VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
OUTCOME BASED EDUCATION (OBE) &
CHOICE BASED CREDIT SYSTEM (CBCS)
CIVIL ENGINEERING BOARD

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS
(Common to all branches)
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER - IV

Course Code	**18MAT41**	**CIE Marks**	**40**
TeachingHours/Week (L:T:P)	**(2:2:0)**	**SEE Marks**	**60**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

Module-1

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences.
Construction of analytic functions: Milne-Thomson method-Problems.

Revised Bloom's Taxonomy Level	L_1-¿ Remembering, $L_2-Understanding$.

Module-2

Conformal transformations: Introduction. Discussion of transformations:
$w=Z^2, w=e^z, w=z+\frac{1}{z}, (z\neq 0)$. Bilinear transformations- Problems.
Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's

Revised Bloom's Taxonomy Level	L_1-¿ Remembering, $L_2-Understanding$.

Module-3

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

Revised Bloom's Taxonomy Level	L_1-¿ Remembering, $L_2-Understanding, L_3-Applying$.

Module-4

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems.
Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form- $y=ax+b, y=a\,x^b \wedge y=a\,x^2+bx+c$.

Revised Bloom's Taxonomy Level	L_1-¿ Remembering, $L_2-Understanding, L_3-Applying$.

Module-5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance. **Sampling Theory:** Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.	
Revised Bloom's Taxonomy Level	$L_2 - Understanding, L_3 - Applying, L_4 - Analysing$

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER - IV

18MAT41COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS

Course outcomes:

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

1. Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.
2. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
3. Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
4. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
5. Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Life-Long Learning, Accomplishment of Complex Problems.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition,2016
2	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition, 2017
3	Engineering Mathematics	Srimanta Pal et al	Oxford University Press	3rd Edition,2016
Reference Books				
1	Advanced Engineering Mathematics	C.Ray Wylie, Louis C.Barrett	McGraw-Hill	6th Edition 1995
2	Introductory Methods of Numerical Analysis	S.S.Sastry	Prentice Hall of India	4th Edition 2010
3	Higher Engineering Mathematics	B.V.Ramana	McGraw-Hill	11th Edition,2010
4	A Text Book of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publications	2014

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

TITLE OF THE COURSE: ANALYSIS OF DETERMINATE STRUCTURES,
[As per Choice Based Credit System (CBCS) scheme]
IV Semester

Course Code	**18 CV42**	**CIE Marks**	**40**
Number of Lecture	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50 (10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: This course will enable students to

1. Apply knowledge of mathematics and engineering in calculating slope and deflections
2. Identify, formulate and solve engineering problems
3. Analyse structural systems and interpret data
4. Engage in lifelong learning with the advances in Structural Engineering

Module-1

Introduction and Analysis of Plane Trusses: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and non linear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.

Module-2

Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions,Derivation of moment-curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple.

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.

Module-3

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.

L2,L4,L5

Module-4

Arches and Cable Structures: Three hinged parabolic 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

Module-5

Influence Lines and Moving Loads: Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses-Reactions, BM and SF in determinate beams using rolling loads concepts.

L2, L4, L6

Course outcomes: After studying this course, students will be able to:

1. Evaluate the forces i n determinate trusses by method of joints and sections.
2. Evaluate the deflection of cantilever, simply supported and overhanging beams by different methods
3. Understand the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames.
4. Determine the stress resultants in arches and cables.
5. Understand the concept of influence lines and construct the ILD diagram for

Text Books:

1. Reddy C S, Basic Structural Analysis, Tata McGraw Hill, New Delhi.
2. Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., New Delhi,2015.
3. Bhavikatti, Structual Analysis, Vikas Publishing House Pvt. Ltd, New Delhi, 2002.

Reference Books:

1. Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition, 2014
2. Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi, 2008.

