VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY

(Formerly Uttarakhand Technical University, Dehradun Established by Uttarakhand State Govt. wide Act no. 415 of 2005)

Suddhowala, PO-Chandanwadi, Premnagar, Dehradun, Uttarakhand (Website- www.uktech.ac.in)

SYLLABUS

For

Master of Engineering Programmes

(M.Tech. Infrastructure Engineering)

(For admission in 2022-23 and onwards)

ProposedSchemeofExaminationofM.Tech.2YearProgrammeforSpecilalization: InfrastructureEngineering

SemesterI

Sr.No.	Course Type	Course Type/Code	CourseName	Teaching Scheme			Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1			AdvancedMathematics	3	1	0	4	50	100	150
2	Core-I	CET-501	InfrastructuralPlanning	3	1	0	4	50	100	150
3	Core-II	CET-502	ProjectmanagementinConstruction andBIM	3	1	0	4	50	100	150
4	Professional Elective-1	CET-503	OptimizationMethods	3	0	0	3	50	100	150
		CET-504	NumericalMethods							
		CET-505	ComputationalMethodsinCivilEngineering							
5	Professional Elective-2	CET-506	UrbanFloodingandDisasterManageme	3	0	0	3	50	100	150
		CET-507	ModernizationofWaterDistributionSystem							
		CET-508	WaterResourcesSystem:PlanningandManagement							
6	Core	CEP-501	InfrastructureEngineeringLabI	0	0	3	1	25	25	50
7	Core	CEP-502	ProgrammingApplicationforEngineers	0	0	3	1	25	25	50
8	Mandatory course	MLC	ResearchMethodologyandIPR	2	0	2	2	50	50	100
9	Audit-1	AHT-303	Technical Writing and Presentation Skill	2	0	0	NC	50	0	NC
			Total	**19**	**3**	**8**	**22**	**400**	**600**	**1000**
10	*OpenElective-1 (Optional)	CET-623	Disaster Management	3	0	0	3	50	100	150

SemesterII

Sr.No.	Course Type	CourseType/Code	CourseName	Teaching Scheme			Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	Core-III	CET-509	FinancingInfrastructureProjects	3	0	0	3	50	100	150
2	Core-IV	CET-510	ConstructionMethodsandEquipment Management	3	0	0	3	50	100	150
3	Professional Elective-3	CET-511	SubsurfaceInvestigationand Insturmentation	3	0	0	3	50	100	150
		CET-512	GroundImprovementTechniques							
		CET-513	EarthRetainingStructures							

4	Professional Elective-4	CET-514	AdvancedConcreteEngineering	3	0	0	3	50	100	150
		CET-515	UrbanEnvironmentalManagement							
		CET-516	AdvancedStructuralDesign							
5	Open Elective-1	CET-317	RiskmanagementinConstruction	3	0	0	3	50	100	150
		CET-318	EnviromentalImpactAssesment							
		CET-319	IndustrialSafety							
6	Core	CEP-503	SubsurfaceInvestigationand InsturmentationLab	0	0	3	1	25	25	50
7	Core	CEP-504	SurveyingforInfrastructureProjects	0	0	3	1	25	25	50
8										
			Total	**15**	**0**	**6**	**17**	**300**	**550**	950
9	Open Elective-2(Optional)	*Open Elective-2(Optional)		3	0	0	3	50	100	150

SemesterIII

Sr.No.	**Course Type**	**CourseType/Code**	**CourseName**	**Teaching Scheme**			**Credits**	**Internal Marks**	**External Marks**	**Total Marks**
				L	T	P				
1	Open Elective-2	CET-320	BusinessAnalytics	3	0	0	3	50	100	150
		CET-321	OperationsResearch							
		CET-322	CostManagementofEngineeringProjects							
2	Seminar	Seminar		0	0	4	2	100		100
3	Project	Project		0	0	10	5	100	150	250
4	Dissertation	Dissertation	Dissertation	0	0	12	6	300		300
			Total	**3**	**0**	**22**	**16**	**550**	**250**	**800**

SemesterIV

Sr.No.	**Course Type**	**CourseType/Code**	**CourseName**	**Teaching Scheme**			**Credits**	**Internal Marks**	**External Marks**	**Total Marks**
				L	T	P				
1	Dissertation	Dissertation	Dissertation	0	0	28	14	250	450	700
			Total	**0**	**0**	**28**	**14**	**250**	**450**	**700**

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus
Advanced Mathematics (AHT-301)

L:T:P:: 3:1:0 **Credits-4**

Course objectives:

From this course, students will be able to:

1. learn distinct methods of solving simultaneous equations.
2. well-versed with partial differential equations and their solutions and applications.
3. acquire the knowledge of transformation to ease the complex problems.
4. acquaintance with basics of random variables and their distribution for dealing with events by chance.
5. study different mathematical domains to deal with real-time engineering problems.

Learning outcomes:

1. Comprehend with engineering problems in different mathematical realm.
2. Learn analytical and numerical methods to deal with mathematical problems.
3. Understand how to model the engineering problems and their solutions.
4. Implement the solutions to real-time complex engineering problems.
5. Apprehend with mathematical methodology.

Course content:

Unit I: Solution of linear simultaneous equations: (8 hours)

Consistency, Iterative method, Convergence, Cholesky's (Crout's) method, Gauss-Jordan method, Gauss-Seidel iteration and relaxation methods, Solution of Eigenvalue problems, Smallest, largest, and intermediate Eigen values

Computer based algorithm and programme for these methods (non-evaluative)

Unit II: Partial differential equation and its applications: (10 hours)

Introduction and classification of partial differential equation, Four standard forms of non-linear partial differential equations and their solutions, linear equations with constant coefficients. Applications of partial differential equationsone and two-dimensional wave equation, one and two-dimensional heat equation, Two-dimensional Laplace's equation.

Syllabus
Advanced Mathematics (AHT-301)

L:T:P:: 3:1:0 **Credits-4**

Unit III: Transform calculus-I: **(8 hours)**

Laplace transform, Properties of Laplace transform, Inverse Laplace transform,Applications of Laplace transform, Fourier integral theorem, Fourier transforms, Application of Fourier transform

Unit IV: Transform calculus-II: **(8 hours)**

Z-transform, Properties of Z-transform, Shifting theorems, Initial and final value theorem, Convolution theorems, Inverse Z-transform, Application of Z-transform

Unit V: Basic probability theory: **(8 hours)**

Concept and laws of probability,Discrete and continuous random variable and their distributions; Some special distributions such as Binomial, Poisson, Negative Binomial, Geometric, Continuous uniform, Normal, Exponential, Weibull, Moments,Moment generating functions, Expectation and variance

Practical demo with statistical software like R, SPSS, SAS, etc. (non-evaluative)

Text Books / References:

1. B.S. Grewal, Engineering Mathematics, Khanna Publications, 44th edition.
2. F.B. Hilderbrand, Method of Applied Mathematics, PHI Publications, 2nd edition.
3. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand Publication, 20th edition.
4. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathmematical Statistics, S. Chand Publication, 4th edition.
5. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th edition.
6. S. Ross, A First Course in Probability, Pearson Education, 8th edition.

CET-501 **INFRASTRUCTURE PLANNING** **3L:1T:0P**

Syllabus

INFRASTRUCTURE PLANNING CET-501

3L: 1T:0P **CREDIT:4**

Course objective: To study the necessity of infrastructure & its management, finance management Fundamentals & Evaluation and managerial economics.

Course outcomes:

On the completion of this course the student will be able to:

1. Summarize the concept of Infrastructure and their status in India.
2. Outline the details of Infrastructure Planning.
3. Prepare the detailed planning process for managing a Infrastructure project.

Syllabus:

Unit- I **(8 hours)**

Introduction to Infrastructure: Types of infrastructure, Role of infrastructure, Infrastructure crisis, Attributes of Infrastructure, Infrastructure and Economic Growth and poverty reduction, Indian scenario and future outlook

Unit- II **(8 hours)**

Infrastructural Sectors and their Status in India: Overview, Characteristics, Performance, Reforms and Policies, Targets, Subsidies and Privatization, Policy Initiatives, Reforms, National policies, Regulatory Authorities in Power Sector, Water sector, Transportation Infrastructure, Telecommunications Infrastructure in India

Unit- III **(8 hours)**

Infrastructure Planning-Part A: Infrastructure planning steps: Problem diagnosis (Population and employment, Land use, Economic base, Transportation system, Travel patterns, Social and value factors, Financial resources, Ordinances, statutes and regulations), Goal articulation, Forecasting, Design of alternatives.

Unit- IV **(8 hours)**

Infrastructure Planning-Part B: Plan testing (Testing against objectives, Testing against constraints), Evaluation and choice (Economic evaluation, Financial evaluation, Environmental evaluation), Implementation of Plan.

Unit- V **(8 hours)**

Managing the planning process: Management summary, Project description and appraisal, Technical section (Work breakdown structure, Task sheets, Deliverables, Flow diagram, Gantt chart, Budget and cash flow), Organization section (Team's structure, Responsibility matrix, Client interface).

