Purbanchal University
Bachelors' Degree in Civil Engineering
(Revised on 2071/03/26)

Curriculum Outline of 7th and 8th

IV / I

S. N.	Course Code	Course Description	Credits	Lectures	Tutorials	Practical	Total
1	BEG 450 CI	Estimation and Valuation	3	3	3	0	6
2	BEG 451 CI	Design of RCC structures	3	3	3	2/2	7
3	BEG 490 MS	Applied Sociology	2	3	0	0	3
4	BEG 453 CI	Hydro-power Engineering	3	3	3	2/2	7
5	BEG 492 MS	Construction Project Management	3	3	2	0	5
6	BEG 454 CI	An Introduction to Earthquake Engineering	2	2	2	0	4
7		Elective I	3	3	2	0	5
			19	**20**	**15**	**2**	**37**

IV / II

S. N.	Course Code	Course Description	Credits	Lectures	Tutorials	Practical	Total
1	BEG 455 CI	Safety Engineering and Disaster risk Management	3	2	1	0	3
2	BEG 456 CI	Engineering Professional Practice	2	2	0	0	2
3	BEG 457 CI	Civil Engineering Project	6	2	7	0	9
4		Elective II	3	3	2	0	5
5		Elective III	3	3	2	0	5
			17	**12**	**12**	**0**	**24**

ESTIMATION AND VALUATION
BEG450 CI

Year: 4 **Part: 1**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	P	T	Duration	Marks	Duration	Marks				
3	0	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.

3.0 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.**

6.1 Estimate of Walls
6.2 Estimates for a One Room Building and Two Room Building
6.3 Estimate of Earthwork of road construction in plane area and hill area
6.5 Estimate of earth work in canal
6.4 Estimate of an Aqueduct
6.5 Estimate of Siphon.
6.5 Estimate of R.C.C. Slab Culvert.
6.6 Estimate of R.C.C. Tee-Beam Decking
6.7 Estimate of a Water Supply (underground RCC water tank) and Sanitation (Soak pit and Septic tank) System of a Residential Building

6.0 Analysis of Rates **8 hrs**

5.1 Introduction
5.2 Purposes of Rate Analysis
5.3 Importance of Rate Analysis
5.4 Requirements of Rate Analysis
5.5 Factors Affecting the Rate Analysis
5.6 Cost of Items
5.6 Norms and Standards of Nepal for Rate Analysis and Cost Estimates
5.7 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

7.0 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 Work

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)

Tutorials

i) Estimates of a Portion of a Roadway
ii) A valuation Report of Property
iii) Preparation of Bar schedule

Recommended books:

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

Evaluation Scheme

The question will cover all the syllabus. The evaluation scheme will be as indicated in the table below

Chapter	Marks	Remarks
1	5	
2	5	
3	6	
4	8	
5	28	
6	18	.
7	10	

** The above marks distribution can be with minor variations.

Design of Reinforced Concrete Structures
BEG451CI

Year: 4 **Part:1**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			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:

1.0 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

2.0 Working Stress Method **4 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

3.0 Limit State Method of Design **6 hrs.**

3.1 Introduction of Limit State Method as a Probabilistic Approach
3.2 Behaviour 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 **15 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 **15 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

Laboratory Works:

1. Test of RCC Beam in Pure Bending Failure (Record the Deflection and Strains for Various Loads and Cracking Patterns)
2. Test of RCC Beam in Shear Failure
3. Test of Beam under Combined Bending and Shear Failure
4. Test on Bond
5. Investigate the Behaviour of Rectangular Beam with Double Reinforcement
6. 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 Soft Ware (i.e. Microfeap, SAP 90 Others)

References:

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

Evaluation Schemes:

The question will cover all the chapters of the syllabus. The evaluation scheme will be indicated in the table below:

Chapter	Marks	Remarks
1	4	Th.
2	8	Th.+Nm.
3	6	Th. Or Nm.
4	12	Th.+Nm.
5	40	Th.+Nm.
6	10	Th. Or Nm.

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** The above marks distribution can be with minor variations.

Applied Sociology
BEG 490 MS

Year: 4 **Parts: 1**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	P	T	Duration	Marks	Duration	Marks				
3	0	0	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:** **5 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: **10 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: **8 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: 12 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: 10 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

, **Recommended Books:**

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

Evaluation Scheme:

The questions will cover the entire syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Marks	Remarks
1	8	
2	8	
3	8	
4	8+8	
5	8	

*There may be minor variation in marks distribution.

Hydropower Engineering
(BEG453CI)

Year: 4 **Semester: 1**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			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:

1.0 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

2.0 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, Seasonal
2.3 Introduction to Power System, Power Grids, Components of Power System

3.0 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

4.0 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

5.0 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

6.0 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

7.0 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:

1. Performance Characteristics of a Pelton Turbine.
2. Performance Characteristics of a Francis Turbine.
3. Characteristics of Centrifugal Pump.
4. Characteristics of Reciprocating Pump.

Field Visit:
Field visit of nearest hydropower site.

Recommended Books:
1. M. M. Dandekar, K. N. Sharma, Water Power Engineering.
2. M. M. Grishin, Hydraulic Structures, Mir Publishers, Moscow, 1982.
3. R. S. Varshney, Hydropower Structures, Nem Chand and Bros., Roorkee, 1986.4.

Evaluation Schemes:
The question will cover all the chapters of the syllabus. The evaluation scheme will be indicated in the table below:

Chapter	Marks	Remarks
1	4	Th.
2	16	Th.+Nm.
3	6	Th. Or Nm.
4	16	Th.+Nm.
5	16	Th.+Nm.
6	6	Th. Or Nm.
7	16	Th.+Nm.

.*There may be minor variation in marks distribution.

CONSTRUCTION PROJECT MANAGEMENT
BEG 492 MS

Year: 4 **Part: 1**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	P	T	Duration	Marks	Duration	Marks				
3	0	2	3	80	--	--	20	--	100	

Course Objectives

- 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.

Tutorial:

Six assignments and two quizzes

Recommended books:

1. “Construction Project Management” P Fewings,Taylaor and Francis, New work
2. "Management – Principles and practice”, M.C. Farland.
3. "Construction Management and Accounts", V.N.Vazirani and S.P. Chandola.
4. "Construction Planning and Equipment", Dr. B. Staya Narayan.
5. "Project Management", Arnold M. Ruskin and W. Eugene Estes, Marcel Dekker Publishers, 1982.
6. "Project Management with CPM and PERT", Joseph J. Moder and Cecil R. Philips ,Van Nostrand Reinhold Publishers, Latest edition
7. "Projects: Preparation, Appraisal, Implementation", Prasanna Chandra, Tata McGraw Hill Publishing Company Ltd. New Delhi

Evaluation Scheme

The question will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapter	Marks	Remarks
1	8	Th.
2	8	Th.
3	8	Th.
4	16	Th.+Nm.
5	8	Th.
6	8	Th.
7	8	Th.
8	8	Th.
9	8	Th.

.*There may be minor variation in marks distribution.

AN INTRODUCTION TO EARTHQUAKE ENGINEERING
BEG 454 CI

Year: IV **Part: I**

Teaching Schedule Hrs./ week			Examination Scheme				Total marks	Remarks
			Final		Internal Assessment			
L	P	T	Theory	Practical	Theory	Practical		
2	0	2	40	-	10		50	

Course Objectives:
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 Modelling 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:

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

Evaluation Scheme:

Chapter	Marks	Remarks
1	2	
2	6	
3	10	
4	10	
5	12	

** The above marks distribution can be with minor variations.

SAFETY ENGINEERING AND DISASTER RISK MANAGEMENT
(BEG 455 CI)

Year: 4 **Semester: 2**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
2	1	0	3	80	--	--	20	--	100	

Course Objectives:

This subject has been designed to impart the knowledge to civil engineering students regarding safety in their profession and also the disaster management. After completion of this course, the students will be able to;

i. explain the need of safety in civil engineering works,
ii. identify various types of hazards and implement the preventive measures,
iii. explain the role of various level of workers and officials, regarding safety,
iv. identify various types of disaster and implement the preventive measures

Course Contents:

1.0 Introduction to Safety Engineering **3 hrs.**

1.1 Introduction to safety engineering and its Scope
1.2 Interrelationships between human / machinery / environmental elements
1.3 Impact of human and machine characteristics on safety
1.4 Safety control devices; Signs, Signals, Instructions and Safety Codes

2.0 Attitude towards safety **2 hrs.**

2.1 Attitude Survey
2.2 Value of safety survey
2.3 Report from safety personal
2.4 The interface between safety problems and concerned parties

3.0 Basic Safety Engineering: Hazard Identification **5 hrs.**

3.1 Mechanical Energy Hazards: Thermal Energy Hazards
3.2 Electrical Energy Hazards: Acoustic Energy Hazards
3.3 Chemical Energy Hazards: Radiant Energy Hazards
3.4 Kinetic (Impact) Energy Hazards: Air/Land/ Sea Energy Hazards
3.5 Potential (Stored) Energy Hazards: Biological Energy Hazards

4.0 Basic of Safety Engineering: Hazard Evaluation **1 hrs.**

4.1 Acceptable vs Unacceptable Risk

5.0 Basic of Safety Engineering: Hazard Control **4 hrs.**

5.1 The First Cardinal Rule of hazard control

5.2 The Second Cardinal Rule of hazard control
5.3 Passive vs Active Hazard Control
5.4 The Third Cardinal Rule of hazard control

6.0 Safety Performance **4 hrs.**

6.1 Injury Frequencies Survey (ISR - IFR).
6.2 Factors to be considered for Appraising Plant Conditions

7.0 Safety and Health Standards **3 hrs.**

7.1 Health hazards in the construction industries
7.2 Government standards of safety and health
7.3 Development of self applied standards
7.4 Regulatory standards
7.5 Plant standards

8.0 Industrial Safety **4 hrs.**

8.1 Introduction
8.2 Employer Liability Laws
8.3 Workmen's Compensation Laws
8.4 Agencies rendering safety services
8.5 Industrial Relations, Trade Unions and Safety Representatives

9.0 Safety Management **6 hrs.**

9.1 Role of Employees
9.2 Role of Supervisors
9.3 Motivating Management
9.4 Stress Management
9.5 Safety Management
9.6 Consideration of human errors
9.7 Contracts and legislation

10. Disaster Management **2 hrs.**

10.1 Introduction
10.2 Types of Disaster
10.3 Government regulation

11.0 Guidelines for hazard, Risk assessment and Vulnerability **2 hrs**.

12.0 Impact of natural disaster on environment and development **2 hrs.**

13.0 Disaster Mitigation **3 hrs.**

13.1 Earthquake
13.2 Floods and debris flow
13.3 Landslides
13.4 Glacier Lake Outcross Flood (GLOF)
13.5 Fire
13.6 Cold and Hot wave
13.7 Avalanche

14.0 Disaster management cycle: Prevention, Preparedness, Disaster response and recovery 2 hrs.

15.0 Disaster Management in Nepal 2 hrs.

Recommended Books:

1. Singh U.K., Dewan J.M., "Safety, Security and Risk Management", APH Corporation, \Delhi 1996
2. Telford T., "\risk Management in \Civil, Mechanical and Structural Engineering", London 1996.
3. Carter W. Nick: "Disaster Management: a disaster manager's hand book", Manila: Asian Development Bank, 1991.
4. "Disaster Mitigation in Asia and Pacific", Manila: Asian Development Bank, 1991.
5. Sharma V.K., "Disaster Management", National Center fir Disaster Management, Indian Institute of Public Administration, 1994.

Evaluation Scheme:

Chapter	Marks	Remarks
1	4	
2	2	
3	8	
4	4	
5	4	
6	8	Numerical / Th.
7	4	
8	8+4	
9	8+4	
10	4	
11	4	
12	4	
13	4	
14	4	
15	2	

****** Above mentioned marks distribution can be with minor variation**

ENGINEERING PROFESSINAL PRACTICE
BEG 456 CI

Year: IV **Semester:II**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	P	T	Duration	Marks	Duration	Marks				
2	0	0	1.5	40	--	--	10	--	50	

Course Objective:

To introduce ethical and legal environment in which engineering is practiced.

Course Contents:

1.0 Engineering Professionalism: **4 hrs**

1.1. Profession/Professional and Professionalism.
1.2. Moral and ethics in engineering profession.
1.3.Codes of ethics and guidelines for engineering Profession.
1.4.Relationship of the engineering Profession to basic science and technology; Relationship to other Profession.
1.5. Key roles of engineers in development activities.
1.6. Law of ethics in engineering practices.
1.7. Fundamental canons for professional engineers.

2.0 **History of engineering Practices:** **2 hrs**

2.1. Concept about society, elements of society and types of society.
2.2. History of engineering practice in eastern and western society.

