-engineers.pdf • https://nptel.ac.in/content/storage2/courses/122104018/node18.html 		
Module-2	L1,L2	8 Hrs.
<p>Differential calculus: Tangent and normal, sub tangent and subnormal both Cartesian and polar forms. Increasing and decreasing functions, Maxima and Minima for a function of one variable. Point of inflections and Problems</p> <p>Beta and Gamma functions: Beta functions, Properties of Beta function and Gamma function ,Relation Between beta and Gamma function-simple problems.</p> <p>Video Link:</p> <ul style="list-style-type: none"> • http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx 		
Module-3	L1,L2	8Hrs.
<p>Analytical solid geometry :</p> <p>Introduction –Directional cosine and Directional ratio of a line, Equation of line in space-different forms, Angle between two line, shortest distance between two line, plane and equation of plane in different forms and problems.</p> <p>Video Link:</p>		

<ul style="list-style-type: none"> • https://www.toppr.com/guides/maths/three-dimensional-geometry/ • https://www.toppr.com/guides/maths/three-dimensional-geometry/distance-between-skew-lines/ 		
Module-4	L1,L2,L3	8 Hrs.
<p>Probability: Random variable, Discrete probability distribution, Mean and variance of Random Variable, Theoretical distribution-Binomial distribution, Mean and variance Binomial distribution -Problems. Poisson distribution as a limiting case of Binomial distribution, Mean and variance of Poisson distribution. Normal Distribution-Basic properties of Normal distribution –standard form of normal distribution and Problems.</p> <p>Video Link:</p> <ul style="list-style-type: none"> • https://nptel.ac.in/courses/111/105/111105041/ • https://www.mathsisfun.com/data/probability.html 		
Module-5	L1,L2,L3	8 Hrs.
<p>Partial differential equation: Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only.</p> <p>Video Link:</p> <ul style="list-style-type: none"> • http://tutorial.math.lamar.edu/Classes/DE/IntroPDE.aspx • https://www.studyyaar.com/index.php/module-video/watch/233-cauchys-legendres-de-a-method-of-variation-of-parameters 		
Course outcomes:		
CO1	Apply the knowledge of Matrices to solve the system of linear equations and to understand the concepts of Eigen value and Eigen vectors for engineering problems.	
CO2	Demonstrate various physical models ,find Maxima and Minima for a function of one variable., Point of inflections and Problems .Understand Beta and Gamma function	
CO3	Understand the 3-Dimensional geometry basic, Equation of line in space- different forms, Angle between two line and studying the shortest distance.	
CO4	Concepts OF Probability related to engineering applications.	
CO5	Construct a variety of partial differential equations and solution by exact methods.	

Text Books:	
1	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43 rd Edition, 2013.
2	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
Reference Books:	
1	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition, 2014.
2	G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19

CIE Assessment:	
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests	
<ul style="list-style-type: none"> - Quizzes/mini tests (10 marks) - Assignments (10 marks) 	
SEE Assessment:	
<p>i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.</p> <p>ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.</p>	
One question must be set from each unit. The duration of examination is 3 hours.	

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1