

III Year – I SEMESTER

T	P	C
3+1*	0	3

CE 501 - ENGINEERING GEOLOGY

Lecture :	3 hrs/Week	Internal Assessment :	30 Marks
Tutorial :	1 hrs/Week	Semester End Examination :	70 Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. To introduce the Engineering Geology as a subject in Civil Engineering.
2. To enable the student to use subject in civil engineering applications.

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

- a. Identify and classify the geological minerals.
- b. Measure the rock strengths of various rocks.
- c. Classify and measure the earthquake prone areas to practice the hazard zonation.
- d. Classify, monitor and measure the Landslides and subsidence.
- e. Prepares, analyses and interpret the Engineering Geologic maps
- f. Analyses the ground conditions through geophysical surveys.
- g. Test the geological material and ground to check the suitability of civil engineering project construction.
- h. Investigate the project site for mega/mini civil engineering projects.Site selection for mega engineering projects like Dams, Tunnels, disposal sites etc...

SYLLABUS:**UNIT-I:**

Introduction: Branches of Geology, Importance of Geology in Civil Engineering with case studies.

Weathering: Weathering of rocks, Geological agents, weathering process of Rock, River process and their development.

UNIT-II

Mineralogy And Petrology: Definitions of mineral and rock, Different methods of study of mineral and rock, The study of physical properties of minerals and rocks for megascopic study for the following minerals and rocks, Common rock forming minerals are Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and other ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite And Bauxite. Classification, structures, textures and forms of Igneous rocks, Sedimentary rocks, Metamorphic rocks, and their megascopic study of granite varieties, (pink, gray, green). Pegmatite, Dolerite, Basalt etc., Shale, Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khondalite and Slate.

UNIT-III

Structural Geology: Strike, Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism and their importance in Civil Engineering.

UNIT-IV

Ground Water: Water table, Cone of depression, Geological controls of Ground Water Movement, Ground Water Exploration Techniques.

Earthquakes And Land Slides: Terminology, Classification, causes and effects, Shield areas and Seismic belts, Richter scale intensity, Precautions of building constructions in seismic areas. Classification of Landslides, Causes and Effects, measures to be taken prevent their occurrence at Land slides.

UNIT-V

Geophysics: Importance of Geophysical methods, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, Radiometric method and Electrical resistivity, Seismic refraction methods and Engineering properties of rocks.

UNIT-VI

Geology Of Dams, Reservoirs And Tunnels: Types and purpose of Dams, Geological considerations in the selection of a Dam site. Life of Reservoirs Purpose of Tunnelling, effects, Lining of Tunnels. Influence of Geology for successful Tunnelling.

TEXT BOOKS:

1. 'Engineering Geology' by Subinoy Gangopadhyay, Oxford University press.
2. 'Engineering Geology' by D. Venkat Reddy, Vikas Publishing House pvt. Ltd, 2013.
3. 'Engineering Geology' by N. Chenn Kesavulu, Trinity Press (Laxmi Publications), 2nd Edition, 2014.
4. 'Engineering Geology' by Vasudev Kanithi, University Press.

REFERENCES:

1. 'Engineering Geology for Civil Engineers' by P.C. Varghese, PHI learning pvt. Ltd.
2. 'Geology for Engineers and Environmental Society' by Alan E Kehew, person publications, 3rd edition
3. 'Fundamentals of Engineering Geology' by P.G. Bell, B.S.P. Publications, 2012.
4. 'Engineering Geology' by V.Parthesarathi et al., Wiley Publications
5. 'Environmental Geology' by K.S. Valdiya, McGraw Hill Publications, 2nd ed.

III Year – I SEMESTER

T	P	C
3+1*	0	3

CE502 - STRUCTURAL ANALYSIS – II

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. Familiarize Students with Different types of Structures
2. Equip student with concepts of Arches
3. Understand Concepts of lateral Load analysis
4. Familiarize Cables and Suspension Bridges
5. Understand Analysis methods Moment Distribution, Kanis Method and Matrix methods.

Course Outcomes:

At the end of this course; the student will be able to

- a. Differentiate Determinate and Indeterminate Structures
- b. Carryout lateral Load analysis of structures
- c. Analyze Cable and Suspension Bridge structures
- d. Analyze structures using Moment Distribution, Kani's Method and Matrix methods.

SYLLABUS:**UNIT I**

Three Hinged Arches: Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature.

Two Hinged Arches: Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening and temperature stresses, tied arches – fixed arches – (No analytical question).

UNIT-II

Lateral Load Analysis Using Approximate Methods: application to building frames. (i) Portal method (ii) Cantilever method.

UNIT – III

Cable Structures And Suspension Bridges: Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.

UNIT – IV

Moment Distribution Method: Stiffness and carry over factors – Distribution factors – Analysis of continuous beams with and without sinking of supports – Portal frames – including Sway-Substitute frame analysis by two cycle.

UNIT – V

Kani's Method: Analysis of continuous beams – including settlement of supports and single bay portal frames with and without side sway.

UNI – VI

Introduction to Matrix Methods:

Flexibility methods: Introduction, application to continuous beams (maximum of two unknowns) including support settlements.

Stiffness method: Introduction, application to continuous beams (maximum of two unknowns) including support settlements.

TEXT BOOKS:

1. 'Structural Analysis' by T.S.Thandavamoorthy, Oxford university press, India.
2. 'Structural Analysis' by R.C. Hibbeler, Pearson Education, India
3. 'Theory of Structures – II' by B.C.Punmia, Jain & Jain, Laxmi Publications, India.
4. 'Structural Analysis' by C.S. Reddy, Tata Mc-Graw hill, New Delhi.

REFERENCES:

1. 'Intermediate Structural Analysis' by C. K. Wang, Tata McGraw Hill, India.
2. 'Theory of structures' by Ramamuratam, Dhanpatrai Publications.
3. 'Analysis of structures' by Vazrani & Ratwani – Khanna Publications.
4. 'Comprehensive Structural Analysis-Vol.I&2' by Dr. R. Vaidyanathan & Dr. P. Perumal- Laxmi Publications Pvt. Ltd., New Delhi.