3.0 Engineering Professional Practice in Nepal: **12 hrs**

3.1. Nepal Engineering Council and Nepal Engineering Association.
3.2. Contract Law, Elements and types of Contract Law.
3.3. Types of Contract: Sealed quotation and tender.
3.4. Quotation and quotation notice.
3.5. Tender and Tender notice.
3.6. Tender guarantee.
3.7. Tender documents and its preparation before inviting tender.
3.8. Prequalification works of contractors.

3.9. Evolution of tenders and selection of contractors.
3.10. Contract acceptance.
3.11. Conditions of Contract.
3.12. Tort liability, Elements of Tort liability and Types of Tort liability.
3.13. Business and labor laws.
3.14. Relationship to foreign firms working in Nepal.

4.0 Engineering Professional Practice Sectors in Nepal: 4 hrs

4.1. General Job description of engineers working in public sectors.
4.2. General Job description of engineers working in private sectors.

5.0 **Engineering Professional Practice in other countries: 2 hrs**

5.1. Other Asian Countries.
5.2. USSR and Eastern Europe.
5.3. Western Europe.
5.4. North America.

6.0 Issues on Engineering Professional ethics: 6 hrs

6.1. Intellectual property rights: Copy rights, Trademark and Patent protection.
6.2. Industrialization and environmental protection.
6.3. Risk/benefit considerations in public transportation.
6.4. Science and technology for medicine.
6.5. Engineers in international development.

References:

1. Carson Morrison and Philip Hughes, "Professional Engineering Practice- Ethical Aspects", McGraw- Hill Ryerson Ltd., Toronto1982
2. Dr. Rajendra Adhikari, "Engineering Professional Practice- Nepalese and International Perspectives" Pashupati Publicing House, Kathmandu Nepal 2010
3. M. Govindarajan; S Natrajan and Senthikumar. "Engineering Ethics"- PHI- Learning Pvt. Ltd. New Delhi 2009

Evaluation Scheme:

The questions will cover the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution
1	4	5
2	2	3
3	12	15
4	4	6
5	2	3
6	6	8
Total	30	40

****** Above mentioned marks distribution can be with minor variation**

CIVIL ENGINEERING PROJECT
BEG 457 CI

Year: 4 **Semester: 2**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	P	T	Duration	Marks	Duration	Marks				
2	7	0	--	--	--	50	--	150	200	

Course Objective:
This course is designed to apply the acquired knowledge in the real engineering fields and to enhance the students' confidence to work as professional**.**

Course content:
Under the supervision and guidance of member/members of faculty each student is required to carry out an individual or group project which provides opportunities for tackling problem to Civil Engineering and is required to submit a project report.

The choice of project will depend upon the interests of the student (s), faculty and the facilities available in the campus.

A project may involve:

a) An experimental investigation,
b) Preparation of Dissertation involving a literature survey and a correlation of existing knowledge,
c) Preparation of a design for an extensive Civil Engineering project

Note:

The project will be conducted under the guidance of the member/members of faculty as they fit beneficial to the students. In the initial phase the faculty may conduct a number of lectures and discussions as to the approach of the project. In the later phase the student will be left on his own to pursue his work and to consult the faculty whenever any problem crops up. He should them submit a draft report prior to the final report so the guide can correct gross mistake. The final report should be submitted to the department Head in duplicate. The final report should be defended with presentation by the students.

EVIRONMENTAL IMPACT ASSESSMENT

(BEG 469 EI)

(ELECTIVE)

Year: IV **Semester: I/II**

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

Course Objectives:

This subject deals with the various impacts of infrastructure projects on the components of environment and method of assessing the impact and mitigating the same. The student is expected to know about the various impacts of development projects on environment and the mitigating measures.

Course Contents:

1. Introduction **4 hrs.**

1.1. Impact of civil engineering development projects on environment
1.2. Environmental impact assessment (EIA)
1.3. Environmental impact statement (EIS)
1.4. Objectives and types of EIA
1.5. Current issues in EIA
1.6. EIA capability and limitations
1.7. History of EIA in Nepal
1.8. Legal provisions on EIA in Nepal

2. Screening and Initial Environmental Examination **4 hrs.**

2.1. Objectives of screening
2.2. Screening criteria and procedure
2.3. Initial environmental examination (IEE)
2.4. Method of IEE

3. Scoping and Preparation of Terms of Reference (ToR) **4 hrs.**

3.1. Objectives of scoping
3.2. Scoping procedure
3.3. Terms of reference and its main components

4. Establishing the Environmental Baseline and Impact Identification **5 hrs.**

4.1. The environmental setting
4.2. Purpose of baseline data
4.3. Method of data collection
4.4. Importance of baseline data
4.5. Methods of impact identification

5. Impact Prediction, Evaluation and Mitigation **10 hrs.**

5.1. Methods of impact prediction
5.2. Impact evaluation techniques
5.3. Types of mitigation measures
5.4. Implementation of environmental protection measures

6. Management of EIA Processes **8 hrs.**

6.1. Environmental management plan
6.2. Environmental monitoring
6.3. Environmental auditing
6.4. EIA report review and decision making
6.5. Stakeholder consultation and public participation

7. Case Study of EIA of Development Projects: **10 hrs.**

7.1. Preparation of environmental management plan
7.2. Preparation of environmental monitoring plan
7.3. Preparation of environmental auditing plan
7.4. Review of IEE/ EIA report
7.5. Involve in process of stakeholder consultation and public participation

References:

1. B.K. Upreti, "Environmental Impact Assessment: Process and Practice", Published by Uttara Uprety, Koteshwor, Kathmandu.
2. J. Glasson, R. Therivel, and A. Chadwick, "Introduction to Environmental Impact Assessment", UCL Press Ltd., London.
3. L. W. Canter, "Environmental Impact Assessment", McGraw Hill, New Yor hrs.k.
4. IUCN/ Nepal, "EIA: Training Manual for Professional and Managers", Published by IUCN/ Nepal.

Question Pattern:

The questions will cover all the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Marks*	Remarks
1.	8	
2.	10	
3.	12	
4.	12	
5.	14	
6.	12	
7.	12	
Total	**80**	

* There may be minor deviation in marks distribution.

ENVIRONMENTAL MANAGEMENT SYSTEM
(BEG 469 EM)
(ELECTIVE)

Year: IV **Semester: I/II**

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	0	2	80	-	20	-	100	

Course Objectives:

The objective of the course is aimed at teaching the students the knowledge of environmental pollution, its impact on society, and management strategies. It would be helpful to the students to understand the global, national and local environmental issues and challenges of the information society.

Course Contents:

1. Environment and Technology **5 hrs.**

1.1. Definition
1.2. Conservation of environment
1.3. Global environmental issues
1.4. The impact of human on environment
1.5. The impact of environment on human
1.6. The role of environmental and civil engineers
1.7. Adverse effects of environmental pollution
1.8. Environmental issues of Nepal
1.9. Environment and human health
1.10. Impact of technology on environmental and society
1.11. Benefits of technology due to new inventions
1.12. Appropriate technology

2. Water Pollution **5 hrs.**

2.1. Water quality standards
2.2. Contaminants in ground water
2.3. Origin and sources of water pollution
2.4. Effect of water pollution on aquatic systems
2.5. Organic pollution

2.6. Inorganic pollution (pesticide, heavy metals)
2.7. Water-borne pathogens and other nuisance aquatic organisms
2.8. Importance of health education
2.9. Water pollution control laws and regulations in Nepal

3. Air Pollution **5 hrs.**

3.1. Sources and causes air pollution
3.2. Classification of pollutants
3.3. Air pollutants and global climate : Global warming, stratospheric ozone depletion, acid rain
3.4. Effects of air pollution on human health, property and visibility
3.5. Indoor air pollution
3.6. Air pollution control laws and regulations in Nepal

4. Noise Pollution **5 hrs.**

4.1. Introduction
4.2. Level of noise and its measurement
4.3. Sensitivity of sound
4.4. Effects of noise
4.5. Adverse effects of noise
4.6. Community noise in Nepal

5. Solid Waste **5 hrs.**

5.1. Development and issues of solid waste management
5.2. Types of solid waste
5.3. Sources of solid waste
5.4. Environmental concerns with wastes (Growing quantities, improper handling and disposal, toxic chemicals, health effects and effects on ecosystems)
5.5. Solid waste management in Nepal

6. Environmental Management **10 hrs.**

6.1. Environmental management tools and techniques
6.2. Benefit of environmental management
6.3. Centralized and decentralized wastewater management system
9.3.1. Types of centralized and decentralized wastewater management techniques
9.3.2. Constructed wetland (Reed bed treatment: Design principle and importance)
6.4. Water management:
9.4.1. Water conservation:
9.4.2. Reducing demand of water, evaporation control, conservation of soil moisture
9.4.3. Rain water harvesting
9.4.4. Artificial recharge methods

9.4.5. Reuse of water

6.5. Solid waste management

9.5.1. Engineered waste disposal facilities

9.5.2. Principles of 3R

9.5.3. Waste management strategies: Pollution preventions, waste minimizations, recycling, incinerations

9.5.4. Engineered system for resource and energy recovery

6.6. Engineered systems for air pollution control

9.6.1. Control devices for particulate contaminants (Gravitational settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitators)

9.6.2. Control devices for gaseous contaminants (adsorption, absorption, condensation, combustion, automotive emission control)

6.7. Control of noise pollution at source

7. Environmental Management System (EMS) 10 hrs.

7.1. Cleaner Production

7.2. Energy Efficiency

7.3. Clean Development Mechanism

7.4. Definition of EMS

7.5. Basic concept of EMS

7.6. Components of EMS

7.7. Types and Benefits of EMS (ISO 14001)

Reference books:

1. G. M. Masters, "Introduction to Environmental Engineering and Sciences", Pearson Education (Singapore) Pte. Ltd., India
2. H. S. Peavy, D. R. Rowe, and G. Tchobanoglous, "Environmental Engineering", McGraw-Hill Inc Editions, New York.
3. N. D. Nevers, Air Pollution Control Engineering", McGraw-Hill Inc., New York.
4. P.K. Goel, "Water Pollution", New Age International Publishers, New Delhi.
5. R.C. Gaur, "Basic Environmental Engineering", New Age International Publishers, New Delhi.
6. S. Cairncross, and R. Feachem, "Environmental Health Engineering in the tropics", John Wiley & Sons, New York.
7. D.P. Bhatt, and L.P. Bhatt, "Environmental Engineering- I, Water Supply Engineering", Laxmi Pustak Bhandar, Maitighar, Kathmandu.
8. S. Somvanshi, and R. Dhupper, "Fundamental of Environmental Studies:, S.K. Kataria & Sons, New Delhi.
9. A.S. Patel, and D.L. Shah, "Water Management", New Age International Publishers, New Delhi.
10. S.K. Soni, "Environmental Engineering- I", S.K. Kataria & Sons, New Delhi.
11. S.K. Soni, "Environmental Engineering- II", S.K. Kataria & Sons, New Delhi.

Evaluation Scheme:

The questions will cover all the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	5	12
2.	5	8
3.	5	8
4.	5	8
5.	5	8
6.	10	18
7.	10	18
Total	**45**	**80**

*** There may be minor deviation in marks distribution**.

ENVIRONMENTAL SOIL SCIENCE

(BEG 469 ES)

(Elective)

Year: IV **Semester: I/II**

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	0	2	80	-	20	-	100	

Course Objectives:

1. After successful completion of this course student will be able to describe physical and chemical process affecting contaminant fate and transport in soil and ground water
2. Explain pollutants in soil and remediation technologies.

