Hydropower Engineering
(BEG453CI)

Year: IV **Semester: I**

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

Course Objective:
The objective of this course is to make the students aware about the development of hydropower and to design the components of hydropower.

Course Contents:

1. Introduction (4 hrs)

1.1 Introduction to Power, their types and comparison
1.2 Power Situation in Nepal and World
1.3 Historical Background and Development of hydropower in
1.4 Classification of Hydropower Plants as Low Head, Medium Head and High head
1.5 Run -off River, Storage and Pump Storage Plants

2. Power Regulation (6 hrs)

2.1 Firm Power, Secondary Power, Mean and Peak Load, Utilization and Diversity Factors, use of flow and power duration curve
2.2 Power Variation: Daily, Weekly and Seasonal
2.3 Introduction to Power System, Power Grids, Components of Power System

3. Planning and Layout of Hydropower Projects (4 hrs)

3.1 Site Selection for Hydropower Projects: Reconnaissance, Preliminary, Hydrological, Geological and Final Investigation
3.2 Requirements for Hydropower: Use of Flow Duration and Mass Curves, Energy Flow Diagram, Estimation of Power Potential, Demand and Prediction
3.3 Reservoir Regulation: Peak and Normal Flow Discharges, Distribution of Sediments and their Control, Life of Reservoir
3.4 Layout of Hydropower Projects: Intake, Reservoir, Pen stock, Supply Conduit, Casing, Draft Tube, Tail Race

4. Water Retaining Structures (9 hrs)

4.1 Dams: purposes, Different types of Dams based upon Function, Head, Hydraulic Consideration, Materials, Storage, rigidity, criteria for selection of a dam
4.2 Choice of Dam Depending upon Site Condition and Economy
4.3 General Consideration for Design of Dams

4.4 Design Principle of Straight Gravity Dam: Strength, Stability and Factor of Safety, middle third rule, elementary profile of a dam

4.5 Foundation Treatment: Grouting, Remedies against Piping and Exit Gradient

4.6 Design of Concrete Gravity Dams: General Considerations, Cross-Sectional Profiles, Strength, Stability and Safety Factors against Overturning, Sliding, Floating, Free-Board

4.7 Design of Earthen Dams: General Considerations, Strength, Stability and Safety Factors against Slope Stability; Phreatic Line, Seepage Flow Discharge

5. Regulatory Structures (10 hrs)

5.1 Intake: Importance, Location and Types

5.2 Design of Intake Structures

5.3 Hydraulic Tunnels: Definition; Rock Pressure; Hardness Coefficient of Rocks; Pressure and Non-Pressure Tunnels, their Types and Design; Head loss in Pressure Tunnels; Design of Tunnel Lining

5.4 Settling Basin: Types of Settling Basins and their Locations; Settling Velocity, Horizontal Velocity and Lifting Velocity; Characteristics of Suspended Sediments, Settling Basins with Periodic and Continuous Flushing; Components of Basins and their Designs

5.5 Forebay and Surge Tanks: Importance, Location, Condition of their Application;

5.6 Design of Forebay Structure, Design of surge tank, water hammer effect

5.7 Pen Stock Liners: Importance, Location, Condition of their Application; Hydraulic Hammer; Hydro dynamic Pressure Calculation; Turbine Head and Determination of Pen Stock Diameter, penstock design

6. Spillway (4 hrs)

6.1 Function of Spillway, Types and Capacity, Provision of Gates

6.2 Occurrence of Cavitation and Erosion

6.3 Energy Dissipation: Types of Energy Dissipators, their necessity; Role of Tail Water Depth

6.4 Design of Stilling Basin

7. Hydro-Electrical Machines (8 hrs)

7.1 Hydro-Mechanical Installation: Turbines - Pelton, Francis, Kaplan and their Performance Characteristics

7.2 Selection of Turbines and their Specific Speed

7.3 Introduction to Bulb Turbine; Draft Tube, Tail Race Canal and their Importance

7.4 Pumps: Centrifugal, Reciprocating and their Performance Characteristics; Selection and Starting Speed

7.5 Electro-Mechanical Installation: Generators and their Types

7.6 Purpose and Working Principles of Governors

7.7 Classification and Dimensions of Powerhouses

Laboratories:

(i) Performance Characteristics of a Pelton Turbine.

(ii) Performance Characteristics of a Francis Turbine.

(iii) Characteristics of Centrifugal Pump.

(iv) Characteristics of Reciprocating Pump.

Field Visit:
One day field visit of nearest hydropower site.