TEXT BOOKS / REFERENCES:

CET-501 **INFRASTRUCTURE PLANNING** **3L:1T:0P**

Syllabus

INFRASTRUCTURE PLANNING CET-501

3L: 1T:0P **CREDIT:4**

1. Infrastructure Planning, Parkin and Sharma, Thomas Telford Publications.
2. https://www.ibef.org, India Brand Equity Foundation.
3. Project Management (A Systems Approach to Planning, Scheduling, and Controlling), Harold Kerzner, John Wiley & Sons Publications.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

PROJECT MANAGEMENT IN CONSTRUCTION AND BIM CET-502

3T:1T:0P **Credit: 4**

Course objective: The objective of the course is to provide efficient communication, collaboration, and productive guidelines to achieve project goals within the estimated time with high quality .BIM helps the construction manager to gather data and information from the relevant disciplines and communicate them more effectively.

Course outcomes:

On the completion of this course the student will be able to:

1. Outline the concept of Project Management and solve the planning by application of various Network Scheduling Techniques
2. Use the concepts of Pricing, quality, safety Management regarding a Project
3. Identify factors of Quality Management
4. Learn new techniques of project management like BIM

Syllabus:

Unit- 1 **(8 hours)**

Introduction to Project Management: Introduction to project management, objectives of a project, Stakeholders, Phases and project organization. Introduction to resource management in construction projects. Life Cycle of a construction project.

Unit- 2 **(8 hours)**

Estimation and Network based project management:

Estimating quantities, estimation of project cost, rate analysis, measurement in civil engineering, Project planning, Activity time, Time management tools, progress monitoring, introduction to network analysis concepts, scheduling, PERT.

Unit- 3 **(8 hours)**

Contract and Quality, Safety Management: Procurement, Types of Contracts, Contract Closure, Quality control in construction, Quality assurance, quality standardization, Elements and economics of quality, Total Quality Management (TQM), Introduction to construction safety, safety management, safety guidelines.

Unit- 4 **(8 hours)**

Modern Developments in Project Management: The Current Business Model, Inefficiencies of Traditional Approaches Definition of BIM, Components of BIM, Advantages of BIM over traditional design-build process, Use of BIM, Benefits of BIM for a construction project, Importance of BIM in construction industry.

Unit- 5 **(8 hours)**

BIM and Smart cities: Concept and definition of Smart Cities. Understanding Smart cities and BIM. Future of BIM and its role in creating Smart Cities. Introduction to various types of sensors and ICT. Role of above modern tools in the BIM process, scan to BIM.

TEXT BOOKS / REFERENCES:

1. BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, Sacks et al., 3rd Edition, John Wiley & Sons Publications, 2018
2. Project Management (A Systems Approach to Planning, Scheduling, and Controlling), Harold Kerzner, 12th Edition, John Wiley & Sons Publications, 2017
3. Construction Project Management: A Practical Guide to Field Construction Management, Sears et al., 6th Edition, John Wiley & Sons Publications, 2015.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

OPTIMIZATION METHODS CET-503

3T:0T:0P **Credit: 3**

Course objective: The objective of the course is to provide optimal solutions to a particular problem.

Course outcomes:

On completion of the course, the student will be able to:

1. Determine the need for optimal design in engineering, necessary and sufficient conditions of optimality.
2. Determine the optimality of constrained and unconstrained problems using classical search techniques.
3. Determine the optimality of non-linear problems and linear problems using classical optimization methods
4. Apply evolutionary algorithms for basic problems as wells as advanced engineering design problems.

Syllabus:

Unit- I **(8 hours)**

Introduction to Optimization: Basics of engineering analysis and design, Need for optimal design, Difficulties associated with optimization problems, Problems of global and local optima, Single and multivariable problems, Necessary and sufficient condition for optimality.

Unit- II **(8 hours)**

Classical Optimization 1: Basics of constrained and unconstrained problems, Stationary points, points of maxima, points of minima and inflection points, Exhaustive search method, Bounding phase method, Region elimination method, Interval halving method, Golden section search method, Newton-Raphson Method and Bisection method.

Unit- III **(8 hours)**

Classical Optimization 2: Definition of descent direction, Steepest descent direction method, Newton method, Quadratic approximation of a function, Convex and concave functions, Convex optimization problem, Kuhn-Tucker conditions, Linear Programming, Simplex method and Dynamic programming.

Unit- IV **(8 hours)**

Non-Classical and Metaheuristic Optimization Algorithms 1: Introduction to Evolutionary algorithms, Introduction to Genetic Algorithm (GA), Differential Evolution (DE), Simulated

Annealing (SA).

Unit- V **(8 hours)**

Non-Classical and Metaheuristic Optimization Algorithms 2: Particle Swarm Optimization (PSO), Firefly Algorithms (FA), Shuffled Frog Leaping Algorithm (SFLA), Invasive Weed Growth Optimization (IWO) and other metaheuristic principles of biomimicry.

TEXT BOOKS / REFERENCES:

1. Deb. K., Optimization for engineering design: Algorithms and examples, PHI Pvt Ltd., 1998.
2. Arora., J.S., Introduction to optimum design, McGraw Hill International edition, 1989.
3. Hafta, R.T. and Gurdal. Z., Elements of structural optimization, Kluwer academic publishers, Third revised and expanded edition, 1996.
4. Bennis, F. and Bhattacharjya, R.K., Nature-Inspired Methods for Metaheuristics Optimization, Springer, 2020.

systems; Adaptive step size; Stiff ODEs, Shooting method; Finite differences; Over/Under Relaxation (SOR).

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADU

Syllabus

NUMERICAL METHODS CET-504

3T:0T:0P **Credit: 3**

Course objective: The objective of the course is to enhance the problem solving skills of engineering students using an extremely powerful problem solving tool namely numerical methods.

Course outcomes:

On completion of the course, the student will be able to:

1. Determine the need for numerical methods in engineering design.
2. Evaluate the linear system of equations using numerical analysis.
3. Estimate the solution to a system of algebraic equations using different iterative methods.
4. Evaluate the techniques of numerical integration and differentiation to solve complex. problems.
5. Apply numerical methods to initial and boundary valued problems and formulate the finite difference forms of partial and ordinary differentials.

Syllabus:

Unit- I **(8 hours)**

Introduction to Numerical Methods: Introduction & Approximations, Motivation and Applications, Accuracy and precision; Truncation and round-off errors; Binary Number System; Error propagation, Error Analysis.

Unit- II **(8 hours)**

Linear Systems and Equations: Matrix representation; Cramer's rule; Gauss Elimination; Matrix Inversion; LU Decomposition; Iterative Methods; Relaxation Methods; Eigen Values.

Unit- III **(8 hours)**

Algebraic Equations: Bracketing Methods, Introduction to Algebraic Equations, Bracketing methods: Bisection, Reguli-Falsi; Open Methods: Secant; Fixed point iteration; Newton-Raphson; Multivariate Newton's method.

Unit- IV **(8 hours)**

Numerical Differentiation and Integration: Numerical differentiation; error analysis; higher order formulae, Trapezoidal rules; Simpson's rules; Quadrature, Linear regression; Least squares; Total Least Squares; Interpolation; Newton's Difference Formulae; Cubic Splines.

Unit- V **(8 hours)**

Applications of Numerical Methods: Initial Value Problems (IVP), Introduction to ODE- IVP,

Euler's methods; Runge-Kutta methods; Predictor-corrector methods; Extension to multi-variable systems; Adaptive step size; Stiff ODEs, Shooting method; Finite differences; Over/Under Relaxation (SOR).

TEXT BOOKS / REFERENCES:

1. Scarborough, J.B., Numerical mathematical analysis, Oxford & IBH Publishing CO Pvt., 2000
2. Jain, K.K., Iyengar, S.R.K and Jain, R.K., Numerical methods-problem and solutions, Wiley eastern limited, 2001
3. Hamming, R.W., Numerical methods for scientist and engineers, McGraw Hill, 1998.
4. Mathews, J.H. and Fink, K.D., Numerical methods using MATLAB, Pearson Education, 2004
5. Hayter, A.J., Probability and statistics, Duxbury, 2002.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADU

Syllabus

COMPUTATIONAL METHODS IN CIVIL ENGINEERING CET-505

3T:0T:0P **Credit: 3**

Course objective: The objective of the course is to introduce students to numerical methods for solving problems in civil engineering (both for modeling and experimental work).

Course outcomes:

On completion of the course, the student will be able to:

1. Identify and formulate a solution procedure for different types of equations encountered in civil engineering curriculum.
2. Discretize the total domain of model using different techniques based on the type of equation that needs to be solved.
3. Apply different numerical techniques to solve the equations and to successfully prepare a numerical model in theory.
4. Develop models that can solve a given partial differential equation under different boundary conditions using Finite Difference Method (FDM), or Finite Volume Method (FVM), or Finite Element Method (FEM) using programming.

Syllabus:

Unit- I **(8 hours)**

Basic equations used in Civil Engineering: Continuum Mechanics and Mechanics of Materials. Approximation of equations using numerical analysis – Taylor's series of expansion, Error analysis, Sources of errors – truncation error, round off error.

Unit- II **(8 hours)**

Mathematical nature of PDEs, Hyperbolic, Parabolic, Elliptic Equations and flow equations. Basic Discretization techniques: Finite Difference Method (FDM), Implicit and explicit formulations of FDM, Stability criteria of the forms of equations using error minimization.

Unit- III **(8 hours)**

Application of FDM to wave, Heat and Laplace equations. Linear multi-step methods; Predictor-corrector schemes, ADI methods, Grid transformations according to the appropriate boundaries. Lax-Wendroff Technique and MacCormack's Technique.