Course Contents:

1. Soil Solid Phase **6 hrs.**

1.1. Function of soils in our ecosystem
1.2. Soil as a three phase system
1.3. Soil formation
1.4. Soil profiles
1.5. Primary particles and soil texture
1.6. Soil structure
1.7. Cation exchange capacity
1.8. Soil pH
1.9. Organic matter

2. Gaseous Phase and Liquid Phase **7 hrs**.

2.1. Constituents of soil atmosphere
2.2. Availability of oxygen and soil respiration
2.3. Properties of water
2.4. Soil water potential

3. Biotic Activities in soil and water **7 hrs.**

3.1. Major Groups of organism (Bacteria, Mode of nutrition, Type of electron acceptor, Fungi)
3.2. Soil Factors affecting the growth and activity of soil microbes

4. Soil-Water Retention and Water Movement in Soil **10 hrs.**

4.1. Water in soil and ground water

4.2. Movement of water in soil and ground water

5. Physical Process Affecting Contaminant Fate and Transport in Soil and Ground Water **10 hrs**.

5.1. Mechanism of chemical transport

5.2. Movement through one- dimensional columns

6. Chemical Process Affecting Contaminant Fate and Transport in Soil and Ground Water **10 hrs.**

6.1. Soil Phases

6.2. Solubility and Volatility

6.3. Sorption of Pollutants

6.4. Transport of Sorbing Pollutants

7. Polluted Soil Remediation **10 hrs.**

7.1. Pollutants in Soil

7.2. Remediation Technologies

References books/ Journal papers:

1. Jury, W. A., and Robert, H., "Soil Physics", John Wiley & Sons, USA
2. Ghildyal, B.P., and Tripathi, R.P." Soil Physics", New Age International Publishers, New Delhi.
3. Komatsu, T., "Environmental Soil Science", International Program on Civil and Environmental Engineering, Saitama University, Japan.
4. Subedi, S., Kawamoto, K., Moldrup, P., de Jonge, L.W., Müller, K., Clothier, B.E., and Komatsu, T. (2013). Contact angles of water-repellent porous media inferred by Tensiometer- TDR probe measurement under controlled wetting and drying cycles. Soil Sci. Soc. Am. J. doi:10/2136/sssaj2013.05.0202
5. Subedi,S., Kawamoto,K., Karunarathna, A.K.,Moldrup, P., de Jonge, L.W., and Komatsu, T. (2013). Mini tensiometer-TDR coil probe for measuring soil water retention properties. Soil Sci. Soc. Am. J. doi: 10.2136/sssaj2012.0106
6. Subedi,S., Kawamoto,K., Jayarathna, L., Vithanage, M., Moldrup, P., de Jonge, L.W., and Komatsu, T. (2012).Characterizing time-dependent contact angles for sands hydrophobized with oleic and stearic acids. Vadose Zone J. doi:10.2136/vzj2011.0055.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	6	8
2.	7	9
3.	7	9
4.	10	12
5.	10	12
6.	10	12
7.	10	18
Total	**60**	**80**

* There may be minor deviation in marks distribution.

PUBLIC HEALTH ENGINEERING

(BEG 469 PH)

(Elective)

Year: IV **Semester: I/II**

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	0	2	80	-	20	-	100	

Course Objectives:

The objective of the course is aimed at teaching the students the knowledge of environmental health engineering and its impact on public.

Course Contents:

1. **Infectious Disease** **5 hrs.**
   - 1.1. Water related infections
   - 1.2. Excreta-related infections
   - 1.3. Refuse related infections
   - 1.4. Housing related infections

2. **Water chemistry and water quality** **10 hrs.**
   - 2.1. Harmful organics and inorganic
   - 2.2. Drinking water quality
   - 2.3. Waste water quality
   - 2.4. Waste and its types (Municipal, Industrial, Hazardous, Radioactive Wastes)
   - 2.5. Bathing water quality
   - 2.6. Irrigation water quality
   - 2.7. Water quality and fish

3. **Water supply** **10 hrs.**
   - 3.1. Water supply in developing countries
   - 3.2. Operation and maintenance
   - 3.3. Appropriate Technology
   - 3.4. Hygiene Education
   - 3.5. Rural water supply (Breakdown and technology, Sources of water, Raising water, Storage, Treatment, Water distribution)
   - 3.6. Urban water supply and water treatment (Coagulation and sedimentation, Filtration, Disinfection, Distribution, Water demand management)

4. Excreta and Refuse: Treatment, Disposal and Re-use **10 hrs.**

4.1. Excreta disposal in developing countries
4.2. Types of excreta disposal system (Latrines and its types)
4.3. Planning a sanitation programme
4.4. Waste water treatment (Conventional and non conventional system)
4.5. Sewage workers health
4.6. Surface water drainage
4.7. Refuse collection and disposal
4.8. Composting
4.9. Health aspects of waste re-use

5. **Environmental Modifications and Vector-borne diseases** **5 hrs.**

5.1. Engineering control of arthropod vectors
5.2. Dams, irrigation and health
5.3. Schistosomiasis

6. Risk Assessment **5 hrs.**

6.1. Perspectives on risks
6.2. Perception of risk
6.3. Risk assessment
6.4. Hazard identification
6.5. Dose-response assessment
6.6. Human exposure assessment
6.7. Risk characterization
6.8. Comparative risk analysis

Reference books:

1. G. M. Masters, "Introduction to Environmental Engineering and Sciences", Pearson Education (Singapore) Pte. Ltd., India
2. H. S. Peavy, D. R. Rowe, and G. Tchobanoglous, "Environmental Engineering", McGraw-Hill Inc Editions, New York.
3. N. D. Nevers, Air Pollution Control Engineering", McGraw-Hill Inc., New York.
4. R.C. Gaur, "Basic Environmental Engineering", New Age International Publishers, New Delhi.
5. S. Cairncross, and R. Feachem, "Environmental Health Engineering in the tropics", John Wiley & Sons, New York.
6. S. Somvanshi, and R. Dhupper, "Fundamental of Environmental Studies:, S.K. Kataria & Sons, New Delhi.

Evaluation Scheme:

The questions will cover the entire syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	5	8
2.	10	12
3.	15	20
4.	15	20
5.	10	12
6.	5	8
Total	**60**	**80**

*** There may be minor deviation in marks distribution.**

SOLID WASTE MANAGEMENT

(BEG 469 SW)

(ELECTIVE)

Year: IV **Semester: I/II**

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	0	2	80	-	20	-	100	

Course Objectives:

- After successful completion of this course student will be able to describe main features and processes involved with technologies and process schemes available for treatment of solid wastes.
- Develop insight into the collection, transfer, and transport of municipal solid waste.
- Explain the design and operation of a municipal solid waste landfill.
- Examine the design and operation of a resource recovery facility.

Course Contents

1. Environment **5 hrs.**

1.1. Definition
1.2. Conservation of environment
1.3. Renewable and non-renewable resource
1.4. Global environmental issues
1.5. The impact of human on environment
1.6. The impact of environment on human
1.7. Improvement of environmental quality
1.8. The role of environmental and civil engineers
1.9. Adverse effects of environmental pollution
1.10. Environmental issues of Nepal
1.11. Environmental Ethics

2. Introduction **5 hrs.**

2.1. Development and issues of solid waste management (SWM)
2.2. Legislation provision of solid waste management in Nepal
2.3. Introduction to integrated solid waste management
2.4. Solid waste management in Nepal
2.5. 3R principles of SWM

3. Source and Types of Solid Waste **5 hrs.**

3.1. Sources of waste
3.2. Classification of waste (Solid Waste, Hazardous Waste, Medical Waste and Special Waste)
3.3. Types of Solid waste (Based on Source, Component Composition and Regulatory Definition)
3.4. Composition of solid waste
3.5. Characteristics of solid waste
3.6. Properties of solid waste (physical, chemical and biological)
3.7. Waste generation, sampling and characteristics

4. Collection, Transfer and Transport **7 hrs.**

4.1. Waste collection planning
4.2. On-site management
4.3. Handling, storage and processing
4.4. Collection-service, analysis of collection system
4.5. Transfer station, processing and transport

5. Disposal of Solid Waste **7 hrs**.

5.1. Landfilling, sanitary landfills, land filling methods and operations
5.2. Incineration
5.3. Leachate collection and removal systems
5.4. Final cover system for MSW landfills
5.5. Gas generation and management
5.6. Design and operation of landfills
5.7. Ground water monitoring

6. Resource Recovery **7 hrs.**

6.1. Introduction
6.2. Material separation and processing techniques
6.3. Materials recovery facilities
6.4. Conversion technology for recovery
6.5. Biological transformation: Composting, Vermicomposting
6.6. Recovery of thermal conversion products (incineration, types and design consideration)
6.7. Wasteland Reclamation

7. Case Study: **9 hrs**.

7.1. Overview and case study of waste management practices in municipality and VDC

Field Trip:
Field observation visit to observe collection, transport and landfill operation of SWM of nearest municipalities

Reference books/ Journal papers:

1. G. Tchobanoglous, H. Theisen, and S. Vigil, "Integrated Solid Waste Management", McGraw-Hill Inc, New York.
2. H. S. Peavy, D. R. Rowe, and G. Tchobanoglous, "Environmental Engineering", McGraw-Hill Inc Editions, New York.
3. G. M. Masters, "Introduction to Environmental Engineering and Sciences", Pearson Education (Singapore) Pte. Ltd., India
4. S. Somvanshi, and R. Dhupper, " Fundamental of Environmental Studies", S.K. Kataria & Sons, India
5. Subedi,S., Kawamoto,K., Jayarathna, L., Vithanage, M., Moldrup, P., de Jonge, L.W., and Komatsu, T. (2012).Characterizing time-dependent contact angles for sands hydrophobized with oleic and stearic acids. Vadose Zone J. doi:10.2136/vzj2011.0055.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	5	8
2.	7	14
3.	8	14
4.	10	14
5.	10	14
6.	10	16
7.	10	
Total	**60**	**80**

*** There may be minor deviation in marks distribution.**

ADVANCED HYDROLOGY

(BEG 469 AD)
(Elective)

Year: IV **Semester: I/II**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course objective:

The objective of this course is to gain the knowledge of atmospheric hydrology, hydrologic process, surface run-off, sub-surface flow and unit hydrograph. It gives the knowledge of run-off characteristics of watershed and it's an analysis

Course Contents:

1.0 **Introduction** **3hrs**

1.1 Hydrologic cycle ware budget equation, world water quantities, residence time, system concepts, transfer function operators, hydrologic model classification

2. 0 **Hydrologic Process** **3hrs**

2.1 Reynolds transport theorem, continuity equation, momentum equation, energy equation, discrete time continuity

3.0 **Atmospheric hydrology** **8hrs**

3.1 Atmospheric circulation ,Water vapor, formation of rainfall ,types and forms of precipitation ,monsoon characteristics in Nepal, rainfall measurement ,density and adequacy of rain gauges, moving measurement of discharge

3.2 Thunderstorm, cell model, IDF Relationships, spatial averaging methods of rainfall, moving average method

3.3 Factors affecting evaporation, estimation and measurement of evaporation, energy balance method, Penman method, Blaney –cridle method, Thronthwait method, Radiation method

4.0 Sub-surface water **7hrs**

4.1 Spoil moisture, porosity, saturated and unsaturated flow, Richarrd`s equation, infiltration, Horton`s Philips and green Ampt methods, Ponding time concept

5. **Surface water:** **7hrs**

5.1 Catchment storage concept, Hortonian and saturation overland flow, stream flow hydrographs, base-flow separation.

5.2 Phi-index, ERH & DRH, algorithm for abstraction using Green-Ampt equation, SCS method, overland and channel flow modeling, time area concepts, and stream networks

6. **Unit Hydrograph:** **9hrs**

6.1 General hydrologic system model, response functions of a linear hydrologic systems and their inter-relationships, convolution equation; definition and limitations of a UH;

6.2 UH derivation from single and complex storms: UH optimization using regression. Matrix, and LP methods;

6.3 Synthetic unit hydrograph, S-Curve, IUH, Clerk model

7. Hydrologic Statistics: **8hrs**

7.1 Probability concepts, random variables, laws of probability, PDFs & CDFs;

7.2 Normal and Binomial distributions; Statistical parameters: expected value, variance, skewness, and peakedness;

7.3 Fitting of a probability distribution, methods of moments and maximum likelihood: Testing the goodness of fit, Chi-square test;

7.4 Frequency analysis: return period, probability plotting, extreme value distributions, frequency factors, Log-Pearson distribution, confidence limits

Reference

1. Applied Hydrology by Ven T. Chow, David R. Maidment, and Larry W. Mays,McGraw Hill International Editions.
2. Engineering Hydrology by K. Subramanya, Tata McGraw Hill Publishing Company, New Delhi.

Examination Scheme:

Chapter	Marks Allocated	Remarks
1	8	
2	10	
3	12	
4	4	
5	8	Theory + Numerical
6	32	
7	16	

***Above mentioned marks can be with minor variations.**

CLIMATE CHANGE
(BEG 469 CC)
(Elective)

Year: IV **Semester: I/II**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objectives:

The objective of the course is to gain the knowledge of climate change, its causes and effect, its knowledge on technology, technological option for mitigation of climate change and their impact on outcomes.

Course contents:

1. **Introduction to climate change science** **10hrs**

   1.1 Radiation balance, atmospheric and ocean circulations, Historic climate change
   1.2 Feedback effects, impacts of landuse, albedo, clouds, ocean, storage of co2
   1.3 GHGS and energy use, inventory of GHGS, the carbon cycle
   1.4 Natural and anthropogenic actors
   1.5 Key indicators of global climate change and evidence like carbon-dioxide concentration, Global surface temperature, Arctic sea ice, Land use, Sea level
   1.6 Effect of green house gases
   1.7 The role of human activities, industrialization, combustion of fossil fuels, deforestation, forest fires, agriculture farming
   1.8 Impact on wildfires, Air pollution, Extreme weather, Deforestation, Agriculture change, Ecosystem and biodiversity, Economic effect, Disease and Water scarcity

2. **Technology** **15hrs**

   2.1 Role of human activities on Combustion of fossils fuels in industry, transport, electricity generation, households, Deforestation and agricultural farming

   2.2 Climate change in infrastructure like building, transportation and energy

2.3 Technology options for mitigating climate change like energy supply, transport, building, industry, agriculture, forest waste.

