Semester: IV		
COMPLEX ANALYSIS, PROBABILITY AND SAMPLING THEORY (Theory)		
Course Code: MVJ21MA41C		CIE Marks:50
Credits: L:T:P: 2:1:0		SEE Marks: 50
Hours:30L+10T		SEE Duration: 03 Hours

Course Learning Objectives: The students will be able to	
1	Understand the concepts of Complex variables and transformation for solving Engineering Problems
2	Understand the concepts of complex integration, Poles, and Residuals in the stability analysis of engineering problems
3	Use statistical methods in curve fitting applications
4	understand the probability distribution in civil and chemical engineering
5	Understand the concepts of Sampling theory in science and engineering

UNIT-I	
Complex variables - I: Functions of complex variables (Review), Analytic function, Cauchy-Riemann Equations in Cartesian and polar coordinates, Construction of analytic functions (Using Milne-Thomson method). **Transformations:** BilinearTransformation, Conformal transformation, Discussion of the transformation $w = z^2, w = e^z and\ w = z + \frac{1}{z}(z \neq 0)$ Applications: Algebraic geometry, applied mathematics, hydrodynamics, thermodynamics, and particularly quantum mechanics. Web Link and Video Lectures: • https://www.youtube.com/watch?v=oiK4gTgncww • https://www.youtube.com/watch?v=WJOf4PfoHow • https://math.mit.edu/~jorloff/18.04/notes/topic4.pdf • https://math.mit.edu/~jorloff/18.04/notes/topic10.pdf	8Hrs
UNIT-II	
Complex variables-II: Complex integration - Cauchy theorem, Cauchy's Integral Theorem- Problems, Taylor & Laurent series- Problems ,Singularities, Types of Singularities, Poles, Residues-definitions, Cauchy residue theorem(without proof) - Problems. Web Link and Video Lectures: • https://www.youtube.com/watch?v=oiK4gTgncww • https://www.youtube.com/watch?v=WJOf4PfoHow • https://math.mit.edu/~jorloff/18.04/notes/topic4.pdf • https://math.mit.edu/~jorloff/18.04/notes/topic10.pdf	8Hrs
UNIT-III	
Statistical Methods: Introduction, Correlation and coefficient of correlation, Regression - line of regression problems. **Curve Fitting:** Curve fitting by	8Hrs

method of least squares- fitting of the curves of the form, $y = ax + b, y = ax^2 + bx + c$ *and* $y = ae^{bx}$. Applications: Correlation and Regression, estimate the value of one variable corresponding to a particular value of the other variable, Curve Fittings such as parabola and hyperbola Web Link and Video Lectures: • https://www.youtube.com/watch?v=xTpHD5WLuoA • https://www.youtube.com/watch?v=fNLeogEjMmM	
UNIT-IV	
Probability Distributions: Random variables (discrete and continuous), probability mass/densityfunctions. Binomial distribution, Poisson distribution , Geometric distribution and normal distributions - problems. **Joint probability distribution:** Joint Probability distribution for two discrete random variables,expectation, covariance. Applications: Industries, quality control, in errors correction, medicine, agriculture, engineering, for analysis and interpretations of basic data obtainedfrom experiments. Web Link and Video Lectures: • https://www.youtube.com/watch?v=nrkd0IlVxkY • https://www.youtube.com/watch?v=6x1pL9Yov1k	8Hrs
UNIT-V	
Sampling Theory and Statistical Inference: Sampling, Type I and Type II errors, standard error, confidence limits, test of hypothesis for means, test for hypothesis for proportions, student's t-distribution, Chi-square distribution as a test of goodness of fit. Applications: A large number of analyses for process control, product quality control for consumer safety, and environmental control purposes are using Sampling Theory. Web Link and Video Lectures: • https://www.youtube.com/watch?v=zmyh7nCjmsg • https://www.youtube.com/watch?v=fuBvQJP0ecw&list=PLp6ek2hDcoNCp9o8aLQrbY15a- o0weoTd&index=2 • https://www.youtube.com/watch?v=tFRXsngz4UQ • https://www.youtube.com/watch?v=Q1yu6TQZ79w	8Hrs

Course Outcomes: After completing the course, the students will be able to	
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 formulaand 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 anddesign engineering
CO5	Demonstrate testing of hypothesis of sampling distributions and illustrate examples relatedto discrete parameters.