Unit- IV **(8 hours)**

The Finite Volume Method (FVM) and conservative discretization. Analysis and Application of

Numerical Schemes: Modified equation, The Runge-Kutta schemes, Numerical solution of the compressible Euler equations: Mathematical formulation of the system of Euler equations.

Unit- V **(8 hours)**

Basics of the Finite Element Method (FEM) and the Galerkin formulations. Basics of the computations of the differential equations using the three methods (FDM, FVM and FEM) in MATLAB, Python etc.

TEXT BOOKS / REFERENCES:

1. "Numerical Methods" by D. Dahlquist, and A. Bork, Dan Prentice-Hall, Englewood Cliffs, NJ,. 1974.
2. H. C. Martin and G. F. Carey, Introduction to Finite ElementAnalysis - Theory and Application, NewYork, McGraw-Hill.
3. J. D. Anderson (Jr.), “Computational Fluid Dynamics”, McGraw-Hill International Edition, 1995.
4. Matlab programming for Engineers, Stephen J. Chapman, 5th Edition, Cengage Learning, 2015.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADU

Syllabus

URBAN FLOODING AND DISASTER MANAGEME CET-506

3T:0T:0P **Credit: 3**

Course objective: To impart knowledge and skills relevant to water management in the context of urbanization and relate engineering principles to storm water and wastewater management, along with Policy, Planning, and Economic evaluation issues in urban areas.

Course outcomes:

On the completion of course student will be able to:

1. Determine the importance of watershed management and analyse the precipitation data.
2. Critique the types of disaster management and mitigation methods.
3. Evaluate the natural disaster types with related cases of urban flooding.
4. Analyse the variability of climate change and its corresponding impact on urban flooding.
5. Design the watershed systems with policies and planning according to the economic issues in urban areas.

Syllabus:

Unit- I **(8 hours)**

Basic Concepts of hydrological phenomena: Course overview, Introduction, Why watershed hydrology & management? Water cycle, Precipitation and Interception: Formation, Intensity and types, plant canopy Interception and through fall, Measurements, Precipitation data analysis and statistical analysis of data.

Unit- II **(8 hours)**

Basic concept of Disaster Management: Vulnerability and disaster. Risk and different types. Flood and its type. Definition of risk mitigation. Different mechanism working on risk mitigation.

Unit- III **(8 hours)**

Natural Hazards Risk Management and Urban flooding: Types of natural disaster, Meaning of urban flooding, Use of GIS in hazard risk management, Disaster Risk management in different parts of India: case study of different states, Disaster Risk management in different parts of world: case study.

Unit- IV **(8 hours)**

Climate Variability & Disaster Risk and Urban-Rural Risk Management: Climate change,

Effect of climate change on Urban flooding, Future sustainability study due to climate change on urban flooding.

Unit- V **(8 hours)**

Watershed modelling and management: Watershed modelling and analysis: Selection, calibration and validation, Watershed management: Policy, Planning, and Economic evaluation issues in urban areas.

TEXTBOOKS/REFERENCES:

1. Chow, V.T, Maidment, D.R., Mays.L.W., Applied Hydrology, McGraw Hill, 1988.
2. Tideman, E.M., Watershed Management – Guidelines for Indian Conditions, Omega Scientific Publishers, New Delhi, 1996.

.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

MODERNIZATION OF WATER DISTRIBUTION SYSTEM CET-507

3T:0T:0P **Credit: 3**

Course objective: To educate the students on economical treatment of water and wastewater, design of water mains, distribution system and sewer networks

Course outcomes:

On the completion of course student will be able to:

1. Determine the different conditions of water demand according to the areas of urbanization.
2. Analyse the basis of water distribution networks and determine the different treatment methods.
3. Evaluate the cases of transients in water distribution systems and remediation's to control the transients.
4. Validate the different wastewater collection systems and design the collection systems
5. Examine the water quality using traditional and modern methods of testing.

Syllabus:

Unit- I **(8 hours)**

Introduction: Components of water supply systems, Water use and demand estimation, Surface water and Groundwater sources, Water quality and drinking water standards, Determination of reservoir capacity. Design period, population data and flow rates for water supply systems, Factors affecting water consumption and variation in demand.

Unit- II **(8 hours)**

Basics of Water distribution networks: Basic methods of designing water distribution networks, Basics of treatment of water distribution: Physico - Chemical Processes, Sedimentation, Coagulation, and Flocculation, Granular Media filtration, Disinfection, Adsorption and ion exchange processes. Effects of Hydraulic Transients in design of pipelines, Equations of unsteady flow in pipes, Method of characteristics, Solution procedure to solve equation of hydraulic transients using finite difference method.

Unit- III **(8 hours)**

Design of Water distribution networks: Transient cases of sudden closure of valves pump failures and initialization of pumps, Methods of analysis for optimal distribution network design, Air valves, pressure relief valves and surge tanks and their optimal locations. Types of reservoirs and design parameters and methods; Design of water pumping stations.

Unit- IV **(8 hours)**

Wastewater collection systems: Design principles, separate, combined and semi- combined sewers, Estimation of dry weather flows, Sewer Materials and Sewer Appurtenances, Sewer pipe hydraulics: sizing of pipes and design, Manhole chambers and storm water overflows.

Unit- V **(8 hours)**

Maintenance of water supply and wastewater systems: Cleaning of water towers (Overhead Tanks), Analysis of wastewater – determination of solids, COD, BOD, nutrients, heavy metals and their significance, BOD progression and its formulations. Pumping stations, screens and inverted screens, Regular checks of leakages from sewer lines, monitoring wells near the potential source locations.

TEXTBOOKS / REFERENCES:

1. Chaudhry, H., Hydraulic Transients, Tata McGraw Hill, 1998.
2. Chaudhry, H., Applied hydraulic transients, Van Nostrand Reinhold, New York, 1987.
3. Streeter, V.L. and Wylie, E.B., Hydraulic Transients, McGraw Hill, New York, 1967
4. McGhee, T. J., Water Supply and Sewerage, McGraw Hill International, 1991.
5. Peavy, H.S., Rowe D.R., and George Tchobanoglous, Environmental Engineering, McGraw Hill, 1985.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

WATER RESOURCES SYSTEM: PLANNING AND MANAGEMENT CET-508

3T:0T:0P **Credit: 3**

Course objective: To make the students understand the basics of water resources system, Urban storm water management.

Course outcomes:

On the completion of course the student will be able to:

1. Understand the need for systems approach for water resources.
2. Solve different problems of reservoir operation using linear programming principles.
3. Analyse different problems of multiple reservoirs and capacity planning using dynamic programming principles and genetic algorithms.
4. Evaluate the effect of time series analysis for the assessment of risk in hydraulic designs
5. Systematize the types of water resource systems and perform analysis related to social and economic impact.

Syllabus:

Unit- I **(8 hours)**

Basic concepts of systems need for systems approach in water resources, system design techniques, problem formulation.

Unit- II **(8 hours)**

Introduction to Optimization, Optimization techniques, Linear Programming, Graphical Method, Simplex Method, Dual Simplex Problem, Reservoir operation and Reservoir sizing using Linear Programming.

Unit- III **(8 hours)**

Non-Linear Programming, Dynamic programming, genetic algorithm, sensitivity analysis, capacity expansion, reservoir operation problems, simulation, case studies, Multi reservoir operation.

Syllabus

WATER RESOURCES SYSTEM: PLANNING AND MANAGEMENT CET-508

3T:0T:0P **Credit: 3**

Unit- IV **(8 hours)**

Probability, risk and uncertainty analysis for hydrologic and hydraulic design, Chance Constrained Linear Programming, Stochastic Processes and Transitional Probabilities, Stochastic Dynamic Programming, Time series analysis.

Unit- V **(8 hours)**

Planning, role of a planner, River basin planning and management, Water distribution system, Groundwater system, Flood plain Management, Urban storm water management, National water policies, public involvement, social impact, economic analysis.

TEXTBOOKS/REFERENCES:

1. Loucks, D.P., Stedinger, P.J.R., Haith, D.A., Water Resources Systems Planning and Management, Prentice Hall, New Jersy, 1987
2. Hall, K., A and Draoup, J.A., Water Resources Systems Engineering, Tata McGraw Hill, 1970.
3. Neil, G.S., Water Resources Planning, McGraw Hill, 1985.
4. National Water Policy, Ministry of Water Resources, Government of India, 1987.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

CEP -501 INFRASTRUCTURE ENGINEERING LABORATORY-1

0L:0T:3P

Course objective: To make the students understand the basics of different software to solve the civil engineering projects related problems.

Course outcomes:

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

1. To plan, schedule and control the construction of the project.
2. To use project planning tools.
3. To carry out cost analysis and project updating.
4. To study risk analysis and resource allocation at site.

