ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus
(From Academic Session 2020-21 onwards)

M.Tech

CIVIL ENGINEERING
SPECIALIZATION: GEOTECHNICAL ENGINEERING

1st Semester

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure
(From Academic Session 2020-21 onwards)

M. Tech: Geotechnical Engineering

1st Semester: Course Structure

Theory/ Practical	Sl. No.	Sub Code	Subject	Hours Per week			Credit C	Marks	
				L	T	P		CE	ESE
Core									
Theory	1	CEG202101	Advanced Soil Mechanics	3	0	0	3	30	70
	2	CEG202102	Dynamics of Soil and Earthquake Engineering	3	0	0	3	30	70
	3	CEG202103	Continuum Mechanics	3	0	0	3	30	70
Practical	1	CEG202114	Geotechnical Lab	0	0	4	2	30	70
Programme Elective-I									
Theory	1	CEG202PE1*	Programme Elective-I	3	0	0	3	30	70
Open Elective-I									
Theory	1	CEG202OE1*	Open Elective-I	3	0	0	3	30	70
Mandatory Learning Course									
Theory	1	MLC202106	Research Methodology and IPR	2	0	0	2	30	70
Audit Course-I									
Theory	1	MAC20211*	Audit Course-I	2	0	0	0	-	100
Total				**19**	**0**	**4**	**19**	**210**	**590**
Total contact hours per week: 23 **Total Credit**: **19**									

Program Elective-I

Sl No	Code	Subject
1	CEG202PE11	Rock Mechanics
2	CEG202PE12	Nature and Behavior of Soils and Rocks
3	CEG202PE1*	Any other subject offered from time to time with the approval of the University

Open Elective-I

Sl No	Code	Subject
1	CEG202OE11	Numerical Analysis and Statistical Methods
2	CEG202OE12	Geohazard Management
3	CEG202OE1*	Any other subject offered from time to time with the approval of the University

Audit Course-I

Sl No	Code	Subject
1	MAC202111	English for Research Paper Writing
2	MAC202112	Disaster Management
3	MAC202113	Sanskrit for Technical Knowledge
4	MAC202114	Value Education
5	MAC20211*	Any other subject offered from time to time with the approval of the University

Detailed Syllabus:

Course Code	Course Title	Hours per week L-T-P	Credit C
CEG202101	Advanced Soil Mechanics	3-0-0	3

MODULE 1: Consolidation and Settlement

3D consolidation theory, Vertical sand drains, stone columns, secondary consolidation settlement.

MODULE 2: Shear Strength of Cohesive and Cohesionless Soil

Drained and undrained shear strength, Peak and residual, significance of pore pressure parameters, true cohesion and apparent cohesion.

MODULE 3: Stress Path

Drained and undrained stress path, stress path with respect to different initial state of soil, stress path for different practical situations, settlement calculation by stress path.

MODULE 4: Critical State Soil Mechanics

Critical state parameters, critical state for normally consolidated and over consolidated soil, Roscoe and Hvorslev state boundary surface, drained and undrained.

MODULE 5: Slope Failure

Mechanism of slope failure, slope under partial or full submergence with seepage without seepage, under drawdown condition, Bishop's rigorous method, cutting and filling, reinforcement.

MODULE 6: Stability Analysis of Retaining Wall

Sheet piles, cantilever and anchored, Braced excavation.

Text/Reference Books:

1. Das, Braja, M., "Advanced Soil Mechanics", Taylor & Francis 1983
2. Lambe, T. William and Whitman, Robert V., "Soil Mechanics", John Wiley. 2000
3. Craig, R.F., "Soil Mechanics", Chapman & Hall. 1993
4. Atkinson, J.H., Bransby, P.L., "The Mechanics of Soils- An Introduction to Critical State Soil Mechanics", McGraw Hill Book Co., UK. 1978.
5. Terzaghi, K. and Peck, R.B., "Soil Mechanics in Engineering Practice", John Wiley. 1967

Course Code	Course Title	Hours per week L-T-P	Credit C
CEG202102	Dynamics of Soil and Earthquake Engineering	3-0-0	3

MODULE 1: Fundamentals of vibrations, vibrations by machine and analysis, design principle, codal provisions, principle of vibration measuring instruments, principle of vibration absorber, vibration isolation.