2.4 Adaption measure on water, agriculture, human health, tourism, transport, energy, biodiversity and ecosystem

2.5 Risk analysis and climate change

3. **Economics** **8hrs**

3.1 Population growth and economic growth as climate change drivers

3.2 Costs of adaptation and impacts

3.3 Consquences of alternative regimes of action and inaction for economic growth, employment, trade

3.4 Carbon trade, economic analysis of CDM and other GHG MITIGATION PROJECTS

3.5 Socio-economic impacts of climate change in Nepal

3.6 Funding sources

4. **Policies** **8hrs**

4.1 The Montreal Protocol, agenda 21

4.2 UNFCC and the Kyoto Protocol

4.3 National adaptation program of action (NAPA) to climate change, Ministry of Environment 2010

4.4 Hydropower Development Policies 1992 and 2001

4.5 Rural Energy Policies2006

4.6 Climate Change Policies in 2011

5. **Legal aspects** **4hrs**

5.1 Water Resource Acts 1992

5.2 Environment protection Act 1997 & rule 1997

5.3 Frost act 1993 & rule 1995

References:

1. Holdren, 2007

2. WWW.AAAS.ORG

Evaluation Scheme

Chapter	Marks Allocated
1	16
2	32
3	16
4	8
5	8

*** Above mentioned marks distribution can be with minor variation**

GROUND WATER ENGINEERING
(BEG 469 GW)
(Elective)

Year: IV **Semester: I/II**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objectives:

Groundwater Engineering is the first course in the physics of saturated flow in porous media with engineering application. The course includes topics such as ground-water occurrence and Darcian flow, well hydraulics, pumping tests for finding aquifer parameters, overview of methods and design, pump selection for lifting groundwater and economics of groundwater utilization . Moreover, the course gives of groundwater resources of Nepal.

Course Contents:

1. Occurrence of groundwater and its importance **5 hrs.**

1.1. Hydrological cycle and groundwater
1.2. Origin and age of groundwater
1.3. Groundwater basins, springs, and their types, Characteristics of groundwater its comparison and relation with surface water
1.4. Basic defination of terms in groundwater hydrology with illustrations: Aquifer, Aquiclude, Aquifuge, Aquitard
1.5. Types of aquifer with illustrations- confined, unconfined, leaky, perched, properties of soil/rock affecting groundwater flow: porosity, storage coefficient, specific yield.

2. Fundamentals of Groundwater motion **8 hrs.**

2.1. Review of continuum approach and REV with specific reference to groundwater flow
2.2. Darcy's experiment and empirical expression of Darcy's law and its extension with 3-d generalization, Range of validity of Darcy's law and examples of non –Darcian flow in sub-surface

2.3. Definition of Hydraulic conductivity (with their typical values), aquifer transmissivity, aquifer heterogeneity and anisotropy.

3. Potential groundwater flow theory and Flow Net analysis 8 hrs.

3.1. Plotting stream lines, equipotential lines, and flow net in groundwater, direction of groundwater flow from piezometric head observations, analysis of water table maps

3.2. Derivation of Laplace equation and its use in steady groundwater flow in isotropic and anisotropic media.

3.3. Application of potential flow theory in steady one-dimensional flow in homogenous unconfined aquifer, horizontal galleries extending up to impervious rock and aquifer with recharge; steady flow in a confine aquifer of constant and variable thickness.

4. Well Hydraulics 4 hrs.

4.1. Steady and unsteady radial flow in fully and partially penetrating non-leak wells,

4.2. Introduction of multiple well systems and interference of wells

5. Pumping test and estimation of aquifer properties 5 hrs.

5.1. Use of pumping tests in Groundwater hydrology, overview of types of pumping tests

5.2. Theis method for unsteady flow in unconfined and in confined non-leaky aquifers

5.3. Thims's equilibrium formula for steady flow in unconfined aquifer, Jacob's time-drawdown and distance drawdown methods for unsteady flow in non-leaky confined aquifer.

6. Overview of Groundwater exploration 2 hrs.

6.1. Objectives of groundwater exploration,

6.2. Overview of methods of groundwater exploration, water winching, Geological, geophysical, electrical resistivity, seismic refraction methods.

7. Water Well Design 6 hrs.

7.1. Classification of wells and tube wells

7.2. Design considerations in wells confined and confined and unconfined aquifer: well diameter, well depth, well screens (slot size, screen diameter, types and selection of screen), gravel pack design, overview of design principle of collector wells and infiltration galleries.

8. Pumps for ground water lifting 4 hrs.

8.1. Type of pumps

8.2. Overview of working principle and suitability of plunger, jet, deep-well vertical turbine, submersible, air-lift and centrifugal pumps, factors to be considered in the selection of pump sets

9. Groundwater Resources of Nepal **3 hrs.**

9.1. Kathmandu valley and Terai aquifer: Schematic zones showing water availability and development possibility

References;

1. Groundwater.H.M.Raghunath, New Age International Publisher, 2ND Edition 1987
2. Hydraulics of Groundwater, Jacob Bear, MCGraw –Hill INC 1979
3. Ground Water Hydrology, David Keith Todd2nd edition4.Handbook of Ground water development, John Wiley and sons US Department of interior, Breau of Reclamation 1995

Examination Scheme:

Chapter	Marks Allocated
1	8
2	8
3	16
4	8
5	8
6	4
7	16
8	8
9	4

***Above mentioned marks distribution can be with minor variation.**

HILL IRRIGATION ENGINEERING
(BEG 469 HI)
(Elective)

Year: IV **Semester: I/II**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objectives:
This course is aimed at training the students specific engineering design considerations for canal irrigation, their operation, maintenance and management with environmental balance and farmer`s participation in the hills of Nepal. The course is emphasized with the design of non – conventional micro irrigation technology such as sprinkler and drip in the remote hills of Nepal. After the completion of this elective course the students will confidently design the canal and micro irrigation projects in the remote hilly areas of Nepal.

Course Contents:

1. Introduction **4 hrs.**
- 1.1. Physiographic Regions and farming system systems of Nepal
- 1.2. Characteristics of Hill Irrigation systems (HIS)
- 1.3. Needs, potentiality and types of Irrigation Development in the hills of Nepal.

2. Environmental aspects of Hill Irrigation **6 hrs.**
- 2.1. Problems of floods ,Soil erosion and landslides
- 2.2. Mountain Zone classification
- 2.3. Engineering and Vegetative measures for canal design in different Mountain Zones
- 2.4. Guidelines for Hill Irrigation design (Scheme, objectives, Agricultural consideration)
- 2.5. Managerial, Social and institutional arrangement : Financial provisions and Engineering solutions

3. Planning and Implementation of hill irrigation **3 hrs.**
- 3.1. Long term planning with farmers participation
- 3.2. Request proposal for project assistance and screening
- 3.3. Stages of project study and data collection

3.4. Detail design and implementation of project.

4. Water availability and irrigation requirement 8 hrs.

4.1. Flow assessment techniques based on data availability (MIP,WECS & HSC)
4.2. Extractable flow for irrigation
4.3. Consumptive use of selected cropping pattern
4.4. Operational water requirement
4.5. Effective rainfall contribution with 80% reliability
4.6. Percolation losses and irrigation efficiencies
4.7. Computation of irrigation requirement

5. Canal irrigation in hills 12 hrs.

5.1. Canal Intakes for hill irrigation
- 5.1.1. Design issues and construction materials for diversion: suitable intakes and their location;
- 5.1.2. Design factors of intake ;Design of single orifice and bottom rack intakes

5.2. Sediment control for hill canals
- 5.2.1 Natural and artificial methods : sediment control structures for hill canals
- 5.2.2 Design for gravel trap and setting basin ;Estimation of sediment load in the absence of data

5.3. Canals and distribution system for hill irrigation
- 5.3.1. Nomenclature ,layout and alignment of hill canal; Design of hill canals; seepage and lining of hill canals
- 5.3.2. Characteristics of distribution systems and layout pattern appropriate to hill irrigation; structural components of the distribution system; flow division structures and operation of Saacho

5.4. Escape and drop structure for hill canals
- 5.4.1. Need of escapes in hills; Suitable escapes for hills ;location of escapes in hills ; suitable drops in hills
- 5.4.2. Design of cascade and chute drops; use of small drops to control water level and erosion

5.5. Cross Drainage structure for hill canals
- 5.5.1. Selection of suitable C/D structure in hill; Aqueducts their advantages and disadvantages;
- 5.5.2. Problems of aqueducts and prevention; Superpassages, their advantages and disadvantages;
- 5.5.3. Problems of super passages and prevention ; siphons and their advantages and disadvantages Problems of siphons
- 5.5.4. and prevention; level crossing ,their advantages and disadvantages; inlets and outlets

6. Sprinkler Irrigation **5 hrs.**

6.1. Advantages and Suitability of Sprinkler for Hill Irrigation
6.2. Limitations and Disadvantages of Sprinkler Irrigation
6.3. Types and Components of Sprinkler Irrigation
6.4. Design of a Portable Sprinkler System
6.5. Design of a Portable Sprinkler System
6.6. Operation and Maintenance of Sprinkler System

7. Drip or Trickle Irrigation **5 hrs.**

7.1. Advantages and Suitability of Drip for Hill Irrigation
7.2. Limitations and Disadvantages of Drip Irrigation
7.3. Types and Components of Drip System
7.4. Design Approach and selection of Drips
7.5. Design of a Portable Drip System
7.6. Operation and Maintenance of Drip System

8. Gabion Structures for remote hill areas **2 hrs.**

8.1. Advantages of Gabion Construction
8.2. Design Considerations for Gabion Structures
8.3. Characteristics of Fill Material

Assignments:

Individual assignment on design of Sprinkler and Drip Irrigation Systems

References:

1. Hill Irrigation Engineering, Institute of Engineering, Pulchowk Campus, TU, Basil S. Jacob, The Ford Foundation, New Delhi, January 1995.
2. Design Manuals for Irrigation Projects in Nepal. M.1 to M.13, Sir M MacDonald and Partners Ltd, PDSP, UNDP, World Bank, DOI, February 1990.

Examination Scheme:

Chapter	Marks Allocated	Remarks
1	4	
2	4	
3	12	
4	12	
5	32	Theory + Numerical
6	8	
7	4	
8	4	

** The above marks distribution can be with minor variations.

Micro Hydropower
(BEG 469 MH)
(Elective)

Year: IV **Semester: I/II**

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

Course Objectives:

After successful completion of this course students will be able to describe/design main features and processes involved in micro hydropower.

Course Contents:

1. **Introduction** **2 hrs.**
   - 1.1 History of MHP in Nepal
   - 1.2 Multipurpose use of MHP
   - 1.3 Site selection for MHP

2. **Hydrology** **6 hrs.**
   - 2.1 Introduction and Definitions
   - 2.2 Guidelines and Standards
   - 2.3 Discharge Measurement
   - 2.4 Hydrology and Nepali MHP
   - 2.5 Hydrological Data
   - 2.6 Medium Irrigation Project (MIP) Method
   - 2.7 WECS/DHM (HYDEST) Method
   - 2.8 Flood Flows

3. **Headworks** **4 hrs.**
   - 3.1 Introduction and Definitions
   - 3.2 Guidelines and Standards
   - 3.3 Weir design
   - 3.4 Intake design
   - 3.5 Intake Trash rack design
   - 3.6 Detail drawing of head works
   - 3.7 Spillway

4. **Headrace/Tailrace** **4 hrs.**
   - 4.1 Introduction and Definitions
   - 4.2 Guidelines and Standards
   - 4.3 Canal design
   - 4.4 Pipe design
   - 4.5 Detail drawings of headrace/tailrace

5. Settling Basins **7 hrs.**

5.1 Introduction and Definitions
5.2 Guidelines and Standards
5.3 Sediment Settling Basins
5.4 Settling Basin Theory
5.5 Gravel Trap design
5.6 Settling Basin design
5.7 Forebay design
5.8 Vertical flushing pipe
5.9 Gate design
5.10 Detail drawings of settling basin

6. Support System **5 hrs.**

6.1 Anchor block design
6.2 Support pier design
6.3 Foundation design for turbine, generator, etc.

7. **Penstock and Power Calculations** **4 hrs**.

