High Diploma, M.SC. & Ph.D. CURRICULUM COURSES

CIVIL ENGINEERING DEPT.

H. Diploma STUDY-STRUCTURAL ENGINEERING

First Semester/ general

Code	Subject	Hours		Units
		P	T	
Eng.Civil 500	Mathematics & Statistics	1	2	2.5
Eng.Civil 501	Surveying and Projects Management	1	2	2.5
Eng.Civil 502	Structural Engineering	--	2	2
Eng.Civil 503	Geotechnical Engineering	--	2	2
Eng.Civil 504	Environmental Engineering	--	2	2
TOTAL		**2**	**10**	**11**

SECOND SEMESTER/specific

Code	Subject	Hours		Units
		P	T	
Eng.Civil 505	Software Applications	2	1	2
Eng.Civil 506	Design of Bridges	--	2	2
Eng.Civil 507	Concrete Technology	--	2	2
Eng.Civil 508	Design of Special Structures	--	3	3
Eng.Civil 509	Retrofitting of Buildings	--	1	1
TOTAL		**2**	**9**	**10**

Third semester
A thesis in the specialty for three months (4 unit)

Total units (25 unit)

First Semester / STRUCTURAL ENGINEERING/ general

MATHEMATICS AND STATISTICS (500)

1. Mathematics:

a. Matrices and determinates

- Basic concepts
- Systems of linear equations
- Rank of matrix
- Eigen values, Eigen vectors
- Properties of Eigen vectors
- System of differential equations

b. Series solution of differential equations

- Power series method
- Legendres equation
- Bessel's equation

2. Statistics:

- Introduction, Definitions
- Normal, Z, T -Distributions
- Chi-Square test, ANOVA
- Simple Regression
- Multiple Regression
- Non-linear Regression

SURVEYING AND PROJECT MANAGEMENTS (501)

1. Surveying

- Traditional Surveying
- Advanced Instruments
- Photogrammetry
- GPS-Surveying
- GIS- Concepts

2. project managements:

- project planning and control
- project planning approaches
- Operation research
- Work breakdown structure
- Value engineering
- Decision making

STRUCTURAL ENGINEERING (502)

1. Structural Concrete

- Limit State analysis and design

- Introduction
- Inelastic behaviour of reinforced concrete
- Moment curvature relation
- Concept of plastic hinge and collapse mechanisms
- Allowable rotation for collapse load design

2. Structural Steel

- Overhead crane
- Composite construction
- Plastic design

GEOTECHNICAL ENGINEERING (503)

Soil investigation and classification

1. Soil condition in the field
2. Stresses in soils
3. Flow through porous media
4. Shallow foundations
5. Engineering properties of rocks

ENVIRONMENTAL ENGINEERING (504)

1. Introduction: What's the environmental engineering.
2. Application of mass transfer concept in environmental engineering.
3. Water quality in rivers
4. Water quality in lakes
5. Water treatment
6. Wastewater treatment
7. Air pollution
8. Solid Waste management
9. Noise pollution

SECOND SEMESTER/ STRUCTURAL ENGINEERING/ specific

SOFTWARE APPLICATION (505)

- Introduction to structural software
- STAAD PRO package
- Applications of STAADPRO
- ETAB package
- Applications of ETAB

DESIGN OF BRIDGES (506)

- Introduction
- Solid slab bridges
- Girder bridges
- Balanced cantilever bridges
- Continuous bridges
- Arch bridges

- Substructure of bridges

CONCRETE TECHNOLOGY (507)

1. Grading of aggregates (New concepts)
2. Shrinkage and creep- Methods and factors affecting
3. Durability of concrete- Aggressive waters and sulphate contents – degrees of exposure
4. Strength of concrete – maturity of concrete, compressive, tensile, & how they are related. Lab work experiments
5. Admixtures – types - classification
6. Mix design – lab work application
7. Special concretes – (SCC) self compacting preplaced aggregate concrete – high strength concrete (According to ACI 211 – 1998)

DESIGN OF SPECIAL REINFORCED CONCRETE STRUCTURES (508)

- Introduction
- Design of water tanks
- Design of shear walls
- Design of portal frames
- Design of domes and shells
- Design of silos

RETROFITTING OF STRUCTURES (509)

- Introduction
- Retrofitting materials
- Types of damages in the structures
- Retrofitting of bearing walls structures
- Retrofitting of portal frame structures
- Retrofitting of other types of structures

H. Diploma-STUDIES SOIL MECHANIC ENGINEERING

First Semester/ general

Code	Subject	Hours		Units
		P	T	
Eng.Civil 500	Mathematics & Statistics	1	2	2.5
Eng.Civil 501	Surveying and Projects Management	1	2	2.5
Eng.Civil 502	Structural Design	--	2	2
Eng.Civil 503	Geotechnical Engineering	--	2	2
Eng.Civil 504	Environmental Engineering	--	2	2
TOTAL		**2**	**10**	**11**

Second Semester/specific

Code	Subject	Hours	Units

		P	T	
Eng.Civil 515	Advanced Soil Mechanics	--	3	3
Eng.Civil 516	Advanced Foundation Engineering	--	3	3
Eng.Civil 517	Software Applications	2	1	2
Eng.Civil 518	Ground Improvement	--	2	2
TOTAL		**2**	**9**	**10**

Third semester
A thesis in the specialty for three months (4 unit)

Total units (25 unit)

First Semester/ Soil Mechanic Engineering/ general

MATHEMATICS AND STATISTICS (500)

1. Mathematics:
b. Matrices and determinates
- Basic concepts
- Systems of linear equations
- Rank of matrix
- Eigen values, Eigen vectors
- Properties of Eigen vectors
- System of differential equations

c. Series solution of differential equations
- Power series method
- Legendres equation
- Bessel's equation

2. Statistics:
- Introduction, Definitions
- 0Normal, Z, T -Distributions
- Chi-Square test, ANOVA

- Simple Regression
- Multiple Regression
- Non-linear Regression

SURVEYING AND PROJECT MANAGEMENTS (501)

