

Geotechnical Engineering - II

T.E. Sem. VI [CIVIL/CONE]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical & Oral Exam	–	–
Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Stability of Slopes

Introduction, different factors of safety, types of slope failures, analysis of finite and infinite slopes, wedge failure, Swedish circle method, friction circle method, stability numbers and charts.

2. Lateral Earth Pressure Theories

Introduction : applications of earth pressure theories, different types of earth pressures – at rest, active and passive pressure. **Rankine's earth pressure theory** : Rankine's earth pressure theory, active earth pressure and passive earth pressure for horizontal and inclined backfill including the direction of failure planes for cohesionless and cohesive soils. **Coulomb's wedge theory** : Coulomb's active pressure in cohesionless soils, expression for active pressure. Coulomb's passive earth pressure. Rebhann's construction for active pressure, Culmann's graphical solutions for active wedge method, passive pressure by friction circle method for cohesionless and cohesive soils.

3. Earth Retaining Structures

Rigid and flexible retaining structures, stability analysis of retaining walls, cantilever retaining walls, deflection, bending moment and earth pressure diagrams for cantilever sheet piles, computation of embedment depth, construction details, drainage and wall joints.

4. Bearing Capacity of Shallow Foundations

Definitions of ultimate bearing capacity, gross, net and safe pressures, allowable bearing pressure, types of shallow foundations, modes of failures. **Bearing capacity theories** : Rankine's approach, Prandtl's approach and Terzaghi's approach, concept behind derivation of equation, general bearing capacity equation, bearing capacity equations for square and circular footings, factors influencing bearing capacity, performance of footings in different soils, Vesic's chart, ultimate bearing capacity in case of local shear failure. Plate load test in detail with reference to IS 1888 and its applications and estimation of settlements, bearing capacity based on standard penetration test.

5. Axially Loaded Pile Foundations

Introduction to pile foundations, necessity of pile foundation, classification of piles, construction methods of bored piles, concrete bored piles, driven cast in-situ piles. Pile capacity based on static analysis, piles in sand, piles in clay, dynamic methods and their limitations, in-situ penetration tests and pile load test as per IS 2911 specifications, negative skin friction. Pile groups, ultimate capacity of groups, settlement of pile groups in sand and in clays as per IS 2911 and critical depth method.

6. Underground Conduits

Classes of underground conduits, load on a ditch conduit, settlement ratio, ditch condition and projection condition, imperfect ditch conduit.

7. Open Cuts

Difference in open cuts and retaining walls, apparent pressure diagrams, average apparent pressure diagrams for sand, soft and stiff clay, estimation of loads on struts.

8. Reinforced soil

The mechanism, reinforcement (elements), reinforced–soil interaction, applications, reinforced soil embankments, simple problems.

Reference :

1. Soil Engineering in Theory and Practice (*Alam Singh*) CBS Publishers & Distributors – New Delhi.
2. Soil Mechanics and Foundation Engineering (*V.N.S. Murthy*) Saitech Publications.
3. Soil Mechanics and Foundation Engineering (*K.R. Arora*) Standard Publishers and Distributors – New Delhi.
4. Soil Mechanics in Engineering Practice (*K. Terzaghi and R.B. Peck*) (2nd Edition).
5. Foundation Engineering (*R.B. Peck, W.E. Hansen & T.H. Thornburn*) Wiley Eastern.
6. Design Aids in Soil Mechanics and Foundation Engineering (*S.R. Kaniraj*) Tata McGraw Hill – New Delhi.
7. Foundation Design Manual (*N.V. Nayak*) Dhanpat Rai Publications – New Delhi.
8. Relevant Indian Standard Specifications & Codes, BIS Publications – New Delhi.