EXPERIMENTS:

1. Introduction to MS Project, Quick Access Tool Bars and Ribbon Customization, opening a File Template, Import from Excel.
2. Calendar Setting Up, Manual and Auto Schedule, Summary, Milestone and Recurring Task, Copying Task from another Program, Work Break down Structure, Linking Task, Task with Dates Constraints, View Task Links.
3. Resources and Adding a Work Resources, Material Resources, Cost Resources and Assigning, Duration Work and Unit, Assigning Resources to Task, Overallocation.
4. Effort Driven Scheduling, Modifying Resources, Replacing Resources, choosing a View, Table Setting: (Column and Its Setting, Multi Windows Feature), Timeline, Sorting Tasks and Resources, Group Filter and Highlight, Formatting Bars and Text.
5. Critical Task, and Slack, Task Inspector and Splitting of Task, Delaying, Work Contours and Levelling of Resources, Updating Schedule, Overtime Work, Update Cost and Rescheduling, Project Status, Schedule and Cost Problems, Report and Printing.
6. Introduction to Primavera, Navigation Toolbars, EPS and OBS, Resources Codes and Roles, Work Break down Structure, Budgets, User Defined Fields, Calendar, Activity Code.

1. Creating a New Project, Adding Activity, Working with Activities, Cost Account, Project Expenses, Maintaining Baseline, Updating Scheduling, Update Project with Auto Actuals Method, Update Project with Manual Method.
2. Removing Progress from Activities, Suspend and Resume Activity, Storing Past Period Performance Scheduling Project, Using Work Product and Documents, Comparing Project, Tracking Progress, Creating and Using Reflections Customising Projects.
3. Resource Levelling, Stacked Histograms, Resource Usage Spreadsheets & Activity Usage Spreadsheet, Schedule Percentage Complete & Performance Percentage Complete, Planned Value & Earned Value Curves
4. Working with Layouts, Grouping and Sorting and Filtering, Customizing Layout, Customizing Report, Printing Layout and Reports, Exporting Data from XER, XML and MS Project Formats, Importing Data from XER, XML and MS Project Formats.

TEXT/REFERENCE BOOKS:

- Paul E Harris, 2015, Planning and Control Using Oracle Primavera P6 Versions 8.1 to 15.1 PPM Professional.
- Jongpil Nam, 2016, Construction Scheduling With Primavera P6, AuthorHouseUK.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

PROGRAMMING APPLICATION FOR ENGINEERS CEP -502

0L: 0T:3P **Credit: 1**

Course objective: To impart knowledge and skills relevant to programming allows implementing new inventions, projects and ideas much faster and easier, which streamlines the job for engineers.

Course outcomes:

On the completion of this course the student will be able to:

1. Determine the different data types and their specificity of application to problems
2. Analyse the importance of loops, algorithms and pseudo codes along with their applications to engineering problems
3. Construct the formulation of mathematical partial differentials into numerical methods of programming using FDM and FVM techniques
4. Solve a given minimization problem using meta heuristic principles

EXPERIMENTS:

1. Introduction to data types, numbers, strings, lists, arrays, vector and tensor arrays
2. Introduction to Python Math, Numpy and Scipy
3. Introduction to for loop, if else condition, while loop and function definitions
4. Conversion of Problems in mathematical form to programming language form
5. Algorithms, Flow charts and pseudo codes for problem examples
6. Practicing iterative optimization and numerical methods of problem-solving using Python
7. Finite difference (FDM) and finite volume (FVM) formulations of Partial Differential Equations (PDEs)
8. Discretization of space and time to solve the different PDEs of Engineering problems
9. Writing a code to solve a given PDE using FDM or FVM techniques
10. Writing a code to write a metaheuristic algorithm (Genetic Algorithm) to solve any optimization problem.

Books,

1. Al Sweigart Automate the Boring Stuff with Python, 2nd Edition
2.Charles Severance Python for Everybody: Exploring Data in Python 3
Python (2nd Edition): Learn Python in One Day and Learn It Well.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

Open Elective-1

(Optional) **DISASTER MANAGEMENT(CET-623)**

3L:0T:0P **Credit: 3**

Course objective: To make the students understand the key concepts in disaster risk reduction and humanitarian, Summarize basics of disaster, Illustrate disaster risk reduction and humanitarian response policy and practice from multiple responses. Describe an understanding of standards of humanitarian response and practical relevance in perspectives.

Course outcomes:

1: Ability to summarize basics of disaster

2. Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.

3. Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

4. Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

5. Ability to develop the strengths and weaknesses of disaster management approaches

Syllabus :

Unit- I (8 hours)

INTRODUCTION Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit- II (8 hours)

REPERCUSSIONS OF DISASTERS AND HAZARDS: Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit- III (8 hours)

DISASTER PRONE AREAS IN INDIA: Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

Unit- IV (8 hours)

DISASTER PREPAREDNESS AND MANAGEMENT: Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

Open Elective-1

(Optional) **DISASTER MANAGEMENT (CET-623)**

3L: 0T:0P **Credit: 3**

Unit- V (8 hours)

RISK ASSESSMENT: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

REFERENCES 1. Goel S. L., "Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009.

2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" NewRoyal book Company,2007.

3. Sahni, PardeepEt.Al. ,"Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

Open Elective-1
(Optional URBAN ENVIRONMENTAL MANAGEMENT(CET-523)

3L: 0T:0P **Credit: 3**

Course objective: To educate the students to prevent pollution, meet compliance obligations and enhance conditions of the environment. and its allied problems.

Course outcomes:

On the completion of course student will be able to:

1. Explain planning of a city and identify various urban environmental issues
2. Prepare project Plans to integrate urban water resource
3. Explain water resource management using available water resources
4. Develop sustainable wastewater management concepts comparing with successful models followed in developed nation
5. Apply the principles of solid waste management

Syllabus:

Unit- I **(8 hours)**

Urban Environmental Issues:Urbanization- Population growth scenario migration-Pollution of surface water resources rivers, tanks, channels ground water exploitation - wastewater - characteristics – pollution problems - Solid waste - air pollution – CPCB norms. Urban master plans- Planning and Organizational aspects.

Unit- II **(8 hours)**

Urban Waste Resources Management:Water in urban ecosystem – urban water resources planning and organization aspects storm water management practices-types of storage-magnitude of storage-storage capacity of urban components - percolation ponds - temple tanks- rainwater harvesting.

Unit- III **(8 hours)**

Urban Water Supply:Demand estimation - population forecasting - source identification - water conveyance -storage reservoirs - fixing storage capacity -Distribution network - types - analysis – computer applications
- Conservation techniques -Integrated urban water planning.

Unit- IV **(8 hours)**

Urban Waste Water Management: Sewage generation - storm drainage estimation-industry contribution-wastewater collection system-separate and combined system - hydraulic design of sewer and storm drain –waste water treatment-disposal methods-concept of decentralization- 3R concepts.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

Open Elective-1
(Optional URBAN ENVIRONMENTAL MANAGEMENT(CET-523)

3L: 0T:0P **Credit: 3**

Unit- V **(8 hours)**

Municipal Solid Waste Management:Sources of solid waste - characteristics - rate of generation - segregation at source -collection of solid waste-methods of collection-route analysis-transfer and transfer stations - processing and disposal of solid waste. Case Studies-Environmental economics-Social and Physiological aspects of pollution- Successful Urban Management -models- Urban Management-Case studies from Developed Nations - Software

TEXTBOOKS/REFERENCES:

1. George Tchobanoglous, Hilary Theisen and Samuel A Vigil" Integrated Solid Waste Management", McGraw Hill Publishers, New York,1993.
2. Martin P. Wanelista and Yousef. "Storm Water Management and Operations", John Wiley and Sons,1993.
3. Neil S. Grigg, "Urban Water Infrastructure Planning-Management and Operations", John Wiley and Sons,1986.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Technical Writing and Presentation Skills (AHT-303)

L:T:P::2:0:0 **Non-credits**

Course Objectives:

- To develop effective writing and presentation skills in students.
- To develop textual, linguistic and presentation competencies instudents appropriate for their professional careers.

Course Outcomes:

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

CO1: Write clearly and fluently to produce effective technical documents.

CO2: Demonstrate an appropriate communication style to different types of audiences both orally and written as per demand of their professional careers.

CO3: Communicate in an ethically responsible manner.

Course Contents:

WRITING SKILLS

Unit-I **(4 hours)**

Technical Writing-Basic Principles: Words-Phrases-Sentences, Construction of Cohesive Paragraphs, Elements of Style.

Unit-II **(4 hours)**

Principles of Summarizing: Abstract, Summary, Synopsis

Unit-III **(6 hours)**

Technical Reports: Salient Features, Types of Reports, Structure of Reports, Data Collection, Use of Graphic Aids, Drafting and Writing

PRESENTATION SKILLS

Unit-IV **(6 hours)**

Speaking Skills: Accuracy vs. Fluency, The Audience, Pronunciation Guidelines, Voice Control.

Unit-V **(8 hours)**

Professional Presentations: Planning, Preparing, Presentation Strategies, Overcoming, Communication Barriers, Using Technology, Effective Presentations.

References:

1. Kumar, Sanjay & Pushp Lata, “Communication Skills”, Oxford UniversityPress,2011.
2. Quirk & Randolph, “A University Grammar of English”, Pearson,2006.
3. Rutherford, Andrea J., “Basic Communication Skills for Technology”, Pearson 2007.
4. Rizvi, M Ashraf, “Effective Technical Communication”, McGraw Hill,2009.
5. Leigh, Andrew & Maynard, Michael, “The Perfect Presentation”, Random House.
6. Barker, Larry L., “Communication”, Prentice-Hall.
7. Lesikar&Flatley, “Basic Business Communication-Skills for Empowering the Internet Generation”, Tata

Syllabus

FINANCING INFRASTRUCTURE PROJECTS (CET 509)

3L:0T:0P **Credit:3**

Course objective: Students should have a basic knowledge of financing of different civil engineering projects.