TITLE OF THE COURSE: **APPLIED HYDRAULICS**

IV Semester

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CV43**	**CIE Marks**	**40**
Number of Lecture	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives: The objectives of this course is to make students to learn:

1. Principles of dimensional analysis to design hydraulic models and Design of various models.
2. Design the open channels of various cross sections including design of economical sections.
3. Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions.
4. The working principles of the hydraulic machines for the given data and analyzing the performance of Turbines for various design data.

Module-1

Dimensional analysis: Dimensional analysis and similitude: Dimensional homogeneity, Non Dimensional parameter, Rayleigh methods and Buckingham ð theorem, dimensional analysis, choice of variables, examples on various applications.

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

Buoyancy and Flotation: Buoyancy, Force and Centre of Buoyancy, Metacentre and Metacentric height, Stability of submerged and floating bodies, Determination of Metacentric height, Experimental and theoretical method, Numerical problems

L1, L2, L3, L4

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. Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Metering flumes, Numerical Problems

L3,L4

Non-Uniform Flow: 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, Control sections

L2,L3,L4

Module-4

Hydraulic Machines:

Introduction, Impulse-Momentum equation. Direct impact of ajet on a 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, General lay out of a hydro-electric plant, Heads and Efficiencies, classification of turbines. Pelton wheel-components, working principle and velocity triangles. Maximum power, efficiency, working proportions – Numerical problems

Module-5

Reaction Turbines and Pumps: Radial flow reaction turbines: (i) Francis turbine-Descriptions, working proportions and design, Numerical problems. (ii) 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, Work done by the impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pump, Numerical problems, Multi-stage pumps.

Course outcomes:

After a successful completion of the course, the student will be able to:

1. Apply dimensional analysis to develop mathematical modeling and compute the parametric values in prototype by analyzing the corresponding model parameters
2. Design the open channels of various cross sections including economical channel sections
3. Apply Energy concepts to flow in open channel sections, Calculate Energy dissipation,
4. Compute water surface profiles at different conditions
5. Design turbines for the given data, and to know their operation characteristics under different operating conditions

Text Books:

1. P N Modi and S M Seth, "Hydraulics and Fluid Mechan ics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi
2. R.K. Bansal, "A Text book of Fluid Mechanics and Hy draulic Machines", Laxmi Publications, New Delhi
3. S K SOM and G Biswas, "Introduction to Fluid Mechan ics and Fluid Machines", Tata McGraw Hill,New Delhi

1. K Subramanya, "Fluid Mechanics and Hydraulic Machin es", Tata McGraw Hill Publishing Co. Ltd.
2. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press
3. C.S.P. Ojha, R. Berndtsson, and P.N. Chandramouli, *"Fluid Mechanics and Machinery"*, Oxford University Publication – 2010
4. J.B. Evett, and C. Liu, *"Fluid Mechanics and Hydraulics "*, McGraw-Hill Book Company.-2009.

TITLE OF THE COURSE: **CONCRETE TECHNOLOGY**

IV Semester

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CV44**	**CIE Marks**	**40**
Number of Lecture	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course objectives: This course will enable students 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.

Module-1

Concrete Ingredients

Cement – Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. 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. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice husk ash.

L1, L2, L3

Fresh Concrete

Workability-factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, 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 and Effect of heat of hydration during mass concreting at project sites.

L1, L2, L3

Hardened Concrete Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –facto rs affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per

IS-456, In situ testing of concrete- Penetration and pull out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.

L1, L2, L3

Module-4

Concrete Mix Proportioning

Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262

Module-5

Special Concretes

RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and aplications

Course outcomes:

After studying this course, students will be able to:

1. Relate material characteristics and their influence on microstructure of concrete.
2. Distinguish concrete behaviour based on its fresh and hardened properties.
3. Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.