Surveying

- Traditional Surveying
- Advanced Instruments
- Photogrammetry
- GPS-Surveying
- GIS- Concepts

project managements:

- project planning and control
- project planning approaches
- Operation research
- Work breakdown structure
- Value engineering
- Decision making

STRUCTURAL ENGINEERING (502)

1. Structural Concrete

- Limit State analysis and design
- Introduction
- Inelastic behaviour of reinforced concrete
- Moment curvature relation
- Concept of plastic hinge and collapse mechanisms
- Allowable rotation for collapse load design

2. Structural Steel

- Overhead crane
- Composite construction
- Plastic design

GEOTECHNICAL ENGINEERING (503)

6. Soil investigation and classification
7. Soil condition in the field
8. Stresses in soils

9. Flow through porous media
10. Shallow foundations
11. Engineering properties of rocks

ENVIRONMENTAL ENGINEERING (504)

10. Introduction: What's the environmental engineering.
11. Application of mass transfer concept in environmental engineering.
12. Water quality in rivers
13. Water quality in lakes
14. Water treatment
15. Wastewater treatment
16. Air pollution
17. Solid Waste management
18. Noise pollution

Second Semester/ Soil Mechanic Engineering/ Specific
ADVANCED SOIL MECHANICS (515)

1. Geotechnical assessment of soil layers and site investigation techniques.
2. Geotechnical problems in Mosul city.
- Collapsibility
- Expansive soils
- Gypsies soils

3. Settlement analysis
4. Earth embankments and rating structures
5. Lab. tests

ADVANCED FOUNDATION ENGINEERING (516)

1. Bearing capacity
2. Structural design of foundation
3. Structural design of retaining walls
4. Special types of footings

SOFTWARE APPLICATIONS (517)

1. Design and analysis using computer programs
2. Foundation design
3. Slope stability
4. Seepage
5. Stress distribution

GROUND IMPROVEMENT (518)

1. Soil stabilization
- Lime
- Cement
- Asphalt
- Special types
2. Grouting
3. Geotextiles and earth reinforcement

H. Diploma-STUDIES-ENVIRONMENTAL ENGINEERING

First Semester/ general

Code	Subject	Hours		Units
		P	T	
Eng.Civil 500	Mathematics & Statistics	1	2	2.5
Eng.Civil 501	Surveying and Projects Management	1	2	2.5
Eng.Civil 502	Structural Design	--	2	2
Eng.Civil 503	Geotechnical Engineering	--	2	2
Eng.Civil 504	Environmental Engineering	--	2	2
TOTAL		**2**	**10**	**11**

Second Semester/specific

Code	Subject	Hours		Units
		P	T	
Eng.Civil 510	Wastewater Treatment	1	2	2.5
Eng.Civil 511	Water Treatment	--	2	2
Eng.Civil 512	Networks Design	2	2	2
Eng.Civil 513	Solid Waste Treatment	--	2	2
Eng.Civil 514	Air Pollution	1	2	1.5
TOTAL		**4**	**8**	**10**

Third semester
A thesis in the specialty for three months (4 unit)

Total units (25 unit)

First Semester/ Environmental Engineering / General

MATHEMATICS AND STATISTICS (500)

1. Mathematics:
d. Matrices and determinates
- Basic concepts
- Systems of linear equations

- Rank of matrix
- Eigen values, Eigen vectors
- Properties of Eigen vectors
- System of differential equations

e. Series solution of differential equations
- Power series method
- Legendres equation
- Bessel's equation

2. Statistics:
- 0Introduction, Definitions
- Normal, Z, T -Distributions
- Chi-Square test, ANOVA
- Simple Regression
- Multiple Regression
- Non-linear Regression

SURVEYING AND PROJECT MANAGEMENTS (501)

Surveying

- Traditional Surveying
- Advanced Instruments
- Photogrammetry
- GPS-Surveying
- GIS- Concepts

project managements:
- project planning and control
- project planning approaches
- Operation research
- Work breakdown structure
- Value engineering
- Decision making

STRUCTURAL ENGINEERING (502)

1. Structural Concrete

- Limit State analysis and design
- Introduction
- Inelastic behaviour of reinforced concrete
- Moment curvature relation

- Concept of plastic hinge and collapse mechanisms
- Allowable rotation for collapse load design

2. Structural Steel

- Overhead crane
- Composite construction
- Plastic design

GEOTECHNICAL ENGINEERING (503)

12. Soil investigation and classification
13. Soil condition in the field
14. Stresses in soils
15. Flow through porous media
16. Shallow foundations
17. Engineering properties of rocks

ENVIRONMENTAL ENGINEERING (504)

19. Introduction: What's the environmental engineering.
20. Application of mass transfer concept in environmental engineering.
21. Water quality in rivers
22. Water quality in lakes
23. Water treatment
24. Wastewater treatment
25. Air pollution
26. Solid Waste management
27. Noise pollution

Second Semester/ Environmental Engineering/ Specific

WASTEWATER TREATMENT (510)

1. Wastewater flowrate; characteristics
2. Wastewater treatment objectives
3. Physical unit operation
- Screening; Grit chambers; Flow equalization; Sedimentation
4. Biological Unit Operation
- Suspended growth units; Activated sludge processes and modifications
5. Aerated lagoons
6. Stabilization ponds
7. Attached growth units
8. Operational difficulties
9. Design of wastewater treatment systems

WATER TREATMENT (511)

1. Physical, chemical, and biological characteristics of water .
2. Drinking water standards .
3. Sedimentation and clarification (kinds and types of tanks and design procedure)
4. Coagulation (theory and design application)
5. Filtration (types and design consideration with applications)
6. Membrane separation technologies .
7. Ion exchange and carbon adsorption .
8. Water sterilization technologies .