MODULE 2: Dynamic soil properties: Elastic constants and damping of soils, strength and deformation characteristics of soils under dynamic loads: transient, vibratory and earthquake loading.

MODULE 3: Dynamic earth pressure: Active and passive states, IS code of practice.

Dynamic bearing capacity of shallow footings, IS code of practice.

MODULE 4: Liquefaction: Factors affecting, field and laboratory assessment of liquefaction potential.

Seismic slope stability analysis.

MODULE 5: Design of machine foundations: Blocked type and frame type.

MODULE 6: Earthquake and ground vibrations, ground response analysis and soil-structure interaction-introduction, local site effects, spectral response.

Text/Reference Books:

1. Braja M. Das, Fundamentals of Soil Dynamics, Elsevier.
2. K.G. Bhatia, Foundations for Industrial Machines, D-CAD publishers, New Delhi.
3. Satyendra Mittal and J.P.Shukla, Soil Testing for Engineers, Khanna Publishers, New Delhi.
4. Shamsher Prakash and V.K. Puri, Foundation for Machines: Analysis and Design, John Wiley & Sons.
5. Shamsher Prakash,Soil Dynamics, McGraw Hill.
6. Swami Saran, Soil Dynamics and Machine Foundations, Galgotia Publications (P) Ltd.

Course Code	Course Title	Hours per week L-T-P	Credit C
CEG202103	**Continuum Mechanics**	**3-0-0**	**3**

MODULE 1: Tensors, Indicial, Kronecker Delta, Alternating Tensor.

Concept of Stress, Stress Tensor, von-Karman Notation, Invariants of Stress, Octahedral Stresses. Equations of equilibrium, Analysis of Strain, Eulerian and Lagrangian Description, Strain Compatibility Equation, Elastic Stress-Strain Relationships. Linear Elastic Stress-Strain Relation in MatrixForm-Plane-Stress/Plane-Strain/Axi-SymmetricFormulation,Anisotropic/Orthotropic/ Transversely Isotropic Linear Elastic Stress-Strain Relations.

MODULE 2: Basics of Plasticity, Flow-Rule-Associated/Non-Associated, Elasto-Plastic Constitute Relations. Hardening-Isotropic/Kinematic/Mixed. Uniqueness/Stability/Normality and Convexity Condition of Plastically Deforming Bodies, Yield Criteria-von-Miscs/Tresca/Mohr-Coulomb/Drucker-Prager.

Text/Reference Books:

1. Timoshenko, S.P. and Goodier, J.N., "Theory of Elasticity", Mc. Graw Hill International.
2. Chen, W.F. and Saleeb, A.F., "Constitutive Equations for Engineering Materials", 1982. Willey International.
3. Slater, R.A.C., "Engineering Plasticity", 1977, Mac Millan Press.

Course Code	Course Title	Hours per week L-T-P	Credit C
CEG202114	Geotechnical Lab	0-0-4	2

Advance Soil Mechanics Laboratory:

The purpose of this laboratory is to familiarize the students with the BIS Methods of soil analysis commonly used by the geotechnical engineering community.

List of Experiments:

1. Consolidation test
2. Direct Shear test
3. Unconfined compression test
4. Triaxial test
5. Vane shear test

Course Code	Course Title	Hours per week L-T-P	Credit C
CEG202PE11	**Rock Mechanics**	**3-0-0**	**3**

Rock material- classification-class I and class II rock, classification on the basis of slake durability index, rock quality designation, Bieniawski's classification, Barton's classification, modified correlation.

Shear strength of intact rock and rock mass, various theories

Rock discontinuity – strength of discontinuities, engineering properties of joined rock mass, anisotropy, deformability and shear strength.

Type of rock slope failure, Stability of slopes- plane wedge analysis, circular and three dimensional wedge analysis

Allowable bearing pressure for building foundations - classification for net safe bearing pressure, allowable bearing pressure

Flow through rock mass-permeability.

Various laboratory tests on intact rock, Uniaxial compressive strength. Triaxial compressive strength, tensile strength, direct shear test, ultrasonic test, point load strength index test, hammer test.