Design & Drawing of Steel Structures

T.E. Sem. VI [CIVIL]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	4 Hrs.	100
Practical & Oral Exam	–	–
Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Introduction to types of steel, mechanical properties of steel, advantages of steel as structural material, design philosophies of Working Stress Method (WSK) and Limit State Method (LSM).
2. Limit state method, limit state of strength and serviceability (deflection, vibration, durability, fatigue, fire), characteristics and design loads, Classification of cross section – plastic, compact, semi-compact and slender, limiting width to thickness ratio.
3. Design of tension members with welded / bolted end connections using single and double angle sections by LSM, design strength due to yielding of gross section, rupture of critical section and block shear.
4. Design of compression members with welded / bolted end connections using single and double angle by LSM, design strength, effective length of compression members.
5. Design of columns with single and built-up sections, design of lacing and batten plates with bolted and welded connections using LSM, column buckling curves, effective length, slenderness ratio, limiting values of effective slenderness ratio, buckling class of various cross sections.
6. Design of slab base and gusseted base using bolted and welded connection by LSM, effective area of a base plate.
7. Design of members subjected to bending by LSM, design strength in bending, effective length, laterally supported and unsupported beams, single and built-up rolled steel sections using bolted and welded connections, shear lag effect, design for shear, web buckling and web crippling.
8. Introduction to bolted and welded connections by LSM, beam to beam and beam to column connections, design of simple framed, unstiffened and stiffened seat connections.
9. **Truss**
Determinate trusses, imposed load on sloping roof, wind load on sloping roof and vertical cladding including effect of permeability and wind drag, analysis of pin jointed trusses under various loading cases, design and detailing of member end connections and supports, design of purlins, wind bracing for roof system.

Reference :

1. Design of Steel Structures (*Arya and Ajmani*) Nemchand Brothers.
2. Design of Steel Structures (Vol. I and II) (*Ramchandra*) Standard Book House .
3. Design of Steel Structures (*Punamia, Jain*) Laxmi Publications.
4. Design of Steel Structures (*Edwin H. Gaylord, Charles N. Gaylord and James E. Stallmeyer*) McGraw Hill – 1992.
5. Design of Steel Structures (*Mac. Ginely T.*)
6. Design of Steel Structures (*N. Subramanian*) Oxford.
7. LRFD Steel Design (*William T. Segui*) PWS Publishing – 1999 (2nd Edition).
8. Structural Steel Design, LRFD Method (*Jack C. McCormac & James K. Nelson Jr.*) Prentice Hall – 2003 (3rd Edition).
9. Steel Structures Design and Behavior (*Charles G. Salmon and John E. Johnson*) Harper Collins – 1996 (4th Edition).
10. Design of Steel Structures (*Syal and Satinder Singh*) Standard Publishers.
11. Design of Steel Structure (*Dayaratnam*) Wheeler Publishers.
12. Behaviour of Structures, Engerlink.
13. Relevant IS Codes, BSI Publications – New Delhi.



Applied Hydraulics - II

T.E. Sem. VI [CIVIL]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical & Oral Exam	–	–
Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Boundary Layer Theory

Development of boundary layer over flat and curved surfaces, laminar and turbulent boundary layer, boundary layer thickness, displacement thickness, momentum thickness, energy thickness, drag force on a flat plate due to a boundary layer, turbulent boundary layer on a flat plate, analysis of turbulent boundary layer, total drag on a flat plate due to laminar and turbulent boundary layer, boundary layer separation and control.

2. Flow Around Submerged Bodies

Force exerted by a flowing fluid on a stationary body, expression for drag and lift, drag on a sphere, terminal velocity of a body, drag on a cylinder, development of a lift on a circular cylinder, development of a lift on an airfoil.

3. Flow Through Open Channel

(i) Classification.

(ii) Uniform flow, Chezy's formula, Manning's formula, Prismatic and non-prismatic channels, hydraulically efficient channel cross-section, Velocity distribution in open channels, pressure distribution in open channels, Applications of Bernoulli's equation to open channel flow.

(iii) Non – uniform flow, Specific energy, Discharge curve, Dimensionless specific energy and discharge curve, applications of specific energy, Momentum principle, application to open channel flow, specific force, small waves and surges in open channels, gradually varied flow, control section, hydraulic jump, location of hydraulic jump.