NETWORKS DESIGN (512)

1. Water resources .
2. Water consumption .
3. Water pumping.
4. Types of distribution systems .
5. Desig0n of pipe lines by hardy cross method , circular method and equivalent pipe method .
6. Epanet program
7. Wastewater quantities and variations .
8. Types of sewerage systems .
   - sanitary sewers
   - storm sewers
   - combined sewers
9. Computer application of sewerage systems by Sewer Card Program.

SOLID WASTE TREATMENT (513)

1. Introduction
2. Solid waste generation
3. Characteristics of solid waste
4. Collection and routing of solid waste
5. Solid wastes recycle and reuse
6. Miscellaneous methods of solid waste treatment
7. Solid waste disposal by sanitary landfill

AIR POLLUTION (514)

1. Introduction; Overview of Emission; clean air standards
2. Types of pollution sources
3. Air pollution and meteorology

- Atmospheric stability and mixing depth
- Smock plumes

4. Indoor air quality
5. Mathematical Models
- The point source Gaussian plume model
- A line-source dispersion model
6. Design and operation of air treatment units

M.Sc. STUDY-STRUCTURAL ENGINEERING
FIRST SEMESTER

Item	code	Subjects	Units	HOURS	
				T	P
1	Eng.Civil 501	MATHEMATICS AND NUMERICAL ANALYSIS	3	3	--
2	Eng.Civil 502	THEORY OF ELASTICITY AND PLASTICITY	3	3	--
3	Eng.Civil 503	ADVANCED STRUCTURAL ANALYSIS	3	3	--
4	Eng.Civil 504	CONCRETE TECHNOLOGY	1.5	1	1
5	Eng. Civil 505	ENGLISH LANGUAGE	1	--	2
TOTAL			11.5	10	3

SECOND SEMESTER

Item	code	Subjects	Units	HOURS	
				T	P
1.	Eng.Civil 506	DYNAMICS OF STRUCTURES	2	2	--
2.	Eng.Civil 507	EXPERIMENTAL STRESS ANALYSIS	1.5	1	1
3.	Eng.Civil 508	ADVANCED REINFORCED CONCRETE	2.5	2	1
4.	Eng.Civil 509	THEORY OF PLATES	3	3	--
5.	Eng.Civil 510	FINITE ELEMENT METHOD	2.5	2	1
6.	Eng.Civil 511	ENGLISH LANGUAGE	1	--	2
TOTAL			12.5	10	5

Advanced Engineering Mathematics And Numirecal Analysis (3-1)\ Eng.Civil (501)

ADVANCED ENGINEERING MATHEMATICS

1. **Singularity Function**
   a. Unit step, delta and double function.
   b. Integration of singularity function.
   c. Application
2. **Laplace Transformation**
   a. Laplace transforms Inverse transform.
   b. Laplace transform of derivative.
   c. Shifting on the s & t axis
   d. Laplace transform of singularity function.
   e. Differentiation and integration of transform.

f. Convolution, Integral equation

g. Periodic function

h. Application

3. Laplace transformation applied to partial differential equation

NUMERCAL ANALYSIS

a. Active column solver and solution of tridiagonal system.

b. Eigen values and eigenvectors.

c. Solution of ordinary differential equation by weight residual method.

d. Numerical integration.

e. Solution of nonlinear system of equation.

Theory of Elasticity and Plasticity (3-0) \ Eng.Civil (502)

Theory of Elasticity

Introduction and definitions

1- Stress-Strain, Hooke's low ,Index relation, stress-strain Tensors, plane Stress and plane strain, strain measurement, Mohr's circle, quilibrium Equations, Boundary conditions and compatibility Equations, stress function.

2- Two-dimensional problems in rectangular coordinates (cantilever Beam, uniform loaded beam).

3- Two-dimensional problems in polar coordinates Stress and strain transformation at points.

4- Axi-symmetry problems

5- Torsion of straight bars, solution of torsional problems by strain energy.

Theory of Plasticity

1-Stress-strain in simple tension,

2-Stress analysis in elasticity and Plasticity, Theory of Plasticity, Equations to stress and strain curve, Max load in tension, strain rate in tension and compression.

3-Yield criteria (Tresca criteria, vone Mises, Parandtl - Reuss, Levy-Mises, Work hardening, Elastic –plastic bending of beam, rings and plates.

Advanced Structural Analysis (3-0)/ Eng. Civil (503)

1. Introduction.
2. Actions and displacements.
3. Work and Energy.
4. Strain Energy.
5. Flexibility Method;
   (i) Plane Truss.
   (ii) Beams.
   (iii) Plane Frames.

6. Stiffness Method;
   (i) Springs.
   (ii) Plane Trusses.
   (iii) Space Trusses.
   (iv) Beams.
   (v) Plane Frames.
   (vi) Grillages.
   (vii) Space Frames.

Concrete Technology (2-1) \ Eng.Civil (504)

1. Grading of aggregates as related to:
   - Particles size distribution
   - Standard deviation.
   - Average sieve size.

- Water demand of the mix.
- New and revised specifications.
- New concepts and applications.
- Related research published works.

2. Properties and strength of concrete
   - Factors affecting quality of concrete.
   - w/c rations and modes of failure.
   - Maturity of concrete.
3. Creep and shrinkage – application of F.I.P method – European code – Theory of linear creep – other approaches.
4. Durability of concrete.
   - Aggressive waters.
   - Sulphate treatments
5. Special concretes
   - Light weight concretes- No fines concrete.
   - Self compacting concrete.
   - Sawdust concrete.
   - Intrusion concrete.
6. Mix Design
   - Philosophy and principles of mix design
   - Methods.
   - Applications and comparison.
7. Introduction to Rheology (Flow of materials) treatment of workability of fresh concrete.
8. Quality control

Dynamics of Structure (2-0) \ Eng.Civil (506)

1 Basic Concept

1-1 Introduction to Structural Dynamic

1-2 Types of Dynamic Loads

7-8 Response Spectra by Numerical Integration

Experimental Stress Analysis (1-1) \ Eng.Civil (507)

Type of Models , Material used in build up models, Dimensional analysis.
Loads (generation, application and measurements), Deflections measurement (mechanical , Optical) Elastic strain measurement (Mechanical , Optical and electrical)
Types of strain gauge (dial gauge, Demic gauge , Extensometer , Electrical strain gauge) Moire Method

Advanced Reinforced Concrete (3-0) /Eng. Civil (508)

1. Shear-Friction.
2. Shear Strength of Corbels and Brackets.
3. Strut-and-Tie Model for the Design of Deep Beams and Brackets.
4. Design of R. C. Shear Walls for Shear and Moments.
5. Moment-Curvature Relationships for Beams and Columns.
6. Limit-Design Method for Beams.
7. Some aspects of Yield line theory.
8. Affinity Theory
9. Strip method for the design of slabs.
10. Serviceability of beams and one-way slabs.
11. Effect of creep and shrinkage on beams and columns.