Stress distribution around openings, support system design (ground reaction curve concept)

Text/Reference Books:

1. Hudson, J.A. and Harrison, John P., "Engineering Rock Mechanics- An Introduction to the Principles", Elsevier. 2000.
2. Jaeger, J.C. and Cook, N.G.W., "Fundamentals of Rock Mechanics", Mathew & Co. Ltd. 1979.
3. Singh, B. and Goel, R.K.,"Rock Mass Classification- A Practical Engineering Approach", Elsevier. 2006.
4. Hoek, E., "Practical Rock Engineering", Rock Science. 2000.
5. Ramamurthy, T., "Engineering in Rocks", PHI Learning Pvt. Ltd.

Course Code	Course Title	Hours per week L-T-P	Credit C
CEG202PE12	**Nature and Behavior of Soils and Rocks**	**3-0-0**	**3**

Geomorphological process. Factors influencing nature and formation of soils. Soils as multiphase material, complexity of soil nature. Soil fabric.

Engineering geology of soils of India with particular reference to N.E. regional soil. Clay minerals-classification and nomenclature, Atomic structure and symbolic representation of clay minerals-Kaolinite, Illite and Montmorillonite groups, Physical and Chemical properties, clay-water electrolyte interaction, base exchange capacity, double layer theory. Identification of clay minerals- X-ray diffraction, Electron microscope, Chemical and Differential Thermal analysis Influence of soil structure.

Geological and Engineering classification of rocks. Classification of rock mass in the field according to R>Q>D, Bieniaski and Q- system. Defects in rock mass and their determination in the field. Measurement of Dip and Strike of beds and their extrapolation. Preparation of geological cross-section on the basis of surface mapping and bore-hole log, polar diagrams. Number of joint sets, joint frequency, joint condition, infilling material between joints.

Geological and Engineering properties of rocks, regional rocks with particular reference to N.E. zone. Rock testing. Analysis of stress and strain, Mohr's representation of stresses, Stress-strain curves under different systems. Fracture mechanism, crack- phenomenon. Rock blasting, improvement of rock- mass properties, rock grouting, and rock bolting and anchoring.

Text/Reference Books:

1. Engineering and General Geology by Parbin Singh
2. Rock Mechanics by B. P. Verma
3. Engineering by Alam Singh
4. Engineering Geology by S. K. Duggal, H.K. Pandey, N. Rawat

Course Code	Course Title	Hours per week L-T-P	Credit C
CEG202OE11	Numerical Analysis and Statistical Methods	3-0-0	3

MODULE 1: Numerical Solution of Linear Simultaneous Equations
Direct Method- Matrix Inversion Method using Cofactors and Gauss Jordan method. Cramer's Rule Gauss. Elimination Method. Triangular Decomposition Method (Cholesky or Croul Method).
Indirect Method- Jacobi Method. Gauss Siedel Method. Successive Overrelaxation Method. Merits and Demerits of Iterative Methods.
Banded Matrix. Sparsed Matrix. Skyline Storage. Concept of Frontal Solver.

MODULE 2: Numerical Solution of Non-Linear Equations and Polynomials
Plotting Successive Substitution. Bi-section, Method of False Position, Regular False Method. Newton- Raphson Method. Modified Newton-Raphson Method. Hally's Method.
For Polynormals- Graffe's Method. Bairstow's Method. Alpha Constant Method.

MODULE 3: Eigen Values and Eigen Vectors
Properties of Eigen Values and Eigen Vectors Determination of Eigen Values and Eigen Vectors- Direct Method or Characteristic Ploynomial Method (Faddeev Leverrier Method), Cordon's Method. Vector Iteration Method- Vianello Stoodola Method. Orthogonality and Normality Principle. Sweeping Technique for Symmetric and Unsymmetric Matrices. Shift Technique. Transformation Methods- Jacobi Diagonalization Method. Given's Tri- Diagonalization Method. Householder's Tri-Diagonalization Method. L. R. Transformation Method. QR Transformation Method. Applications- Frequency and Mode Shapes.

MODULE 4: Numerical Solution of Different Equations
Ordinary Differential Equation- Local and Global Error Runga Kutta Method of Order 2, 3 and 4. Milne's Predictor Corrector Method.
Boundary Value Problems- Dirichlet Condition. Newmann Condition. Cauchy Condition Partial Differential Equation- Elliptic, Parabolic and Hyperbolic. Finite Difference Method (FDM).