4. Irrigation Channels (Silt Theories) :

Kennedy's theory, Kennedy's methods of channel design, silt supporting capacity according to Kennedy's theory, drawbacks in Kennedy's theory, Lacey's regime theory, Lacey's theory applied to channel design, comparison of Kennedy's and Lacey's theory, defects in Lacey's theory.

Reference :

1. Hydraulics and Fluid Mechanics (*Modi P.M. and Seth S.M.*) Standard Book House.
2. Theory and Applications of Fluid Mechanics (*Subramanaya K.*) Tata McGraw Hill.
3. Fluid Mechanics (*Dr. Jain A.K.*) Khanna Publishers.
4. Fluid Mechanics (*Nagarathnam S.*) Khanna Publishers.
5. Flow in Open Channels (*Subramanya K.*) Tata McGraw Hill.
6. Irrigation and Water Power Engineering (*B.C. Punmia*) Standard Publishers.
7. Irrigation Engineering and Hydraulic Structures (*S.K. Garg*) Khanna Publishers.



Transportation Engineering - II

T.E. Sem. VI [CIVIL/CONE]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical & Oral Exam	–	–
Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Highway Planning

Classification of roads, brief history of road developments in India, present status of roads in India. Highway alignment, basic requirement of ideal alignment, factors governing highway alignment. Highway location survey, map study, reconnaissance, topographic surveys, highway alignment in hilly area, drawing and report preparation.

2. Geometric Design of Highway

Terrain classification, vehicular characteristics, highway cross section elements, salient dimensions, clearances, width of carriage way, shoulders, medians, width of road way, right of way, camber and its profile. Design speed, sight distance, perception time, break reaction time, analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance. Horizontal curves: design of superelevation and its provisions, minimum radius of horizontal curves, widening of pavement, transition curves. Gradients: different types, maximum, minimum, ruling and exceptional, grade compensation in curves, vertical curves: design factors, comfort and sight distance. Summit curve, valley curve. Introduction of geometric design software.

3. Pavement Materials

Subgrade materials: desirable properties, modulus of elasticity, modulus of subgrade reaction, classification of subgrade soils, importance of CBR. Subbase material: desirable properties, different tests on aggregate, requirement of aggregate for different types of pavements. Bituminous materials: types of bituminous material, test on bituminous material, desirable properties, grade of bitumen.

4. Pavement Design

Types of pavements, different method of pavement design, comparison of flexible and rigid pavements, design wheel load, equivalent single wheel load, equivalent wheel load factor. Flexible pavement design: GI method, IRC approach, Burmister's layers theory, introduction to AASHTO method. Stress in Rigid Pavements, critical load position, stress due to load, stress due to temperature variation, combine loading and temperature stress. Introduction to pavement design software, relationship between number of cumulative axle, strain value and elastic modulus of materials.

5. Highway Construction

Modern equipment for road construction, construction of different types of roads: water bound macadam (WBM) road, different types of bituminous pavements, cement concrete pavement. Constructions of stabilized roads: different method of soil stabilization, use of geo-textile and geogrid in highway subgrade.

6. Highway Maintenance and Rehabilitation

Pavement failure: flexible pavement failure, rigid pavement failure, maintenance of different types of pavements. Evaluation of pavements: structural evaluation of pavements, functional evaluation of pavement. Strengthening of existing pavement: objective of strengthening, types of overlay, different types of overlay, design of overlay using Benkeleman beam method.

7. Traffic Engineering and Control

Traffic study and surveys: speed studies, presentation of data, journey time and delay studies, use of various methods, merits and demerits. Vehicular volume count: types, various available methods, planning of traffic count. O-D survey, need and uses, various available methods. Parking survey need and types, traffic sign and marking, signals, miscellaneous traffic control aids, traffic regulations, traffic signals. Intersection types: at grade and grade separation, factors influencing design. Introduction to traffic design related softwares.

8. Highway drainage, necessity, surface drainage, subsurface drainage.

9. Bridge Engineering

Bridge engineering: importance, investigations, site selection, collection of data, determination of flood discharge, waterway, afflux, economic span, scour depth. Pier, abutment, Bearing.