Theory of Plates (3-0) /Eng. Civil (509)

1- Introduction, Type of plates (Thick and thin plate, linear and nonlinear plate , Isotropic and Anisotropic plate),Cylindrical Bending of pate, pure bending of plate, moment curvature relation in Rectangular plate, moments and curvature transformation, strain Energy in pure bending

2- Small deflection of laterally load plates and boundary conditions Membrane active of plates

3- Exact theory of plates

4- Simply supported of plates (method of solution)(Nauier solution, le'vy's solution)

5- Plate with different boundary conditions, plate on elastic foundation

6- Effect of transverse shear deformations on bending of plate

7- Plate of various shapes

8- Application of finite difference method

9- Bending of Anisotropic plate

10- Combined action of lateral load and in plane forces, large deflection of plates

FINITE ELEMENT METHOD (2-1)/ Eng.Civil (510)

1. Basic concept of finite element method.
2. Convergence criteria.
3. Triangular element for plain stress-plain strain and axisymmetrical stress analysis.
4. Isoparametric element formulations for plain stress, plain strain, plates and shells.

COLLEGE OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
Ph.D STUDY-STRUCTURAL ENGINEERING
FIRST SEMESTER

Item	code	Subjects	Units	HOURS	
				T	P
1	Eng.Civil 601	ADVANCED ENGINEERING MATHEMATICS (II)	2	2	--
2	Eng.Civil 602	PLASTICITY APPLICATIONS	2	2	--
3	Eng.Civil 603	STABILITY OF STRUCTURES	2	2	--
4	Eng.Civil 604	PRESTRESSED CONCRETE	2	2	--
5	Eng.Civil 605	THEORY OF SHELLS	2	2	--
6	Eng.Civil 606	ENGLISH LANGUAGE	1	--	2
TOTAL			**11**	**10**	**2**

SECOND SEMESTER

Item	code	Subjects	Units	HOURS	
				T	P
1.	Eng.Civil 607	DYNAMICS OF STRUCTURES	2	2	--
2.	Eng.Civil 608	RELIABILITY OF	2	2	--

		STRUCTURES			
3.	Eng.Civil 609	ADVANCED STEEL STRUCTURES	2	2	--
4.	Eng.Civil 610	SPECIAL TOPICS	2	2	--
5.	Eng.Civil 611	NONLINEAR FINITE ELEMENT	3	3	--
6.	Eng.Civil 612	ENGLISH LANGUAGE	1	--	2
TOTAL			**12**	**11**	**2**

ADVANCE ENGINEERING MATHEMATICS (II)\ Eng.Civil 601

Two dimensional partial differnetial equations

1. Vibreating strings and Membranes
    a. The Transversely vibreting string.
    b. The Transversely vibreting membranes.
    c. Steady state string and membranes.
2. Two dimensional consolidation equation.
3. Two dimensional laplace equation.
4. Application in civil engineering.
5. Solutions of plate equations / Navier solution

- Introduction to optimization
- Objective of optimization

- Generalized optimization problem
- Single variable optimization without and with constraints.
- Multivariable optimization with out and with constraints.
- Optimization using numerical search techniques.

PLASTICITY APPLICATIONS \ Eng.Civil (602)

1. General Theory
   1.1 Analysis of Stress and strain in plasticity
   1.2 Matrices of stress and strain and rate of change of strain.
   1.3 Rate of change in tension and compression.
   1.4 Two and Three dimension system in tension and compression.
   1.5 Three dimension mohr circular
   1.6 Strain – Deformation relationship
2. Yield criteria (yield surface)
   2.1 criteria of Tresca
   2.2 criteria of Von- Mises
   2.3 Equation of Brandel – Russe
   2.4 Equation of Levi – Mises
   2.5 Work Harding
3. Perfecting plastic body
   3.1 Combined Tension Torsion in circular rode.
   3.2 Elasto plastic flexural in beam
   3.3 Axisymmetric axis strain
   3.4 Louder band Theory
   3.5 Plane stress : line of discontinues
   3.6 Thick wall cylinder
   3.7 Cylindrical tube and compression
   3.8 Plastic stress in the layer under Tension –compression
4. Plastic analysis structure
   4.1 Plane frame
   4.1.1. Lower and upper theory in plastic analysis
   4.1.2. Combined mechanism theory
   4.1.3. Minimum weight design theory
   4.1.4. Estimation of Deformation
   4.2 Space structure three dimension
   4.3 Grillage
   4.4 Complex frame
   4.5 Arches
5. Plastic bending in circular plate
   5.1 Plastic bending in rectangular

5.2 Steel plate
5.3 Reinforced concrete plate

STABILITY OF STRUCTURES\ Eng. Civil (603)

1. General principle-Bifurcation and Energy approaches.
2. Stability of simple structures.
3. Beam-Columns, bending and axial thrust
4. Material and geometric nonlinearatiy.
5. Beam column under lateral loadings.
6. Stability function
7. Torsional bukling of beam.
8. Stability of rigid frames.
9. Bukling of plates and shells.