MODULE 5: Numerical Differentiation and Integration
Newton, Bessel, Lagrange, Gregory, Newton and Hermitian Formulae for Numerical Differentiation. Trapezoidal, Simpson, Newton Cores Open Quadrature and Gauss Quadrature Rules for Numerical Integration- Computer Implementation.

MODULE 6: Probability and Statistics
Discrete and continuum random variables, probability distributions, statistical tests for goodness of fit-chi-square test, t-test, F-test. Estimation of parameters by least square method, curve fitting and regression analysis-simple, multiple and partial co-relations. Introduction to stochastics.

Text/Reference Books:

1. Numerical Mathematical Analysis by James B. Scarborough.
2. Numerical Methods in Science and Engineering by S. Rajasekaran.
3. Numerical Methods Software and Analysis by John R. Rice.

Course Code	Course Title	Hours per week L-T-P	Credit C
CEG202OE12	**Geohazard Management**	**3-0-0**	**3**

MODULE 1: Meaning of hazard, vulnerability, risk, disaster, types of disasters and their social and economic significance, international concern.

MODULE 2: Need of comprehensive approach for management of geo-hazards and disasters, introduction to sustainable development and geo-hazard management.

MODULE 3: Geohazards in regional context: Earthquake, landslides and floods; basic idea of causes of earthquake, magnitude, intensity scales, seismic waves, earthquake disaster scenario and factors affecting, comprehensive earthquake disaster management plan; factors affecting landslides and flood disaster, comprehensive landslide and flood disaster management plan.

MODULE 4: GIS and remote sensing as a tool for geo-hazards management.

Text/Reference Books:

1. Dr. Indu Prakash, 1994 Disaster Management, Rastriya Prahari Prakashan, Sahibabad, Ghaziabad.
2. V. K. Sharma (editor), 1995 Disaster Management, Indian Institute of Public Administration, New Delhi.
3. U. R. Rao: Space Technology for Sustainable Development, Tat McGraw Hill.

Course Code	Course Title	Hours per week L-T-P	Credit C
MLC202106	**Research Methodology and IPR**	**2-0-0**	**2**

Course Outcomes:

At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Unit 1:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2:

Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 3:

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
- Mayall, "Industrial Design", McGraw Hill, 1992.
- Niebel, "Product Design", McGraw Hill, 1974.
- Asimov, "Introduction to Design", Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
- T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Code	Course Title	Hours per week L-T-P	Credit C
MAC202111	**English for Research Paper Writing**	**2-0-0**	**0**

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

Ensure the good quality of paper at very first-time submission

Unit 1:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3:

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit 4:

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 5:

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Unit 6:

useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Course Code	Course Title	Hours per week L-T-P	Credit C
MAC202112	**Disaster Management**	**2-0-0**	**0**

Course Objectives: -Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Unit 1: Introduction

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

Unit 2: Repercussions of Disasters and Hazards

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

Unit 3: Disaster Prone Areas in India

Study of Seismic Zones; Areas Prone to Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

Unit 4: Disaster Preparedness and Management

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Unit 5: Risk Assessment

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Unit 6: Disaster Mitigation

Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.

Course Code	Course Title	Hours per week L-T-P	Credit C
MAC202113	**Sanskrit for Technical Knowledge**	**2-0-0**	**0**

Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. Enhancing the memory power
5. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Output

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

Unit 1:

- Alphabets in Sanskrit,
- Past/Present/Future Tense,
- Simple Sentences

Unit 2:

- Order
- Introduction of roots
- Technical information about Sanskrit Literature

Unit 3:

- Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Suggested reading

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Code	Course Title	Hours per week L-T-P	Credit C
MAC202114	**Value Education**	**2-0-0**	**0**

Course Objectives

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let they should know about the importance of character

Unit 1:

- Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgements

Unit 2:

- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism. Love for nature, Discipline

Unit 3:

- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature

Unit 4:

- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Nonviolence,Humility, Role of Women.
- All religions and same message. Mind your Mind, Self-control.
- Honesty, Studying effectively

Suggested reading

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

Course outcomes

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

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