Course outcomes:

On the completion of course student will be able to:

1. Differentiate the concept of Infrastructure financing from general financing and illustrate various types of project agreements
2. Relate to various types of risks in infrastructure projects
3. Demonstrate various financial structures of infrastructure projects and compare between various financial support options.
4. Differentiate the concept of Infrastructure financing from general financing and illustrate various types of project agreements
5. Relate to various types of risks in infrastructure projects
6. Demonstrate various financial structures of infrastructure projects and compare between various financial support options

Syllabus:

Unit- I **(8 hours)**

Introduction to Infrastructure Financing: Introduction to infrastructure financing; Elements of a project-finance structure, Benefits of Project finance, Sponsors and other investors, Procurement of infrastructure projects, Commercial banks, Bonds

Unit- II **(8 hours)**

Project Agreement: Types of project agreement (BOT, BTO, BOOT, BOO), Offtake contract, Concession agreement, Other 'PPP-like' contracts, Aspects of project agreements, Compensation events, Relief events, Termination of project agreement

Unit- III **(8 hours)**

Risks in Infrastructure Projects: Commercial risks, Analysis of commercial risks, Macro-Economic Risks, Time value of money, discounted cash Flow, Internal rate of return, Inflation, Regulatory and Political Risks, Change in law, Investment risks, Risk evaluation and Allocation

Unit- IV **(8 hours)**

Financial Structuring: Investors analysis and equity structure, Debt cover ratios, Debt: Equity ratio, Debt service profile, Interest rate and fees, Additional costs, optimizing the financial structure

Unit- V **(8 hours)**

Financial Support: Indirect and direct Public-sector financial support, Gap Financing, Credit Guarantee Finance, Capital Grant, Viability-Gap Funding, Minimum Revenue Guarantee, Tariff

Syllabus

FINANCING INFRASTRUCTURE PROJECTS (CET 509)

3L:0T:0P **Credit:3**

Subsidy, Export Credit Agencies, Multilateral Development-Finance Institutions

Text books:

1. Principles of Project Finance, E.R. Yescombe, Elsevier Publications
2. Infrastructure Planning and Management: An Integrated Approach, Virendra Proag Springer Publications.

Reference books:

1. Project Finance in Theory and Practice: Designing, Structuring and Financing Private and Public Projects 2012 Gatti.

Syllabus

CONSTRUCTION METHODS & EQUIPMENT MANAGEMENT (CET 510)

3L: 0T:0P **Credit:3**

Course objective: To study the Initiation, Planning and Design, Construction and Execution, Monitoring and Control, Completion.

Course outcomes:

On the completion of course student will be able to:

1. Explain Equipment Economics and perform Ownership and operating costs calculation
2. Classify various types of equipment and calculate their capacities along with productivity
3. Assess appropriate type of equipment to be employed in a construction activity

Syllabus:

Unit- I **(8 hours)**

Introduction to Equipment Economics: Planning Process for Equipment and Methods; Cost of Owning and Operating Construction Equipment - Ownership cost, Depreciation, Operating cost, and Ownership and operating costs calculation methods; Replacement Decisions, Rent and Lease Considerations

Unit- II **(8 hours)**

Planning for Earthwork Construction, Compaction and Stabilization Equipment: Graphical Presentation of Earthwork, Earthwork Quantities, Mass Diagram, Structural Excavation, Pricing Earthwork Operations, Compaction of Soil and Rock, Compacting Methods, Types of Compacting Equipment, Soil Stabilization

Unit- III **(8 hours)**

Power Requirements and Equipment: Dozers and Graders: General Information, Project Employment, Production Estimating Scrapers: General Information, Types, Operations, Performance Charts, Production Cycle Excavators: General Information, Types

Unit- IV **(8 hours)**

Trucks and Hauling Equipment, Asphalt Mix Production and Placement: Capacities of Trucks and Hauling Equipment, Calculating Truck Productivity, Truck Performance Calculations;

Paving Equipment, Sweeper, Asphalt Distributors, Haul Trucks, Asphalt Pavers, Compaction Equipment

Unit- V **(8 hours)**

Concrete Equipment and Pile-Driving Equipment: Batching Concrete Materials, Mixing and

Syllabus

CONSTRUCTION METHODS & EQUIPMENT MANAGEMENT (CET 510)

3L: 0T:0P **Credit:3**

Placing Concrete, Consolidating Concrete, Finishing and Curing Concrete ,Driving Piles, Pile Hammers, Supporting and Positioning Piles During Driving, Spudding and Preaugering.

Text books:

1. Peurifoy, R., Schexnayder, C., Shapira, A., & Schmitt, R. (2011). "Construction Planning, Equipment, and Methods" (8th ed.). McGraw-Hill.
2. Gransberg, D. D., Popescu, C. M., & Ryan, R. C. (2006). "Construction equipment management for engineers, estimators, and owners" (2nd ed.). CRC Press.

Reference Books:

1. Day, D. A., & Benjamin, N. B. H. (1991). "Construction equipment guide" (2nd ed.). John Wiley & Sons.
2. Harris, F. (1994). "Modern construction and ground engineering equipment and methods" (2nd ed.). Pearson Longman.
3. Nunnally, S. W. (2011). "Construction methods and management" (8th ed.). Prentice Hall.

Syllabus

SUBSURFACE INVESTIGATION AND INSTRUMENTATION (CET 511)

3L:0T:0P **Credit:3**

Course objective: To study the necessity of infrastructure & its management, finance management Fundamentals & Evaluation and managerial economics.

Course outcomes:

On the completion of course student will be able to:

1. Describe the phases of soil investigation in depth and identify the plan for soil investigation
2. Identify various methods of soil investigation and soil sampling
3. Illustrate various field test of soils and rocks
4. Examine components of soil exploration report and estimate properties using correlations.
5. Work with relevant instrumentation required for characterizing the soil

Syllabus:

Unit- I **(8 hours)**

Introduction to Soil Exploration: Objectives of Site Investigation, Phases of investigation, Classification, Planning for Subsurface Exploration, Fact finding and Geological survey, Reconnaissance, Preliminary Exploration, Detailed Exploration, Codal Provisions.

Unit- II **(8 hours)**

Methods of investigations and Sampling: Trial pits/Trenches, Borings/drilling, Auger boring, Wash boring, Percussion drilling, Rotary drilling, Sample Disturbance, Disturbed Sample, Undisturbed Samples, Sampling by standard split spoon, Sampling by thin-wall tube, Sampling by Piston sampler.

Unit- III **(8 hours)**

Geotechnical investigation (Semi-direct methods): Vane Shear test, Standard Penetration Test, Pressure meter Test, Cone Penetration Test, Dilatometer test, Rock core drilling, Sampling of rock, Core stacking, Rock Quality Designation (RQD), Total Core Recovery (TCR).

Unit- IV **(8 hours)**

Geophysical Tests (Indirect methods): Seismic reflection survey, Seismic refraction survey, Electrical resistivity Survey, Applications, Advantages, Disadvantages and Limitations

Unit- V **(8 hours)**

Soil Exploration Report and Field Instrumentation: Components of Soil Exploration Report, Drafting of Reports, Graphic Presentations of Bore Log, Study of Sample Reports, Field Instrumentation: Pressure meters, Piezometer, Pressure cells, Sensors, Inclinometers, Strain gauges etc.

Text books:

Syllabus

SUBSURFACE INVESTIGATION AND INSTRUMENTATION (CET 511)

3L:0T:0P **Credit:3**

1. Principles of Geotechnical Engineering, Braja M. Das, Cengage
2. Basic and applied Soil Mechanics, Rajan & Rao, New Age International Publishers

Reference books:

1. Soil Properties and their correlations, Micheal Carter and Stephen P. Bentley, Wiley Publications.
2. Latest version of relevant IS codes for various tests.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

GROUND IMPROVEMENT TECHNIQUES (CET 512)

3L:0T:0P **Credit:3**

Course objective: The objectives of the course are for the students to improve bearing capacity and reduce settlement of soft ground, prevent earthquake liquefaction, control groundwater, stabilize excavation bottom, prevent deformation of surrounding ground, or clean up contaminated ground.

Course outcomes:

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

1. Identify the necessity of ground improvement.
2. Understand the different types of ground modification can be done depending upon the site condition, type and purpose of structure to be constructed.
3. Understand the functions of geosynthetics and soil nailing in engineering constructions.

Syllabus:

Unit- I **(8 hours)**

PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES: Role of ground improvement in foundation engineering – Methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

Unit- II **(8 hours)**

DEWATERING: Dewatering Techniques - Well points – Vacuum and electroosmotic methods – Seepage analysis for two-dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.

Unit- III **(8 hours)**

INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS: Insitu densification of cohesionless soils – Shallow as deep compaction – Dynamic compaction – Vibro flotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime piles-Installation techniques – Simple design - Relative merits of above methods and their limitations.

Unit- IV **(8 hours)**

EARTH REINFORCEMENT: Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism – Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.

Unit- V **(8 hours)**

Syllabus

GROUND IMPROVEMENT TECHNIQUES (CET 512)

3L:0T:0P **Credit:3**

GROUTING TECHNIQUES: Types of grouts – Grouting equipments and machinery – Injection methods – Grout monitoring – Stabilization with cement, lime and chemicals – Stabilization of expansive soil.