Reference :

1. A Course of Railway Engineering (*Sexena S.C. and Arora S.P.*) Dhanpat Rai and Sons – New Delhi.
2. Airport Planning and Design (*Khanna & Arora*) Nemchand Bros. – Roorkee.
3. Indian Railway Track (*Agarwal M.M.*) Suchdeva Press – New Delhi.
4. Docks and Harbour Engineering (*Bindra S.P.*) Dhanpat Rai & Sons.
5. Harbour, Dock and Tunnel Engineering (*R. Shrinivas*) Charotar Publishing House.
6. A text book on Highway Engineering and Airports (*Sehgal S.E., Bhanot K.L.*) S. Chand & Co.
7. Planning & Design of Airport (*Horonjeff and McKelrey*) Tata McGraw Hill.
8. Design and Construction of Ports and Marine Structures (*Quinn A.D.*) Tata McGraw Hill.
9. Airport Engineering (*Rao G.V.*) Tata McGraw Hill.



Environmental Engineering – I

T.E. Sem. VI [CIVIL]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical & Oral Exam	–	–
Oral Exam	–	–
Term Work	–	25

SYLLABUS

1. Ecology

Basic Principles, food chain, food webs and ecological pyramids, trophic structure gross production to total community, respiration ratio (p/r), biochemical cycles, limiting factors-Liebig's law, extended ecological regulation, important ecosystems such as the seas, estuaries and Sea shores, streams and rivers, lakes and ponds.

2. Environmental Pollution

Definition, different types of pollutions such as water pollution, air pollution, noise pollution, thermal pollution, soil pollution, marine pollution, nuclear hazards.

Water Pollution : Water resources. Oxygen demanding wastes, pathogens, nutrients, salts thermal pollution, heavy metals, pesticides, volatile organic compounds. Surface water quality, water quality in lakes, rivers and ground water.

3. Water :

Man's environment : importance of environmental sanitation. *Water supply systems* : Need for planned water supply schemes, components of water supply system and determination of their design capacities, distribution system of water, types of intake structure. *Quality of water* : Wholesomeness and palatability, physical chemical, bacteriological standards. *Treatment of water* : Impurities in water-processes for their removal typical flow sheets. *Sedimentation* : factors affecting efficiency, design values of various parameters, tube settlers. *Coagulation and flocculation* : Mechanisms, common coagulations, rapid mixing and flocculating devices, G and GT values, Jar test, coagulant aids-polyelectrolyte, etc. *Filtration* : Classification, slow and rapid sand filters, dual media filters, sand, gravel and under-drainage system, mode of action, cleaning, limitations, operational difficulties, performance, basic design consideration, pressure filters : construction and operation. *Water Softening* : Lime soda and base exchange methods, principle reactions, design considerations, sludge disposal. *Miscellaneous Treatments* : Removal of iron and manganese, taste, odour and colour, principles and methods, de-fluoridation, reverse osmosis. *Disinfection* : Chlorination, chemistry of chlorination, kinetics of disinfection, chlorine demand, free and combined chlorine, break point chlorination, superchlorination, dechlorination, chlorine residual, use of iodine, ozone, ultraviolet rays and chlorine dioxide as disinfectants, well water disinfection.

4. Municipal Solid Waste Management :

Solid Waste : Source, types, composition, physical and biological properties of solid wastes, sources and types of hazardous and infectious wastes in municipal solid wastes. Solid waste generation and collection, storage, handling transportation, processing. Treatment and disposal methods. Material separation and recycle, physico-chemical and biological stabilization and solidification thermal methods, land disposal, site remediation, leachate and its control. *Hazardious waste* : Definition, identification, mutagenesis, carcinogenesis, toxicity testing, human studies, lot of evidence categories for potential carcinogens.