Prestressed Concrete /Eng. Civil (604)

1. Introduction.
2. Materials and Prestressing systems.
3. Analysis of sections for flexure.
4. Design of sections for flexure;
(i) Service load design.
(ii) Strength design.
(iii) Cable Profile.
(iv) End Block design of Pre-Tensioned and Post-Tensioned members.
5. Design of Prestressed tension members.
6. Design of Prestressed Compression Members.
7. Design of Prestressed concrete slabs.

THEORY OF SHELLS\ Eng.Civil 605

1. Cylindrical Shells
1.1 Membrane theory of Cylindrical Shells
1.1.1 Cylindrical shells with circular Directrix
1.1.2 Cylindrical shells with Cycloidal Directrix
1.1.3 Cylindrical shells with Catenary Directrix
1.1.4 Cylindrical shells with Parabolic Directrix

1.2. Bending Theory of Cylindrical Shells.
1.2.1 The Finster walder Theory.
1.2.2 The D-k-j Theory.

2. Shells of Double Curvature.
2.1 Surface of Revolution.
2.1.1 Membrane Theory
2.1.2 The Spherical Shell
2.1.3 Rotational hyperboloid Shell
2.2 Bending Theory of Surface of Revolution .

3. General Membrane Theory of shell with Double Curvature .
4. Bending Theory of Shallow Shells of Double Curvature

Dynamics of Structure (607)

Multi-dgree-of-freedom (MDOF) system

General Properties Matrices for Vibrating System

1. Flexibility Matrix
2. Stiffness Matrix
3. Inertia Properties: Mass Matrix
4. The Eigenproblem in Vibration Analysis
5. Static Condensation of the Stiffness Matrix

Equations of motion and undamped free vibration

1. Hamilton s Principle and the Lagrange Equation
2. Natural Vibration Frequencies
3. Natural Vibration Modes
4. Orthogonality of Natural Modes
5. System Admiting Rigid-Body Modes
6. Generalized Mass and Stiffness Matrices
7. Free Vibration Response to Initial Condition
8. Approximate Method for Estimating the Fundamental Frequency

Numerical Solution Methods for Natural Frequencies and Mode Shapes

1. General Solution Methods for Eigenproblems
2. Inverse Vector Iteration
3. Forward Vector Iteration
4. Generalized Jacobi Method
5. solution Methods for Large Eigenproblems

Analysis of Dynamic Response by Mode Superpotion

1. Mode Displacement Method for Undamped System
2. Model Participation Factor
3. Mode superposition Solution for System with Classical Damping
4. Numerical Evaluation of Model Response
5. Normal Mode Response to Support Motions
6. Response Spectrum Analysis
7. Mode Acceleration Method

Analysis of Dynamic Response by Direct Interation

1. Basic Concepts of Direct Integration Methods
2. The Central Difference Method
3. The Wilson-0 Method
4. The Newmark Method
5. Practical Considerations for Damping
6. Stability and Accuracy of Direct Integration Method
7. Direct Integrations Versus Mode superposition

Continuous system

Vibrations of Continuous system

1. Longitudinal Vibration of a Uniform Rod
2. Transverse Vibration of a Pretensioned Cable
3. Free Transverse Vibration of Uniform Rod
4. Orthogonality of Normal Modes
5. Undamped Forced Vibration of beams by Mode Superposition
6. Approximate Method

Practical Applications

Earthquakes and Earthquake Ground Motion

1. Causes of Earthquakes
2. Faults
3. Seismic Waves
4. Earthquake Intensity
5. Earthquake Magnitude
6. Seismicity
7. Earthquake Ground Motion
8. Earthquake Damage Mechanisms

Earthquake Response Structures

1. Time-History Analysis: Basic Concepts
2. Earthquake Response Spectra
3. Earthquake Design spectra
4. Response of MDOF system
5. Generalized SDOF system

6. In-Bulding Response spectrum
7. Inelastic Response
8. Sesmic design Codes

Blast Loads on Structures

1. Sources of Blast Loads
2. Shock Waves
3. Determination of Blast Loads
4. Strain-Rate Effects
5. Approximate Solution Technique for SDOF System

Reliability Theory of Structures (608)

1. The Safety problem
2. Limit states, safety margin and Safety factor
3. Simulation method
4. Measures of structural reliability
5. Reliability of structural system
6. Statistical uncertainty and model uncertainty
7. codes and structural reliability

Advanced steel Structural (609)

1. Steel and Properties
2. Tension and Compression members
3. Laterally supported members
4. Laterally torsional buckling
5. Frames-Braced and Unbraced
6. Welding
7. Composite Steel-concrete; beams, slabs, columns, and frames

Special Topics, Eng. Civil (610)

1. Design of Beam-Column joints for gravity and lateral loads.
2. Strut-and Tie method for the design of Joints.
3. Design considerations for fatigue of concrete and steel.
4. Assigned Limit method for the design of R. C. Frames.
5. Introduction and general description and objective.

6. Metals: constitutive relation-fracture-fatigue-crack
7. Plain concrete: constitutive relation-fracture-crack crush
8. R.C.: constitutive relation-bond-steel behavior.
9. Application-formulation of different problems and simple soluation.

NON LINEAR FINITE ELEMENT civil eng (611)

1. Introduction and review on finite element and programming
2. Nonlinear formulation in one dgree of freedom
3. Material nonlinearity constitutive relation-types: nonlinear elasticity, plasticity, ect…
4. geometrical nonlinearity: small and large strain, formulations
5. Nonlinear solution method: newton rafson
6. Time integration for nonlinear dynamic problem: newmark, nilson
7. coupled problem: introduction-types-formulation-simple cases solution
8. Error estimation: principle, calculation
9. Application on the above topics