Text books:

1. Hausmann, M.R., "Engineering Principles of Ground Modification", McGraw-Hill International Editions, 1990.
2. Yonekura, R., Terashi, M. and Shibazaki, M. (Eds.), "Grouting and Deep Mixing", A.A. Balkema, 1966.
3. Moseley, M.P., "Ground Improvement", Blackie Academic & Professional, 1993.
4. Xanthakos, P.P., Abramson, L.W. and Bruce, D.A., "Ground Control and Improvement", John Wiley & Sons, 1994.

Reference books:

1. Koerner, R. M., "Designing with Geosynthetics", Prentice Hall Inc. 1998.
2. Shukla, S.K., Yin, Jian-Hua, "Fundamentals of Geosynthetic Engineering", Taylor & Francis.
3. Purushothama Raj. P, "Ground Improvement Techniques", Lakshmi Publications, 2nd Edition, 2016.
4. Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas Publishing House, First Edition, 2012.

VEER MADHO SINGH BHANDARI UTTARAKHND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

EARTH RETAINING STRUCTURES (CET 513)

3L: 0T:0P **Credit:3**

Course objective: To understand lateral earth pressure theories and pressure theories and design of retaining walls. To design anchored bulkheads by different methods. To understand pressure envelops and design of various components in braced cuts and cofferdams. To understand stability of earth dams and its protection and construction.

Course outcomes:

On the completion of course student will be able to:

1. Analyze the earth retaining structures for their stability against earth pressure.
2. Apply engineering knowledge for the designing of earth retaining structures in various site conditions.
3. Evaluation of retaining structures using appropriate design methods, factors of safety, earth pressure diagrams and check their stability.
4. Determine the required depth of penetration and embedment of free and fixed sheet pile walls in cohesion and cohesionless soils.
5. Evaluate anchored sheet pile walls in free and fixed earth support conditions, spacing between bulkheads and anchors, resistance of anchor plates.

Syllabus:

Unit- I **(8 hours)**

Earth Pressure: Introduction to earth pressure – basic concepts, Earth Pressure Types, Rankine's theory, backfill features – soil type, surface inclination, loads on surface, soil layers, water level, Coulomb's theory, Effects due to wall friction and wall inclination, Graphical methods and their interpretations.

Unit- II **(8 hours)**

Earth Retaining Structures: Types of earth retaining structures, Rigid Retaining Structures, Types, Empirical methods and Stability analysis. Flexible Retaining Structures, Types, Material, Design specifications and pressure distribution variations.

Unit- III **(8 hours)**

Sheet Piles and Bulkheads: Sheet Piles and Bulkheads in Granular and Cohesive Soils - Materials Used for Sheet Piles – Free Earth and Fixed Earth Support Methods, Cantilever sheet

piles, Anchored bulkheads, moment reduction factors, anchorage, Braced Excavation Types, Construction methods, Pressure distribution in sands and clays.

Unit- IV **(8 hours)**

Seepage Analysis: seepage control in embankments and foundations, seepage analysis, stability

Syllabus

EARTH RETAINING STRUCTURES (CET 513)

3L: 0T:0P **Credit:3**

analysis: upstream and down-stream for steady seepage, rapid draw down, end of construction, method of slices and Bishop's method, Coffer dams: Braced coffer dams – walls and supports, bottom heave and piping, Arching in Soils - Soil Pressures on Braced Walls and their Design.

Unit- V **(8 hours)**

Slope Protection and Geo-synthetics: Slope protection, filters, embankment construction materials and construction, quality control, grouting techniques. Instrumentation and performance observations in earth dams, Drum- debris walls, Classification of Geo-synthetics, Functions and applications, Properties of Geo-textiles, Geo-grids and Geo-membranes.

Text books:

1. Terzaghi, K., "Theoretical Soil Mechanics", John Wiley, 1965
2. Bowles, J.W., "Analysis and Design of Foundations", McGraw-Hill, 4th and 5th Ed. 1996.

Reference books:

1. Lambe, T.W. and Whitman, R.V., "Soil Mechanics", Wiley Eastern Limited, 1976.
2. Gulhati, K. Shashi and M. Datta, "Geotechnical engineering", Mc. Graw Hill Book Company, 2005.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

ADVANCED CONCRETE ENGINEERING (CET - 514)

3L:0T:0P **Credit:3**

Course objective: To study the properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete.

Course outcomes:

On the completion of course student will be able to:

1. Understand the physical and chemical properties of cement.
2. Understand the various properties of concrete.
3. Understand, Analyze and Evaluate the Concrete mix design.
4. Understand the various special concrete and its uses.

Syllabus:

Unit- I **(8 hours)**

Materials and Their Properties: Review of properties of cement, their physical and chemical properties, special purpose cements, Classification and properties of aggregates, soundness of aggregates, alkali aggregate reaction, thermal properties of aggregates, Importance of shape and Surface area and grading, gap graded and aggregates. Admixtures & construction chemicals, Use of Fly Ash, Silica Fumes, Metakaolin & GGBS in concrete Introduction to prestressed concrete.

Unit- II **(8 hours)**

Properties of Concrete: Rheological behaviour of concrete, requirements of workability of concrete, Durability & Effect of environmental conditions, Strength & maturity of hardened concrete, Impact, Dynamic and fatigue behaviour of concrete, shrinkage and creep of concrete, behaviour of concrete under fire.

Unit- III **(8 hours)**

Permeability and durability of concrete: Permeability and Durability of concrete, Parameters o

Syllabus

ADVANCED CONCRETE ENGINEERING (CET - 514)

3L:0T:0P **Credit:3**

f durability of concrete, chemical attack on concrete, Production of concrete; batching mixing,

transportation, placing, compaction of concrete. Special methods of concreting and curing, Hot weather and cold weather concreting, Guniting (Shotcreting).

Unit- IV **(8 hours)**

Concrete Mix Design: Concrete mix design, Basic considerations and choice a mix proportions, various methods of mix designs including IS Code method. Quality control and quality assurance of concrete, Acceptance criteria, Quality management in concrete construction, Inspection and testing of concrete. Non-destructive testing of concrete, core test and load test.

Unit- V **(8 hours)**

Special Concrete: Special concrete such as high strength, Lightweight, heavy weight, vacuum processed concrete, Mass concrete, high performance concrete, Pumpable concrete, Self-Compacting concrete, Air entrained concrete, Ferro cement, fiber reinforced concrete, Polymer impregnated concrete. Jet concrete. Recycling & re-use of industrial waste material. Deterioration and repair technology of concrete, Distress and type of repairs, crack sealing techniques.

Text books:

1. Neville, A.M., Properties of Concrete, Pearson Education Asia (P) Ltd, England, 2000.
2. Concrete Technology, Gambhir M.L, Tata McGraw Hill

Reference books:

1. Concrete Technology, M.S. Shetty, S. Chand & Company New Delhi
2. Concrete microstructure, properties & materials, P. Kumar Mehata, Paulo & J.M.
3. Monteiro,Light Weight Concrete, Short & Kenniburg, Asia Publishing House, Bombay.

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

URBAN ENVIRONMENTAL MANAGEMENT (CET-515)

3L: 0T:0P **Credit:3**

Course objective: To study the urban growth and environmental problems from the management and planning perspectives to contribute to the development of sustainable, inclusive and resilient cities.

Course outcomes:

On the completion of course student will be able to:

1. Explain planning of a city and identify various urban environmental issues
2. Prepare project Plans to integrate urban water resource
3. Explain water resource management using available water resources
4. Develop sustainable wastewater management concepts comparing with successful models followed in developed nation
5. Apply the principles of solid waste management

Syllabus:

Unit- I **(8 hours)**

Urban Environmental Issues: Urbanization- Population growth scenario migration-Pollution of surface water resources rivers, tanks, channels ground water exploitation - wastewater - characteristics - pollution problems - Solid waste - air pollution -CPCB norms. Urban master plans- Planning and Organizational aspects.

Unit- II **(8 hours)**

Urban Waste Resources Management: Water in urban ecosystem – urban water resources planning and organization aspects storm water management practices-types of storage-magnitude of storage-storage capacity of urban components - percolation ponds - temple tanks- rainwater harvesting.

Unit- III **(8 hours)**

Urban Water Supply: Demand estimation - population forecasting - source identification - water conveyance -storage reservoirs - fixing storage capacity -Distribution network - types - analysis - computer applications- Conservation techniques -Integrated urban water planning.

Unit- IV **(8 hours)**

Urban Waste Water Management: Sewage generation - storm drainage estimation-industry contribution-wastewater collection system-separate and combined system - hydraulic design of sewer and storm drain –waste water treatment-disposal methods-concept of decentralization- 3R concepts.

Syllabus

URBAN ENVIRONMENTAL MANAGEMENT (CET-515)

3L: 0T:0P **Credit:3**

Municipal Solid Waste Management: Sources of solid waste - characteristics - rate of generation - segregation at source -collection of solid waste-methods of collection-route analysis-transfer and transfer stations - processing and disposal of solid waste. Case Studies-Environmental economics-Social and Physiological aspects of pollution- Successful Urban Management -models- Urban Management-Case studies from Developed Nations - Software

Text books:

1. George Tchobanoglous, Hilary Theisen and Samuel A Vigil" Integrated Solid Waste Management", McGraw Hill Publishers, New York,1993.
2. Martin P. Wanelista and Yousef. "Storm Water Management and Operations", John Wiley and Sons, 1993.