Reference :

1. Water supply and Sanitary Engineering (*S.K. Hussain*) Oxford & IBH publications – New Delhi.
2. Manual on Water supply and Treatment, Ministry of works & Housing – New Delhi (latest Edition)
3. Introduction to environmental Engineering (*Vesilind*) PWS Publishing Company.
4. Water Supply & Sewage (*E.W. Steel*) Tata McGraw Hill.
5. Water Supply & Sewage (*T.J. McGhee*) Tata McGraw Hill.
6. Water Supply & Pollution Control (*J.K. Clark, W. Veisman, M.J. Hammer*) International Text Book Co.
7. Relevant Indian Standard Specifications.
8. CPHEEO Manual on Water Supply & Treatment.
9. Water Supply Engineering (*Dr. P.N. Modi*).
10. Fundamentals of Ecology (*Eugene P. Odum*) Nataraj Publications.
11. Integrated Solid Waste Management : Tchbanoglous (*Theissen & Vigil*) McGraw Hill Publication.
12. Solid Waste Management in Developing Countries (*A.D. Bhide & B.B. Sundaresan*).
13. Manual on municipal Solid Waste Management, Ministry of Urban Development – New Delhi.
14. Environmental Pollution, Gilbert Masters.
15. Basic Environmental Engineering (*Nathanson J.A.*) Prentice Hall of India.
16. Environmental Pollution Control Engineering (*C.S. Rao*) New Age International.
17. Water Supply engineering (*S.K. Garg*) Khanna Publications.



Theory of Reinforced & Prestressed Concrete

T.E. Sem. VI [CIVIL]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical & Oral Exam	–	–
Oral Exam	–	–
Term Work	–	25

SYLLABUS

1. Concept of reinforced concrete, Working Stress Method (WSM) of design for reinforced concrete, permissible stresses as per IS-456-2000, stress strain curve of concrete and steel, characteristics of concrete and steel reinforcement.
2. Analysis and design of singly reinforced and doubly reinforced rectangular, Tee, Ell-beams for flexure by WSM, balanced, under reinforced and over reinforced sections.
3. Design for shear and bond by WSM.
4. Analysis and Design of rectangular and circular columns subjected to axial and bending by WSM.
5. Design of one way and two way slab by WSM
6. Design of axially loaded isolated sloped and pad footings.
7. **Prestressed Concrete:** Basic principles of prestressed concrete, materials used and their properties, methods and systems of prestressing, losses in prestress, analysis of various types of sections subjected to prestress and external loads.
8. **General design principles:** Concepts of centre of compression, kern of a section, efficiency of the section, pressure line and safe cable zone, principal tension in prestressed concrete members.
9. Simple design of prestressed concrete I beams (excluding end block design)

Reference :

1. Design of Reinforced Concrete structures (*Dayaratnam P.*) Oxford & IBH.
2. Fundamentals of Reinforced Concrete (*Sinha and Roy*) S. Chand & Co. – New Delhi.
3. Reinforced Concrete (*Warnerr, R.F. Rangan B.C. & Hall A.S.*) Pitman.
4. Reinforced Concrete (Vol. I) (*H.J. Shah*) Charotar Publisher.
5. Reinforced Concrete (*Syal and Goel*) Wheeler Publishers.
6. Design of Prestressed Concrete structures (*Lin T.Y. & Ned Burns*) John Wiley.
7. Prestressed Concrete (*Krishan Raju*) Tata McGraw Hill.
8. Prestressed Concrete (*Evans R.H. & Bennet E.W.*) Chapman & Hall.
9. Prestressed Concrete (*N. Rajgopalan*) Narosa Publishers.
10. Relevant IS codes, BIS Publicaitons – New Delhi.
11. Reinforced Concrete Design (*Pillai S.U., Menon Devdas*) Tata McGraw Hill.