M.Sc-STUDIES SOIL MECHANIC ENGINEERING

First Course

Item	code	Subjects	Units	Hr.	
				Theoretical	Practical
1.	Eng. Civil 512	ADVANCE ENGINEERING MATHEMATICS	2	2	–
2.	Eng. Civil 513	NUMERCAL ANALYSIS	2	1	2
3.	Eng.Civil 520	SPECIAL TOPICS	2	2	--
4.	Eng. Civil 515	ADVANCED SHEAR STRENGTH AND APPLICATION	3	2	2
5.	Eng.Civil 516	GROUND IMPROVEMENT	3	3	–
6	Eng.Civil 505	ENGLISH LANGUAGE	1	–	2
TOTAL			**13**	**10**	**6**

Second Course

Item	code	Subjects	Units	Hr.	
				Theoretical	Practical
1.	Eng. Civil 514	ADVANCED MECHANICS	3	2	2

		of MATERIAL			
2.	Eng. Civil 517	ADVANCED STRESSES AND SETTLEMENT ANALYSIS	2	2	--
3.	Eng. Civil 518	FINIT ELEMENT	2.5	2	1
4.	Eng. Civil 519	FOUNDATION ENGINEERING	2.5	2	1
5.	Eng.Civil 521	EARTH STRUCTURES	2	2	--
6.	Eng.Civil 511	ENGLISH LANGUAGE	1	–	2
TOTAL			**13**	**10**	**6**

ADVANCE ENGINEERING MATHEMATICS\ Eng. Civil 512

1. Series Solution of Differential Equations:

a. Power series method.

b. Theory of Power series method.

c. Legender equation.

d. Legender polynomials Pn (x0).

e. Extended Power series method.

2. Singularity Functions:

a. Unit step, Delta and doublet function.

b. Integration of singularity functions.

c. Applications.

3. Lap lace Transformation:

a. Lap lace transform, Inverse transform.

b. Lap lace transform of derivatives.

c. Shifting on the s & t axis.

d. Lap lace transform of singularity functions.

e. Differentiation and Integration of transform.

f. Convolution, Integral equation.

g. Periodic functions.

h. Applications.

4. Partial Differential equations:

a. Basic concepts.

b. One - Dimensional wave equation.

c. Free longitudinal vibration of beams.

d. Free transverse vibration of beams.
e. One - Dimensional heat equation.
f. One - Dimensional consolidation equation.
g. Two - Dimensional Lap lace equation.
h. Lap lace transformation applied to partial differential equations

NUMERCAL ANALYSIS\ Eng. Civil 513

1. Solution of linear system of equations.
2. Eigenvalues and eigenvectors.
3. Roots of non-linear equations.
4. Solution of ordinary differential equations.
5. Solution of partial differential equations.
6. Finite difference method.
7. Interpolation.
8. Numerical integration.

ADVANCED MECHANICS of MATERIAL\ Eng. Civil 514

1. Introduction and basics of elasticity.
2. Stress Strain Relationship.
3. Direct, shear and torsion stresses.
4. The kinetic equation.
5. The equilibrium equations.
6. Experimental strain analysis.
7. Viscoelasticty .

ADVANCED SHEAR STRENGTH APPLICATION\Eng. Civil 515

1- Shear strength (Saturated and unsaturated soil, Effective stresses, Pore water pressure parameters, stress path),

2- Slope stability.

3- Experimental tests (Index tests, Triaxial test for soil and rock, Rowe cell, Collapse and swelling tests, etc)

GROUND IMPROVEMENT \ Eng. Civil516

1. Problematic soils.
2. Expansive soils and introduction to clay mineralogy.
3. Mechanical stabilization.
4. Soil Stabilization (Cement stabilization, Lime stabilization, Asphalt stabilization).
5. Combined stabilization.
6. Deep compaction methods.
7. Introduction to grouting.
8. Introduction to reinforced earth and geotextiles.

ADVANCED STRESSES AND SETTLEMENT ANALYSIS\Eng. Civil 517

1. Stresses distribution in soils.
2. Compressibility and volume change.
3. Settlement analysis.

FINIT ELEMENT\ Eng. Civil 518

1 - Introduction.

Variational methods numerical solution, general concept of the finite element method.

2- Programming review, computer methods for problems solving.

3- Finite element formulation - physical types of problems element type , interpolation shape functions.

4- Elements assembling - solution methods, with simple examples using Fortran language .

5- Introduction in using finite element software instead of programming in Fortran Using ANSYS preprocessing

6- Problem modeling - solution - postprocessing using ANSYS

7- Applications on soil problems, seepage & soil structure Interaction.

FOUNDATION ENGINEERING\ Eng. Civil 519

1- Introduction.

2- Sub-grade reaction.

3- Field test and their usage in bearing capacity.

4- Bearing capacity of shallow and deep foundation.

Pile foundation.

SPECIAL TOPICS IN SOIL MECHANICS\ Eng. Civil 520

1- Rock mechanics (6 weeks)

2- Introduction to soil dynamics (3 weeks)

3- Geotechnical site investigation (3 weeks)

4- Drilled caissons (3 weeks)

EARTH STRUCTURES\ Eng. Civil 521

1- Seepage flow and application
2- Lateral earth pressure (Coulomb and Rankine earth pressure theories
3- Retaining walls
4- Sheet piles
5- Anchored bulkheads
6- Bracing of excavation)
7- Flexible retainin

M.Sc-STUDIES-ENVIRONMENTAL ENGINEERING

First Course

Item	code	Subjects	Units	Hr.	
				Theoretical	Practical
1.	Eng. Civil 522	Advanced Engineering Statistics (software)	1.5	1	1
2.	Eng .Civil 523	Advanced Water Supply Engineering	2.5	2	1
3.	Eng. Civil 524	Advanced Wastewater Treatment and Reuse	4	3	2
4.	Eng. Civil 525	Numerical Analyses	2	1	2
5.	Eng. Civil 526	Chemistry and Microbiology for Environmental Engineering	2.5	2	1
6.	Eng. Civil 505	English Language	1	1	---