III Year – I SEMESTER

T	P	C
3+1*	0	3

**CE503-DESIGN AND DRAWING OF REINFORCED
CONCRETE STRUCTURES**

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. Familiarize Students with different types of design philosophies
2. Equip student with concepts of design of flexural members
3. Understand Concepts of shear, bond and torsion
4. Familiarize students with different types of compressions members and Design
5. Understand different types of footings and their design

Course Outcomes:

At the end of this course the student will be able to

- a. Work on different types of design philosophies
- b. Carryout analysis and design of flexural members and detailing
- c. Design structures subjected to shear, bond and torsion
- d. Design different type of compression members and footings

SYLLABUS:**UNIT –I**

Introduction: Working stress method Design codes and handbooks, loading standards – Dead, live, wind and earthquake loads, elastic theory, design constants, modular ratio, neutral axis depth and moment of resistance, balanced, under-reinforced and over-reinforced sections, working stress method of design of singly and doubly reinforced beams.

Limit State Design: Concepts of limit state design – Basic statistical principles – Characteristic loads –Characteristic strength – Partial load and safety factors – representative stress-strain curves for cold worked deformed bars and mild steel bars. Assumptions in limit state design – stress - block parameters – limiting moment of Resistance.

UNIT –II

Design for Flexure: Limit state analysis and design of singly reinforced sections- effective depth- Moment of Resistance- Doubly reinforced and flanged (T and L) beam sections- Minimum depth for a given capacity- Limiting Percentage of Steel- Minimum Tension Reinforcement- Maximum Flexural Steel- Design of Flanged Sections (T&L)- Effective width of flange –Behavior- Analysis and Design.

UNIT – III

Design for Shear, Torsion and Bond: Limit state analysis and design of section for shear and torsion – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing.**Limit state design for serviceability:** Deflection, cracking and code provision, Design of formwork for beams and slabs.

UNIT – IV

Design of Compression members: Effective length of a column, Design of short and long columns – under axial loads, uniaxial bending and biaxial bending – Braced and un-braced columns – I S Code provisions.

UNIT –V

Footings: Different types of footings – Design of isolated and combined footings - rectangular and circular footings subjected to axial loads, uni-axial and bi-axial bending moments.

UNIT – VI

Slabs: Classification of slabs, design of one - way slabs, two - way slabs, and continuous slabs using IS Coefficients (conventional), design of waist-slab staircase.

NOTE: All the designs to be taught in Limit State Method

Following plates should be prepared by the students.

1. Reinforcement detailing of T-beams, L-beams and continuous beams.
2. Reinforcement detailing of columns and isolated footings.
4. Detailing of one-way, two-way and continuous slabs and waist-slab staircase.

INTERNAL EXAMINATION PATTERN:

The total internal marks (30) are distributed in three components as follows:

1. Descriptive (subjective type) examination : 25 marks
2. Assignment : 05 marks

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

TEXT BOOKS:

1. 'Limit State Design' by A. K. Jain
2. 'Design of Reinforced concrete Structures' by N. Subrahmanyian
3. 'Reinforced Concrete Structures' by S. Unnikrishna Pillai & Devdas Menon, Tata McGraw Hill, New Delhi.

REFERENCES:

1. 'Design of concrete structures' by Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata McGrawHill, 3rd Edition, 2005.
2. 'Reinforced Concrete Structures' by Park and Pauley, John Wiley and Sons.

IS Codes:

- 1) IS -456-2000 (Permitted to use in examination hall)
- 2) IS – 875
- 3) SP-16

III Year – I SEMESTER

T	P	C
3+1*	0	3

CE504-GEOTECHNICAL ENGINEERING – I

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. To enable the student to determine the index properties of the soil and classify it.
2. To impart the concept of seepage of water through soils and determine the discharge of water through soils.
3. To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
4. To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

Course Outcomes:

Upon the successful completion of this course

- a. The student must know the definition of the various quantities related to soil mechanics and establish their inter-relationships.
- b. The student should be able to know the methods of determination of the various index properties of the soils and classify the soils.
- c. The student should be able to know the importance of the different engineering properties of the soil such as compaction, permeability, consolidation and shear strength and determine them in the laboratory.
- d. The student should be able to apply the above concepts in day-to-day civil engineering practice.

SYLLABUS:**UNIT – I**

Introduction: Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass- volume relationship –Relative density - Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control.

UNIT – II

Index Properties Of Soils: Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.

UNIT –III

Permeability: Soil water – capillary rise – One dimensioned flow of water through soils – Darcy’s law- permeability – Factors affecting –laboratory determination of coefficient of permeability –Permeability of layered systems. Total, neutral and effective stresses –quick sand condition – 2-D flow and Laplace’s equation - Seepage through soils –Flow nets: Characteristics and Uses.

UNIT – IV

Stress Distribution In Soils: Stresses induced by applied loads - Boussinesq’s and Westergaard’s theories for point loads and areas of different shapes– Newmark’s influence chart – 2:1 stress distribution method.

UNIT – V

Consolidation: Compressibility of soils – e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi’s theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (c_v) - Over consolidated and normally consolidated clays.

UNIT - VI

Shear Strength of Soils: Basic mechanism of shear strength - Mohr – Coulomb Failure theories – Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions.

TEXT BOOKS:

1. ‘Basic and Applied Soil Mechanics’ by Gopal Ranjan and A.S.R.Rao, New Age International Publishers.
2. ‘Soil Mechanics and Foundation Engineering’ by V.N.S.Murthy ,CBS publishers.
3. ‘Soil Mechanics’ by M.Palani Kumar, PHI Learning.

REFERENCES:

1. ‘Fundamentals of Soil Mechanics’ by D.W.Taylor., Wiley.
2. ‘An introduction to Geotechnical Engineering’ by Holtz and Kovacs; Prentice Hall.

III Year – I SEMESTER

T	P	C
3+1*	0	3

CE505-TRANSPORTATION ENGINEERING – I

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. To impart different concepts in the field of Highway Engineering.
2. To acquire design principles of Highway Geometrics and Pavements
3. To learn various highway construction and maintenance procedures.

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

- a. Plan highway network for a given area.
- b. Determine Highway alignment and design highway geometrics.
- c. Design Intersections and prepare traffic management plans.
- d. Judge suitability of pavement materials and design flexible and rigid pavements.
- e. Construct and maintain highways

SYLLABUS:**UNIT I**

Highway Planning and Alignment: Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans – First, second, third road development plans, road development vision 2021, Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

UNIT – II

Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements- Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment- Design of

Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment-Gradients- Vertical curves.

UNIT – III

Traffic Engineering:Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method.

UNIT – IV

Highway Materials:Subgrade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Requirements – Marshall Method of Mix Design.