References:

- M. M. Dandekar, K. N. Sharma, Water Power Engineering.
- M. M. Grishin, Hydraulic Structures, Mir Publishers, Moscow, 1982.
- R. S. Varshney, Hydropower Structures, Nem Chand and Bros., Roorkee, 1986.4.

ESTIMATION AND VALUATION
BEG450 CI

Year: IV **Semester: I**

Teaching Schedule Hours/ Week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory Marks	Practical Marks	
L	P	T	Duration	Marks	Duration	Marks			
3	-	3	3	80	-	-	20	-	100

Course Objective:
The objective of this course is to give the students basics knowledge of estimating and valuation of civil engineering works. After completing this course the students will also be able to analyze the rates and estimate the various construction works.

Course Contents:

1.0 Introduction **(2 hrs)**

1.1 General (definition, principle, Importance and purpose)
1.2 Estimated cost and actual cost
1.3 System of Units
1.4 Units of measurement and payments for items of work and materials
1.5 Data requirement of estimating

2.0 Method of Estimating **(3 hrs)**

2.1 Methods of measurements of building and civil engineering works
2.2 Subheads of various items of work
2.3 Various methods of calculating quantities: center line method, long and short wall method; crossing method
2.4 Abstracting bill of quantities
2.5 Transportation cost, overheads and contingency.

3. Specification **(3 hrs)**

3.1 Introduction
3.2 Importance
3.3 Purpose of specification
3.4 Types of specification – general, detailed
3.5 Detail of specification writing of building works

3.5.1 Site works
3.5.2 Civil works
3.5.3 Building materials and finishing
3.5.4 Water supply and sanitary work in building.

4.0 Types of Estimates (4 hrs)

4.1 Approximate estimates
4. 2 Detailed estimates
4.3 Revised estimates
4.4 Supplementary estimates
4.5 Annual repair or annual maintenance estimates
4.6 Extension and improvement of estimates
4.7 Complete estimates

5.0 Detailed Estimates (20 hrs)

5.1 Estimate of walls
5.2 Estimates for a one room building and two room building
5.3 Estimate of earthwork of road construction in plane area and hill area
5.4 Estimate of earth work in canal
5.5 Estimate of an Aqueduct
5.6 Estimate of Siphon.
5.7 Estimate of R.C.C. Slab Culvert.
5.8 Estimate of R.C.C. Tee-Beam Decking
5.9 Estimate of a water supply (underground RCC water tank) and sanitation (Soak pit and Septic tank) system of a residential building

6. Analysis of Rates (8 hrs)

6.1 Introduction
6.2 Purposes of rate analysis
6.3 Importance of rate analysis
6.4 Requirements of rate analysis
6.5 Factors affecting the rate analysis
6.6 Cost of items
6.7 Norms and standards of Nepal for rate analysis and cost estimates
6.8 Procedure of rate analysis: for building works, for sanitary and water supply works, for road works, for irrigation works, for suspension and suspended bridge works

7. Valuation (5 hrs)

7.1 Introduction
7.2 Purpose of valuation
7.3 Principles of valuation
7.4 Terms used in valuation
7.5 Methods of determining value of property
7.6 Methods of valuation report writing

Course Project:
Detailed Estimates and Costing of a Two Storey Residential Building in a Particular Place of Nepal. (The Nepalese Norms and Standards of Rate Analysis should be followed)

References:

- Amarjit Aggarwal, Civil Engineering Quantity Surveying and Valuation, Katson Publishing House, 1985.
- Seymour Berger and Jules B. Godel, Estimating and Project Management for Small Construction Firms, Van Nostrand Reinhold Publishing Company, New York, 1977

Design of Reinforced Concrete Structures
BEG451CI

Year: IV **Semester: I**

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

Course Objective:

The main objective of this course is to impart the knowledge and skill for the design of different elements of buildings structure using reinforced concrete. This course specially focuses on limit state method of design and students will be able to perform structural analysis of different elements of building structure corresponding to the codal provision and detailing of reinforcement.