Reference books;

1. Neil S. Grigg, "Urban Water Infrastructure Planning-Management and Operations", John Wiley and Sons, 1986.

Syllabus

ADVANCE STRUCTURAL DESIGN(CET 516)

3L: 0T:0P **Credit:3**

Course objective: To develop the conceptual understanding of the advanced concrete design

Course outcomes:

On the completion of course student will be able to:

1. The students will be able to effectively analyse and design the structures for seismic forces.
2. Students will have the understanding of basic concepts, behaviour and design of various reinforced concrete structures
3. Students will be conversant with various IS code provisions of reinforced concrete design and reinforced detailing
4. Students can assess the ductility requirement of design and detailing
5. Students will be well aware about yield line analysis of slabs and prestressed concrete.

Syllabus:

Unit- I **(8 hours)**

Modelling of Reinforced Concrete and Masonry buildings, response spectrum for with special emphasis on Code spectrum, Equivalent static Analysis, Seismic design philosophy, concept of strength, over strength, ductility and capacity design

Unit- II **(8 hours)**

Seismic Design of Building Components: Seismic resistant properties of reinforced concrete; Seismic behavior and design of linear reinforced concrete elements; Seismic behavior of planar reinforced concrete elements, code provisions

Unit- III **(8 hours)**

Design of slabs; One-way slab, Two-way slab, Flat slab and Waffle slab; Yield Line Analysis of slab

Unit- IV **(8 hours)**

Design of Columns; Design of Column section under axial load, axial load and uni-axial moment, axial load and bi-axial moments; Design of short and slender column elements; Ductile reinforcement detailing of column

Unit- V **(8 hours)**

Prestressed concrete and design of prestressed concrete structural elements

Text books:

1. RCC Design, S.N. Sinha, Tata MacGraw Hill
2. Design of RCC, Pillai and Menon, Tata MacGraw Hill

Syllabus

ADVANCE STRUCTURAL DESIGN(CET 516)

3L: 0T:0P **Credit:3**

3. Design of Prestressed Concrete, Krishna Raju, Tata MacGraw Hill
4. Seismic Design of Reinforced Concrete and Masonry Buildings, Pauley, T. and Priestley, M.J.N, John-Wiley & Sons.

Reference Books:

1. Reinforced Masonry Design, Schneider, R.R. and Dickey, W.L, 3nd Ed., Prentice Hall.
2. Concrete Structure in earthquake regions, Edmund Booth, Design & Analysis" Longman Scientific & Technical.
3. IS Codes: IS 456: 2002, SP:16 and SP:32, IS 13920: 1993

Syllabus

RISK MANAGEMENT IN CONSTRUCTION (CET-317)

3L:0T:0P **Credit:3**

Course Objectives:

- To train the students with the latest and the best in the rapidly Risk management in the fields of Construction Engineering.
- To understand the concept of construction risks.
- How to recognize potential risks.
- To know how to quantify the likelihood and potential impact of risks.
- Analyze potential risks and create strategies.

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

1. Demonstrate knowledge of the range of financial and financial related risks facing organizations.
2. Understand the approach to risk management through risk identification, risk measurement and risk management (or mitigation).
3. Understand reputational risk.
4. Be able to apply theoretical and practical aspects of risk management techniques to achieve project goals.
5. Be able to apply knowledge and skills of modern construction practices and techniques.

Syllabus:

UNIT-I **(8 hours)**

Introduction: Concept risk management in construction, types of risks in risk management in construction, Importance of construction safety management, safety policy in construction. Study of safety policies, methods, equipment, training provided on any ISO approved construction Company, safety in office, working on sites of high-rise construction, deep excavation.

UNIT-II **(8 hours)**

Risk analyses: Tools and techniques, impactPotential impacts in risk, risk impact charts mind tools, risk prioritization, probability and risk response strategies. Execute risk management in plan, involves member of the teams.

UNIT-III **(8 hours)**

Construction safety management: Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general employees, safety committee, safety training, incentives and monitoring. Writing safety manuals, preparing safety checklists and inspection reports.

UNIT-IV **(8 hours)**

Safety in construction operations: Safety of accidents on various constructions sites such as buildings, dams, tunnels, bridges, roads, etc. safety at various stages of construction. Prevention of accidents. Safety measures. Safety in use of construction equipment e.g. Vehicles, cranes, hoists and lifts etc.

UNIT-V **(8 hours)**

Safety of scaffolding and working platforms: Safety while using electrical appliances. Explosives used,

Syllabus

RISK MANAGEMENT IN CONSTRUCTION (CET-317)

3L:0T:0P **Credit:3**

various safety equipment and gear used on site. First aid on site, safety awareness program, labor laws, legal requirement and cost aspects of accidents on site, incentive for safety.

Text Book:

1. Amit Bijon dutta,"Understanding Risk management in construction"Evincepub publishing 2020.
2. Roger Flanagan,George Norman,"Risk management and construction"Wiley-Blackwell 1993.

Reference books:

1.Construction Safety Handbook – Davies V.S.Thomasin K, Thomas Telford, London.
2. ISI for safety in Construction – Bureau of Indian Standrads.
3. "Safety management" –Girimaldi and Simonds, AITBS, New Delhi.

Syllabus

ENVIRONMENTAL IMPACT ASSESMENT(CET-318)

3L:0T:0P **Credit:3**

Course Objectives:

- To study the importance of EIA
- To know the role of public in EIA studies
- Understand phenomena of impacts in the environment
- Know the impact quantification of various projects on the environment

Course Outcomes:

1. Identify the objectives and scope of EIA
2. Explicate the concept of EIA
3. Illustrate the necessity of public participation in EIA studies
4. Summarize the importance of Environmental Attributes
5. Explain the phenomena of Impacts on environment
6. Quantify impacts for various developmental projects

Syllabus:

UNIT-I

(8 hours)

INTRODUCTION TO EIA: Definition, Evaluation of EIA in INDIA, Rapid and Comprehensive EIA, EIA, EIS, FONSI and NDS. Need for EIA studies, Baseline data, Step-by-step procedure for conducting EIA, Advantages and Limitations of EIA, Hierarchy in EIA, Statutory requirements in EIA, MoEF guidelines in siting Developmental Projects.

UNIT-II

(8 hours)

OBJECTIVES AND SCOPE OF EIA: Contents of EIA, Methodologies and Evaluation Techniques of EIA, Selection for specific projects.

UNIT-III

(8 hours)

Syllabus

ENVIRONMENTAL IMPACT ASSESMENT(CET-318)

3L:0T:0P **Credit:3**

PUBLIC PARTICIPATION IN EIA: Elements of Effective Public Participation, Benefits and Procedures, EMP and DMP, Environmental Information System, Environmental Monitoring Systems, Public information network.

UNIT-IV

(8 hours)

ENVIRONMENTAL ATTRIBUTES: Value functions, Environmental attributes - Construction project, Industrial project, Developmental projects - Construction and Operational Phase, Mitigation measures – On Air, Water, Land, Ecology and Socio-economic Environment.

UNIT-V

(8 hours)

ENVIRONMENTAL IMPACT CASE STUDIES: Case studies on Human impact on Himalayan Ecosystem, Urban solid waste management with reference to Hyderabad City, Irrigation impacts of Upper Thunga Project (UTP) at Shimoga, Impact on air quality due to cement making – A case study of ACC limited, Madhukkarai, Coimbatore,Bhopal Gas tragedy.

Impact quantification study on - Water resource Developmental projects, Hazardous waste disposal sites, Sanitary land filling, Mining projects, Thermal/Nuclear power plant and Pharmaceutical industries

Text Book:

1. Environmental Impact Analysis, Urban & Stacey, Jain R.K.
2. Environmental Impact Assessment, Mc Graw Hill Inc, L.W. Canter (1996)
3. Environmental Impact Assessment and Management, Daya Publishing house, Hosetti B.B., Kumar A. (2014)

Reference books:

1. Guidelines for EIA of Developmental Projects, MoEF, GOI
2. Environmental Quality management, south asian publishers pvt ltd., Bindu N. Lohani

Syllabus

INDUSTRIAL SAFETY (CET-319)

3L:0T:0P **Credit:3**

Course Objectives:

- To know about Industrial safety programs and toxicology, Industrial laws , regulations and source models
- To understand about fire and explosion, preventive methods, relief and its sizing methods

Course Outcomes:

By the end of the course the students will be able to

1. Analyze the effect of release of toxic substances
2. Understand the industrial laws, regulations and source models.
3. Apply the methods of prevention of fire and explosions.
4. Understand the relief and its sizing methods.

Syllabus:

UNIT-I **(8 hours)**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II **(8 hours)**

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III **(8 hours)**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV **(8 hours)**

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V **(8 hours)**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Book:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

Reference books:

3.Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4.Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

Syllabus

Subsurface Investigation and Instrumentation (Lab) CEP-503

0L:0T:3P **Credit:1**

Course objective: To make the students understand the basics of a subsurface exploration to describe the geometry of the soil, rock, and water beneath the surface; and to determine the relevant engineering characteristics of the earth materials using various field tests and/or laboratory tests.