TOTAL	13.5	10	7

Second Course

Item	Code	Subjects	Units	Hr.	
				Theoretical	Practical
1.	Eng. Civil 527	Water Quality Engineering	2	2	--
2.	Eng. Civil 528	Industrial Wastewater Treatmen	2.5	2	1
3.	Eng. Civil 529	Advanced Fluid Mechanics	1.5	1	1
4.	Eng. Civil 530	Air Pollution	1.5	1	1
5.	Eng. Civil 531	Finite Element	1.5	1	1
6.	Eng. Civil 532	Special topics	2.5	2	1
7.	Eng. Civil 511	English Language	1	1	--
TOTAL			**12.5**	**10**	**5**

ADVANCED ENGINEERING STATISTICS (SOFWARE) \ Eng. Civil 522

1. Test of hypothesis

   Z and t – test
   Unpaired t – test
   Paired t- test
2. Experimental design and analysis

   Analysis of variance ANOVA
   Completely randomized design CRD
   Turkey test
3. Randomized complete block design RCBD
4. Duncan multiple range test
5. Factorial experiments
6. Simple linear regression
7. Multiple regression
8. Chi square test

ADVANCED WATER SUPPLY ENGINEERING \ Eng. Civil 523

1. Water systems: source of supply, transmission works, distribution works and design analysis (computer programming)
2. Water volumes and rate concepts, population growth and population density, capacity requirements for constituents structure.
3. Improving reservoirs and service storage capacity pumping and pumps characteristics.
4. Purification works: clarification, coagulation and flocculation, Filtration, design criteria and plant units capacity.
5. Miscellaneous water treatment methods, water softening, cation exchange, lime – soda method, disinfection, solar disinfection, chlorinating, ozonation, water desalination and method used.

ADVANCED WASTEWATER TREATMENT AND REUSE \ Eng. Civil 524

10. Wastewater flowrate; characteristics
11. Wastewater treatment objectives, methods and design
12. Physical unit operation

    -Screening Grit chambers Flow equalization Sedimentation

Flotation

13. Biological Unit Operation
14. Suspended growth units

    -Activated sludge processes and modifications Processes for biological nitrogen removal
15. Operational difficulties
16. Aerated lagoons
17. Stabilization ponds
18. Categories of wastewater reuse and its applications
19. Mass balance applications in water reuse
20. Mathematical models used for risk assessment
21. Water reclamation technologies
22. Types and calculations of reclaimed water storage

NUMERICAL ANALYSES \ Eng. Civil 525

1. Solution of linear system of equations.
2. Eigenvalues and eigenvectors.
3. Roots of non-linear equations.
4. Solution of ordinary differential equations.
5. Solution of partial differential equations.
6. Finite difference method.
7. Interpolation.
8. Numerical integration

CHEMISTRY AND MICROBIOLOGY FOR ENVIRONMENTAL ENGINEERING \ Eng. Civil 526

1. Physical and chemical properties of water (Physical properties, inorganic chemical properties , organic chemical properties of water, solubility , oxidation and reduction .

2. Atmospheric chemistry (structure of earth's atmosphere, chemical composition of earth's atmosphere
3. Soil chemistry
4. Chemical and biological reactions (kinetics)
5. Materials balance and reaction configuration
6. Microbiology (classification of microbial world, bacterial growth, aspects of bacteria of special interest to environmental engineering)

WATER QUALITY ENGINEERING \ Eng. Civil 527

1. Characteristics of waters and wastewaters, engineer's role.
2. Quality of water supplies, rivers pollution, self purification, toxic material, overall effects of pollution, control river pollution.
3. Water reuse and land disposal, water quality management, water reclamation, wastewater and sludge disposal, land disposal, spray irrigation, rapid infiltration and overland runoff.
4. Characteristics of water, physical, chemical, and biological method of analysis and sampling, criteria and standards of domestics, industrial and agricultural.
5. Miscelleous treatment plant control, quality control in distribution systems, corrosion phenomenon, causes and cures.

INDUSTRIAL WASTEWATER TREATMENT\Eng. Civil 528

1. Introduction ; Industrial wastewater characteristics
2. Effect of industrial wastewater on municipal wastewater treatment plants and on environment
3. Management strategies for pollution preventation and waste minimization
4. In-plant survey; Identifying wastewater generating operations; Preparing mass balance calculations for industrial operations; In-plant control; Industrial water conserving and recycling
5. Industrial wastewater treatment technologies

6. Physical units; Chemical units; Biological units: Attached growth systems(Rotating biological contactors; Trickling filters)
7. Studying of selected wastewater industries
8. Dairy industry; Textile industry; Drugs industry; Soft drinking industry; Slaughterhouses; Tannery industry;

ADVANCED FLUID MECHANICS \ Eng. Civil 529

General description of fluid mechanics. Fluid statistics and relative motion of liquids Kinematics. General theory of Stress and rate of strain fundamental equations of flow, one dimensional, two and three dimensional laminar and turbulent flow . Compressible and incompressible.

AIR POLLUTION \ Eng. Civil 530

7. Introduction; Overview of Emission
8. Criteria Pollutant and clean air standards
9. Types of pollution sources
10. Air pollution and meteorology
    - Adiabatic lapse rate
    - Atmospheric stability
    - Radiation inversion
    - Subsidence inversion
    - Atmospheric stability and mixing depth
    - Saturated adiabatic lapse rate and cloud formation
    - Smock plumes
11. Indoor air quality
12. Mathematical Models
    - The point source Gaussian plume model
    - A line-source dispersion model
    - Area-source models
    - In door air quality model

FINITE ELEMENT \ Eng. Civil 531

1. Concept of an element
2. Variations element shape – one, two and three dimensional elements
3. Finite element procedure, variational principle and method of weighted residual principle of minimum potentional energy.
4. Convergence and compatibility requirements
5. Finite element formulation for diffusion problems

SPECIAL TOPICS \ Eng. Civil 532

1. Radiation :

-Sources of radiation
-Nature of radiation
-Environmental impact
-Methods of disposal

2. Noise pollution:

-Introduction,
-Physical properties of sound,
- Noise criteria and standards
- Noise measurement,
- Environmental impact
-Noise control (sound insulation)