Reference Books	
1.	Prof G.B.Gururajachar "Engineering Mathematics-III , Academic Excellent series Publications, 2016-17
2.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 44th Edition, 2013.
3.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition, 2014.
4.	Ramana B. V., "Higher Engineering Mathematics", Tata McGraw-Hill, 2006.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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	1	0
CO2	3	3	0	3	0	0	0	0	0	0	0	1
CO3	2	3	0	3	0	0	0	0	0	0	1	0
CO4	3	3	0	3	0	0	0	0	0	0	0	0
CO5	3	3	0	3	0	0	0	0	0	0	0	0

Semester: IV		
ANALYSIS OF DETERMINATE STRUCTURES (Theory)		
Course Code: MVJ21CV42		CIE Marks:50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours:40L		SEE Duration: 03Hours
Course Learning Objectives: The students will be able to		
1	Analyze different forms of structural systems.	
2	Use concept of ILD and moving loads s.	
3	Impart principles of elastic structural analysis and behavior of determinate structures.	
4	Impart knowledge about various methods involved in the analysis of determinate structures.	

UNIT-I	
Introduction: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and nonlinear 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	8Hrs
UNIT-II	
Influence Lines: Concepts of influence lines- ILD for reactions, SF and BM for determinate beams, numerical problems. **Moving Loads:** Reactions, BM and SF in determinate beams 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 Defection for determinate beams using Excel Sheet Applications: (Self Study) • Calculation of Forces in Design of Bridges • https://nptel.ac.in/courses/105105166/32	8Hrs
UNIT-III	
Deflection of Beams: Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate	8Hrs

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) • Single Span Beams Experiment • Continuous Beams Experiment • Deflection check at different points Applications: (Self Study) • Knowledge on Behaviour of determinate structure	
UNIT-IV	
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 using total strain energy. 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.	8Hrs
UNIT-V	
Arches and Cable Structures: Three-hinged circular and parabolic arches with supports at the same level; Determination of normal thrust, radial shear and bending moment; Analysis of cables under point loads and UDL; Length of cables with supports at the same levels.ps. 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.	8Hrs

Course Outcomes: After completing the course, the students will 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 beams 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.

Reference Books

1.	Bhavikatti, Structual Analysis, VikasPublishing House Pvt. Ltd, New Delhi, 4th edition, 2002.
2.	Reddy C S, "Basic Structural Analysis" , Tata McGraw-Hill Publishing CompanyLtd.,3rd edition, 2010.
3.	L S Negi and R S Jangid, "Structural Analysis", Tata McGraw-Hill Publishing Company Ltd.,6th edition,2004
4.	Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., New Delhi, 2015.

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):
Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	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

Semester: IV		
TRANSPORTATION ENGINEERING (Theory)		
Course Code: MVJ21CV43		CIE Marks:50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours:40L		SEE Duration: 03Hours
Course Learning Objectives: The students will be able to		
1	Brief on different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.	
2	Detail on different aspects of geometric elements and train them to design geometric elements of a highway network.	
3	Analyze pavement and its components, pavement construction activities and its requirements.	
4	Illustrate the basic knowledge in railways	
5	State the basic knowledge of airport planning and design	

UNIT-I	
Highway Development and Planning: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021. **Highway Alignment and Surveys**: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects.	8Hrs
UNIT-II	
Highway Geometric Design: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves. **Highway Drainage**: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location	8Hrs
UNIT-III	
Pavement Materials: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material **Pavement Design**: Pavement types, Components	8Hrs
UNIT-IV	
Railways: Introduction to rail transportation and its limitation, merits and	

