Water Supply Engineering
BEG 355 CI

Year: III **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	1	2/2	3	80	-	-	20	25	125

Course Objective:
The objective of the course is to provide students with sound knowledge in the water supply system development water treatment technology and its distribution system

Course Contents:

1.0 Introduction **(2 hrs)**
- 1.1 Water supply, its objectives, immediate and long term impact
- 1.2 Definition of portable, contaminated and wholesome water.
- 1.3 Major components of water supply systems
- 1.4 Need of water supply engineering
- 1.5 Water supply scheme : Urban and Rural

2.0 Water Sources **(3 hrs)**
- 2.1 Surface source: lake, streams/rivers and impounded reservoir. Capacity calculation of impounded reservoir
- 2.2 Underground sources: springs wells and infiltration galleries
- 2.3 Selection of water sources

3.0 Water Supply/Quantity **(5 hrs)**
- 3.1 Different types of water demand (domestic, livestock, commercial, industrial and public uses, fire fighting, losses and wastage control measures, per capita demand) and its variation
- 3.2 Definition of design period
- 3.3 Population forecasting methods:
  - 3.3.1 Mathematical method – Arithmetical, geometric/increment increase, decrease rate of growth
  - 3.3.2 Graphical method – extension and comparison
- 3.4 Factors affecting demand of water

4.0 Water Quality **(5 hrs)**
- 4.1 Impurities in water ,their classification and effects
- 4.2 Hardness of water ,types of hardness, Alkalinity in waters
- 4.3 Living organism in water: virus, algae, worms and bacteria
- 4.4 Water born diseases: water-born, water-washed, water-based, water-vector, etc.
- 4.5 Physical, chemical and biological analysis of water: tests for temperature, color, odor, taste, turbidity, pH, solids, MPN chlooiform etc
- 4.6 Water quality standard, WHO standard and Nepal standard for domestic use

5.0 Intake Works **(3 hrs)**
- 5.1 Site selection for intake
- 5.2 Characteristics of river ,reservoir and springs intakes

6.0 Water Treatment **(14 hrs)**
- 6.1 Objectives of water treatment
- 6.2 Treatment Systems:
  - 6.2.1 Screening: Purpose; coarse and fine screens
  - 6.2.2 Plain sedimentation: Purpose, theory of settlement, effect of temperature on settlement, ideal sedimentation tank, design of sedimentation tank, and types of sedimentation tanks
  - 6.2.3 Sedimentation with coagulation: Purpose, types of coagulants, determination of optimum dose of coagulant, flocculation and clarifier

6.2.4 Filtration: Purpose, theory of filtration, construction, operation and maintenance of slow sand, rapid sand and pressure filters

6.2.5 Disinfection: Purpose chlorination, chlorine dose , residual chlorine, contact time, forms of chlorination, plain chlorination, break-point chlorination, super chlorination, and dechlorination, factors affect in chlorination, ozonation

6.2.6 Softening: Removal of temporary hardness by boiling and lime treatment, removal of permanent hardness by lime soda, zeolite and ionization processes.

6.2.7 Miscellaneous treatments: Methods of aeration, removal of iron and manganese, and removal of color, odor and taste

7.0 Reservoirs and Distribution System (6 hrs)

7.1 Different types of water reservoirs: clear water reservoir, service reservoir, balancing reservoir and determination of the capacity of reservoirs.

7.2 System of water supply: continuous and Intermittent, radial, circular ,Grid iron, dead end

7.3 Layout of the distribution system

7.4 Method of water supply: Gravity and lift

7.5 Design of the distribution system

8.0 Conveyance of Water (3 hrs)

8.1 Different types of pipe: CI GI, WI, Steel, concrete, AC and PVC

8.2 Laying of pipes

8.3 Pipe joints and their types

9.0 Valves and Fittings (4 hrs)

9.1 Different types of valves: sluice valve, reflux valve, safety valve, air valve and drain valve

9.2 Different types of pipe fittings: stop cocks, nipples, sockets, joint coupling water taps and bends.

9.3 Public stand post and break pressure tank

9.4 Operation and Maintenance of the water supply system

Laboratories:

Five laboratory exercises will be performed in this course. These are:

(a) Physical tests of water: temperature, color, turbidity, and PH.