UNIT – V

Design Of Pavements:Types of pavements; Functions and requirements of different components of pavements; Design Factors

Flexible Pavements: Design factors – Flexible Pavement Design Methods – CBR method – IRC method – Burmister method – Mechanistic method – IRC Method for Low volume Flexible pavements.

Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method – Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.

UNIT – VI

Highway Construction and Maintenance:Types of Highway Construction – Earthwork; Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads, Bituminous Pavements and Construction of Cement Concrete Pavements.

Pavement Failures, Maintenance of Highways, pavement evaluation, strengthening of existing pavements.

TEXT BOOKS:

1. 'Highway Engineering' by Khanna S.K., Justo C.E.G and Veeraragavan A, Nem Chand Bros, Roorkee.
2. 'Traffic Engineering and Transportation' Planning by Kadiyali L.R, Khanna Publishers, New Delhi.
3. 'Highway Engineering' by Srinivasa Kumar R, Universities Press, Hyderabad.

REFERENCES:

1. 'Transportation Engineering and Planning' by Papacostas C.S. and PD Prevedouros, Prentice Hall of India Pvt. Ltd; New Delhi.
2. 'Principles of Highway Engineering' by Kadiyali LR, Khanna Publishers, New Delhi.
3. 'Transportation Engineering - An Introduction' by Jotin Khisty C, Prentice Hall, Englewood Cliffs, New Jersey.
4. 'Highway Engineering' by Paul H. Wright and Karen K Dixon, Wiley Student Edition, Wiley India (P) Ltd., New Delhi .
5. 'Principles of Transportation Engineering' by Partha Chakroborthy and Animesh Das, PHI Learning Private Limited, Delhi
6. 'Practice and Design of Highway Engineering' by Sharma SK, Principles, S.Chand & Company Private Limited, New Delhi.

III Year – I SEMESTER

T	P	C
3+1*	0	2

INTELLECTUAL PROPERTY RIGHTS AND PATENTS**Unit I**

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics - Types of Intellectual Property - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement - Regulatory – Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues.

Unit II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law- Semiconductor Chip Protection Act.

Unit III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

Unit IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law

Unit V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.

Unit VI

Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy - International aspects of Computer and Online Crime.

REFERENCE BOOKS:

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning , New Delhi
2. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections
4. Prabhuddha Ganguli: ‘ Intellectual Property Rights” Tata Mc-Graw – Hill, New Delhi
5. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
6. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
7. M.Ashok Kumar and Mohd.Iqbal Ali: “Intellectual Property Right” Serials Pub.

III Year – I SEMESTER

T	P	C
0	0	2

CE507-GEOTECHNICAL ENGINEERING LAB

Lecture :	--	Internal Assessment :	25 Marks
Tutorial :	--	Semester End Examination :	50 Marks
Practical :	3 hrs/Week	Credits :	2

Course Learning Objectives:

The objective of this course is:

1. To impart knowledge of determination of index properties required for classification of soils.
2. To teach how to determine compaction characteristics and consolidation behavior from relevant lab tests; to determine permeability of soils.
3. To teach how to determine shear parameters of soil through different laboratory tests.

Course Outcomes:

Upon successful completion of this course, student will be able to

- a. Determine index properties of soil and classify them.
- b. Determine permeability of soils.
- c. Determine Compaction, Consolidation and shear strength characteristics.

SYLLABUS:**LIST OF EXPERIMENTS**

1. Specific gravity, G
2. Atterberg's Limits.
3. Field density-Core cutter and Sand replacement methods
4. Grain size analysis by sieving
5. Hydrometer Analysis Test
6. Permeability of soil - Constant and Variable head tests
7. Compaction test
8. Consolidation test (to be demonstrated)
9. Direct Shear test
10. Triaxial Compression test (UU Test)

11. Unconfined Compression test
12. Vane Shear test
13. Differential free swell (DFS)
14. CBR Test

At least **Ten** experiments shall be conducted.

LIST OF EQUIPMENT:

1. Casagrande's liquid limit apparatus.
2. Apparatus for plastic and shrinkage limits
3. Field density apparatus for
 - a) Core cutter method
 - b) Sand replacement method
4. Set of sieves: 4.75 mm, 2 mm, 1 mm, 0.6 mm, 0.42 mm, 0.3 mm, 0.15 mm, and 0.075 mm.
5. Hydrometer
6. Permeability apparatus for
 - a) Constant head test
 - b) Variable head test
7. Universal auto compactor for I.S light and heavy compaction tests.
8. Shaking table, funnel for sand raining technique.
9. Apparatus for CBR test
10. 10 tons loading frame with proving rings of 0.5 tons and 5 tons capacity
11. One dimensional consolidation test apparatus with all accessories.
12. Triaxial cell with provision for accommodating 38 mm dia specimens.
13. Box shear test apparatus
14. Laboratory vane shear apparatus.
15. Hot air ovens (range of temperature 50° - 150° C)

Reference:

1. 'Determination of Soil Properties' by J. E. Bowles.
2. IS Code 2720 – relevant parts.

III Year – I SEMESTER

T	P	C
0	3	2

CE508-ENGINEERING GEOLOGY LAB

Lecture :	--	Internal Assessment :	Marks
Tutorial :	--	Semester End Examination :	Marks
Practical :	3 hrs/Week	Credits :	2

Course Learning Objectives:

The objective of this course is:

1. To identify the mega-scopic types of Ore minerals & Rock forming minerals.
2. To identify the mega-scopic types of Igneous, Sedimentary, Metamorphic rocks.
3. To identify the topography of the site & material selection

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

- a. Identify Mega-scopic minerals & their properties.
- b. Identify Mega-scopic rocks & their properties.
- c. Identify the site parameters such as contour, slope & aspect for topography.
- d. Know the occurrence of materials using the strike & dip problems.

SYLLABUS:**LIST OF EXPERIMENTS**

1. Physical properties of minerals: Mega-scopic identification of
 - a. Rock forming minerals – Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum, etc...
 - b. Ore forming minerals – Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc...
2. Megascopeic description and identification of rocks.
 - a) Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc...
 - b) Sedimentary rocks – Sand stone, Ferruginous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc...

- c) Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite & Biotiteschist, Marble, Khondalite, etc...
3. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc.
 4. Simple Structural Geology problems.
 5. Bore hole data.
 6. Strength of the rock using laboratory tests.
 7. Field work – To identify Minerals, Rocks, Geomorphology & Structural Geology.