7.1 Introduction and Definitions
7.2 Guidelines and Standards
7.3 Detail drawings of penstock pipe and alignment

8. Turbine Selections **4 hrs.**

8.1 Introduction and Definitions
8.2 Guidelines and Standards
8.3 Detail drawing of turbine

9. Electrical Equipment Selections **4 hrs.**

9.1 Introduction and Definitions
9.2 Guidelines and Standards
9.3 Selection of generator size and type
9.4 Sizing and RPM of Synchronous Generator
9.5 Sizing and RPM of Induction Generator
9.6 Detail drawings of electrical component (line diagram)

10. Transmission and Distribution **3 hrs.**

10.1 Introduction and Definitions
10.2 Guidelines and Standards
10.3 Design and Calculation of transmission and distribution
10.4 Detail drawings of transmission and distribution

11. Loads And Benefits **2 hrs**.

11.1 Introduction and Definitions
11.2 Guidelines and Standards
11.3 Calculation of load and benefits

References

1) Allen R. Inversin (1986), Micro-Hydropower Sourcebook, A Practical Guide to Design and
2) Implementation in Developing Countries, NRECA International Foundation, 1800 MassachusettsAvenue N. W., Washington, DC 20036.
3) Adam Harvey (1993), Micro-Hydro Design Manual, A guide to small-scale water powerschemes, Intermediate Technology Publications, ISBN 1 85339 103 4.
4) BPC Hydro consult, Intermediate Technology Development Group (ITDG), Kathmandu, Nepal (2002), Civil Works Guidelines for Micro-Hydropower in Nepal.
5) GTZ/Department of Energy Development, Energy Division, Papua New Guinea, Micro HydropowerTraining Modules (1994), Modules 1-7, 10, 13, 14 & 18B.
6) European Small Hydropower Association (1998), Layman's Guidebook on How to Develop a SmallHydro Site

Evaluation Scheme:

Chapter	Marks	Remarks
1	4-6	Th.
2	8	Th. /Numerical
3	8	Th. /Numerical
4	8	Th. / Numerical
5	8+8	Th. + Numerical
6	4+8	Numerical / Th.
7	4+8	Th. + Numerical
8	4 - 6	Th. /Numerical
9	4 - 6	Th. / Numerical
10	2-4	Th.
11	2-4	Th.

Note: * There will be total 6 questions and each question will contain two questions, (a) and (b). Each question will have weightage of 8 marks. The students will have to answer 5 questions out of six.

** The above marks distribution can be with minor variations

COMPUTATIONAL TECHNIQUE IN CIVIL ENGINEERING

(BEG469CT)
(Elective)

Year: 4 **Semester: I/II**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	P	T	Duration	Marks	Duration	Marks				
3	0	2	3	80	--	--	20	--	100	

Course Objective:

The object of this course is to equip students with knowledge of numerical solutions of various civil engineering problems and design of structures

Course Contents

1. Introduction **4 hrs**

1.1 History of numerical computations of civil engineering problems
1.2 Brief description of solution techniques
- 1.2.1 Finite Element Method
- 1.2.2 Finite Difference Method
- 1.2.3 Boundary Conditions
- 1.2.4 Discretization
- 1.2.5 Smoothed particle hydrodynamics

2. Solutions for Linear Equations **6 hrs**

2.1 System of linear equations.
2.2 Gaussian Elimination
2.3 Data storage and memory optimization
2.4 Conjugate gradient method
2.5 Fourier Integral
- 2.5.1 Discrete Fourier Transform
- 2.5.2 Fast Fourier Transform

2.6 Principal of Minimum Potential Energy (Rayleigh – Ritz Method)

3. Elasticity in solids **5 hrs**

3.1 Stress Displacement relationship
3.2 Stress- strain relationship (constitutive) relations
- 3.2.1 3D state of solid, Lame constants
- 3.2.2 Plane stress and plane strain condition
- 3.2.3 Axi-symmetric stresses

3.3 Equilibrium equations

4. One Dimensional Finite Element Formulation **12 hrs**

4.1 Linear Bar Element
4.2 Coordinates and Shape Functions
4.3 Generation of Stiffness Equation
4.4 Quadratic Bar Element and Shape Functions
4.5 Generation of Stiffness Equation
4.6 Beam Element and shape functions
4.7 Generation of Stiffness Equation
4.8 Truss Elements and shape functions
4.9 Generation of Stiffness Equation
4.10 Frame Elements and shape functions
4.11 Application by Potential Energy Approach: Discretization of problem domain, Element Stiffness Matrix, Stress calculations, Temperature effects

5. Two Dimensional Finite Element Formulation **7 hrs**

5.1 Triangular Elements
5.2 Generation of Shape Functions; Constant Strain Triangle
5.3 Four- Noded Quadrilateral Elements
5.4 Plane Stress Problems
5.5 Plane Strain Problems
5.6 Axisymmetric Problems
5.7 Application by Potential Energy Approach; Discritization, Element Stiffness Matrix, Stress Calculation

6. Finite difference method **5 hrs**

6.1 Finite difference
6.2 Explicit scheme and implicit scheme
6.3 Governing equations of movement of fluid (Momentum and continuity equations)
6.4 Discretization of kinematic wave motion (linear and non linear)
6.5 Order of accuracy of the scheme and its applications
6.6 Numerical diffusion, dispersion and stability of scheme
6.7 Applications of the schemes in hydraulic channel routing
6.8 Implicit dynamic wave model
6.9 finite difference schemes for Saint – Venant equations

7. Solving Problems Through Computer Applications **6 hrs**

7.1 Solution Techniques
7.2 Computer Solution of One- Dimensional Problems
7.3 Computer Solution of Two- Dimensional Problems
7.4 Mesh Generation Techniques for Simple One- and Two - Dimensional Problems
7.5 Computer Codes for Simple One- and Two - Dimensional Problems
7.6 Presentation of Results

References:

1. Robert D. Cook, David S. Malkus, Michael E. Plesha; Concepts and Applications of Finite Element Analysis; John Wiley & Sons.

2. T. R. Chandrupatla and A.D. Belegundu; Introduction to Finite Elements in Engineering; Pearson Education Asia.
3. J.N. Reddy: An Introduction to Finite Element Method.
4. P. Seshu; Text book of Finite Element Analysis
5. J.F. Abel and C.S. Desai; Introduction to the Finite Element Methods, CBS Publications
6. O.C. Zeinkiewicz, The Finite Element Method.

Evaluation Scheme:

Chapter	Time allocated in hour	Marks Distribution
1	4	8
2	6	10
3	5	8
4	12	20
5	7	16
6	5	8
7	6	10

** The above marks distribution can be with minor variations.

DESIGN OF RCC BRIDGE
(BEG469DB)
(Elective)

Year: 4 **Semester: I/II**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objectives:

- Introduce bridge structures & their types and make capable to select appropriate bridge type
- Make capable to analyze and design simple reinforced concrete and steel bridge deck, bridge bearing and substructure of bridge
- Introduce with the construction and maintenance techniques of bridges

Course Contents:

1. Introduction to Bridge Structures and Fundamentals of Bridge Design. 4 hrs.

1.1. Bridge and its components
1.2. Types of bridges and their characteristics
1.3. Selection of bridge type
1.4. General design requirements

2. Bridge Loading and Responses 4 hrs.

2.1. Bridge Loads
2.2. Bridge responses

3. Bridge Deck Analysis and Method of Lateral Load Distribution 6 hrs.

3.1. General principle and methods of bridge deck analysis
3.2. Effective Width Method
3.3. Courbon's Method
3.4. Distribution Coefficient / Hendry Jaegar Method
3.5. Longitudinal and lateral positioning of moving loads and response

4. Design of Bridge Deck 14 hrs.

4.1. Design of RC Culvert / Slab Bridge
4.2. Design of RC T-Beam Bridge
4.3. Introduction to design of plate girder /composite /steel truss bridge

5. Design of Bridge Substructure **8 hrs.**

5.1. Design of Pier

5.2. Design of Abutment

5.3. Introduction to Bridge Foundation

6. Bridge Bearing and Expansion Joint **5 hrs.**

6.1. Bridge Bearing

6.1.1. Types of bearing

6.1.2. Design of metallic bearing

6.1.3. Design of elastomeric bearing

6.1.4. Expansion Joint

6.1.4.1. Requirement to expansion joint

6.1.4.2. Types of expansion joint and their design

7. Construction and Maintenance of Bridge **4 hrs.**

7.1. Introduction to construction of bridges

7.2. Introduction to maintenance of bridges

References:

1. Essential of Bridge Engineering; Victor, D.J.
2. Analysis & Design of Substructure; Swami Saran
3. Standard Specification & Code of Practice for Road Bridge

Evaluation Scheme

Chapter	Time allocated in hour	Marks Distribution
1	4	6
2	4	6
3	6	12
4	14	24
5	8	16
6	5	10
7	4	6

** The above marks distribution can be with minor variations.

SEISMIC RESISTANCE DESIGN OF STRUCTURES
(BEG469 SR)
(Elective)

Year: 4 **Semester: I/II**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objectives:

After completion of the course, the students should be able

- To understand the mechanics of masonry elements, subjected to various load effects including bending, shear, and axial forces.
- To discuss the code principles of masonry structures and apply them in design of masonry structures.

Course Contents:

1. Fundamentals of Earthquake Engineering **5 hrs.**

1.1. Origin of earthquake
1.2. Nature of earthquake force
1.3. Earthquake force parameters
1.4. Earthquake as lateral force in building
1.5. Dynamic Parameter (Time history, frequency spectra and response spectra) of earthquake force

2. Introduction to masonry and non-engineered construction **5 hrs.**

2.1. Nature of masonry structures
2.2. Mechanical and physical properties of bricks and walls
2.3. Types of masonry structures: Load bearing walls, infill masonry and confined masonry
2.4. Elements of masonry structures

3. Response of masonry structures to earthquakes **6 hrs.**

3.1. Lateral force resisting systems
3.1.1. In-plane and out-of-plane behavior
3.1.2. Typical damages to masonry buildings in earthquakes
3.1.3. Modes of failure of masonry structures

4. Seismic analysis and design of masonry buildings 12 hrs.

4.1. Design principles and code specifications for masonry construction
4.2. Design for axial load and bending
4.3. Slenderness effects
4.4. Design for shear
4.5. Seismic design of masonry shear walls

5. Reinforced masonry 8 hrs.

5.1. Introduction to reinforced masonry
5.1.1. Flexural strength
5.1.2. Shear strength of reinforced masonry
5.1.3. Reinforced masonry columns and beams

6. Seismic Evaluation / Retrofit techniques in Masonry Structures. 5 hrs.

7. Repair and strengthening techniques for damaged masonry buildings after earthquakes 4 hrs.

Practical/Project Work

Design a 2-3 storey masonry building considering seismic load.
(The students should carry out survey of masonry building and select one of the buildings for design. Each student shall submit design for unique building)

References:

1. T. Paulay, M.J.N. Priestley. Seismic Design of Reinforced Concrete and Masonry Buildings. John Wiley & Sons, Inc., New York, 1992.
2. W. Hendry, B.P. Sinha, S. R. Davies, Design of Masonry Structures. E & FN Spon, Londn UK, 1997.
3. W. Hendry. Structural Masonry. Macmillan, Hounmills, Basingstoke, 1998.
4. Tomazevic, M, 1999. Earthquake-resistant design of masonry buildings, Imperial College Press.
5. Arya A, Boen T, Ishiyama Y, Martemianov A, Meli R, Scawthorn C, Vargas J and Yaoxian Y (1986/2010). Guidelines for earthquake resistant non-engineered construction.

Marks Distribution

Chapter	Time allocated in hour	Marks Distribution
1	5	8
2	5	8
3	6	10
4	12	24
5	8	16
6	5	8
7	4	6

** The above marks distribution can be with minor variations.

STRUCTURAL DYNAMICS
(BEG 469 SD)
(ELECTIVE)

Year: IV **Semester: I/II**

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

Course Objectives:
This subject deals with the fundamental concepts of structural dynamics, and the dynamic behavior of structures along with the underlying principles. Students are expected to know the mathematical description of the response of SDOF systems with and without damping to free vibration, harmonic, and arbitrary excitations as well as to compute the dynamic response of structural components and structural systems under dynamic loads.