(b) Determination of suspended, dissolved and total solids in water.

(c) Determination of dissolved oxygen in water by Winkler method and D.O. meter.

(d) Determination of optimum does of coagulant by the jar test.

(e) Micro-biological test of water

Field Visit:

Field visit of water supply systems, group presentation and submission of individual report to the respective teacher.

References:

- P.N.Modi, Water supply Engineering , Standard book house
- B.C.Punimia, Water supply Engineering, Laxmi Publication-+
- G.S. Birdie, Water Supply and Sanitary Engineering, Dhanpat Rai and Sons Publishers.

Transportation Engineering I

BEG 356 CI

Year: III **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	3	2/2	3	80	-	-	20	25	125

Course Objective:
After the completion of the course, students will be able to plan, survey and design the road projects. They will attain the knowledge of road development and its planning. They will gain the knowledge based on the Nepalese context.

Course Contents:

1. Introduction to Transportation Planning and engineering (4 hrs)

1.1. Modes of transportation: Highways, railways, waterways and airways
1.2. Comparison between various modes of transportation and constraint on their development in Nepal
1.3. Historical development of roads and road construction in Nepal
1.4. Classification of roads (Nepal Road Standard and Nepal Rural Road Standard)
1.5. Transport planning including objective of road planning, National network planning, urban road network planning and ring roads

2. Highway Alignment and Engineering Survey (3 hrs)

2.1. Highway Alignment
  2.1.1. Introduction
  2.1.2. Requirements of highway alignment
  2.1.3. Factors controlling highway alignment

2.2. Engineering survey and its stages (map study, reconnaissance, preliminary and detailed surveys)

3. Geometric Design of Highway (18 hrs)

3.1. Definition and scope of geometric design
3.2. Basic design controls and criteria for design
3.3. Elements of cross-section
3.4. Elements of horizontal alignments
  3.4.1. Definition and types of horizontal curve
  3.4.2. Design of horizontal curves including night visibility consideration
  3.4.3. Sight distance: Stopping sight distance, Overtaking sight distance, Set-back from obstructions
  3.4.4. Super elevation
  3.4.5. Extra widening
  3.4.6. Transition Curves: Definition and types of transition curve, design of transition curve
3.5. Elements of Vertical Alignment
  3.5.1. Definition and types of gradient
  3.5.2. Momentum grade
  3.5.3. Grade compensation
  3.5.4. Definition and types of vertical curve
  3.5.5. Design of vertical summit curve
  3.5.6. Design of vertical valley curve
  3.5.7. Lowest and highest point of vertical curve

4. Highway Drainage (5 hrs)

4.1. Introduction and importance of highway drainage system
4.2. Causes of moisture variation in sub-grade soil
4.3. Surface drainage system
  4.3.1. Different types of road side drain
  4.3.2. Cross drainage structures
  4.3.3. Different types of energy dissipating structures
4.4. Subsurface Drainage System
  4.4.1. Drainage of infiltrated water
  4.4.2. Control of seepage flow
  4.4.3. Lowering of water table
  4.4.4. Control of capillary rise

5. Hill Roads (7 hrs)

5.1. Introduction
5.2. Special consideration in hill road design
  5.2.1. Alignment of hill road design: General consideration, route location in hills, gradient, design and types of hair pin bends, different types of hill road cross sections
5.3. Special structures in hill road
  5.3.1. Types of retaining structures, river training structures, land slide stabilization structures and gully control structures
5.4. General introduction to bio-engineering

