TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
PULCHOWK CAMPUS
DEPARTMENT OF CIVIL ENGINEERING

Our Ref: **Date.** .....

To,

Date: 2073-02-24

Deputy Chief

Civil Engineering Department

Subject: About the Information

Dear Sir,

Please find herewith the information about the MSc in Geotechnical Engineering Program

Name of the Program: **MSc in Geotechnical Engineering**

Admission requirement, Enrollment (Students): **BE in Civil Engineering, 20(Twenty)**

Curriculum and course structure: **Attached herewith**

Facilities: **Laboratory should have to be improved and there is no proper manpower to handle the lab and to assist the students.**

With best regards

Dr.Indra Prasad Acharya

Program Coordinator

MSc in Geotechnical Engineering

Ananda Niketan, Pulchowk, Lalitpur, Nepal. G. P. O. Box 1175, Kathmandu, Tel : 5521260 Ext. 408, 403
Telephone : 5525477, 5543070 Fax : 977-1-5525477 E-mail : civil_dept@ioe.edu.np URL : http://ioe.edu.np

Example: EG 821 CE denotes the course *Introduction to Solid Mechanics* which is offered in the fist year of the first semester of M.Sc. program by the Department of Civil Engineering.

As the elective courses are offered on the basis of minimum number of students registered for the course and the availability of the faculty, the above explanation of the course codes may not be strictly applicable to the electives.

The courses offered are listed as follows:

A. **CORE COURSES**

EG 821 CE	Introduction to Solid Mechanics, (3-1-0), 4 credits
EG 822 CE	Fundamentals of Engineering Geology, (3-1-0), 4 credits
EG 823 CE	Advanced Soil Mechanics, (3-1-0), 4 credits
EG 831 CE	Advanced Rock Mechanics, (3-1-0), 4 credits
EG 832 CE	Advanced Foundation Engineering (3-1-0), 4 credits
EG 833 CE	Geotechnical Exploration and Testing (2-0-2), 4 credits

B. **ELECTIVE COURSES**

EG 824 CE	Geosynthetics (3-1-0), 4 credits
EG 825 CE	Ground Improvement Techniques, (3-1-0), 4 credits
EG 834 CE	Earth Dams and Embankments, (3-1-0), 4 credits
EG 835 CE	Advanced Numerical Methods, (3-1-0), 4 credits
EG 836 CE	Underground Excavation and Tunneling, (3-1-0), 4 credits
EG 837 CE	Mountain Risk Engineering, (3-1-0), 4 credits
EG 921 CE	Rock Slope Engineering, (3-1-0), 4 credits
EG 922 CE	Seepage Problems in Soils, (3-1-0), 4 credits
EG 923 CE	Geotechnical Earthquake Engineering, (3-1-0), 4 credits
EG 924 CE	Soil Mechanics for Unsaturated Soils, (3-1-0), 4 credits

The list of elective courses in each semester may be determined based on the need, availability of teaching facilities and teaching faculty in that particular semester.

C. **RESEARCH PROJECT WORK (THESIS)**

EG 900 CE Research Project in Geotechnical Engineering (Thesis), 16 credits.

3.4 Instructional Methods

Each course will mainly consist of lecture sessions, tutorials, laboratory sessions, computer sessions, seminar, etc. as applicable. Additional consultations by the related faculty will be provided to the students. Generally four to eight assignments will be given in each course. Practical classes in the form of laboratory works, field

5. COURSE SYLLABUS

5.1 CORE COURSES

EG 821 CE Introduction to Solid Mechanics (3-1-0)
Partial differential equations and integral equations, Fourier integral, functional approximation, theory of stress and strain, stress and strain tensor, elastic constitutive equation, stress displacement function, principle of virtual work and is applications, plate bending theory, plasticity, element of plasticity.

EG 822 CE Fundamentals of Engineering Geology (3-1-0)
Parameters of the Engineering Geological System (EGS); documentation of the parameters of the EGS, different rock types of Nepal; geological structures; documentation of geological structures; analysis of geological data; engineering geology with reference to different phases of the projects; engineering geology in land use planning, mitigation of geological hazards and environmental protection; engineering geology related to earthquake and ground vibration; engineering geological case histories of some prominent civil engineering projects in Nepal.