demerits, Railway track, concept of gauge, Advantages of uniform gauge and loading gauge, Components of permanent way and its ideal requirement, Wheel and Axles, Coning of Wheels, Components of permanent way and its ideal requirement, Rail ,various type of rail cross section, length of rail, defects in rail and remedies to reduce the defects, Measure to reduce the wear of rails, Characteristics of an ideal rail joints ,Rail fastening and fixtures Purpose of welding of rail joints, Type, function and requirement of an ideal sleeper.	8Hrs
UNIT-V	
Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.	8Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Restate the different modes of transportation, history, organizations. Also understanding of planning, types of roads and highway projects.
CO2	Get insight in to alignment, essential surveys and geometrical elements with specifications as per IRC and design of highway geometric elements
CO3	Understand the pavement and its components and design of the pavement
CO4	Predict the capability of choosing alignment and design geometric aspects of railway system, runway and taxiway
CO5	Restate the layout plan of airport and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same Evaluating the highway economics by B/C, NPV, IRR, methods and also to introduce highway financing concepts.

Reference Books	
1.	Stephen P. Robbins & Mary Coulter, Management‖, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009
2.	JAF Stoner, Freeman R.E and Daniel R Gilbert , Management‖, Pearson Education,
3.	Stephen A. Robbins & David A. Decenzo& Mary Coulter, Fundamentals of Management‖ Pearson Education, 7th Edition, 2011.
4.	Robert Kreitner& Mamata Mohapatra, Management‖, Biztantra, 2008.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for

the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Semester: IV		
FLUID MECHANICS AND HYDRAULIC MACHINERY LABORATORY (Theory and Practice)		
Course Code: MVJ21CV44		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours:40L+26P		SEE Duration: 03+03 Hours
Course Learning Objectives: The students will be able to		
1	Provide the Fundamental properties of fluids and its applications	
2	Make the students to explain on Hydrostatic laws and application to solve practical problem	
3	Gain the knowledge on Principles of Kinematics and Hydrodynamics for practical applications.	
4	Basic design of pipes and pipe networks considering flow, pressure and its losses	
5	Arrive the basic flow rate measurements	

UNIT-I	
Prerequisites: Knowledge on basic Fluid Properties, Newton's Laws **Fluids & Their Properties:** Concept of fluid, Fluid as a continuum, Properties of fluid - Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Newton's law of viscosity (theory & problems), Compressibility and bulk modulus. **Fluid Pressure and Its Measurements:** Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth on fluid at rest. Types of pressure. Measurement of pressure using simple, differential manometers, Numerical problems. **Hydrostatic forces on Surfaces**: Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane surface submerged in liquid. Laboratory Sessions/ Experimental learning: (Self Learning) • Determination of Capillary Rise of water and Capillary fall of mercury in a vertical tube • Measurement of Pressure in Differential U-tube Mercury Manometer • Calculation of pressure under curved surface using Excel Sheet Applications: (Self Learning) • Lifting Mechanism of hydraulic Jack and Hydraulic Press • Pressure in Artesian Wells, Water Tower and Dams Video link /Additional online information: (Self Learning) • Fluid Pressure : https://nptel.ac.in/courses/112105171/	8Hrs
UNIT-II	
Prerequisites: Knowledge on Centroid, Moment of Inertia, Knowledge of Calculus, Partial Derivative Equations **Kinematic Flow**: Introduction, Methods of describing fluid motion, types of fluid flow, rate of flow, basic principles of fluid flow, three-dimensional continuity equation in Cartesian coordinate system, Velocity of a fluid particle, Numerical problems.	8Hrs