Course Contents:

1. Reinforced Concrete Structures (2 hrs)

1.1 Limitation of the Use of Plain Concrete
1.2 Concept of Reinforced Concrete Structure
1.3 Various Types of Loads and Stresses in Reinforced Concrete Structures
1.4 Methods of Design

2. Working Stress Method (6 hrs)

2.1 Conception of Materials Strength and Loading and Modular Ratio
2.2 Introduction to the Design of Beams: Singly Reinforced, Doubly Reinforced and T Beams

3. Limit State Method of Design (6 hrs)

3.1 Introduction of Limit State Method as a Probabilistic Approach
3.2 Behavior of Concrete and Steel
3.3 Strength and Serviceability Requirements
3.4 Characteristic Strength of Materials and Partial Safety Factors
3.5 Characteristics of Loads and Their Partial Safety Factors
3.6 Limit State of Collapse: Flexure, Shear, Torsion, Compression
3.7 Limit State of Serviceability: Deflection, Cracking

4.0 Reinforcement Detailing (5 hrs)

4.1 Spacing of Reinforcement and Concrete Cover
4.2 Minimum and Maximum Reinforcement in Beams, Slabs, Columns etc.
4.3 Minimum and Maximum Sizes of Reinforcing Bars
4.4 Minimum and Maximum Spacing of Reinforcing Bars
4.5 Curtailment of Reinforcements
4.6 Reinforcement Splices
4.7 Details of Reinforcement in Columns
4.8 Details of Beam - Column Connections
4.9 Bar Bending Schedule

5.0 Design by the Limit State Method (20 hrs)

5.1 Singly and Doubly Reinforced Concrete Continuous Beam
5.2 Flanged Beams
5.3 One-way and Two-way Slabs
5.4 Axially and Eccentrically Loaded Columns
5.5 Isolated and Combined Footings for Columns
5.6 Staircases

6.0 Pre-stressed Concrete Structure (8 hrs)

6.1 Introduction to Concept
6.2 Materials Used and Their Properties
6.3 Pre-stressing Systems and Anchorage
6.4 Losses of Pre-stress
6.5 Analysis and Design of Homogeneous Beam Section under Flexure: Flexural Approach, Load balancing Approach and Line of Thrust Approach
6.6 Cable Layout, Camber and Deflection
6.7 Limit State Design of Pre-stressed Concrete Beam
6.8 Design of a Pre-stressed Concrete Beam by Limit State Method

Laboratories:

(i) Test of RCC Beam in Pure Bending Failure (Record the Deflection and for Various Loads and Cracking Patterns)
(ii) Test of RCC Beam in Shear Failure
(iii) Test of Beam under Combined Bending and Shear Failure
(iv) Test on Bond
(v) Investigate the Behaviour of Rectangular Beam with Double Reinforcement
(vi) Investigate the Behaviour of Reinforced Concrete Column till Failure

Course Project:

Two Storey RCC Framed Building with Design and Detailing of typical Slab, T- beam and I beam, Column, Staircase Footing (Isolated and Combined). Analysis of the Structure will be carried out by using any Software (i.e. Microfeap, SAP 90 Others)

References:

- A. K. Jain, Reinforced Concrete, Limit State Design, Nem Chand & Bros, Roorkee, Fifth Edition, 1999, P. 844.
- P. C. Varghese, Limit State Design of Reinforced Concrete, Prentice Hall of India. Pvt. Ltd., New Delhi, 1997, P. 541.
- Unnikrishna Pillai, Devdas Menon, Reinforced Concrete Design, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998. P. 762.
- Libby J. R. Modern Prestressed Concrete, Design Principles and Construction Methods, First Indian Edition, 1986, P. 635.
- N. Krishna Raju, Prestressed Concrete, Third edition, Tata McGraw-Hill Publishing Company Limited, New Delhi,, 1995, P. 797.
- Dr. Rajan Suwal, Design of Reinforced concrete Structures, Mark line Publications, 2013, P 208

CONSTRUCTION PROJECT MANAGEMENT

BEG 492 MS

Year: IV **Semester: I**

Teaching Schedule Hours/ Week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory Marks	Practical Marks	
L	P	T	Duration	Marks	Duration	Marks			
3	-	2	3	80	-	-	20	-	100

Course Objective:

- To establish an understanding of how construction industry operates including the Project life cycle and participants involved.
- To introduce the principles of project management and its functions
- To provide the students with essentials of construction management including Procurement, planning, estimating, and scheduling
- To familiarize students with measuring and managing performance in Construction
- To present and discuss some tools to improve performance at project and Organizational level
- To increase the awareness of students on the emerging issues and advanced Processes in construction

Course Contents:

1.0 Introduction (**3 hrs)**

1.1 Construction management as a discipline
1.2 Context of construction management
1.3 Characteristics of the construction industry
1.4 Domestic and global construction market

2.0 Construction Project Management **(4 hrs)**

2.1 Definition of a project
2.2 Nature of construction projects
2.3 Project life-cycle
2.4 Principles of Project management
2.5 Project management functions.