Course Content:

1. Introduction **4 hrs.**
- 1.1. Time dependent problems
- 1.2. Types of dynamic loadings
- 1.3. Degrees of freedom
- 1.4. Force and displacement measurement
- 1.5. Structural Vibration
- 1.6. Damping
- 1.7. Behavior of structure to vibration

2. **Matrices in Structures** **7 hrs.**
- 2.1. Flexibility and Stiffness matrices
- 2.2. Generation of Flexibility and Stiffness matrix
- 2.3. Partitioned matrix and its use in structure
- 2.4. Gauss-Jordan method
- 2.5. Eigen value problems and eigen vector

3. **Single Degree of Freedom (SDOF) System** **12 hrs.**
- 3.1. Equation of Motion and Natural Frequency
- 3.2. Modeling of SDOF structures
- 3.3. Undamped free vibration response
- 3.4. Critically- damped, under- damped and over- damped systems
- 3.5. Damped free vibration response
- 3.6. Logarithmic decrement

3.7. Forced harmonic response
3.8. Vibration Isolation and Force transmissibility
3.9. Vibration measuring instruments
3.10. Energy dissipation by damping
3.11. Forced vibration response to periodic forces
3.12. Forced vibration response to Impulsive forces
3.13. Force vibration response to general dynamic loading
3.14. Convolution integral and Duhamel integral
3.15. Time domain analysis
3.16. Frequency domain analysis

4. Multi Degree of Freedom (MDOF) System **14 hrs.**

4.1. Simple MDOF systems
4.2. Reduction of DOF's and static condensation
4.3. Modeling of MDOF system structures
4.4. Concept of generalized co-ordinates
4.5. Lagrange's equation of motion
4.6. Free vibration analysis of undamped MDOF system
4.7. Natural vibration frequencies and mode shapes
4.8. Modal expansion
4.9. Free vibration response of MDOF systems
4.10. Normal co-ordinates and Normal mode theory
4.11. Uncoupled equation of motion
4.12. Mode superposition method
4.13. Dynamic analysis of Linear MDOF systems
4.14. Modal response analysis of undamped and damped systems
4.15. Element forces
4.16. Modal contribution factors
4.17. Forced vibration response of MDOF system
4.18. Practical methods to determine natural frequencies and mode shapes(Rayleigh's method, Stodola's method, Holzer's method)

5. **Continuous Systems** **8 hrs.**

5.1. Partial differential equations of motion (for string, bar, beam)
5.2. Transverse vibration of string
5.3. Transverse vibration of beam
5.4. Axial vibration of a bar
5.5. Approximate methods to determine natural frequencies and mode shapes in cases where orthogonality conditions are not satisfied

References:

1. Clough R.W., Penzien J, Dynamics of Structures, 2nd edition: McGraw Hill 1993.
2. Chopra A.K., Dynamics of Structures: Theory and Applications to Earthquake Engineering, Prentice Hall, 2007.
3. Paz, M., and Leigh, W., Dynamics of Structures- Theory and Computation, 5th Kluwer Academic Publishers, 2004. Edition,

4. Thompson, W.T., Theory of Vibration with Applications, Prentice-Hall, Fourth Edition, 1993.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	4	8
2.	7	12
3.	12	24
4.	14	24
5.	8	12
Total	**45**	**80**

* There may be minor variation in marks distribution.

ADVANCED GEOTECHNICAL ENGINEERING
(BEG469AG)
(Elective)

Year: 4 **Semester: I/II**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objective:
The objective of the course is to provide the student with the concept and the tools that can be used to incorporate in the field of geotechnical engineering. The course includes the advanced techniques that are not dealt in the courses of soil mechanics and foundation engineering.

Course Contents:

1 Dynamically Loaded Foundations **5 hrs.**

1.1 Selection of design criteria
1.2 Identification of dynamic Loads
1.3 Design of foundations subjected to dynamic loaded (machine foundations, etc.) : spring-supported model, analysis of foundation vibration on elastic layers, effect of foundation shape and embedment
1.4 Vibration transmission, isolation and monitoring

2 Foundations in Earthquake Regions **5 hrs.**

2.1 Selections of design earthquake
2.2 Site response to earthquake: site specific conditions soil structure interaction and their influence on ground motions, response spectra
2.3 Seismic analysis: selection of response spectrum corresponding to the design earthquake, determination of seismic loads
2.4 Design of foundations for earthquake conditions: earth retaining structures, footing foundations, mat foundations, etc.

3 Field Instrumentation and Monitoring **11 hrs.**

3.1 Types of field measurement and their uses
3.2 Monitoring displacements of foundations and structures: vertical displacements and horizontal displacements
3.3 Monitoring slope/rockmass movement: slope movement using borehole extensometers, Inclinometers and Tiltmeters; rockmass displacement in underground excavations etc. Using optical electro-optical methods of borehole extensometers
3.4 Monitoring pressures/loads in earth walls and structures; monitoring pressures in the body of earth structures; monitoring loads on temporary

supports

3.5 Monitoring In-situ stresses in rock: hydraulic fracture techniques, direct stress measurement techniques, and borehole methods

3.6 Monitoring pore pressure: methods based on various types of piezometers, selection of piezometers to suit the ground conditions

3.7 Recording and data handling

4 Geosynthetics **9 hrs.**

4.1 Types of geosynthetics

4.2 Application of geosynthetics drainage, filtration reinforcement and separation

4.3 Design considerations: physical properties, mechanical / hydraulic / durability requirements

4.4 Construction requirements: site preparation, selection of equipment, placement and compaction requirements

5 Anchors, Rock Bolts and Shotcrete **9 hrs.**

5.1 Application and types of anchors and rock bolts

5.2 Design criteria: safety against uplift, overturning, tangential displacement, shear failure and caving in

5.3 Installation: drilling, insertion, grouting (anchoring) stressing and final grouting

5.4 Mechanism of load transfer in anchors

5.5 Testing of anchors

5.6 Protection from corrosion

5.7 Selection of materials and mix design of shotcrete

5.8 Engineering properties of shotcrete

5.9 Placement of shotcrete

6 Grouting **6 hrs.**

6.1 Purpose of grouting

6.2 Classification of grouting materials

6.3 Characteristics of good routing materials: viscosity, setting time, permeability of grouting works

6.4 Planning of grouting works

6.5 Selection of grouting materials

6.6 Grouting methods

6.7 Control of grouting works

Two days field visit to learn the following works related to geotechnical engineering:

1 Monitoring displacements of foundations and structures

2 Monitoring slope/rockmass movement

3 Monitoring In-situ stresses in rock

4 Monitoring pore pressure

5 Monitoring pressures/loads in earth walls and structures

6 Installation of rock bolts and anchors

7 Grouting works

8 Application of geosynthetic

References:

1 "Engineering Principles of Ground Modifications", M.R. Housmann, McGraw-Hill Co., New York.
2 "Grouting in Engineering Practice", R. Bowen, Allied Science Pub., London
3 "Underground Excavation", E. Hoek & E. Brown, Institution of Mining & Metallurgy, London
4 "Foundation Instrumentation", T.H. Hanna, Trans. Tech. & McGraw Hill Book Co.
5 "Principles of Geotechnical Engineering", B.M. Das, Boston PWS Engineering

Marks Distribution of Advanced Geotechnical Engineering

Chapter	Time allocated in hour	Marks Distribution
1	5	8
2	5	8
3	11	24
4	9	16
5	9	16
6	6	8

Transport Planning and Engineering
(BEG469TP)
(Elective)

Year: IV **Semester: I/II**

			Examination Scheme				Total marks	Remarks
			Final		Internal Assessment			
L	T	P	Theory	Practical	Theory	Practical		
3	2	0	80	-	20	-	100	

Course Objectives:

The main objective of the course "Transport Planning and Engineering" is to impart knowledge about transport planning process. Furthermore, the course includes the new topics which are not included in the regular course of Transportation Engineering I & II. These topics are Airport Engineering and Railway Engineering. Transport planning as an issue of high importance for the developing country, it should be followed by the future transport demand analysis. Key topics of the course attempt to impart knowledge in the following contemporary concepts:

- Conceptual knowledge in transportation system;
- Issues, relative importance and methods of Transport Planning;
- Introductory knowledge on Airport Engineering, Railway Engineering and Ropeways;

This course may be good platform for the Graduate (Masters' degree) course in Transportation Engineering.

Course Contents:

1. Introduction **5hrs.**

1.1 Scope and significance of Transportation planning and system engineering
1.2 Transport planning and modeling
1.3 Transport related problems in cities
1.4 Transportation network and their characteristics

2. Urban and Regional Transport Planning **3hrs.**

2.1 Difference between urban and regional planning
2.2 Transport demand surveys and studies
2.3 Travel demand forecasting

3. Urban transport planning process **8hrs.**

3.1 The conventional approach
3.2 Four step transport planning
3.3 Other recent approaches to transportation planning

4. Transportation System analysis **5hrs.**

4.1 Generation of alternatives
4.2 Evaluation of alternatives
4.3 Selection criteria: capital and operating expenditures

5. Introduction to Airport Engineering **8hrs.**

5.1 Airport classification:
5.2 Aircraft type
5.3 Predicting air travel demand
5.4 Selection airport sites
5.5 Layout of airfield and their geometric standards
5.6 Terminal facilities and their space requirement
5.7 Introduction to the design of airfield pavements

6. Introduction to Railway engineering **8hrs.**

6.1 Classification of railways
6.2 Components of railway section
6.3 Geometric design of Railway Track
6.4 Design of track structure
6.5 Railway switches and crossings
6.6 railway side tracks and yards

7. Ropeways **5hrs.**

7.1 Classification
7.2 Components of Ropeways
7.3 Design Criteria

8. Transport system in Nepal **3hrs.**

8.1 Overview of existing system and future trend
8.2 National Transport Policy, Five Year Plans
8.3 Existing planning process

Tutorials:

1. A case study on transportation system analysis
2. A research on airport management system in Nepal

References

1. Traffic Engineering and Transport Planning. L.R. Kadiyali, Khanna Publishers, Delhi, 2000.
2. Transportation Engineering & Planning, Third Edition (Indian Reprint). C. S. Papacostas & P. D. Prevedouros. Prentice-Hall of India, New Delhi.2002.
3. Urban Transportation planning. Michael D. Meyer & Eric J. Miller. Mc Graw Hill, 2002.

Evaluation Schemes:

SN	Chapter	Marks allocated
1	1	6
2	2	6
3	3	10
4	4	12
5	5	16
6	6	16
7	7	6
8	8	8
	Total	**80**

Rock Engineering
(BEG469RE)
(Elective)

Year: 4 **Semester: I/II**

Teaching Schedule Hrs./week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objective:
The general objective of this elective course is to equip students with knowledge, skill and tools required for analysis and design of underground opening and related structures applicable to hydropower development.

Course Contents:

1. Background **2 hrs.**

1.1. Brief history on the development of rock engineering
1.2. The role of rock engineering in hydropower development
1.3. Main elements of underground hydropower plants

2. Properties of Rocks and Rock Masses **6 hrs.**

2.1. Introduction
2.2. Physical properties of rocks
2.3. Special features of Rocks
  2.3.1. Swelling and squeezing
  2.3.2. Drillability and blastability
2.4. Strength of rocks
2.5. Jointing of the rock mass and its characteristics
2.6. Shear strength of joints
2.7. Weakness zones and fault

3. Rock stresses **6 hrs.**

3.1. Introduction
3.2. Origin of rock stresses
3.3. Stresses surrounding underground opening
3.4. Stability problems due to stress
3.5. Rock stress measurements

4. Groundwater in Rock Masses **4 hrs.**

4.1. Introduction
4.2. Permeability and hydraulic Conductivity
4.3. Estimation of water leakages
  4.3.1. Basic flow theory
  4.3.2. Numerical modeling
4.4. Field measurements
4.5. Problems caused by groundwater
4.6. Sealing of water leakage

5. Engineering geological Investigation for underground structures **4 hrs.**

5.1. Introduction
5.2. Investigation stages
5.3. Preconstruction phase investigations
5.4. Construction phase investigations
5.5. Engineering geological report

6. Rock Mass Classification **6 hrs.**

6.1. Introduction
6.2. Quality rating and support estimation
  6.2.1. The RMR System
  6.2.2. The Q System
  6.2.3. The RMi – support method
6.3. Comments on classification systems for rock support estimates

7. Design approach of Underground Opening **6 hrs.**

7.1. Introduction
7.2. Shallow seated and deep seated openings
7.3. Design procedures
7.4. Drill and Blast Tunneling
7.5. TBM Tunnels

8. Support and Lining **6 hrs.**

8.1. Introduction
8.2. Support Methods and principles
  8.2.1. Scaling
  8.2.2. Rock bolts
  8.2.3. Shotcrete
  8.2.4. Concrete lining
  8.2.5. Composite lining
  8.2.6. Other methods
8.3. Evaluation of support requirements
  8.3.1. Empirical Approach
  8.3.2. Classification Systems

8.3.3. Analytical Methods
8.3.4. Numerical Modeling
8.3.5. Observational Approach (NATM)

9. Improved and cost saving solutions **2 hrs.**

9.1. Introduction
9.2. Unlined high – pressure Tunnels and Shafts

10. Ground Vibrations **3 hrs.**

10.1. Earthquake vibrations
10.2. Blast Vibrations

Tutorial:

1) Stresses surrounding underground opening
2) Estimation of water leakages in rock mass
3) Presentation of geological data: joint rossete
4) Estimation of the rock support for underground structures

Practical:

1) Field visit to hydropower project in vicinity
2) Field report and group presentation

References:

1. Nilsen, B. and Thidemann, A. 1993. Rock Engineering.
2. Nilsen, B. and Palmstrom, A. 2000. Engineering Geology and Rock Engineering.