3. Solid Waste:

-Sources of solid waste
-Classification and composition
- Municipal solid waste treatment
-Biological treatment
-Thermal treatment
-Reuse and recycle

First Course :

No.	Subject	Hours		Units
		Theory	Lab.	
1.	Advanced Traffic Engineering	3	——	3
2.	Pavement Analysis and Design	3	——	3

3.	Soil Stabilization	2	——	2
4.	Advanced Engineering Statistics	2	——	2
5.	Urban Transportation Planning	2	——	2
6.	English Language	1	——	1
	Total	13		13

Second Course :

No.	Subject	Hours		Units
		Theory	Lab.	
1.	Advanced Geometric Design	2	——	2
2.	Highway Material	2	2	3
3.	Highway traffic and environmental safety	2	——	2
4.	Railway and Airport Engineering	3	——	3
5.	Finite Element Method	2	——	2
6.	English Language	1	——	1
	Total	13	1	13

Syllabus of the Highway and Transportation Courses:-

Advanced Traffic Engineering:-

Week No.	Syllabus
1	Introduction
2	Capacity and Level of Service
3,4	Basic Freeway System
5	Wearing Areas
6,7	Multi-lane Highways
8,9	Two-lane highways
10	Intersection Control
11	Unsignalized Intersection
12	Traffic Signal
13,14,15	Signalized Intersection (Analysis, Designed and Planning)

Pavement Analysis and Designed:-

Week No.	Syllabus
1	Introduction
2,3	Stress and Strain in Flexible Pavements
4,5	Stress and Deflection in Rigid Pavements
6,7	Traffic loading and Volume
8	Pavement Performance
9,10,11	Flexible Pavement Design
12,13	Rigid Pavement Design
14,15	Design of Overlays

Soil Stabilization:-

Week No.	Syllabus
1	Introduction
2	Principles of Soil Stabilization
3	Problematic Soil
4,5	Mechanical and Stabilization Densification
6,7	Cement Stabilization
8,9	Lime Stabilization
10,11	Asphalt Stabilization
12,13	Special Methods of Stabilization
14,15	Methods and Machinory

Advanced Engineering Statistics:-

Week No.	Syllabus
1	Introduction and Data Presentation
2	Measures of Central Tendency and Dispersion
3	Probability Distribution
4	Sampling and Estimation Theory
5	Test of Hypothesis
6	Normal Distribution
7	t-Distribution
8	f-Distribution
9	Chi-Square Distribution
10,11,12	Analysis of Variance
13	Simple Linear Regression
14	Multiple Linear Regression
15	Simple Non-Linear Regression

Advanced Geometric Design:-

Week No.	Syllabus
1	Highway Functional Classification
2,3	Design Control and Criteria
4	Elements of Design
5	Cross Section Elements
6,7	Sight Distance
8,9,10	Design of the Alignment
11	Geometric design of Highway Facilities
12	At Grade Intersection
13	Grade Separation and Interchanges
14,15	Highway drainage

Highway Material:-

Week No.	Syllabus
1	Introduction
2	Soil Characteristics
3	Basic Engineering Properties of Soil
4	Classification of Soil for highway Uses
5	Soil Survey for highway Construction
6,7	Properties of Asphaltic Materials
8,9	Tests for Asphaltic Materials
10,11,12	Asphaltic Concrete Mixtures
13,14,15	Superior Performing Asphalt Pavements

Urban Transportation Planning:-

Week No.	Syllabus
1	Introduction
2	Transportation Plan
3	Overview of Information Needs
4	Travel forecasting
5,6	Trip generation(Technique and Analysis)
7,8	Trip Distribution(Method and Analysis)
9,10	Mode Split(Method and Analysis)
11,12	Trip Assignment(Method and Analysis)
13	Calibration and Validation
14	Load Use Plan
15	Travel Data

Railway and Airport Engineering:-

Week No.	Syllabus
1	Introduction to Railway Engineering
2	Rail Track Element
3	Clearance Gauges
4	Ballast and Subgrade System
5	Design of Concrete Sleepers
6	Train Rolling Dynamic
7	Geometric design of Railroad
8	Introduction to Airport Engineering
9	Characteristics of Aircraft
10	Airport Master Planning
11	Airport Capacity and Configuration
12,13	Geometric design of of Airside
14	Requirement for Vertical Takeoff and Landing
15	Airport Drainage

Finite Element Method

Week No.	Syllabus
1-2	Introduction -Fundamental requirements -Method process -Finite element technique -Force –deflection relation -Type of elements -Procedures
3-4	The Concept of Stiffness Analysis -General -Stiffness matrix for single elastic spring -Stiffness matrix for assembly of springs
5	Formation of the Element Stiffness Matrix [K^e]
6	Principle of Virtual Work
7	Convergence Requirements
8-9	Two-Dimensional Analysis -Triangular Finite element for Plane Elasticity - Rectangular element (Isoparamatric element)
10	Three-Dimensional Analysis
11	Numerical Integration
12	Axisymmetric Stress Analysis
13	Analysis of Beams
14-15	Review on Finite Element Applications

Traffic Simulation Syllabus:

Week No.	Syllabus
1	Introduction to computer simulation.
2	System simulation.

3	Probability concepts and statistical distributions.
4	Arrival patterns and service times.
5	The role of random numbers.
6-7	Model built
8-9	Simulation programming.
10-11	Calibration and validation of simulation models.
12-13	Implementations in traffic engineering.
14-15	Applications in simulation Models.

Highway traffic and environmental safety

1. Introduction and essential concepts of traffic safety
2. Fundumental characteristics of highway accidents
3. Factors which affecling highway accdents
4. Cuses of traffic accidents
5. Accident reposhing sustems and analysis
6. Engineeering and traffic considerations for highway traffic safety
7. Conceptof highway environmental safety
8. Air pollution safety on highways
9. Traffic noise study
10. Engineering and traffic consider htions for highway environmental safety
11. Highway tools and implements
12. Traffic signs,markings and signals.