LAB EXAMINATION PATTERN:

1. Description and identification of FOUR minerals
2. Description and identification of FOUR (including igneous, sedimentary and metamorphic rocks)
3. ONE Question on Interpretation of a Geological map along with a geological section.
4. TWO Questions on Simple strike and Dip problems.
5. Bore hole problems.
6. Project report on geology.

REFERENCE:

1. 'Applied Engineering Geology Practicals' by M T Mauthesha Reddy, New Age International Publishers, 2nd Edition.
2. 'Foundations of Engineering Geology' by Tony Waltham, Spon Press, 3rd edition, 2009.

III Year – II SEMESTER

T	P	C
3+1*	0	3

CE601-DESIGN AND DRAWING OF STEEL STRUCTURES

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is to:

1. Familiarize Students with different types of Connections and relevant IS codes
2. Equip student with concepts of design of flexural members
3. Understand Design Concepts of tension and compression members in trusses
4. Familiarize students with different types of Columns and column bases and their Design
5. Familiarize students with Plate girder and Gantry Girder and their Design

Course Outcomes:

At the end of this course the student will be able to

- a. Work with relevant IS codes.
- b. Carryout analysis and design of flexural members and detailing.
- c. Design compression members of different types with connection detailing.
- d. Design Plate Girder and Gantry Girder with connection detailing
- e. Produce the drawings pertaining to different components of steel structures.

SYLLABUS:**UNIT – I**

Connections: Riveted connections – definition, rivet strength and capacity, Welded connections: Introduction, Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints.

UNIT – II

Beams: Allowable stresses, design requirements as per IS Code-Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, laterally unsupported beams.

UNIT –III

Tension Members and compression members: General Design of members subjected to direct tension and bending –effective length of columns. Slenderness ratio – permissible stresses. Design of compression members, struts etc.**Roof Trusses:** Different types of trusses – Design loads – Load combinations as per IS Code recommendations, structural details –Design of simple roof trusses involving the design of purlins, members and joints – tubular trusses.

UNIT – IV

Design of Columns: Built up compression members – Design of lacings and battens. Design Principles of Eccentrically loaded columns, Splicing of columns.

UNIT – V

Design of Column Foundations: Design of slab base and gusseted base. Column bases subjected moment.

UNIT – VI

Design of Plate Girder: Design consideration – I S Code recommendations Design of plate girder-Welded – Curtailment of flange plates, stiffeners – splicing and connections.

Design of Gantry Girder: impact factors - longitudinal forces, Design of Gantry girders.

NOTE: Welding connections should be used in Units II – VI.

The students should prepare the following plates.

Plate 1 Detailing of simple beams

Plate 2 Detailing of Compound beams including curtailment of flange plates.

Plate 3 Detailing of Column including lacing and battens.

Plate 4 Detailing of Column bases – slab base and gusseted base

Plate 5 Detailing of steel roof trusses including joint details.

Plate 6 Detailing of Plate girder including curtailment, splicing and stiffeners.

INTERNAL EXAMINATION PATTERN:

The total internal marks (30) are distributed in three components as follows:

1. Descriptive (subjective type) examination : 25 marks
2. Assignment : 05 marks

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

TEXT BOOKS

1. 'Steel Structures Design and Practice' by N.Subramanian, Oxford University Press.
2. 'Design of Steel Structures' by Ramachandra, Vol – 1, Universities Press.
3. 'Design of steel structures' by S.K. Duggal, Tata Mcgraw Hill, and New Delhi

REFERENCES

1. 'Structural Design in Steel' by Sarwar Alam Raz, New Age International Publishers, New Delhi
2. 'Design of Steel Structures' by P. Dayaratnam; S. Chand Publishers
3. 'Design of Steel Structures' by M. Raghupathi, Tata Mc. Graw-Hill
4. 'Structural Design and Drawing' by N. Krishna Raju; University Press,

IS Codes:

- 1) IS -800 – 2007
- 2) IS – 875
- 3) Steel Tables.

These codes and steel tables are permitted to use in the examinations.

III Year – II SEMESTER

T	P	C
3+1*	0	3

CE602-GEOTECHNICAL ENGINEERING – II

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. To impart to the student knowledge of types of shallow foundations and theories required for the determination of their bearing capacity.
2. To enable the student to compute immediate and consolidation settlements of shallow foundations.
3. To impart the principles of important field tests such as SPT and Plate bearing test.
4. To enable the student to imbibe the concepts of pile foundations and determine their load carrying capacity.

Course Outcomes:

Upon the successful completion of this course:

- a. The student must be able to understand the various types of shallow foundations and decide on their location based on soil characteristics.
- b. The student must be able to compute the magnitude of foundation settlement and decide on the size of the foundation accordingly.
- c. The student must be able to use the field test data and arrive at the bearing capacity.
- d. The student must be able to apply the principles of bearing capacity of piles and design them accordingly.

SYLLABUS:**UNIT – I**

Soil Exploration: Need – Methods of soil exploration – Boring and Sampling methods – Field tests – Penetration Tests – Pressure meter – planning of Programme and preparation of soil investigation report.

UNIT – II

Earth And Earth-Retaining Structures: Infinite and finite earth slopes in sand and clay – types of failures – factor of safety of infinite slopes – stability

analysis by Swedish arc method, standard method of slices – Taylor’s Stability Number-Stability of slopes of dams and embankments - different conditions.

Rankine’s & Coulomb’s theory of earth pressure – Culmann’s graphical method - earth pressures in layered soils.

UNIT-III

Shallow Foundations – Bearing Capacity Criteria: Types of foundations and factors to be considered in their location - Bearing capacity – criteria for determination of bearing capacity – factors influencing bearing capacity – analytical methods to determine bearing capacity – Terzaghi’s theory - IS Methods.

UNIT-IV

Shallow Foundations – Settlement Criteria: Safe bearing pressure based on N- value – allowable bearing pressure; safe bearing capacity and settlement from plate load test – Types of foundation settlements and their determination - allowable settlements of structures.

UNIT -V

Pile Foundation: Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae– Pile load tests - Load carrying capacity of pile groups in sands and clays.

UNIT-VI

Well Foundations: Types – Different shapes of well – Components of well – functions – forces acting on well foundations - Design Criteria – Determination of steining thickness and plug - construction and Sinking of wells – Tilt and shift.

TEXT BOOKS:

1. ‘Principles of Foundation Engineering’ by Das, B.M., - (2011) –6th edition (Indian edition) Cengage learning
2. ‘Basic and Applied Soil Mechanics’ by Gopal Ranjan & ASR Rao, New Age International Pvt. Ltd, (2004).