Evaluation Scheme

Chapter No:	Title	Hrs.	Marks Distribution*
1	Background	2	4
2	Properties of Rocks and Rock Masses	6	12
3	Rock stresses	6	12
4	Groundwater in Rock Masses	4	8
5	Engineering geological Investigation for underground structures	4	6
6	Rock Mass Classification	6	8
7	Design approach of Underground Opening	6	8
8	Support and Lining	6	12
9	Improved and cost saving solutions	2	6
10	Ground Vibrations	3	4
	Total	**45**	**80**

*** Note: Above mentioned mark distribution can be with minor deviation**

Rock Slope Engineering
(BEG469RS)
(Elective)

Year: 4 **Semester: I/II**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objective:
The general objective of this elective course is to equip students with knowledge, skill and tools required for analysis and design of excavation and embankments.

Course Contents:

1. Principles of Rock Stability Analysis **2 hrs.**
- 1.1. Introduction
- 1.2. Aims of Slope Stability Analysis
- 1.3. Planning stability investigations

2. Basic Mechanics of Slope Failure **6 hrs.**
- 2.1. Slope features and dimensions: Definitions
- 2.2. Factors affecting the slope stability
- 2.3. Methods for Rock Slope Stability Analysis
  - 2.3.1. Empirical Methods
  - 2.3.2. Deterministic Method
  - 2.3.3. Probabilistic Method
  - 2.3.4. Numerical Modeling

3. Graphical Presentation of Geological Data **5 hrs.**
- 3.1. Definitions of Geological and Geometrical terms
- 3.2. Graphical techniques for data problems
- 3.3. Kinematic Analysis: Identification of Slope instability
  - 3.3.1. Plane Failure
  - 3.3.2. Wedge Failure
  - 3.3.3. Toppling Failure

4. Site Investigation and Geological Data Collection **5 hrs.**
- 4.1. Planning an investigation program
- 4.2. Site Reconnaissance

4.3. Geological mapping
4.4. Spacing, Persistence and roughness measurement
4.5. Drill coring and core logging

5. Shear Strength of Rock **6 hrs.**

5.1. Introduction
5.2. Shear Strength of Planar Discontinuities
5.3. Shear Strength of Rough Surfaces
5.4. Factors influencing Shear strength of rock
  5.4.1. Rock type
  5.4.2. Surface roughness
  5.4.3. Discontinuity infilling
  5.4.4. Orientation and spacing of joints
  5.4.5. Ground water
  5.4.6. Seismic force
5.5. Determination of shear strength
  5.5.1. Empirical methods
  5.5.2. Laboratory tests
  5.5.3. Field tests
  5.5.4. Back Analysis

6. Quantification of Groundwater Pressure **2 hrs.**

6.1. Occurrence and Characteristics of Groundwater
6.2. Effects of groundwater on slope stability
6.3. Groundwater pressure models
6.4. Measurement of water pressure

7. Plane Failure **4 hrs.**

7.1. Introduction
7.2. General conditions of plane failure
7.3. Analysis of plane failure
7.4. Factors influencing plane failure

8. Wedge Failure **5 hrs.**

8.1. Definition of wedge geometry
8.2. General conditions of wedge failure
8.3. Analysis of wedge failure

9. Circular Failure **3 hrs.**

9.1. Condition of circular failure
9.2. Derivation of circular failure charts
9.3. Groundwater flow assumptions
9.4. Use of the circular failure charts

10. Toppling Failure **3 hrs.**

10.1. Definition of Toppling Failure
10.2. General conditions of Toppling failure
10.3. Types of Toppling Failure
10.4. Analysis of Toppling failure

11. Stabilization of Rock Slopes **4 hrs.**

11.1. Introduction
11.2. Stabilization by rock reinforcement
11.3. Stabilization by rock removal
11.4. Protection measures against rock falls

Tutorial:

1) Graphical presentation of geological data
2) Shear strength of rock
3) Plane failure
4) Wedge failure
5) Circular failure
6) Toppling failure

Practical:

1) Field visit to potential unstable slope
2) Field report and group presentation

References:

1. Hoek, E. and Bray, J. W. 1981. Rock Slope Engineering.
2. Wyllie, D. C. and Mah, C. W.2005. Rock Slope Engineering.

Evaluation Scheme

Chapter No:	Title	Hours	Marks Distribution*
1	Principles of Rock Slope Stability Analysis	**2**	**4**
2	Basic Mechanics of Slope Failure	**6**	**4**
3	Graphical Presentation of Geological Data	**5**	**6**
4	Site Investigation and Geological Data Collection	**5**	**6**
5	Shear Strength of Rock	**6**	**8**
6	Quantification of Groundwater Pressure	**2**	**4**
7	Plane Failure	**4**	**12**
8	Wedge Failure	**5**	**16**
9	Circular Failure	**3**	**8**
10	Toppling Failure	**3**	**6**
11	Stabilization of Rock Slopes	**4**	**6**
	Total	**45**	**80**

*** Note: Above mentioned marks distribution can be with minor variation.**

RURAL ROAD ENGINEERING
(BEG469RR)
(Elective)

Year: IV **Semester: I/II**

			Examination Scheme				Total marks	Remarks
			Final		Internal Assessment			
L	P	T	Theory	Practical	Theory	Practical		
3	0	2	80	-	20	-	100	

Course Objectives:

The main objective of the course "Rural Road" is to impart knowledge about design and construction of rural road systematically and scientifically with the use of concept of engineering. Rural roads are the fundamentals for the upgrading of urban roads. Key topics of the course attempt to impart knowledge in the following contemporary concepts:

- Conceptual knowledge in design and construction of rural road;

Course Contents:

1.0 Planning and Alignment: **3hrs.**

1.1 Planning of rural roads
1.2 Concept of Network Planning
1.3 rural roads plan
1.4 road alignment and surveys
1.5 governing factors for route selection

2.0 Geometric Design Standards: **6 hrs.**

2.1 Classification of rural roads,
2.2 Design standards for rural road components

3.0 Low cost road: **6 hrs.**

3.1 Definition
3.2 Classification
3.3 Planning, Survey and Design Overview
3.4 EIA Procedure
3.5 Construction aspects
3.6 Agencies involved for low cost road construction in Nepal

4.0 Culverts and Small Bridges: **6 hrs.**

4.1 Geometric standards for culverts,

4.2 Design loading, design of culverts,
4.3 types of culverts, causeways, scupper and submersible bridge

5.0 Construction and Specifications: 5 hrs.

5.1 Selection of materials and Methodology
5.2 Embankment and subgrade, sub-base, base course
5.3 shoulder, bituminous constructions
5.4 semi-rigid pavement construction

6.0 Rigid and Flexible Pavement Construction 6hrs.

6.1 Types of pavements,
6.2 Equipment required for different operations.

7.0 Ropeways 3 hrs.

7.1 Classification
7.2 Components of Ropeways
7.3 Design Criteria

8.0 Bio-engineering 3 hrs.

8.1 Vegetation in Engineering, the law and road side vegetation
8.2 standard specifications for bioengineering
8.3 vegetation used for road side bioengineering

9.0 Green Road 5 hrs.

9.1 Concept of green road
9.2 suitability of green road
9.3 components of green road
9.4 design standards
9.5 construction technology and equipments used in green road
9.6 agencies involved in Nepal

10.0 Agencies for rural road development in Nepal 2 hrs.

10.1 Overview of agencies
10.2 National Policy, Five Year Plans
10.3 Existing planning process

Tutorial:

1. A case study on road side bioengineering
2. Design of cross structures

References:

1. IRC SP 20: Rural Roads Manual, Indian Roads Congress, New Delhi, 2002.
2. NRRS -2055 DoLIDAR

3. Road Side BioEngineering - Reference Manual, Department of Roads, 2002
4. Overseas Road Note 16- Transport Research Laboratory

Marks distribution Scheme:

SN	Chapter	Marks allocated
1	1	4
2	2	6
3	3	10
4	4	10
5	5	12
6	6	12
7	7	6
8	8	8
8	8	8
8	8	4
Total		**80**

** The above marks distribution can be with minor variations.

Traffic Engineering Management
(BEG469TE)
(Elective)

Year: 4 **Semester: I/II**

Teaching Schedule Hours/week			Examination Scheme				Total marks	Remarks
			Final		Internal Assessment			
L	T	P	Theory	Practical	Theory	Practical		
3	2	0	80	-	20	-	100	

Course objectives:

The main objective of the course "Traffic Engineering Management" is to impart knowledge about traffic management systematically and scientifically with the use of concept of engineering. Traffic management as a burning issue and is of high importance for the developing cities, it should be followed by the future traffic load analysis. Key topics of the course attempt to impart knowledge in the following contemporary concepts:

- Conceptual knowledge in traffic management system;
- Issues, relative importance and methods of Transport Management;

This course may be good platform for the Graduate (Masters' degree) course in Traffic Engineering and Management.

Course Contents:

1. Introduction **2 hrs.**

1.1 Scope and significance of Traffic Engineering Management
1.2 Traffic planning and modeling using prototype
1.3 Traffic related problems in major cities
1.4 Transportation network and their characteristics

2. Urban Traffic Planning **3 hrs.**

2.1 Introduction to urban traffic planning
2.2 Calculation of traffic volume
2.3 Travel demand forecasting

3. Traffic Characteristics **3 hrs**.

3.1 Basic traffic characteristics - Speed, volume and concentration.
3.2 Relationship between Flow, Speed and Concentration

4. Traffic Measurement And Analysis: **5 hrs.**

4.1Volume Studies - Objectives, Methods;
4.2 Speed studies - Objectives: Definition of Spot Speed, time mean speed and space mean speed;
4.3Methods of conducting speed studies

5. Speed Studies: **5 hrs.**

5.1 Methods of conducting speed studies;
5.2 Presentation of speed study data;
5.3 Head ways and Gaps;
5.4 Critical Gap;
5.5 Gap acceptance studies.

6. Highway Capacity And Level Of Service: **5 hrs.**

6.1 Basic definitions related to capacity
6.2 Level of service concept
6.3 Factors affecting capacity and level of service
6.4 Computation of capacity and level of service for two lane highways Multilane highways and free ways.

7. Parking Studies And Analysis: **5 hrs.**

7.1 Types of parking facilities - on street parking and off street Parking facilities;
7.2 Parking studies and analysis.

8. Traffic Safety: **7 hrs.**

8.1 Accident studies and analysis;
8.2 Causes of accidents - The Road, The vehicle, The road user and the Environment;
8.3 Engineering, Enforcement and Education measures for the prevention of accidents.

9. Traffic Control And Regulation: **5 hrs.**

9.1 Traffic Signals - Design of Isolated Traffic Signal by Webster method,
9.2 Warrants for signalisation, Signal Co-ordination methods, Simultaneous, Alternate, Simple progressic and Flexible progression Systems.

10. Traffic And Environment: **3 hrs.**

10.1 Detrimental effects of Traffic on Environment;
10.2 Air pollution; Noise Pollution;
10.3 Measures to curtail environmental degradation due to traffic.

11. Traffic Management In Nepal **2 hrs.**

11.1 Overview of existing system and future trend
11.2 National Transport Policy, Five Year Plans
11.3 Existing planning process

Tutorials:

1. A case study on traffic measurement and analysis

References

1. Traffic Engineering and Transportation Planning - L.R. Kadiyali, Khanna Publishers.
2.Traffic Engineering - Theory & Practice - Louis J. Pignataro, Prentice Hall Publication.
3. Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter P. Kilareski, John Wiley & 50ns Publication.
4. Transportation Engineering - An introduction - C. Jotin Khistry, Prentice Hall

Publication.

5. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.

Evaluation Scheme:

Chapter	**Marks allocated**
1	4
2	4
3	4
4	10
5	10
6	10
7	10
8	10
9	10
10	4
11	4
Total	**80**

*****Above mentioned marks can be with minor variations.**

CONFLICT MANAGEMENT
(BEG499CM)
(Elective)

Year: 4 **Semester: 2**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objectives:
The goal of the course is to provide students with a broad understanding of Conflict Management and conflict resolution techniques.

Course Contents:

1: Introduction to conflict management **7 hrs.**
- 1.1 Concept of conflict management
- 1.2 Development conflict management as a discipline
- 1.3 Basic Terminologies used in conflict management.
- 1.4 Global conflict trends and analysis

2: Organizational and Interpersonal Conflict **6 hrs.**
- 2.1 The nature of conflict
- 2.2 Causes of conflict
- 2.3 Stimulating conflict
- 2.4 Controlling conflict
- 2.5 Managing Conflict in Organization.

3: Conflict Prevention **6 hrs.**
- 3.1 Concept of Early warning in relation to Conflict Prevention
- 3.2 Conflict Prevention and Early Warning in Practice
- 3.3 UN Efforts to Prevent Conflicts

4: Approaches to Conflict Analysis **8 hrs.**
- 4.1 Conflict dynamic approach.
- 4.2 Basic need approach
- 4.3 Rational Calculation Approach
- 4.4 Triple R and Triple M approach
- 4.5 Conflict Mapping Techniques.