6. Highway Materials (8 hrs)

6.1. Introduction and classification of road materials
6.2. Sub-grade Soil
  6.2.1. General
  6.2.2. Characteristics of sub-grade soil
  6.2.3. Desirable properties of sub-grade soil
6.3. Road Aggregate
  6.3.1. Definition and classification of road aggregates
  6.3.2. Desirable properties of road aggregates
  6.3.3. Tests on road aggregates and their significance
  6.3.4. Comparing gradation specification and method of translating specification
  6.3.5. Combining of the aggregates
6.4. Bituminous Road Binders
  6.4.1. Definition and classification of road binders
  6.4.2. Liquid btumen: Cut-back bitumen and Bitumen emulsion
  6.4.3. Tests on Bituminous binders
6.5. Bituminous Mixes
  6.5.1. Definition and Classification
  6.5.2. Marshal Method of bitumen mix design

Laboratories:

(i) Los Angeles Abrasion value and crushing value of aggregates
(ii) Penetration value; Viscosity; softening point and ductility of bitumen
(iii) Skid resistance test on road surface
(iv) Marshall stability test and asphalt mix design
(v) Extraction of bitumen from mix and gradation of aggregate after extraction

References:

- "A Text-book on highway engineering and airports", S.B.Sehgal and K.I. Bhanot, S. Chand and Co. Publishers Ltd., New Delhi
- "Principles, Practice and Design of Highway Engineering", S.K. Sharma, S. Chand and Co. Publishers Ltd., New Delhi
- "Highway Engineering" Dr. S.K. Khanna and Dr. C.E.G.Justo, Nem Chand & Bros Roorkee (U.P.)

SURVEY CAMP

BEG 353 CI

Year: III **Part: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
-	-	-	-	-	-	40	-	60	100

Course Objective:

Two primary objectives of the survey camp are as follows:

a) It will provide the students ample opportunities to consolidate and update their practical and theoretical knowledge in engineering surveying in the actual field conditions with practical problems.

b) It will provide the students' real field based exposure to learn and apply different surveying, modern instruments, computational practices and ways of presentation of their final reports.

To fulfill this purpose a field works of 14 days close survey camp is prescribed

1.0 Topographic surveying

1.1 Horizontal and Vertical Control Practices for Large Area: Major Traversing (4 days)

Around 1500 m periphery (not less than 15 stations) shall be enclosed by forming the close traverse and coordinates of those traverse stations shall be controlled with reference to national grid system (Using GPS or Resection method).Easting and northing coordinates shall be controlled by Total Station and elevation must be controlled by Auto Level (fly leveling)

1.2 Horizontal and Vertical Control inside the Major Traverse: Minor traversing (2 days)

Detailed Topographic survey shall be conducted within the perimeter of semi built up area around 500 m^2 of land(about 3 to 6 control stations).Easting and Northing coordinates shall be controlled by total station and elevation must be controlled by Auto level(fly leveling).Link traverse exercise is compulsory.

1.3 Computation and plotting (2 days)

Computation for major and minor traverses shall be performed for horizontal and vertical coordinates in proper format. Plotting shall be done in A1 grid sheet. Orientation check of plot shall be performed to proceed.

1.4 Topographic surveying: detailing **(2 days)**

After proper computation and plotting of traverse in prescribed format and detailing shall be proceeded. For this propose detailing shall be done by Total station. Data saving in data logger (electronic field book) and manual booking both should be practiced.

2 .0 Bridge site survey **(2 days)**

Detail topographic survey of suitable bridge site shall be conducted by which topographic map, longitudinal section; cross section etc shall be prepared at standard scale.

3.0 Road alignment survey **(2 days)**

At least 700 m road alignment survey shall be done from where plan, longitudinal section, cross section etc shall be drawn at standard scale including selection of grades formations levels.

R**equirements:**

Number of students in each groups should be 4 or 5. As far as possible modern surveying equipments such as GPS, total stations, EDM, Theodolite, planimeter etc are introduced to conduct the survey camp .Each facilitator should not have more than 2 groups.

Theory of Structure II
BEG354CI

Year: III **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	3	2/2	3	80	-	-	20	25	125

Course Objective:

Three fold objective of the course is to;

a. Familiarize the technologies and concepts of displacements, stresses, strains, stiffness etc. and their parameters in the contest of indeterminate system,
b. Practice in examples the basic concepts and theorem on static (equilibrium), geometrical (compatibility) and physical (Force, Stiffness and Displacements) conditions in the context of indeterminate systems,
c. Prepare the candidates for advance courses in structural mechanics by introducing to the necessary tools like matrix method, force method, displacement method, plastic analysis etc.