3.0 Construction Cost Estimation and Bidding **(5 hrs)**

3.1 Planning and design
3.2 Project scope management
3.3 Elements of cost estimation
3.4 Estimating methods
3.5 Project budgeting
3.6 Bidding

4.0 Construction Project Planning and Scheduling **(10 hrs)**

4.1 Scheduling process
4.2 work breakdown structures
4.3 Scheduling techniques
4.4 Critical path method
4.5 Resource management
4.6 Project crashing.

5.0 **Construction Procurement** **(5 hrs)**

5.1 Investing in construction projects
5.2 Project finance
5.3 Procurement strategies
5.4 Project delivery methods
5.5 Contract types
5.6 National and International contracts
5.7 Contract and claim management.

6.0 **Construction Equipment** **(4 hrs)**

6.1 Equipment for excavation, fill, transportation and compaction
6.2 Aggregate handing and concrete construction equipment
6.3 Equipment for construction of pipes and caissons
6.4 Cranes for lifting materials and parts
6.5 Equipment for tunnel construction
6.6 Equipment for hydraulic construction
6.7 Equipment for highway and pavement construction

7.0 Performance Measurement **(4 hrs)**

7.1 Definition of performance
7.2 Performance issues in construction
7.3 Factors affecting project success
7.4 Industry reports
7.5 Performance measurement tools
7.6 Key performance indicators.

8.0 **Personnel Management in Construction Project** **(5 hrs)**

8.1 Management principles: administration and organization principles
8.2 Centralization and leadership styles
8.3 Supervisory and leadership styles
8.4 Importance of communication
8.5 Information systems for decisions
8.6 Motivating and directing: human elements, elements, evaluation and merit rating
8.7 Personnel selection, testing and training

8.8 Trade unions and relation with management

9.0 **Performance Improvisation in Construction** **(5 hrs)**

9.1 Benchmarking
9.2 Risk management
9.3 Financial management
9.4 Claims and dispute resolution
9.5 Human resources management
9.6 Knowledge management
9.7 Total quality management
9.8 Strategic use of IT Strategic collaborations
9.9 Health and safety.

References:

- Fewings, P., Construction Project Management, Taylor and Francis, New York
- Farland, M. C., Management – Principles and practice", M.C. Farland.
- Vazirani, V. N. and Chandola, S. P., Construction Management and Accounts.
- Staya Narayan, B., Construction Planning and Equipment
- Ruskin, A. M., and Eugene Estes, W., Project Management, Marcel Dekker Publishers, 1982.
- Moder, J. J. and Philips, C., R. Project Management with CPM and PERT, Philips ,Van Nostrand Reinhold Publishers, Latest edition
- Chandra, P., Projects: Preparation, Appraisal, Implementation, Tata McGraw Hill Publishing Company Ltd. New Delhi

AN INTRODUCTION TO EARTHQUAKE ENGINEERING
BEG 454 CI

Year: IV **Semester: I**

Teaching Schedule Hours/ Week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory Marks	Practical Marks	
L	P	T	Duration	Marks	Duration	Marks			
2	-	2	1.5	40	-	-	10	-	50

Course Objective:
The student will learn the basic understanding and nature of the earthquakes, analysis of structures subjected to earthquakes and design of structures to resist strong ground motions. The student will also learn the practical approach including use of prevalent codes in analysis and design of structures for earthquake loads.

Course Contents:

1.0 Introduction **(2 hrs)**
- 1.1 Effects of earthquakes
- 1.2 Theories and criteria of earthquake design
- 1.3 Basic requirements for earthquake resistant structures

2.0 Fundamental of Earthquake Engineering **(6 hrs)**
- 2.1 Earthquake and Seismicity
- 2.2 Causes of earthquakes
- 2.3 Mechanism of earthquakes
- 2.4 Measure of earthquakes
- 2.5 Attenuation laws
- 2.6 Local soil conditions
- 2.7 Response spectra of earthquakes
- 2.8 Seismic risk and seismic zoning

3.0 Basics Structural Dynamics **(6 hrs)**
- 3.1 Introduction
  - 3.1.1 Dynamic problems
  - 3.1.2 Response of structures of vibration
- 3.2 Introduction to Single degree of freedom (SDOF) system
  - 3.2.1 Simple harmonic motion
  - 3.2.2 Equation of motion and natural frequency
  - 3.2.3 Free vibration response (damped and undamped) of SDOF system
- 3.3 Multi degree of freedom (MDOF) System
  - 3.3.1 Modeling of MDOF system structures
  - 3.3.2 Equation of motion in matrix form