Text Books:

1. Neville A.M. “Properties of Concrete”-4th Ed., Long man.
2. M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
3. Kumar Mehta. P and Paulo J.M. Monteiro “Concrete-Mi crostructure, Property and Materials”, 4th Edition, McGraw Hill Education, 201 4
4. A.R. Santha Kumar, “Concrete Technology”, Oxford Un iversity Press, New Delhi (New Edition)

1. M L Gambir, “Concrete Technology”, McGraw Hill Educ ation, 2014.
2. N. V. Nayak, A. K. Jain Handbook on Advanced Concrete Technology, ISBN: 978-81-8487-186-9
3. Job Thomas, “Concrete Technology”, CENGAGE Learning , 2015
4. IS 4926 (2003): Code of Practice Ready-Mixed Concrete [CED 2: Cement and Concrete]Criteria for RMC Production Control, Basic Level Certification for Production Control of Ready Mixed Concrete-BMTPC
5. Specification and Guidelines for Self-Compacting Concrete, EFNARC, Association House

TITLE OF THE COURSE**: ADVANCED SURVEYING**

IV Semester

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**18CV45**	**CIE Marks**	**40**
Number of Lecture	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40 (8 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives: This course will enable students to:

1. Apply geometric principles to arrive at solutions to surveying problems.
2. Analyze spatial data using appropriate computational and analytical techniques.
3. Design proper types of curves for deviating type of alignments.
4. Use the concepts of advanced data capturing methods necessary for engineering practice

Module-1

Curve Surveying

Curves – Necessity – Types, Simple curves, Elements , Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankines deflection angle method (numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius). Transition curves Characteristics , numerical problems on Length of Transition curve, Vertical curves –Types – (theory).

L1,L3,L5

Module-2

Geodetic Surveying and Theory of Errors

Geodetic Surveying: Principle and Classification of triangulation system, Selection of base line and

stations, Orders of triangulation, Triangulation figures, Reduction to Centre, Selection and marking of stations Theory of Errors: Introduction, types of errors, definitions, laws of accidental errors, laws of weights, theory of least squares, rules for giving weights and distribution of errors to the field observations, determination of the most probable values of quantities.

L1,L2, L3

Introduction to Field Astronomy: Earth, celestial sphere, earth and celestial coordinate

systems, spherical triangle, astronomical triangle, Napier's rule

L4,L5

Module-4

Aerial Photogrammetry

Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problems), Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of aerial survey, overlaps and mosaics, Stereoscopes, Derivation Parallax

L2,L3, L5

Module-5

Modern Surveying Instruments

Introduction, Electromagnetic spectrum, Electromagnetic distance measurement, Total station,

Lidar scanners for topographical survey. Remote Sensing: Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation. Digital image processing, Global Positioning system Geographical Information System: Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning).

Course outcomes: After a successful completion of the course, the student will be able to:

1. Apply the knowledge of geometric principles to arrive at surveying problems
2. Use modern instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems.
3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments;
4. Design and implement the different types of curves for deviating type of alignments.

Text Books:

1. B.C. Punmia, “Surveying Vol.2”, Laxmi Publications pvt. Ltd., New Delhi.
2. Kanetkar T P and S V Kulkarni , Surveying and Levelling Part 2, Pune Vidyarthi Griha Prakashan,
3. K.R. Arora, “Surveying Vol. 1” Standard Book House, New Delhi.
4. Sateesh Gopi, Global Positioning System, Tata McGraw Hill Publishing Co. Ltd. New Delhi

Reference Books:

1. S.K. Duggal, “Surveying Vol.I & II”, Tata McGraw Hi ll Publishing Co. Ltd. New Delhi.
2. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi.
3. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers
4. B Bhatia, Remote Sensing and GIS , Oxford University Press, New Delhi.
5. T.M Lillesand,. R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation , 5th edition, John Wiley and Sons India
6. James M Anderson and Adward M Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw Hill Publication.
7. Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill

Course Title: **WATER SUPPLY AND TREATMENT**

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:VI

Subject Code	**18CV46**	**IA Marks**	**40**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**
CREDITS – 03		**Total Marks- 100**	

Course objectives: This course will enable students to

1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Evaluate the sources and conveyance systems for raw and treated water.
3. Study drinking water quality standards and to illustrate qualitative analysis of water.
4. Design physical, chemical and biological treatment methods to ensure safe and potable water

Module -1

Introduction: Need for protected water supply. Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial, public use, fire demand, Factors affecting per capita demand, Variations in demand of water, Peak factor, Design period and factors governing design period.