1.0 Statically Indeterminate Structures (3 hrs)

1.1 Types of indeterminate structures
1.2 Static indeterminacy and methods of determination for various types of structures
1.3 Kinematic indeterminacy and methods of determination for various types of structures

2.0 Theorem on Displacements (2 hrs)

2.1 Law of reciprocal deflection (Maxwell's Theorem, Betti's Law)
2.2 Castigliano's Theorem

3.0 Force Method (10 hrs)

3.1 Introduction to force method
3.2 Equilibrium conditions and compatibility equations
3.3 Analysis of statically indeterminate beams including yielding of support
3.4 Analysis of the statically indeterminate frames
3.5 Analysis of statically indeterminate trusses including temperature effects and lack of fit
3.6 Analysis of two-hinged parabolic arches including yield of support and temperature effect

4.0 Slope-Deflection Method (7 hrs)

4.1 Introduction
4.2 Derivation of the slope-deflection equations
4.3 Analysis of statically indeterminate beams including support settlement and rotation of joints
4.4 Analysis of statically indeterminate frames

5.0 Moment Distribution Method (7 hrs)

5.1 Introduction and basic concept
5.2 Stiffness and Carry-over factors
5.3 Distribution factors
5.4 Analysis of statically indeterminate beams
5.5 Analysis of statically indeterminate frames

6.0 Influence Lines for Indeterminate Structures (4 hrs)

6.1 Influence lines for statically indeterminate beams

6.2 Muller-Breslau principle and its application for drawing ILD of continuous Beams

7.0 Introduction to Matrix Method (8 hrs)

7.1 Flexibility matrix and Stiffness matrix

7.2 Relationship between Flexibility and Stiffness Matrix

7.5 Analysis of statically indeterminate beams, frames and trusses by matrix method

8.0 Plastic Theory of Structures (4 hrs)

8.1 Plastic bending of beams

8.2 Shape factor

8.3 Load factor

8.4 Plastic analysis – Determination of collapse load and plastic moment capacity.

Laboratories:

(i) Obtain experimentally the influence line for the horizontal thrust in a two-hinged arch

(ii) Verify the Maxwell's Theorem of reciprocal deflection with the help of a truss and two-hinged arch model.

(iii) Experimental analysis of a portal frame.

(iv) Experimental analysis of a continuous beam.

References:

- C. K. Wang, Intermediate structural analysis, international student edition, McGraw Hill Company Limited, 1989.
- G. S. Pandit, S. P. Gupta, Structural analysis, a matrix approach, Tata McGraw hill company Limited, New Delhi, 1981.
- A. Darkov, Kuznetsov, Structural mechanics, Mir Publishers, Moscow
- C. B. Kukreja, V. V. Sastry, Experimental methods in structural mechanics, Standard Publishers Distributors, Delhi, 1991.
- C.H Norris, Elementary structural analysis
- S.S. Bhavikatti, Structural analysis volume 2
- Reddy, Structural analysis
- Ramaruthum, Theory of structures

Soil Mechanics
BEG352CI

Year: III **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	3	2/2	3	80	-	-	20	25	125

Course Objective:
The objective of this course is to provide the students concepts and nature of soil with relating to index and engineering properties of soil. It will also provide the knowledge about the slope stability.