EG 823 CE Advanced Soil Mechanics (3-1-0)
Soil formation, physical and chemical properties of soils, soil structures, clay minerals, phase relationship, plasticity, particle size distribution, soil classification; soil compaction, engineering properties of compacted soils; effective stress concept; permeability, seepage, flow net, flow through earth dam; stress distribution theories; one-dimensional consolidation, isotropic and anisotropic consolidation, secondary consolidation, radial consolidation, settlement analysis; shear strength tests, stress-strain characteristics of soils, effective strength and total strength parameters, pore pressure parameters, stress path concept, normalized behaviour, water content-strain contours, water content-shear strength relationship, critical void ratio, soil rheological models, critical state concept; slope stability analysis.

EG 831 CE Advanced Rock Mechanics (3-1-0)
Rock mass and the intact rocks; in-situ stress field in rocks and rock masses; rock mass and discontinuities; index properties and classification of the rock mass; rock dynamics; distribution and engineering behaviour of rocks in Nepal; foundation design in rocks, case histories with particular reference to Nepal.

EG 832 CE Advanced Foundation Engineering (3-1-0)
General requirements, types and suitability of shallow foundation, bearing capacity and settlement analysis, foundation subjected to eccentric and inclined loads, footings on slopes; analysis of mat foundation by conventional method, elastic line method, finite difference method; types and methods of construction of pile foundation, bearing capacity analysis, pile testing, pile group, laterally loaded piles, pile group subjected to inclined load; components of well foundation: design, construction, sinking problems and solutions of well foundation, bridge sub-structure, forces on bridge foundation; rigid and flexible walls: design of retaining walls, design of sheet pile walls, backfill & drainage; types of cofferdams, stability analysis of cofferdam, interlocking stresses

EG 833 CE Geotechnical Exploration and Testing (2-0-2)
Site investigation planning, field investigation and testing, soil sampling methods, site specific record keeping, report writing; direct methods of surface and subsurface

exploration: test pits, trenches, drilling methods, drilling spacing and depth; indirect methods of soil exploration: seismic and electrical resistivity methods; ground water observation; soil sampling techniques; field test methods: standard penetration test, static cone penetrometer test, pressuremeter test, In-situ permeability test, plate loading test, recent development of field testing methods: field instrumentation and measurement techniques; laboratory tests: index tests, grain size distribution tests, laboratory permeability test, unconfined compression tests, direct shear test, consolidation test, triaxial test.

5.2 ELECTIVE COURSES

EG 824 CE Geosynthetics (3-1-0)
Types and functions of geosynthetics, material and manufacturing methods, testing and evaluation; soil reinforcement, geogrids and geotextile reinforced soils; retaining walls; reinforced slopes; landslide control; reinforced pavement and other highway applications; filtration and erosion control; soft soil stabilization; bearing capacity improvement; canal and reservoir lining.

EG 825 CE Ground Improvement Techniques (3-1-0)
The need for ground improvement; classification of ground improvement techniques; surface compaction and deep compaction; pre-loading, pre-loading with vertical drains, vacuum drains; reinforced earth, stone columns, granular piles, micro piles, soil nailing, fiber-reinforced soil; soil stabilization with admixtures.

EG 834 CE Earth Dams and Embankments (3-1-0)
Types of dams, selection and requirement of foundations and materials of construction, causes of failure and criteria for safe design, zoning and design details; foundation investigation; Casagrande and Kozeny's solutions for seepage through dams, flow nets for homogeneous and zoned earth/rockfill dams, steady seepage and sudden drawdown conditions, control of seepage through dams and foundations and methods of seepage reductions; selection of core types and other materials; stability analysis of dams under steady state seepage as well as different drawdown conditions, seismic stability of dams; dam construction: compaction theories, compaction characteristics of soils, methods of construction for cohesive and non-cohesive soils, placement of materials and quality control measures; foundation treatment; dam instrumentation; special problems related to cracking, compression, swelling, foundation settlement, crest movement and controlling methods.