Fluid Dynamics: Introduction, Euler's equation of motion along a streamline, Bernoulli's equation, Assumptions and limitations of Bernoulli's equation, Modified Bernoulli's equation (real fluid) (Online Mode), Numerical Problems (with and without losses). Laboratory Sessions/ Experimental learning: (Self Learning) • Model Making of Streamline and Potential line under Gravity Dam • Draw the Flow net diagram for upstream storage of Barrage • Formulation of Design steps for Lock Gate Analysis using Excel Sheet Applications: (Self Learning) • Design of different parts of Hydraulic Equipment • Pressure on Water Control Structures like Gravity Dam • Steady Flow Analysis in Turbines	
UNIT-III	
Prerequisites: Knowledge on basic dynamic principles. **Application of Bernoulli's Equation:** Introduction. Venturi meter, Numerical Problems. **Open Channel flow Hydraulics (Uniform flow):** Introduction, Classification of flow through channels. Chezy's and Manning's equation for flow through open channel. Most economical channel sections. Uniform flow through Open channels. Numerical problems. **Notches and Weirs:** Introduction, Classification, discharge over rectangular, triangular, trapezoidal notches, Numerical problems. Laboratory Sessions/ Experimental learning: (Self Learning) • Model Making Flow through pipe and calculation of energy loss under given slope • Formulate and analyze the pipe bend by momentum equation using Excel Sheet Applications: (Self Learning) • Liquid ejection instruments like Paint Gun and Insect-Sprayer • Dynamic lift acts on the Plane	8Hrs
UNIT-IV	
Hydraulic Machines: Introduction, Impulse-Momentum equation. Impart of a jet on stationary and moving curved vanes. Introduction to concept of velocity triangles. Impact of jet on a series of curved vanes-Problems. **Turbines**-Impulse Turbines: Introduction to turbines, Classification of turbines. Pelton wheel- Components, working principle and velocity triangles. Maximum power, efficiency, working proportions- Numerical problems. General layout of a hydro-electric plant, heads and efficiencies. Laboratory Sessions/ Experimental learning: (Self Learning) • Model Making of Rectangular, Triangular, Trapezoidal and Cippoletti notches under given Discharge • Experimental determination of hydraulic coefficients of given vertical orifice • Analyze the Cippoletti notch using Excel Sheet programming	8Hrs

Applications: (Self Learning) • Emptying of Fluid Storage Tanks	
UNIT-V	
Flow through Pipes: Introduction, Major and minor losses in pipe flow (Online Mode), Darcy- Weisbach equation for head loss due to friction in a pipe, Pipes in series, Pipes in parallel, Equivalent pipe, Head loss due to sudden expansion, Contraction, Numerical problems. **Centrifugal Pumps:** Components and working of centrifugal pumps. Types of centrifugal pumps (online mode). Work done by impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pumps. Numerical problems, Multi-stage pumps. Laboratory Sessions/ Experimental learning: (Self Learning) • Determination of distribution of flow rate by Hardy Cross Method for a Residential Buildings • Converting Water supply line into Single Equivalent pipe system • Formulate Excel Sheet Program for Hardy Cross Method Applications: (Self Learning) • Design of Water Supply Network for a Village • Create a simple Water Pump (Hydraulic Ram) • Leaks detection in Pipelines • Identification of enclosed air packets in pipelines.	8Hrs
LABORATORY EXPERIMENTS	
1. Calibration of Venturi meter 2. Calibration of rectangular and triangular notches. 3. Determination of Friction Factor of the Pipe Materials (Major losses). 4. Determination of head losses for different pipe fittings (Minor losses: Sudden Enlargement, Bends and Contraction Only). 5. Measurement of Flow through Orifice 6. Calibration of Ogee and Broad crested weir 7. Experimental determination of force exerted by a jet on flat and curved plates 8. Determination of Cd for Venturi flume 9. Performance characteristics of centrifugal pump. 10. Performance characteristics of Pelton wheel. 11. Performance characteristics of Francis turbine. 12. Demo experiment on Verification of Bernoulli's theorem 13. Demo experiment Performance characteristics of Kaplan Turbine. 14. Demo experiment on Multistage centrifugal pump.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Recall the fundamental properties of fluids and fluid continuum
CO2	Solve problems on hydrostatics and kinematic flow
CO3	State the kinematic concepts related to fluid flow
CO4	Apply Bernoulli's principle for Orifice, Mouthpiece, Notches and Weirs.
CO5	Compute the discharge through pipes in a Pipe Network

Reference Books	
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", 9th Edition, 2015, Laxmi Publications, New Delhi.
3.	Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics", Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008.
4.	S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi, 2017.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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

Semester: IV		
CONCRETE TECHNOLOGY AND MATERIAL TESTING LABORATORY (Theory and Practice)		
Course Code: MVJ21CV45		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours:40 L+ 26 P		SEE Duration: 03+03 Hours

Course Learning Objectives: The students will be able to	
1	Recognize the importance of material characteristics and their contributions to strength development in Concrete
2	Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3	Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