Course Content:

1.0 Introduction (2 hrs)
- 1.1 Importance of soil and soil problems in Civil engineering
- 1.2 Historical development of soil mechanics
- 1.3 General approach of solving soil mechanics problems

2.0 Physical and Index Properties of Soils (5 hrs)
- 2.1 Soil as a three –phase material
- 2.2 Index properties of soil
- 2.3 Determination of various index properties

3.0 Soil Identification and Classification (4 hrs)
- 3.1 Field identification of soils
- 3.2 Soil Classification: Descriptive, Textural, ISI, MIT and Unified
- 3.3 Practical implications of the soil classification system

4.0 Soil Compaction (3 hrs)
- 4.1 Compaction process and compaction theories
- 4.2 Moisture – density relationship and degree of compaction
- 4.3 Laboratory determination of compaction characteristics
- 4.4 Field compaction and compaction control
- 4.5 Effects of compaction on engineering behaviour of soils

5.0 Soil – Water Interaction (4 hrs)
- 5.1 Mode of occurrence of water in soils
- 5.2 Surface tension and the capillary phenomenon
- 5.3 Flow of water through the soil mass
- 5.4 Permeability of soils
- 5.5 Determination of the coefficient of permeability: laboratory and field methods
- 5.6 Pumping tests through confined and unconfined aquifers
- 5.7 Effects of water on swelling and shrinkage of soils

6.0 Principles of Effective Stress (3 hrs)
- 6.1 Stresses in subsoil
- 6.2 Effective stress principle
- 6.3 Physical interpretation of effective stress equations of the static and flow conditions
- 6.4 Quick sand phenomenon and remedial measures

7.0 Seepage Analysis (5 hrs)

7.1 Two dimensional fluid flow
7.2 Conditions for continuity of flow
7.3 Laplace's equation, flow nets and their principles
7.4 Boundary conditions
7.5 Flow nets and their application
7.6 Laplace's equation for an Isotropic soil and its application
7.7 Deflection of flow lines at the interface of two different soils
7.8 Phreatic line in an earth dam
7.9 Design of filter

8.0 Stress Distribution in Soils (4 hrs)

8.1 State of stress at a point in the subsoil
8.2 Stress from elastic theories
8.3 Boussinesqu's theory of stress distribution
8.4 Extension of Boussinesq's analysis to uniformly loaded areas
8.5 Use of Newmark's charts and other tables and charts in computing stresses
8.6 Effects of layer systems on stress distribution
8.7 Elastic settlement and contact pressure

9.0 Shear Strength of Soils (5 hrs)

9.1 Concept of shear strength
9.2 Principal planes and principal stresses
9.3 Mohr – Coulomb theory of shear strength
9.4 Mohr's stress Circle and failure envelop
9.5 Relation between Principal stresses at failure
9.6 Types of shear tests
9.8 Vane shear test
9.9 Shear strength of sands
9.10 Shear strength of saturated and unsaturated clays

10.0 Consolidation and Settlement (5 hrs)

10.1 Behaviour of soil under compressive loads
10.2 Settlement of structures resting on soil: its nature, causes and remedial measures
10.3 The consolidation process and Terzaghi's spring Analogy.
10.4 Primary and secondary consolidation
10.5 Consolidation test
10.6 Compressibility of soil
10.7 Normally consolidated (NC) clays, over consolidated (OC) clays and pre-consolidation pressure
10.8 Determination of field pressure – void curve
10.9 Estimation of consolidation settlement
10.10 Rate and degree of consolidation
10.11 Terzaghi's theory of one dimensional consolidation
10.12 Determination of coefficient of consolidation
10.13 Estimation of rate and magnitude of settlement

11.0 Stability of Slopes (5 hrs)

11.1 Causes of slope movements and failures
11.2 Types of slope and slope failures
11.3 Critical surfaces and factors of safety
11.4 Method of stability analysis and stability number
11.5 Stability Analysis of Infinite slopes
11.6 Stability Analysis of finite slopes

11.7 Methods of slices
11.8 Remedial measures for slope stability problems

Laboratories:

Seven Laboratory exercises will be performed in this course, in addition to one-day field trip. They are:

(i) Determination of Atterberg limit of soil
(ii) Use of in – situ density core cutter and the method of sand replacement
(iii) Determination of optimum moisture content and maximum dry density
(iv) Unconfined compression test
(v) Direct shear test
(vi) Constant head permeability test
(vii) UU triaxial test

References:

- "A Text Book of Soil Mechanics", Dr. Sehgal, S. B. CBS Publishers and Distributors, New Delhi, 1988.
- " Soil Mechanics in Engineering practice" , Terzaghi, K and Peck, R.B. , John Wiley, 2nd Edition, New York, 1967.
- "Soil mechanics and Foundation engineering" Dr. K.R.Arora
- Soil mechanics and Foundation engineering" B.C. Punmia
- "Geotech Engineering" V.N.S. Murthy

Numerical Method

BEG370CO

Year: III **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	1	2/2	3	80	-	-	20	50	150

Course Objective:

To solve the engineering problems by using the theory of numerical computational procedures.

1 Introduction **(4 hrs)**

1.1. Numerical computing process
1.2. New trends in Numerical Computing
1.3. Application in Numerical Computing
1.4. Taxonomy of errors in numerical method.
1.5. Absolute Relative & percentage errors .

2. Solution of non – Linear equation **(7 hrs)**

2.1. Iterative methods and stopping criteria
2.2. Bisection method & its Convergence
2.3. Horner's method
2.4. Newton- Raphson method and its convergence
2.5. Secant method and its convergence
2.6. Evaluation of polynomials using Horner's Rule

3. Curve Fitting **(8 hrs)**

3.1.Interpolation
- 3.1.1. Linear interpolation
- 3.1.2. Lagrange interpolation
- 3.1.3. Newton interpolation
- 3.1.4. Newton Divided Different interpolation
- 3.1.5. Spine interpolation: cubic spines
- 3.1.6. Control Interpolation (Gauss Forward/ Backward Formulae)

3.2. Regression
- 3.2.1 Least squares Regression
  - 3.2.2 Fitting Transcendental Equations.
  - 3.2.3 Fitting a polynomial function

4. Numerical Differentiation & integration **(7 hrs)**

4.1. Differentiating continuous function
- 4.1.1. Forward Difference Quotient
- 4.1.2. Backward Difference Quotient
- 4.1.3. Central Difference quotient

4.2. Newton cotes methods of integration
- 4.2.1. Trapezoidal rule and composite trapezoidal rule
- 4.2.2. Simpson's 1/3 rule & its composite
- 4.2.3. Simpson's 3/8 rule.
- 4.2.4. Bode 's Rule

4.3. Romberg integration
4.4. Gaussian integration

5. Linear Algebraic Equations (10 hrs)

5.1. Elimination Approach
- 5.1.1. Basic Gauss Elimination
- 5.1.2. Gauss Elimination with partial pivoting
- 5.1.3. Gauss Jordon method
- 5.1.4. LU decomposition methods
  - 5.1.4.1. Do Little Algorithm
  - 5.1.4.2. Crout Algorithm
- 5.1.5. Matrix Inversion Method
- 5.1.6. Cholesky Method

5.2 Iterative method
- 5.2.1 Iconic method
- 5.2.2 Gauss- Seidal method
- 5.2.3 Eigen values and Eigen vectors using power method & inverse power method

6 Solution of Ordinary Differential Equations (6 hrs)

6.1 Euler's method.
6.2 Heun's method (predictor – Corrector method)
6.3 Fourth order Runge-kutta method
6.4 Systems of differential equations using Heun's method
6.5 Higher order differential equations using Heun's method

7 Solutions of Partial Differential Equations (3 hrs)

7.1 Elliptic equations
- 7.1.1 Poisson's equations
- 7.1.2 Laplace's equations

7.2 Parabolic Equations
7.3 Hyperbolic Equations

Laboratories:

(i) Review of properties of programming language
(ii) Bisection method
(iii) Newton-raphson method
(iv) Secant method & Horner's rule
(v) Lagrange interpolation
(vi) Linear Regression
(vii) Basic gauss elimination method
(viii) Gauss seidal method
(ix) Matrix inversion method
(x) Trapezoidal rule
(xi) Simpson's 1/3 rule
(xii) Simpson's 3/8 rule
(xiii) Solution of differential equation using Euler's method
(xiv) Solution of differential equation using Runge-Kutta method