5: Theoretical concept on Resolving Conflict **8 hrs.**
- 5.1 The Conflict Management School

5.2 The Conflict Resolution School
5.3 The complementary school
5.4 The conflict transformation school

6: Diplomacy **4 hrs.**

6.1 Introduction and Basic Concept of Diplomacy
6.2 Track I, Track II and Track III Diplomacy
6.3 The role of Diplomacy to Peace making

7: Arbitration, Adjudication and Humanitarian Intervention **3 hrs.**

7.1 Arbitration
7.2 Adjudication

8: Indigenous and Traditional Mechanism of Conflict Resolution in Nepal **3 hrs.**

8.1 Overview of Indigenous and Traditional Mechanism of Conflict Resolution in Nepal
8.2 Community Mediation in Nepal

References:

1. Ackermann. A. (2003). The Idea and Practice of Conflict Prevention. Journal of Peace Research, 40 (3), 339-347.

2. Goodhand. J. (2001). Conflict Assessment, A synthesis Report: Kyrgyzstan, Moldavia, Nepal and Srilanka. Kings College London: The Conflict, Security and Development Group.

3. Thapa. M. (2005). Back to Negotiation: Diagnosis and Prognosis for future Negotiation in Nepal. European Peace University- Research Paper Series, 02(2006).

Evaluation Scheme:

The questions will cover all the syllabus. The evaluation scheme will be as indicated in the Table below:

Chapter	Hours	Marks Distribution
1	7	14
2	6	12
3	6	10
4	8	14
5	8	14
6	4	6
7	3	5
8	3	5
Total	45	80

** The above marks distribution can be with minor variations.

GEOGRAPHICAL INFORMATION SYSTEM (GIS)
(BEG 499 GI)
(Elective)

Year : 4 **Semester: 2**

Teaching Schedule Hours/Week			Examination Scheme						Total marks	Remarks
			Final				Internal assessments			
			Theory		Practical		Theory	Practical		
L	T	P	Duration (hrs)	Marks	Duration	Marks	Marks	Marks		
3	2	0	3	80	-	-	20	-	100	

Course Objectives;

The objectives of this course is to make the students aware of the principles, concepts and the applications of geographic information system (GIS) applied to different civil engineering fields.

Course Contents:

1 Introduction **4 hrs.**

1.1 The philosophy of GIS
1.2 Need of GIS
1.3 Definition of GIS
1.4 History of GIS
1.5 Spatial operation
1.6 Component of GIS
1.7 Different types of data
1.8 Vector representation
1.9 Raster representation

2 Data capture and automation **8 hrs.**

2.1 Sources of data
2.2 Data capture
2.3 Introduction to map
2.4 Manual Digitization and Scanning system
2.5 Geo referencing
2.6 Projection systems
2.7 Coordinate systems
2.8 Accuracy and precision

3 Database concept and design **7 hrs.**

3.1 Databases for GIS
3.2 Database systems
3.3 Database processing and management systems
3.4 Database design
3.5 Data dictionary

4 Geographic analysis **6 hrs.**

4.1 Introduction; Spatial analysis and its application areas
4.2 Overlay operations
4.3 Network analysis
4.4 Relationship of modelling to Analysis

5 Output and Information communication **6 hrs.**

5.1 Important aspects in design of output maps
5.2 Cartographic tools and visual variables
5.3 Data output types

6 Application of GIS **6 hrs.**

6.1 Characteristics of GIS Technology
6.2 Spatial data infrastructure
6.3 Component of spatial data infrastructure
6.4 Institutional and Organizational Considerations
6.5 Outlook GIS trends
6.6 Digital terrain model

7 Remote Sensing **8 hrs.**

7.1 Brief history of remote sensing for earth observation
7.2 Remote Sensing Basics
7.3 Frame Captured Sensors and Line Scanners
7.4 Satellite-based Sensors in Visible and Infrared Wavelengths
7.5 Active Sensors: Radar and Lidar
7.6 Sonar
7.7 Aerial Imagery – Visual Interpretation
7.8 Remote Sensing Applications

Laboratory:

1 Introduction to GIS
2 Vector, attribute and cartography
3 Vector, attribute and analysis
4 Map projections
5 Raster, structure and analysis
6 Interpolation
7 Presenting Data
8 Introduction to Remote sensing

References:

1 Jensen, RJ "**Introduction to Digital Image Processing. A Remote Sensing Perspective, 3rd Edition**", Prentice Hall
2 Paul A. Longley, Michael F. Goodchild, David J. Maguire and David W. Rhind "**Geographic Information Systems and Science**"
3 O. Huisman, R.A. de By (ed.) "**Principles of Geographic Information Systems"** Publisher**: ITC 2009**

Marks Distribution of Geographic Information Systems:

Chapter	Time allocated in hour	Marks Distribution
1	4	8
2	8	16
3	7	16
4	6	16
5	6	12
6	6	12
7	8	16

** The above marks distribution can be with minor variations.

PRODUCTIVITY MANAGEMENT
(BEG499PM)
(Elective)

Year: 4 **Semester: 2**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objective:
After the completion of this course, student will be able to develop awareness and understanding of productivity and its importance for individuals, organization and society.

Course Contents:

1.0 Introduction to productivity and productivity management: 6 hrs.

1.1. What is productivity?
1.2. Characteristics of productivity.
1.3. Importance and evolution of productivity movement.
1.4. Evolution theories and themes of productivity management.

2.0 Productivity measures: 6hrs.

2.1. Effective use of resources.
2.2. Compare people, departments, companies and nations.
2.3. Track performance over time and comparison to a previous period.
2.4. Measures.
2.5. Factors distorting productivity.
2.6. Approximate indicators, not precise.

3.0 Factor affecting productivity: 7 hrs.

3.1. Capital.
3.2. Technology.
3.3. Quality.
3.4. Management.
3.5. Methods.
3.6. Workers.

4.0 People and technology: 7 hrs.

4.1. Productivity gains.
4.2. Making people work harder.

4.3. Buying new technology.
4.4. Strategic planning.

5.0 Improving productivity: **8 hrs.**

5.1. Development of measures.
5.2. Critical operations, system approach, bottlenecks.
5.3. Development of methods for improvement.
5.4. Workers improvement and team work.

6.0 Improving productivity: **7 hrs.**

6.1. Establishment of reasonable goals.
6.2. Management support and Incentives.
6.3. Measure and publicizing improvements.

7.0 Case studies based on Organizational Productivity Management. **4 hrs.**

References:

1. National Productivity and Competitiveness Council, NPCC Newsletter, Mauritius.
2. Productivity in the age of changing technology (1987), Parliamentary Forum on Public Sector Centre for Public sector Studies, National Productivity Council, India, ILO, APO, UNIDO.
3. Monga R.C. (2004), "Managing Enterprise Productivity and Competitiveness, Action Programme on Productivity Improvement, Competitiveness and Quality Jobs in Developing Countries"- Working Paper PMD- 3.
4. Stevenson, "Productivity, Competitiveness and Strategy"

Evaluation Scheme:

The question will cover the entire syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution
1	6	12
2	6	12
3	7	12
4	7	10
5	8	12
6	7	10
7	4	12
Total	**45**	**80**

** The above marks distribution can be with minor variations.

QUALITY MANAGEMENT
BEG 469 QM
(Elective)

Year - IV **Semester: 2**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
			Theory	Practical	Theory	Practical	
3	2	-	20	-	80	-	100

Course Objective,

This course is designed to educate and train Civil Engineering students in the area of Quality Management (QM) that includes quality evolution, concept of QM, QM tools and techniques including statistical process control, TQM implementation and continuous improvement in products or services of any organization.

Course Contents:

1. **Introduction to Quality and Quality Management** **6 hrs.**
   1.1 Concept of quality
   1.2 Dimensions of quality
   1.3 Importance of quality
   1.4 Concept and Principles of Quality Management
   1.5 Strategic Quality Management
   1.6 Bench Marking
2. **Total Quality Management** **8 hrs.**
   2.1 History of quality
   2.2 TQM definition
   2.3 Main elements of TQM
   2.4 Pioneers of TQM
   2.5 Total Productive Maintenance (TPM)
3. **Quality Standards** **9 hrs.**
   3.1Quality System Standards
   3.2 International Organization for Standardization
   3.3 Conformance to Specification
   3.4 Types of Quality Audits
   3.3 Quality assurance
   3.4 ISO standards (ISO 9000, 14000 …)
   3.5 Nepal Standard (NS)
4. **TQM tools and Techniques** **6 hrs.**
   4.1 Process variation
   4.2 Statistical tools
   3 .3 Management tools

5. **Six Sigma** **5 hrs.**
   5.1 Meaning of six sigma
   5.2 The seven Magnificent Quality Tools

6. **Service Quality Management** **4 hrs.**
   6.1 products and services
   6.2 Classification of Services
   6.3 Service Quality

7. **Leadership in TQM and Continuous Improvement** **7 hrs.**
   7.1 Leadership elements
   7.2 Tasks of a leader for quality
   7.3 Customer-supplier chain
   7.4 Continuous improvement

Reference Books

1. Bedi K. (Eighth edition 2011), Quality Management, Oxford University Press, India.
2. Besterfield, et al. Total Quality Management. PHI
3. Ehresman, Terry (1996). Small Business Success through TQM. Tata McGraw-Hill Publishing Company Limited, Delhi, India.
4. Hansen and Ghare (latest ed.). Quality control and application. PHI
5. Suganthi & Samuel. Total Quality Management. PHI
6. Zairi, Mohamed (1992 /or latest one). Total Quality Management for Engineers. Aditya Books Private Limited, Delhi, India.

Evaluation Scheme:

Chapter	Marks*	Remarks
1	8	
2	16	
3	16	
4	8	
5	8	
6	8	
7	16	
Total	**80**	

* There could be minor changes in indicated marks.

STRATEGIC MANAGEMENT
(BEG499 SM)
(Elective)

Year: 4 **Semester: 2**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	0	3	80	--	--	20	--	100	

Course Objective:

To provide the students an understanding of importance of strategic management in today's competitive business environment.

Course contents:

1. Introduction to Strategic Management **4 hrs.**

1.1 Introduction of course,
1.2 definition of strategic management,
1.3 Concept of strategic management,
1.4 Phases of strategic management,
1.5 Benefits of strategic management,
1.6 Basic model of strategic management
1.7 Strategic decisions

2. Environment Scanning and Industry Analysis **6 hrs.**

2.1 Identifying external environmental variables:
2.2 PESTEL;
2.3 Industry Analysis: analyzing the Task Environment,
3.4 Porter's approach to Industry Analysis: threats of new entrants, rivalry among existing firms,
3.5 Threat of substitute products or services,
3.6 Bargaining power of buyers, bargaining power of suppliers, relative power of other stakeholders.

3. Internal Scanning: Organizational Analysis **6 hrs.**

3.1 Corporate Value Chain Analysis,
3.2 Organizational structures,
3.3 Corporate culture

4. Strategy Formulation: Corporate Strategy **4 hrs.**

4.4 Directional Strategies: growth, concentration and diversification,

4.5 Stability and retrenchment Portfolio Analysis: BCG Market Growth, Parenting Strategy.

5. Strategy Formulation: Business strategy 5 hrs.

5.1 Porter's Competitive Strategies: low cost, differentiation, focus,

5.2 Cooperative Strategies: collusion, strategic alliances, mutual service consortia, joint venture, licensing agreement

6. Strategy Formulation: Functional Strategy and Strategic Choice 3 hrs.

6.1 Internal factors: marketing & sales, R&D, operations, personnel, finance, strategic groups, strategic types, McKinsey 7s Framework

7. Strategy Implementation; Organizing for Action- Who, What and How? 3 hrs.

7.1 Who implements strategy, what must be done,

7.2 Developing programs, budget and procedures, Structure follows strategy

8. Strategy Implementation: Staffing and Directing 4 hrs.

8.1 Staffing, Staffing follows Strategy,

8.2 Management by Objectives (MBO)

9. Evaluation and Control 4 hrs.

9.1 Evaluation and control,

9.2 Measuring performance, Types of control

10. Case Study and student presentation 6 hrs.

Recommended Books

1. Thomas l. Wheelen, J. David Hunger, Krish Rangarajan, 2006, *Strategic Management and Business Policy*, Pearson Education, India
2. Lawrence R. Jauch, Rajiv Gupta, William F. Glueck, *Business Policy and Strategic Management*, 2003, Frank Bros. & Co, India

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as Indicated in the table:

Chapter	Hours	Marks Distribution
1	4	6
2	6	10
3	6	10
4	4	6
5	5	10
6	3	5
7	3	5
8	4	6
9	4	6
10	6	16
Total	**45**	**80**

** The above marks distribution can be with minor variations.