REFERENCES:

1. Foundation Analysis and Design’ by Bowles, J.E., (1988) – 4th Edition, McGraw-Hill Publishing Company, Newyork.
2. ‘Theory and Practice of Foundation Design’ by N.N.SOM & S.C.DAS PHI Learning Private limited.

III Year – II SEMESTER

T	P	C
3+1*	0	3

CE605-TRANSPORTATION ENGINEERING – II

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. To know various components and their functions in a railway track
2. To acquire design principles of geometrics in a railway track.
3. To know various techniques for the effective movement of trains.
4. To acquire design principles of airport geometrics and pavements.
5. To know the planning, construction and maintenance of Docks and Harbours.

Course Outcomes:

At the end of course, Student can

- a. Design geometrics in a railway track.
- b. Provide good transportation network
- c. Design airport geometrics and airfield pavements.
- d. Plan, construct and maintain Docks and Harbours.

SYLLABUS:**A.RAILWAY ENGINEERING****UNIT – I**

Components of Railway Engineering:Permanent way components – Railway Track Gauge - Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast –Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints.

UNIT – II

Geometric Design of Railway Track:Alignment – Engineering Surveys - Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve –

Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves – cheek rails on curves.

UNIT – III

Turnouts & Controllers:Track layouts – Switches – Design of Tongue Rails – Crossings – Turnouts – Layout of Turnout – Double Turnout – Diamond crossing – Scissors crossing.

Signal Objectives – Classification – Fixed signals – Stop signals – Signalling systems – Mechanical signalling system – Electrical signalling system – System for Controlling Train Movement – Interlocking – Modern signalling Installations.

B.AIRPORT ENGINEERING

UNIT – IV

Airport Planning & Design:Airport Master plan – Airport site selection – Air craft characteristics – Zoning laws – Airport classification – Runway orientation – Wind rose diagram – Runway length – Taxiway design – Terminal area and Airport layout – Visual aids and Air traffic control.

UNIT – V

Runway Design:Various Design factors – Design methods for Flexible pavements – Design methods for Rigid pavements – LCN system of Pavement Design – Airfield Pavement Failures – Maintenance and Rehabilitation of Airfield pavements – Evaluation & Strengthening of Airfield pavements – Airport Drainage – Design of surface and subsurface drainage.

C.DOCKS & HARBOURS

UNIT – VI

Planning, Layout, Construction & Maintenance Of Docks & Harbours:Classification of ports – Requirement of a good port – classification of Harbours – Docks - Dry & wet docks – Transition sheds and workhouses – Layouts; Quays – construction of Quay walls – Wharves – Jetties – Tides - Tidal data and Analysis – Break waters – Dredging – Maintenance of Ports and Harbours – Navigational aids.

TEXT BOOKS:

1. Railway Engineering by Satish Chandra and Agarwal M.M., Oxford University Press, New Delhi
2. Airport Engineering by Khanna & Arora - Nemchand Bros, New Delhi.

3. Docks and Harbour Engineering by Bindra S.P. - Dhanpathi Rai & Sons, New Delhi.

REFERENCES:

1. 'Railway Engineering' by Saxena & Arora - Dhanpat Rai, New Delhi.
2. 'Transportation Engineering Planning Design' by Wright P.H. & Ashfort N.J. - John Wiley & Sons.
3. 'Airport Engineering' by Virendra Kumar, Dhanpat Rai Publishers, New Delhi.
4. 'Transportation Engineering' by Srinivasa Kumar R, University Press, Hyderabad
5. 'Highway, Railway, Airport and Harbour Engineering' by Subramanian KP, Scitech Publications (India) Pvt. Limited, Chennai.

III Year – II SEMESTER

T	P	C
3+1*	0	3

CE604- ENVIRONMENTAL ENGINEERING – I

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The course will address the following:

1. Outline planning and the design of water supply systems for a community/town/city.
2. Provide knowledge of water quality requirement for domestic usage
3. Impart understanding of importance of protection of water source quality and enlightens the efforts involved in converting raw water into clean potable water.
4. Selection of valves and fixture in water distribution systems.
5. Impart knowledge on design of water distribution network.

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

- a. Plan and design the water and distribution networks and sewerage systems.
- b. Identify the water source and select proper intake structure.
- c. Characterisation of water .
- d. Select the appropriate appurtenances in the water supply .
- e. Selection of suitable treatment flow for raw water treatments.

SYLLABUS:**UNIT-I**

Introduction: Importance and Necessity of Protected Water Supply systems, Water borne diseases, Flow chart of public water supply system, Role of Environmental Engineer, Agency activities.

Water Demand and Quantity Estimation: Estimation of water demand for a town or city, Per capita Demand and factors influencing it - Types of water demands and its variations- factors affecting water demand, Design Period, Factors affecting the Design period, Population Forecasting.

UNIT-II

Sources of Water: Lakes, Rivers, Impounding Reservoirs, comparison of sources with reference to quality, quantity and other considerations- Capacity of storage reservoirs, Mass curve analysis. Groundwater sources of water: Types of water bearing formations, springs, Wells and Infiltration galleries, Yields from infiltration galleries.

Collection and Conveyance of Water: Factors governing the selection of the intake structure, Types of Intakes. Conveyance of Water: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, Pipe joints, Design aspects of pipe lines, laying of pipe lines.

UNIT-III

Quality and Analysis of Water: Characteristics of water–Physical, Chemical and Biological–Analysis of Water – Physical, Chemical and Biological characteristics. Comparison of sources with reference to quality-I.S. Drinking water quality standards and WHO guidelines for drinking water

UNIT-IV

Treatment of Water: Flowchart of water treatment plant, Treatment methods: Theory and Design of Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration.

UNIT-V

Disinfection: Theory of disinfection-Chlorination and other Disinfection methods, Softening of Water, Removal of color and odours - Iron and manganese removal –Adsorption-fluoridation and defluoridation–aeration–Reverse Osmosis-Iron exchange–Ultra filtration.

UNIT-VI

Distribution of Water: Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods -Components of Distribution system: valves such as sluice valves, air valves, scour valves and check valves, hydrants, and water meters–Laying and testing of pipe lines- selection of pipe materials, pipe joints.

TEXT BOOKS

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, George George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.

2. Elements of Environmental Engineering – K.N. Duggal, S. Chand & Company Ltd., New Delhi, 2012.

REFERENCES

3. Water Supply Engineering – Dr. P.N. Modi
4. Water Supply Engineering – B.C. Punmia
5. Water Supply and Sanitary Engineering – G.S.Birdie and J.S. Birdie
6. Environmental Engineering by D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.