Different methods of population forecasting -with merits and demerits. Numerical Problems.

L1,L2,L3

Module -2

Water Treatment: Objectives, Treatment flow chart – significance of each unit

Sources and Characteristics: surface and subsurface sources -suitability with regard to quality and quantity. Sampling - Objectives, methods, Preservation techniques.

Water quality characteristics: Physical, Chemical and Microbiological.

L1,L2,L3

Module -3

Sedimentation -theory, settling tanks, types, design. Concept of Plate and Tube settlers.

Coagulation aided sedimentation-types of coagulants, chemical feeding, flash mixing, Clarriflocculators . Filtration: mechanism -theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning. Operational problems in filters. Design of slow and rapid sand filter without under drainage system.

Ultra and micro filtration: Basic principles, membrane materials, pore size, flux, normalizing permeability, fouling mechanism, Overview of ultra and micro filtration elements and systems, Fouling in MF/UF systems, fouling control and pre treatment.

L1,L2,L3

Module -4

Softening: Overview of Lime soda, Zeolite process, RO and Nano filtration:

Basic principles, Flux, Salt passage, rejection and concentration polarization. Overview of RO and nano filtration membranes and elements, Conventional pre treatment techniques for RO and nano filtration.

Disinfection: Methods of disinfection with merits and demerits, Theory of disinfection, emphasis on treatment of water for community bathing. (melas and fairs) Fluoridation and De-fluoridation.

Module -5

Collection and Conveyance of water: Intake structures - types of intakes –Factors to be considered in selection of intake structures.

Pumps: Types of pumps with working principles. Numerical Problems.

Pipes: Design of the economical diameter for the rising main; Numerical Problems.

Pipe appurtenances, Valves, Fire hydrants

Pipe materials: Different materials with advantages and disadvantages. Factors affecting selection of pipe material.

Distribution system: Methods- Gravity, Pumping, Combined gravity and pumping system, Service reservoirs and their capacity determination.

Visit to Intake structure, Water treatment plant and report working of each unit Design of water treatment plant units and distribution system with population forecasting for the given city

L1,L2,L3

Course Outcomes: After studying this course, students will be able to:

1. Estimate average and peak water demand for a community.
2. Evaluate available sources of water, quantitatively and qualitatively and make appropriate choice for a community.
3. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
4. Design a comprehensive water treatment and distribution system to purify and

Program Objectives:

1. Engineering knowledge
2. Problem analysis
3. Interpretation of data

Question Paper Pattern:

1. The question paper will have 5 modules comprising of ten questions. Each full question carrying 16 marks
2. There will be two full questions (with a maximum of three subdivisions, if necessary) from each module.
3. Each full question shall cover the topics as a module
4. The students shall answer five full questions, selecting one full question from each module. If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.

Text Books:

1. S.K.Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2010

Reference Books:

1. B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P)Ltd., New Delhi 2010.
2. Howard S. Peavy, Donald R. Rowe, George T , Environmental Engineering - McGraw Hill International Edition. New York, 2000
3. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.

Title of the Course: ENGINEERING GEOLOGY LABORATORY

IV Semester

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	18CVL47	CIE Marks	40
Number of Hours/Week	03(1hrtutorial+2hr laboratory)	SEE Marks	60
Total Number of Hours Lecture	40 hr	Exam Hours	03
RBT Levels	L1, L2, L3, L4		
CREDITS–02			

Course objectives: This course will enable students

1.To identify the minerals and rocks based on their inherent properties and uses in civil engineering

2. To interpret the geological maps related to civil engineering projects.

3. To learn the dip and strike, bore hole problems, thickness of geological formation related to foundation, tunnels, reservoirs and mining.