UNIT-I	
Cement – Cement manufacturing process flow chart, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, Effect of heat of hydration during mass concreting at project sites. **Fine aggregate:** Functions, requirement, alternatives to River sand, M-sand introduction and manufacturing. **Coarse aggregate**: Importance of size, shape and texture. 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.	8 Hrs
UNIT-II	
Workability-factors affecting workability. Measurement of workability–slump, Compaction factor, Vee-Bee Consistometer tests, and flow tests. Segregation and bleeding. **Process of manufacturing of concrete**- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete.	8 Hrs
UNIT-III	
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.	8Hrs
UNIT-IV	
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 .	8Hrs

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.	
UNIT-V	
RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages, quality control, 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. In-situ testing of concrete- penetration and pull-out test. Rebound hammer test, ultrasonic pulse velocity, core extraction- principal, application, and limitations.	**8 Hrs**
LABORATORY EXPERIMENTS	
1. Cement testing- normal consistency, setting time, fineness, specific gravity, compressive strength. 2. Fine aggregate- moisture content, specific gravity, bulk density, bulking, sieve analysis. 3. Coarse aggregate- water absorption, specific gravity, moisture content, bulk density, sieve analysis. 4. Workability tests- Slump, Vee Bee consistometer, compaction factor. 5. Compressive strength – Cubes and Cylinders. 6. NDT – UPV, Rebound Hammer	

Course Outcomes: After completing the course, the students will be able to	
CO1	Assess quality of materials used for making concrete
CO2	Distinguish concrete behavior based on its fresh properties
CO3	Design appropriate concrete mix
CO4	Assess strength and durability
CO5	Select appropriate special concrete.

Reference Books	
1.	Concrete Technology - Theory and Practice, M.S. Shetty, 8, 2018, S. Chand and Company, 978-9352533800.
2.	Concrete Technology, M L Gambir, 5, 2017, McGraw Hill Education, 978-1259062551.
3.	Properties of Concrete, Neville A.M, 5, 2012, Pearson, 978-8131791073.
4.	IS 456, IS10262.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50

marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO Mapping												
CO/PO	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	-	-

Semester: IV		
CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (Theory)		
Course Code: MVJ21CPH46		CIE Marks:50
Credits: L:T:P: 1:0:0		SEE Marks: 50
Hours:15L		SEE Duration: 02 Hours

Course Learning Objectives: The students will be able to	
1	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.
2	To provide overall legal literacy to the young technograts to manage complex societal issues in the present scenario.
3	To understand engineering ethics & their responsibilities, identify their individual roles and ethical responsibilities towards society.

UNIT-I	
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.	3Hrs
UNIT-II	
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.	3Hrs
UNIT-III	
Elections, Amendments and Emergency Provisions: Elections, Electoral Process, and Election Commission of India, Election Laws. 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). Emergency Provisions, types of Emergencies and it's consequences. **Constitutional Special Provisions:** Special Constitutional Provisions for SC & ST, OBC, Special Provision for Women, Children & Backward Classes.	3Hrs
UNIT-IV	
Professional / Engineering Ethics: Scope & Aims of Engineering &	3Hrs

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.	
UNIT-V	
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.	3Hrs

Course Outcomes: After completing the course, the 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.
Reference Books	
1.	Constitution of India and Professional Ethics, T.S. Anupama, Sunstar Publisher
2.	Durga Das Basu (DD Basu): "Introduction to the Constitution on India", (Students Edition.) Prentice –Hall EEE, 19th/20th Edn., (Latest Edition) or 2008.
3.	Shubham Singles, Charles E. Haries, and Et al : "Constitution of India and Professional Ethics" by Cengage Learning India Private Limited, Latest Edition – 2018.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

Semester End Examination (SEE):

SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 50 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

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	-

Semester: IV		
PYTHON FOR CIVIL ENGINEERS (Ability Enhancement Course)		
Course Code: MVJ21CVA47		CIE Marks:50
Credits: L:T:P: 1:0:1		SEE Marks: 50
Hours:30		SEE Duration: 02 Hours
Course Learning Objectives: The students will be able to Write programs in python		