III Year – II SEMESTER

T	P	C
3+1*	0	3

CE603-WATER RESOURCES ENGINEERING-I

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The course is designed to

1. Introduce hydrologic cycle and its relevance to Civil engineering.
2. Make the students understand physical processes in hydrology and, components of the hydrologic cycle.
3. Appreciate concepts and theory of physical processes and interactions.
4. Learn measurement and estimation of the components hydrologic cycle.
5. Provide an overview and understanding of Unit Hydrograph theory and its analysis.
6. Understand flood frequency analysis, design flood, flood routing.
7. Appreciate the concepts of groundwater movement and well hydraulics.

Course Outcomes

At the end of the course the students are expected to

- a. Have a thorough understanding of the theories and principles governing the hydrologic processes.
- b. Be able to quantify major hydrologic components and apply key concepts to several practical areas of engineering hydrology and related design aspects.
- c. Develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.
- d. Be able to develop design storms and carry out frequency analysis.
- e. Be able to determine storage capacity and life of reservoirs.
- f. Develop unit hydrograph and synthetic hydrograph.
- g. Be able to estimate flood magnitude and carry out flood routing.
- h. Be able to determine aquifer parameters and yield of wells.
- i. Be able to model hydrologic processes.

SYLLABUS:**UNIT I**

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

Precipitation: Types and forms, measurement, raingauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm.

UNIT-II

Abstractions from Precipitation: Initial abstractions.

Evaporation: factors affecting, measurement, reduction

Evapotranspiration: factors affecting, measurement, control

Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices.

UNIT-III

Runoff : Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph.

UNIT-IV

Floods: Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management.

Flood Routing: Hydrologic routing, channel and reservoir routing- Muskingum and Puls methods of routing.

UNIT-V

Groundwater: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of an open well-recuperation test.

UNIT VI

Advanced Topics in Hydrology: Rainfall-runoff Modelling, instantaneous unit hydrograph (IUH) - conceptual models - Clark and Nash models, general hydrological models- Chow - Kulandaiswamy model.

TEXT BOOKS:

1. 'Engineering Hydrology' by Subramanya, K, Tata Mc Graw-Hill Education Pvt. Ltd, (2013), New Delhi.
2. 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi
3. 'Applied hydrology' by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt. Ltd., (2011), New Delhi.
4. 'Engineering Hydrology' by Ojha C.S.P, R. Berndtsson and P. Bhunya, Oxford University Press, (2010).

REFERENCES:

1. 'Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013).
2. 'Hydrology' by Raghunath. H.M., New Age International Publishers, (2010).
3. 'Engineering Hydrology –Principles and Practice' by Ponce V.M., Prentice Hall International, (1994).
4. 'Hydrology and Water Resources Engineering' by Patra K.C., Narosa Publications, (2011).

III Year – II SEMESTER

T	P	C
3+1*	0	3

(Open Elective)**CE606 (a) - ENVIRONMENTAL POLLUTION AND CONTROL**

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. Impart knowledge on fundamental aspects of air pollution & control, noise pollution, and solid waste management.
2. Provide basic knowledge on sustainable development.
3. Introduces some basics of sanitation methods essential for protection of community health.
4. Differentiate the solid and hazardous waste based on characterization.

Course Learning Outcomes:

By the end of successful completion of this course, the students will be able to:

- a. Identify the air pollutant control devices
- b. Have knowledge on the NAAQ standards and air emission standards
- c. Differentiate the treatment techniques used for sewage and industrial wastewater treatment methods.
- d. Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city.
- e. Appreciate the methods of environmental sanitation and the management of community facilities without spread of epidemics.
- f. Appreciate the importance of sustainable development while planning a project or executing an activity.

SYLLABUS:**UNIT – I**

Air Pollution: Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards.

Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000.

UNIT –II

Industrial wastewater Management: – Strategies for pollution control - Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants - Recirculation of industrial wastes – Effluent standards.

UNIT – III

Solid Waste Management: solid waste characteristics – basics of on-site handling and collection – separation and processing - Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

UNIT – IV

Environmental Sanitation: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fairs), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

UNIT – V

Hazardous Waste: Characterization - Nuclear waste – Biomedical wastes – Electronic wastes - Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

UNIT- VI

Sustainable Development: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability- sustainable development.

TEXT BOOKS:

1. Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elsevier, 2003.
2. Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Pearson Education.
3. Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill Publishing.

REFERENCES:

1. Air Pollution and Control by M.N. Rao & H.N. Rao
2. Solid Waste Management by K. Sasi Kumar, S.A. Gopi Krishna. PHI New Delhi.
3. Environmental Engineering by Gerard Kiley, Tata McGraw Hill.
4. Environmental Sanitation by KVSG Murali Krishna, Reem Publications, New Delhi.
5. Industrial Water Pollution Control by Nemerow Jr., McGraw Hill Publishing.
6. Unit Operations and Processes in Environmental Engineering by Reynolds. Richard – Cengage Learning.
7. Environmental Engineering by D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.
8. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.

CE606 (b) - DISASTER MANAGEMENT**(Open Elective)**

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
2. Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
3. Understand the 'relief system' and the 'disaster victim.'
4. Describe the three planning strategies useful in mitigation.
5. Identify the regulatory controls used in hazard management.
6. Describe public awareness and economic incentive possibilities.
7. Understand the tools of post-disaster management.

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

- a. Affirm the usefulness of integrating management principles in disaster mitigation work
- b. Distinguish between the different approaches needed to manage pre-during and post- disaster periods
- c. Explain the process of risk management
- d. Relate to risk transfer

SYLLABUS:**UNIT-I**

Natural Hazards And Disaster Management: Introduction of DM – Inter disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides.

UNIT-III

Man Made Disastar And Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics –

solid waste management – post disaster – bio terrorism -threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.

UNIT-III

Risk And Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

UNIT-IV

Role Of Technology In Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earth quakes –flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training-transformable indigenous knowledge in disaster reduction.

UNIT-V

Education And Community Preparedness: Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery –Community based disaster management and social capital-Designing resilience- building community capacity for action.

UNIT-VI

Multi-sectional Issues: Impact of disaster on poverty and deprivation-Climate change adaptation and human health -Exposure , health hazards and environmental risk-Forest management and disaster risk reduction.- Institutional capacity in disaster management -The Red cross and red crescent movement.-Corporate sector and disaster risk reduction-A community focused approach.