Design & Fabrication of Steel Structures

T.E. Sem. VI [CONE]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical & Oral Exam	–	–
Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Introduction to types of steel, mechanical properties of steel, advantages of steel as structural material, design philosophies of Working Stress Method (WSM) and Limit State Method (LSM).
2. Limit state method, limit state of strength and serviceability (deflection, vibration, durability, fatigue, fire), characteristics and design loads, Classification of cross section-plastic, compact, semi-compact and slender, limiting width to thickness ratio.
3. Fabrication techniques :
Welding tools and equipment, welding machines. Welding process-gas welding, arc welding, selection of welding process for a job, precautions to be taken. Cutting, process of flame cutting, precautions to be taken, factors affecting flame cutting. Inspection and testing – testing of weld material and tests on welded joints, bend test, tensile test, Nick break test, tightness test. Process of preparation of shop drawings for beam-column system.
4. Design of tension members with welded / bolted end connections using single and double angle sections by LSM, design strength due to- yielding of gross section, rupture of critical section and block shear.
5. Design of compression members with welded / bolted end connections using single and double angle by LSM, design strength, effective length of compression members.
6. Design of columns with single and built-up sections, design of lacing and batten plates with bolted and welded connections using LSM, column buckling curves, effective length, slenderness ratio, limiting values of effective slenderness ratio, buckling class of various cross sections.
7. Design of slab base and gusseted base using bolted and welded connection by LSM, effective area of a base plate.
8. Design of members subjected to bending by LSM, design strength in bending, effective length, laterally supported and unsupported beams, single and built-up rolled steel sections using bolted and welded connections, shear lag effect, design for shear, web buckling and web crippling.
9. Introduction to bolted and welded connections by LSM, beam to beam and beam to column connections, design of framed, unstiffened and stiffened seat connections.

References :

1. Design of Steel Structures (*Arya and Ajmani*) Nemchand Brothers.
2. Design of Steel Structures (Vol. I and II) (*Ramchandra*) Standard Book House.
3. Design of Steel Structures (*Punamia, Jain*) Laxmi Publications.
4. Design of Steel Structures (*Edwin H. Gaylord, Charles N. Gaylord and James E. Stallmeyer*) McGraw Hill – 1992.
5. Design of Steel Structures (*Mac. Ginely T.*)
6. Design of Steel Structures (*N. Subramanian*) Oxford.
7. LRFD Steel Design (*William T. Segui*) PWS Publishing – 1999 (2nd Edition).
8. Structural Steel Design, LRFD Method (*Jack C. McCormac & James K. Nelson Jr.*) Prentice Hall – 2003 (3rd Edition).
9. Steel Structures Design and Behavior (*Charles G. Salmon and John E. Johnson*) Harper Collins – 1996 (4th Edition).
10. Design of Steel Structures (*Syal and Satinder Singh*) Standard Publishers.
11. Design of Steel Structure (*Dayaratnam*) Wheeler Publishers.
12. Behaviour of Structures, Engerlink.



Quality Management in Construction

T.E. Sem. VI [CONE]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical & Oral Exam	–	–
Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Basic Concepts and Definition

Quality, quality engineering, quality control, quality assurance, total quality management.

2. Elements of Quality

- (i) Quality characteristics : tangible and intangible parameters of quality.
- (ii) Quality of design : role of various agencies involved and codes and specifications.
- (iii) Quality of conformance and quality of performance.

3. Economics of Quality

Cost of quality, cost of conformance, cost of non-conformance and cost of lost opportunities.

4. Organization for Quality

Identifying tasks, responsibilities and procedures, quality systems, typical organization structures, preparation of manuals, flow charts and checklists, role of inspection, stages in quality inspection.

5. Statistical Quality Control

- (i) Review of basic concepts of statistics : measures of central tendency, measures of dispersion, frequency curves, frequency distributions.
- (ii) Sampling : methods of sampling, sample size, acceptance sampling.
- (iii) Controls charts : construction, interpolation and inferencing.

6. Miscellaneous concepts and tools to quality management : kaizen concepts, quality circles, Fishbone diagram (Ishikawa diagram), Pareto diagram.

Reference :

- 1. The Essence of Total Quality Management (*John Bank*) Prentice Hall of India – 1995.
- 2. Inspection and Quality Control in Building Works (*A.C. Panchandhari*) Mandakini Publishers.
- 3. Quality assurance in Construction (*Dunkan, Thorpe & Summer*) Grower.