References:

- E. Balagurusamy " Numencal Methods ' Tatal Mc Graw Hill
- S.Yakwitz and F. szidarouszky '' An Introduction to Numerical Computations "2nd Edition Macmillan Publishing co ', New York .
- W. Cdhency and D kixaid " Numerical Mathematics 4 computing "2nd Editior, Brooks /Cole publishing
- C.F Gerald and P.o. Wheatley " Applied Numerical Analysis "4th Editim Addipon wesley publishing co. New york .
- W. It presss, B p. Flannery et . al "Numerical Recises Inc", 1st Edition, Cambridge press 1988

Concrete Technology and Masonry Structures
BEG 351 CI

Year: III **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	2	2/2	3	80	-	-	20	25	125

Course Objective:
After completion of this course, the students will be well aware of concrete technology and masonry structures. They will be well aware of various properties of concrete ingredients and will also be able to design concrete mix of different grades using different methods. The students will also learn the tools and techniques of quality control in different stages of use of concrete. They will also learn classification, construction technologies and behavior of masonry structures. The students will be able to analyze and design masonry structures for gravity and lateral loads.

Course Contents:

1.0 Constituents of Concrete (8 hrs)
- 1.1 Aggregates
  - 1.1.1 Classification
  - 1.1.2 Gradation
  - 1.1.3 Characteristics and significance
- 1.2 Cement
  - 1.2.1 Oxide and compound composition
  - 1.2.2 Hydration of cement
- 1.3 Admixtures
  - 1.3.1 Types, uses and effects
  - 1.3.2 Local materials as admixtures in Nepal
- 1.4 Water
  - 1.4.1 Quality of water for use in concrete for various purposes
  - 1.4.2 Water cement ratio, workability, segregation, bleeding and other Properties of fresh concrete

2.0 Mix Design of Cement Concrete (8 hrs)
- 2.1 Introduction of Nominal mix
- 2.2 Mix design by DOE, ACI and IS methods
- 2.3 Some aspects of probabilistic approach on strength
- 2.4 Choice of constituents in different mixes
- 2.5 Curing
- 2.6 Properties of hardened concrete

3.0 Strength of Concrete (6 hrs)
- 3.1 Concrete as a three-phase system
- 3.2 Strength - porosity relationship
- 3.3 Various types of strengths and their tests
- 3.4 Behavior of concrete under various conditions: Stress variation, effect of time and temperature, cyclic and dynamic loads

4.0 Dimensional Stability of Concrete (3 hrs)
- 4.1 Stress-Strain relationship of concrete
- 4.2 Modulus of elasticity
- 4.3 Durability
- 4.4 Shrinkage and Creep
- 4.5 Thermal Properties

5.0 Constituents of Masonry Structures (3 hrs)

5.1 Masonry Units
- 5.1.1 Bricks
- 5.1.2 Stones
- 5.1.3 Adobes
- 5.1.4 Concrete blocks
- 5.1.5 Bonds in Bricks

5.2 Mortar
- 5.2.1 Properties of wet mortar
- 5.2.2 Strength of mortar

6.0 Testing of Masonry Structures (3 hrs)

6.1 Basic Physical Tests
6.2 Determination of mortar strengths
6.3 Determination of brick strengths
6.4 Determination of stone strengths

7.0 Design of Masonry Structures (12 hrs)

7.1 Design of masonry in compression
7.2 Design of masonry in bearing
7.3 Design of masonry in bending
7.4 Design of masonry in shear
7.5 Design and detailing of reinforced masonry structures

8.0 Strengthening of Masonry Structures (2 hrs)

8.1 Traditional and modern methods: Use of bond stones, bands in masonry Structures

8.2 Introduction of composite masonry
- 8.2.1 Infill walls in reinforced concrete frames
- 8.2.2 Use of bamboo in masonry structures

Laboratories:

(i) Mixed design of concrete by DOE, ACI and IS methods
(ii) Compressive strength test of cube and cylinder
(iii) Compressive and Tensile test of brick masonry

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