UNIT-I	
Introduction to python -syntax, installation	3Hrs
UNIT-II	
Python basics- print statement, comments, data structures and types, input and output, operations.	3Hrs
UNIT-III	
Python program flow-If statement, looping structures, break and continue.	3Hrs
UNIT-IV	
Functions and modules- parameters, variable arguments, scope of a function, standard modules.	3Hrs
UNIT-V	
Classes in python: creating classes, instance, inheritance and polymorphism. Programs related to civil engineering	3Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge of python to solve civil engineering problems
CO2	Demonstrate various physical models
CO3	Understand python programs and Apply concepts of looping.
Reference Books	
1.	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser Data Structures and Algorithms in Python John Wiley & Sons, Incorporated.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks: CIE for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

Semester End Examination (SEE): SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 50 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level. **Total marks: 50+50=100**

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	1	1

Semester: IV		
ADDITIONAL MATHEMATICS-II (Theory)		
Course Code: MVJ21MATDIP-II		CIE Marks:50
Credits: L:T:P: 1:1:0		SEE Marks: 50
Hours:30L+10T		SEE Duration: 03 Hours
Course Learning Objectives: The students will be able to		
1	To familiarize the important concepts of linear algebra.	
2	Aims to provide essential concepts differential calculus, beta and gamma functions.	
3	Introductory concepts of three-dimensional geometry along with methods to solve them.	
4	Linear differential equations	
5	Formation of partial differential equations.	

UNIT-I	
Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and eigen vectors of a square matrix. Diagonalization of a square matrix of order two. Self study: Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	8Hrs
UNIT-II	
Differential calculus: Indeterminate forms: L-Hospital rule (without proof), Total derivatives, and Composite functions. Maxima and minima for a function of two variables. **Beta and Gamma functions:** Beta and Gamma functions, Relation between Beta and Gamma function-simple problems. Self study: Curve tracing. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	8Hrs
UNIT-III	
Analytical solid geometry : 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. Self study: Volume tetrahedron. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	8Hrs
UNIT-IV	
Differential Equations of higher order: Linear differential equations of second and higher order equations with constant coefficients. Inverse Differential operator, Operators methods for finding particular integrals , and Euler –Cauchy equation.	8Hrs

Self study: Method of variation of parameters Video Link: http://nptel.ac.in/courses.php?disciplineID=111	
UNIT-V	
Partial differential equation: Introduction- Classification of partial differential equations, formation of partial differential equations. Method of elimination of arbitrary constants and functions. Solutions of non-homogeneous partial differential equations by direct integration. Solution of Lagrange's linear PDE. Self study: One dimensional heat and wave equations and solutions by the method of separable of variable Video Link:http://nptel.ac.in/courses.php?disciplineID=111	8Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Make use of matrix theory for solving system of linear equations and compute eigenvalues and eigen vectors required for matrix diagonalization process.
CO2	Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.
CO3	Understand the Three-Dimensional geometry basic, Equation of line in space- different forms, Angle between two line and studying the shortest distance .
CO4	Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
CO5	Construct a variety of partial differential equations and solution by exact methods.

Reference Books	
1.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2013, .
2.	G. B. Gururajachar, Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19
3.	Chandrashekar K. S, Engineering Mathematics-I, Sudha Publications, 2010.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):
Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Semester: IV	
SUMMER INTERNSHIP I (Intra/Inter College)	
Course Code: MVJ21INT48	
Course Learning Objectives: The students will be able to	
1	Get the skill exposure to different specialization
2	Apply the theoretical concept in field application
3	Prepare the comparison statement of difference activities
Inter/Intra Institutional Internship: This shall be carried out by students for 3 weeks during the intervening vacation of II and III semesters for students admitted to the I semester and during the intervening vacation of III and IV semesters for lateral entry Diploma students admitted to III semester. The Summer Internship-I shall include inter/intra institutional activities.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop skills related to different specialization of engineering
CO2	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO3	Prepare them for life-long learning to face the challenges and support the technological changes

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	2	2	2	3	3	2	1	1	2	1	1	2
CO2	2	2	2	3	3	2	1	1	2	1	2	2
CO3	2	2	2	3	3	2	1	1	2	1	2	2