EG 835 CE Advanced Numerical Methods (3-1-0)
Finite element and boundary element methods. Linear and non-linear analysis. Sequence construction and excavation problems. Analysis of foundations, dams, underground structures and earth retaining structures. Analysis of flow through dams and foundations. Evaluation of material parameters for linear analysis. Recent developments.

EG 836 CE Underground Excavation and Tunneling (3-1-0)
Types of underground openings, elastic and elasto-plastic stress and displacements around underground openings of circular, elliptical, other shapes and multiple openings; shallow tunnels: rock load theories and design considering dip of bedding planes, Barton's theory; deep tunnels: elasto-plastic theory of rock pressure, rock burst, ground reaction curve and design of support systems, importance of loose backfill material and swelling pressure on the tunnel; design of concrete and shotcrete lining, design of steel

liner; consideration of ground water pressure and hill slopes; design of rock bolts system for stratified and/or fractured rock mass; excavation methods, excavation systems for large openings and difficult ground conditions; support and linings, determination of rock loads; exploration and instrumentation; case histories with particular reference to Nepal; environmental impacts, ventilation, lighting.

EG 837 CE Mountain Risk Engineering (3-1-0)
Mass movements: classification, causes, mechanism and monitoring mass movements; slope stability; hazards and risks: introduction and interrelation in mountainous area, hazards and risks assessment, landslides and other project specific hazard mapping, use of hazard and risk in decision making; soil erosion: soil erosion processes, transportation and deposition, interill, rill and gullies, site monitoring of erosion, particle size analysis, qualitative and quantitative methods of erosion estimation; mitigation measures: civil engineering mitigation measures, bio-engineering mitigation measures, moisture content and ground water table reduction.

EG 921 CE Rock Slope Engineering (3-1-0)
Structural mapping and graphical representation of geological data; classification of natural slopes; factors governing rock mass stability: quality of rock mass, rock defects, geotechnical properties of discontinuities, ground water flow along the discontinuous rock mass; mechanics and modes of slope failure: plane failure, wedge failure, circular failure, toppling, rock falls; kinematics of slope stability analysis: stability of natural and cut slopes, infinite slopes and stratified slopes; design of cut slope in rocky terrain: concept of safety factor, Hoek and Bray stability charts; rock slope stabilization.

EG 922 CE Seepage Problems in Soils (3-1-0)
Basic principles, Darcy's law of flow, Laplace equation and solution by graphical, electrical analogy method and relaxation method, computation of head loss, seepage pressure, uplift and exist gradient, piping; three dimensional problem of flow and solutions; seepage through earth dam, phreatic line and its determination, flow net for anisotropic soil and zoned earth dams, earth dam under steady seepage and rapid draw-down conditions, control of seepage, mapping technique solution, conformal mapping, Kozeny basic parabola, Swarz-Christoffel transformation, Khosla's solution velocity hydrograph; flow character at singular points, complex velocity approach, solution to triangular dam; seepage on foundation, construction dewatering, foundation improvement by drainage, drainage in retaining structures; influence of seepage on stability of slope, drainage method for improving stability of slopes.

EG 923 CE Geotechnical Earthquake Engineering (3-1-0)
Seismic hazard, seismic waves, plate tectonics, fault rupture, earthquake size, theory of vibration, ground motion parameters, seismic hazard analysis, wave propagation, dynamic soil properties, ground response analysis, response spectra, local site effects and design ground motion, soil structure interaction, liquefaction, seismic slope stability, seismic design of retaining walls and footings, soil improvement for remedial measures of seismic hazard.

EG 924 CE Soil Mechanics for Unsaturated Soils (3-1-0)
Phase properties and relations, stress state variables for unsaturated soils; axis translation techniques, stress analysis, stress paths, theory of soil suction, measurement of soil suction; flow law, permeability, methods of measurement of water and air coefficient of permeability; pore pressure parameters, derivation of pore pressure parameters for

various loading conditions; shear strength theory, plastic and limit equilibrium; total lateral earth force, effect of unsaturation on active and passive earth pressures. Terzaghi's bearing capacity theory and its extension to unsaturated soils. Slope stability for unsaturated soils; volume change predictions, theory of heave prediction, expansive soils; one dimensional consolidation and swelling, derivation of equation for unsaturated soils, solution by finite difference method.