3. To understand subsurface geological conditions through huge physical techniques and water shed management.

4. To visit the civil engineering projects like dams, reservoirs, tunnels, quarry sites,

Modules	Teaching Hour	RevisedBloom's Taxonomy (RBT Level)
1. Identification of minerals as mentioned in theory, their properties, uses and manufacturing of construction materials.	6 Hours	L1, L2,L3
2. Identification of rocks as mentioned in theory, their engineering properties and uses in construction and	6 Hours	L1,L2, L3
3. Dip and Strike problems: Determination of dip and strike direction in Civil Engineering projects (Railway lines, tunnels, dams, roads)	6 Hours	L3,L4
4. Bore hole problems: Determination of subsurface behavior of rocks, their attitude related	6 Hours	L3, L4
5. Calculation of Vertical, True thickness and width of the outcrops.	3 Hours	L3,L4
6. Interpretationof Electricalresistivitycurvestofind out subsurface information such as thickness	4 Hours	L3, L4
7. Interpretation of Toposheets and geological maps related to Civil Engineering Projects	9	L2,L3, L4

Course outcomes: During this course, students will develop expertise in;

1. Identifying the minerals and rocks and utilize them effectively in civil engineering practices
2. Understanding and interpreting the geological conditions of the area for the implementation of civil engineering projects.
3. Interpreting subsurface information such as thickness of soil, weathered zone, depth of hard rock and saturated zone by using geophysical methods.

Program Objectives(asperNBA):

1. Engineering Knowledge.
2. Problem Analysis.
3. Design/development of solutions (partly).

Reference Books:

1. MPBillings,StructuralGeology,CBSPublishersandDistributors,NewDelhi
2. B.S.SatyanarayanaSwamy, Engineering Geology Laboratory Manual, DhanpatRai Sons, NewDelhi.
3. LRANarayan, Remote sensing and its applications, UniversityPress.
4. P.K.MUKERJEE, Textbook of Geology, WorldPress Pvt. Ltd., Kolkatta
5. JohnIPlattandJohnChallinor,SimpleGeologicalStructures,ThomasMurthy&Co,London

TITLE OF THE COURSE: **FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY**

IV Semester

Course Code	**18CVL48**	**CIE Marks**	**40**
Number of Lecture	**03=(1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
Total Number of Hours	**40**	**Exam Hours**	**03**
RBT Levels	**L1, L2, L3, L4**		

Credits – 02

Course Objectives: This course will enable students to;

1. calibrate flow measuring devices
2. determine the force exerted by jet of water on vanes
3. measure discharge and head losses in pipes
4. understand the fluid flow pattern

Experiments:

1. Verification of Bernoulli's equation
2. Determination of Cd for Venturimeter and Orifice meter
3. Determination of hydraulic coefficients of small vertical orifice
4. Calibration of Rectangular and Triangular notch
5. Calibration of Ogee and Broad crested weir
6. Determination of Cd for Venturiflume
7. Experimental determination of force exerted by a jet on flat and curved plates (Hemispherical Vane).
8. Experimental determination of operating characteristics of Pelton turbine
9. Determination of efficiency of Francis turbine
10. Determination of efficiency of Kaplan turbine
11. Determination of efficiency of centrifugal pump
12. Determination of Major and Minor Losses in Pipes
13. Demonstration Experiments:
    a. Reynold's experiment to understand laminar and turbulent flow
    b. Flow Visualization
    c. Calibration of Sutro-weir

Course outcomes: During the course of study students will develop understanding of:

1. Properties of fluids and the use of various instruments for fluid flow measurement.
2. Working of hydraulic machines under various conditions of working and their characteristics.

- All experiments are to be included in the examination except demonstration exercises.
- Candidate to perform experiment assigned to him
- Marks are to be allotted as per the split up of marks shown on the cover page of answer script

Reference Books:

1. Sarbjit Singh , *Experiments in Fluid Mechanics* - PHI Pvt. Ltd.- New Delhi
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