Course outcomes:

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

1. Perform various soil investigation tests
2. Plan a soil investigation survey according to the structure and the sub-soil
3. Choose the appropriate field instrumentation for a particular test

EXPERIMENTS:

1. Study of various boring tools and techniques
2. Study of various sampling tools
3. Vane Shear test
4. Standard Penetration Test
5. Cone Penetration Test
6. Pressure meter Test
7. Dilatometer Test
8. Seismic refraction Test
9. Electrical resistivity Test
10. Study of Field Instrumentation

TEXTBOOKS:

1. Geotechnical Testing, Observation, and Documentation, 2nd Edition, Tim Davis, ASCE Press, 2008.
2. In Situ Testing Methods in Geotechnical Engineering, Alan J. Lutenegger, CRC Press, 2021

REFERENCE BOOKS:

1. Geotechnical instrumentation in practice: Purpose, performance and interpretation, ICE Publishing, 1990.
2. Latest version of relevant Indian and International codes for various tests.

2.

Syllabus

SURVEYING FOR INFRASTRUCTURE PROJECT(CEP-504)

0L:0T:3P
Credit:1

Course objective: To determine the relative position of any objects or points of the earth. To determine the distance and angle between different objects. To prepare a map or plan to represent an area on a horizontal plan.To develops methods through the knowledge of modern science and the technology and use them in the field. To solve measurement problems in an optimal way.

Course outcomes:

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

1. Perform layout the building bridge and curve.
2. Estimate the height and length of inaccessible object.
3. Perform the stake out using total station.

EXPERIMENTS:

1. Taking longitudinal and crass sectional levelling profile of a road using Auto level.
2. Setting out the horizontal curve using Rankine's method
3. Setting out the horizontal curve using Two theodolite method
4. Setting out works for buildings & pipe lines
5. Setting out work for bridges
6. Trigonometric Leveling - Heights and distance problem
7. Heights and distance using Principles of tacheometric surveying
8. Determination of remote height using total station.
9. Stake out using total station.
10. Distance, gradient, diff, height between two inaccessible points using total station.

TEXTBOOKS:

1. Duggal S. K., "Surveying Vol 1 & 2" Tata McGraw Hill.
2. Subramanian R., "Surveying and Levelling" Oxford Higher Education.

REFERENCESBOOKS:

3. Anderson, J.M. and Mikhail, E.M., "Surveying: Theory and Practice", McGraw Hill. 1998
4. Schofield, W. and Breach M., "Engineering Surveying", 6th Ed., Butterworth-Heineman.
5. 2007

VEER MADHO SINGH BHANDARI UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

Syllabus

Air Pollution Control Engineering

3L:0T:0P **Credit:3**

FOR OPEN ELECTIVE

Course objectives:

1. To provide general understanding of quality of air and impact on local and global effects of air pollution on human, materials, properties and vegetation.
2. To study the fate and transport of air pollutants and its measurement techniques.
3. To discuss the various types of air pollution control equipment and their design principles and limitation

Course outcomes:

At the end of the course student will be able

1. Classify and identify the sources of air pollutants and predict the effects of air pollutant on human health and environment.
2. Apply and relate the significance of various air pollution dispersion models.
3. Analyze the air quality and relate with air pollution regulation
4. Design various air pollution control equipment and evaluate its use.

Syllabus:

Unit- I **(8 hours)**

Air Pollution Control, Air Pollution Effects, Effects of Air Pollution on Human Health Air Pollution Control Laws and Regulations, Emission Standard, Air Quality Standard

Unit- II **(8 hours)**

Emission Estimates, Concentration Determination, Averaging, Standard Analytical Methods,

Syllabus

Air Pollution Control Engineering

3L:0T:0P **Credit:3**

isokinetic Sampling, Meteorology, Horizontal and Vertical Motion in the Atmosphere, Atmospheric Stability

Unit- III **(8 hours)**

Fixed-Box, Diffusion model, Gaussian Plume Derivation, Plume Rise, Pollutant Creation and Decay in the Atmosphere Air Pollution Control, Process Change, Pollution Prevention, Downstream Pollution Control Device

Syllabus

Air Pollution Control Engineering(CET-624)

3L:0T:0P **Credit:3**

Unit- I V **(8 hours)**

Fluid Velocities in Air Pollution Control Equipment, Minimizing Volumetric Flow Rate and Pressure Drop, Calculations on Inert Flow rates, Combustion, Combustion Kinetics, Mixing in Combustion Reactions, Volume and Composition of Combustion Products, Nature of Particulate Pollutants, Settling Velocity and Drag Forces, Stoke Law, Particle Size Distribution Functions, Control of Primary Particulates, Wall Collection Devices, Working and designing of Centrifugal Separators, Electrostatic Precipitators (ESP), Surface Filters, Depth Filters, Scrubbers for Particulate Control, Control of Volatile Organic Compounds(VOCs), Control by Prevention, Substitution, Process Modification, Leakage Control - Control by Concentration and Recovery

Unit- V **(8 hours)**

Reduction chemistry of Sulfur, Absorbers and Strippers, Removal of SO2 from Rich and Lean Waste Gases, Control of Nitrogen Oxides,Zeldovich Kinetics of Thermal NO Formation, Air Pollution from Motor Vehicles, Tailpipe Emissions, Lean Operation, Exhaust Gas Recirculation (EGR), Reduce Flame Quenching, Speed the Warm-up,Catalylic Treatment of Combustion Products, Air Pollutants and Global Climate, Global Warming, Greenhouse Gases

Text books:

1. Noel de Nevers.2000. Air Pollution Control Engineering. 2nd Edn., McGraw Hill., New York
2. Rao M.N. and H.V.N. Rao, 2010, Air Pollution, Tata – McGraw hill Pub. Co., New Delhi.
3. Cheremisinoff, N.P., 2002. Handbook of air pollution prevention and control. Elsevier.
4. Clarke, A.G. ed., 2012. Industrial air pollution monitoring. Springer Science & Business Media.
5. Cheremisinoff, N.P., 2002. Handbook of air pollution prevention and control. Elsevier.
6. Clarke, A.G. ed., 2012. Industrial air pollution monitoring. Springer Science & Business Media.

Reference books:

Syllabus

Air Pollution Control Engineering(CET-624)

3L:0T:0P **Credit:3**

1. Rao, C.S., 2007. Environmental pollution control engineering. New Age International.
2. Tiwary, A. and Williams, I., 2018. Air pollution: measurement, modelling and mitigation. CRC Press.
3. Vallero, D.A., 2014. Fundamentals of air pollution. Academic press.
4. Wang, L.K., Pereira, N.C. and Hung, Y.T. eds., 2005. Advanced air and noise pollution control. Totowa, NJ, USA: Humana Press.

Syllabus
Research Methodology and IPR (AHT-302)

L:T:P:: 2:0:0 **Credits-2**

Course Objectives: Students will be able to:

1. To understand the fundaments of research in today's world controlled by technology, ideas, concept, and creativity.
2. To understand different methods of research designing and data collections.
3. To understand the methods of report writing and its different methods of interpretations.
4. To understand research ethics and methods of research publications
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and inturn brings about, economic growth and social benefits.

Course Outcomes:

1. To understand research problem formulation.
2. To study research design and method of data collections.
3. To study methods of report writing.
4. To follow research ethics.
5. To enhance student's competence to discover new inventions.

Syllabus Contents:

UNIT I: FUNDAMENTAL OF RESEARCH

Meaning of research; objectives of research; basic steps of research; criteria of good research; Research methods vs. Methodology. Types of research –criteria of good research; Meaning of research problem; selection of research problem; Approaches of investigation of solutions for research problem, Errors in selecting a research problem, Scope and objectives of research problem, Review of related literature- Meaning, necessity and sources.

Unit 2: RESEARCH DESIGN AND DATA COLLECTION

Research design: Types of research design- exploratory, descriptive, diagnostic and experimental;Variables- Meaning and types; Hypothesis- Meaning, function and types of hypothesis; Null/Alternative hypothesis; Sampling- Meaning and types of sampling; Probability and Non-Probability; Tools and techniques of data collection- questionnaire, schedule, interview, observation, case study, survey etc.

Unit 3:REPORT WRITING AND ITS INTERPRETATION

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Conclusions.

Unit 4:RESEARCH ETHICS AND SCHOLARY PUBLISHING

Syllabus
Research Methodology and IPR (AHT-302)

L:T:P:: 2:0:0 **Credits-2**

Ethics-ethical issues, ethical committees (human & animal); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism and its concept and importance for scholar.

Unit 5: INTELLECTUAL PROPERTY RIGHT (IPR)

IPR- intellectual property rights and patent law, commercialization, New developments in IPR; copy right, royalty, trade related aspects of intellectual property rights (TRIPS); Process of Patenting and Development; Procedure for grants of patents, Patenting under PCT;Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases.

Reference Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science &engineeringstudents'"
2. WayneGoddardandStuartMelville,"ResearchMethodology:AnIntroduction"
3. RanjitKumar,2ndEdition,"ResearchMethodology:AStepbyStepGuideforbeginners"
4. Halbert,"ResistingIntellectualProperty",Taylor&FrancisLtd,2007.
5. Mayall,"IndustrialDesign",McGrawHill,1992.
6. Niebel,"ProductDesign",McGrawHill,1974.
7. Asimov,"IntroductiontoDesign",PrenticeHall,1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age",2016.
9. T.Ramappa,"IntellectualPropertyRightsUnderWTO",S.Chand,2008