4.0 Lateral Load Resisting Systems for Buildings (8 hrs)

4.1 Different structural systems for lateral loads
4.2 Floor diaphragms
4.3 Lateral load distribution with rigid floor diaphragms
4.4 Centre of mass and centre of rigidity
4.5 Torsionally coupled and uncoupled system
4.6 Moment resisting frames
4.7 Shear walls

5.0 Earthquake Design Buildings (8 hrs)

5.1 Strength, stiffness and stability requirements
5.2 Ductility of the system and members
5.3 Seismic coefficient method and code provisions
5.4 Response spectrum method and the code provision
5.5 Introduction to modal analysis
5.6 Code provision on ductility factors, drift limit
5.7 Detailing of reinforced concrete moment resisting frames for earthquakes

References:

- V.K. Manicka Selvam, Elementary Structural Dyanamics, Dhanpat Rai Publication Clough
- 2. R.W., Penzien J., Dynamics of Structures, McGraw-hill Inc.
- Chopra Anil, Dynamics of Structures, Prentice-Hall
- P. Agrawal & M. Shrikhande, Earthquake Resistance Design of Structures. Printice Hall of India, New Delhi, 2006.
- V.K. Manicka Selvam, An Introduction to Earthquake Analysis of Structures, Dhanpat Rai Publications
- I.S. 1893.2002 (Part I) Indian Standard Criteria for Earhtquake Resistant Design of Structures,
- Bureau of Indian Standards
- I.S. 13920:1993 – Indian Standard Ductile Detailing of Reinforcement Concrete Structures, Bureau of Indian Standards

Applied Sociology
BEG 490 MS

Year: IV **Semester: I**

Teaching Schedule Hours/ Week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory Marks	Practical Marks	
L	P	T	Duration	Marks	Duration	Marks			
3	-	-	1.5	40	-	-	10	-	50

Course Objective:
Civil engineers work in co-ordination with society so that the civil engineers must be acquainted with the society. The Objective of this course is to make the students aware of the Nepalese society, Community, Culture, Stratification and Adaptation.

Course Contents:

1.0 Introduction **(2 hrs)**
- 1.1 Evolution of Sociology
- 1.2 Relationship of Sociology with other social sciences (Anthropology, Economics, History, Political Science)
- 1.3 Application of Sociology in addressing contemporary social issues in Nepal.

2.0 Language of Sociology **(7 hrs)**
- 2.1 Society and Culture
- 2.2 Tribe, Caste & Ethnicity
- 2.3 Community and Institutions
- 2.4 Homogenous & Heterogeneous
- 2.5 Norms and Values
- 2.6 Co-operation & Conflict.
- 2.7 Status & Roles
- 2.8 Association and group

3.0 Fundamental concepts in sociology **(5 hrs)**
- 3.1 Social System
- 3.2 Social Structure: Family, Caste and Ethnic Group, Religions, Festivals
- 3.3 Social Process
- 3.4 Socialization
- 3.5 Social and Cultural Change
- 3.7 Social Stratification

3.8 Social Problem
3.9 Social Control.

4.0 Nepalese Culture and Society (9 hrs)

4.1 Historical, Ideological and Political Dimension of Nepalese Culture and Society.
4.2 Caste System in Nepal
4.3 Ethnic Groups and Interrelationship among them.
4.4 Religions and Festivals in Nepal
4.5 Social Stratification in Nepalese Societies on the Association and group
4.6 Basis of Caste, Gender, Ethnicity and Age

5.0 Community Development: (7 hrs)

5.1 Meaning and Definition
5.2 Nature and History
5.3 Approaches of Community Development
5.3.1 Community Participation
5.3.2 Community Mobilization
5.3.3 Communications and Community Education
5.3.4 People's Empowerment
5.3.5 Application of Indigenous and Appropriate
5.4 Gender Differences and Role of Women in Energy Conservation & Development,
5.5 Application of Knowledge of Sociology with Special Reference Energy, Policy, Legal Issues
5.6 Identification of Issues & Resolution

, **References:**

- Inkels Alex, "What is Sociology? Introduction in the descipline and profession, Prentice Hall of India\
- Foster G. M. :"Traditional Culture and impact of Technological Change"
- Mair L. :" Applied Sociology, Anthropology"
- Gsanlender A. W. :"Applied Sociology opportunity and Problems"
- Regmi Rishikeshav Raj "Dimenshion of Nepali society and culture"
- Gurung, Sant Bahadur: "Rural Development Approach in Nepal" Deva Publications, Kathmandu