TEXT BOOKS:

1. 'Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy(2009),Universities press.
2. 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.

REFERENCE BOOKS:

1. 'Disaster Management' edited by H K Gupta (2003),Universities press.

CE606 (c) -INDUSTRIAL WATER & WASTE WATER MANAGEMENT

(Open Elective)

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The course will address the following:

1. Enables the student to distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation.
2. To impart knowledge on selection of treatment methods for industrial wastewater.
3. To know the common methods of treatment in different industries.
4. To acquire knowledge on operational problems of common effluent treatment plant.

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

- a. Suggest treatment methods for any industrial wastewater.
- b. Learn the manufacturing process of various industries.
- c. Student will be in a position to decide the need of common effluent treatment plant for the industrial area in their vicinity.

SYLLABUS:

UNIT – I

Industrial water Quantity and Quality requirements: Boiler and cooling waters–Process water for Textiles, Food processing, Brewery Industries, power plants, fertilizers, sugar mills.

UNIT – II

Miscellaneous Treatment: Use of Municipal wastewater in Industries – Advanced water treatment - Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Freezing, elutriation, Removal of Iron and Manganese, Removal of Colour and Odour.

UNIT – III

Basic theories of Industrial Wastewater Management: Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis -

Wastewater characterization-Toxicity of industrial effluents-Treatment of wastewater-unit operations and processes-Volume and Strength reduction – Neutralization – Equalization and proportioning- recycling, reuse and resources recovery.

UNIT – IV

Industrial wastewater disposal management: discharges into Streams, Lakes and oceans and associated problems, Land treatment - Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastes- Effluent Disposal Method.

UNIT – V

Process and Treatment of specific Industries-1: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants.

UNIT – VI

Process and Treatment of specific Industries-2: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Pharmaceutical Plants.

Text book

1. Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH, New Delhi.
2. Industrial Wastewater Treatment by KVSG Murali Krishna.
3. Industrial Wastewater treatment by A.D. Patwardhan, PHI Learning, Delhi.
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3rd Edition.

References

1. Industrial Water Pollution Control by W. Wesley Eckenfelder, McGrawHill, Third Edition
2. Wastewater Engineering by Metcalf and Eddy Inc., Tata McGrawhill Co., New Delhi
3. Wastewater Treatment- Concepts and Design Approach by G.L. Karia & R.A. Christian, Prentice Hall of India.
4. Unit Operations and Processes in Environmental Engineering by Reynolds. Richard, Cengage Learning.

CE606 (d) - ARCHITECTURE AND TOWN PLANNING**(Open Elective)**

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. Initiating the students to different architectures of the world. The distinctions between the eastern and western architecture styles are focused.
2. The salient features of Egyptian, Greek, Roman, Indian Vedic, Indus valley civilization, Buddhist, Hindu and Indo-Sarsanic Architecture are introduced.
3. Architectural design concepts, principles of planning and composition are imparted.
4. To enable the student to understand town planning from ancient times to modern times.
5. To impart the concepts of town planning standards, land scaping and expansion of towns.

Course Outcomes:

Upon the successful completion of this course:

- a. The student should be able to distinguish architectural styles of eastern and western world.
- b. The student should understand the importance of Orders of architecture.
- c. Should be able to compose spaces of buildings using design concepts, planning principles.
- d. Should understand the town planning standards, landscaping features and regulations controlling expansion of the towns and the cities.

SYLLABUS:**UNIT – I**

History of Architecture: Western Architecture: Egyptian, Greek, Roman Architectures- Orders. Indian Architecture: Vedic age, Indus valley civilization– Buddhist period: Stambas, Stupa, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles-Temple of Aihole,

Madurai, Bhuvaneshwar, Mount Abu. Indo Sarsanic (Islamic) Architecture: Mosque - Palace - Fort - Tomb.

UNIT – II

Architectural Design: Principles of designing – Composition of Plan – relationship between plan and elevation- building elements, form, surface texture, mass, line, color, tone- Principles of Composition: Unity, contrast, proportion, scale, balance, circulation, rhythm, character, expression.

UNIT - III

Principles of Planning: Principles of planning a residence- site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors.

Post-classic Architecture: Introduction of post-classic architecture- contribution of eminent architects to modern period-Edward Lutyens, Le Corbusier, Frank Lloyd Wright, Walter Groping.

UNIT – IV

Histoical Back Ground of Town Planning: Town planning in India – Town plans of mythological Manasa-Town plans of ancient towns: Harappa, Mohenjodaro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

UNIT – V

Modern Town Planning: Zoning- Roads and road traffic- Housing- Slums, Parks, Play grounds- Public Utility Services- Surveys and maps for planning- Neighborhood Planning.

Standards of Town planning: Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation- planning regulations and limitations.

UNIT – VI

Land Scaping and Expansion of Towns: Land scaping for the towns, horizontal and vertical expansion of towns- garden cities, satellite towns- floating towns- sky scrapers-pyramidal cities.

TEXTBOOKS:

1. 'The great ages of World Architecture' by G.K. Hiraskar.
2. 'Planning and Design of Buildings by Section of Architecture' by Y. S. Sane.

3. 'Professional Practice' by G.K.Krishnamurthy, S.V.Ravindra, PHI Learning, New Delhi.
4. 'Indian Architecture – Vol. I & II' by Percy Brown, Taraporevala Publications, Bombay.
5. 'Fundamentals of Town Planning' by G.K. Haraskar.

REFERENCES:

1. 'Drafting and Design for Architecture' by Hepler, Cengage Learning
2. 'Architect's Portable Handbook' by John Patten Guthrie – Mc Graw Hill International Publications.
3. 'Modern Ideal Homes for India' by R. S. Deshpande.
4. 'Town and County Planning' by A.J.Brown and H.M.Sherrard.
5. 'Town Design' by Federik Glbbard, Architectural press, London.

CE606 (e) - FINITE ELEMENT METHOD**(Open Elective)**

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. Equip the students with the fundamentals of Finite Element Analysis
2. Enable the students to formulate the design problems into FEA.
3. Enable the students to solve Boundary value problems using FEM.

Course Outcomes:

Upon completion of the course, the student will be able to

- a. Solve simple boundary value problems using Numerical technique of Finite element method.
- b. Develop finite element formulation of one and two dimensional problems and solve them.
- c. Assemble Stiffness matrices, Apply boundary conditions and solve for the displacements.
- d. Compute Stresses and Strains and interpret the result.

SYLLABUS:**UNIT-I**

Introduction: Review of stiffness method- Principle of Stationary potential energy-Potential energy of an elastic body- Rayleigh-Ritz method of functional approximation.

UNIT-II

Principles of Elasticity- Equilibrium Equations- Strain Displacement relationships- Constitutive relationship for plane stress, plane strain and axisymmetric bodies of revolution with axisymmetric loading.

UNIT-III

Finite Element formulation of truss element: Stiffness matrix- properties of stiffness matrix –Selection of approximate displacement functions- solution of a plane truss- transformation matrix- Galerkin's method for 1-D truss – Computation of stress in a truss element.

UNIT-IV

Finite element formulation of Beam elements: Beam stiffness- assemblage of beam stiffness matrix- Examples on Analysis of beams Subjected to Concentrated and Distributed loading.

UNIT-V

Finite element formulation for plane stress and plane strain problems- Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces

UNIT-VI

Iso-parametric Formulation: An isoparametric bar element- plane bilinear isoparametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature for performing numerical integrations.

TEXT BOOKS

1. 'A first course in the Finite Element Method' by Daryl L. Logan, Thomson Publications.
2. 'Introduction to Finite Elements in Engineering' by Tirupati R. Chandrupatla, Ashok D. Belgundu, PHI publications.
3. 'Introduction to Finite Element Method' by Desai & Abel CBS Publications.

REFERENCES:

1. 'Concepts and applications of Finite Element Analysis' by Robert D. Cook, Michael E Plesha, John Wiley & sons Publications.
2. 'Text book of Finite Element Analysis' by P. Seshu, Prentice Hall of India.

CE606 (f) - GREEN TECHNOLOGIES**(Open Elective)**

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. To present different concepts of green technologies.
2. To acquire principles of Energy efficient technologies.
3. To impart knowledge on the methods of reducing CO₂ levels in atmosphere.
4. To gain knowledge of the importance of life cycle assessment
5. To learn the importance of green fuels and its impact on environment.

Course Learning Outcomes

Upon successful completion of this course, the students will be able to:

- a. Enlist different concepts of green technologies in a project
- b. Understand the principles of Energy efficient technologies
- c. Estimate the carbon credits of various activities
- d. Identify the importance of life cycle assessment
- e. Recognize the benefits of green fuels with respect to sustainable development.

SYLLABUS:**UNIT- I**

Introduction : Green Technology – definition- Importance – Historical evolution – advantages and disadvantages of green technologies-factors affecting green technologies- Role of Industry, Government and Institutions – Industrial Ecology – role of industrial ecology in green technology.

UNIT- II

Cleaner Production (CP): Definition – Importance – Historical evolution - Principles of Cleaner Production–Benefits–Promotion – Barriers – Role of Industry, Government and Institutions – clean development mechanism, reuse, recovery, recycle, raw material substitution-Wealth from waste, case studies.

UNIT- III

Cleaner Production Project Development and Implementation: Overview of CP Assessment Steps and Skills, Process Flow Diagram, Material Balance,

CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - Total Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress- ISO 14000.

UNIT- IV

Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Life Cycle Costing – Eco Labelling.

UNIT -V

Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Solar Energy-solar energy conversion technologies and devices, their principles, working and application.

UNIT- VI

Green Fuels – Definition-benefits and challenges – comparison of green fuels with conventional fossil fuels with reference to environmental, economical and social impacts- public policies and market-driven initiatives.

Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in Indian context; tidal and geothermal energy.

TEXT BOOKS:

REFERENCES:

1. 'Pollution Prevention: Fundamentals and Practice' by Paul L Bishop (2000), McGraw Hill International.
2. 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production' by World Bank Group (1998), World Bank and UNEP, Washington D.C.
3. 'Cleaner Production Audit' by Prasad Modak, C.Visvanathan and Mandar Parasnis (1995), Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok
4. 'Handbook of Organic Waste Conversion' by Bewik M.W.M.
5. 'Energy, The Solar Hydrogen Alternative' by Bokris J.O.
6. 'Non-conventional Energy Sources' by Rai G.D.
7. 'Solar Energy' by Sukhatme S.P.
8. 'Waste Energy Utilization Technology' by Kiang Y. H.

III Year – II SEMESTER	T	P	C
	0	3	2

CE607-COMPUTER AIDED ENGINEERING DRAWING

Lecture :	--	Internal Assessment :	Marks
Tutorial :	--	Semester End Examination :	Marks
Practical :	3 hrs/Week	Credits :	2

Course Objectives:

The objective of this course is:

- To enhance the students knowledge and skills in engineering drawing
- To introduce computer aided drafting packages and commands for modeling and sketching.
- To learn surface modeling techniques required designing and machining
- To draw the geometric entities and create 2D and 3D wire frame models.
- To learn various modelling techniques such as edit, zoom, cross hatching, pattern filling, rotation, etc.

Course outcomes:

Up on completion of the course, the student shall be able to :

- 1) Understand the paper –space environment thoroughly
- 2) Develop the components using 2D and 3D wire frame models through various editing commands.
- 3) Generate assembly of various components of compound solids.

UNIT-I

Objective: The knowledge of projections of solids is essential in 3D modelling and animation. The student will be able to draw projections of solids. The objective is to enhance the skills they already acquired in their earlier course in drawing of projection and sections of solids.

Projections Of Planes & Solids : Projections of Regular Solids inclined to both planes – Auxiliary Views. Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

UNIT-II

Objective: The knowledge of development of surfaces of solids is required in designing and manufacturing of the objects. Whenever two or more solids combine, a definite curve is seen at their intersection. The intersection of

solids also plays an important role in designing and manufacturing. The objective is to impart this knowledge through this topic.

Development And Interpenetration Of Solids: Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts.

Interpenetration of Right Regular Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT-III

Objective: Isometric projections provide a pictorial view with a real appearance. Perspective views provides a realistic 3D View of an object. The objective is to make the students learn the methods of Iso and Perspective views.

Isometric Projections : Principles of Isometric Projection – Isometric Scale – Isometric Views

– Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts.

Transformation of Projections: Conversion of Isometric Views to Orthographic Views – Conventions.

Perspective Projections: Perspective View: Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods (General Method only).

PART- B COMPUTER AIDED DRAFTING

UNIT- IV

Introduction To Computer Aided Drafting: Generation of points, lines, curves, polygons, dimensioning. Types of modelling: object selection commands – edit, zoom, cross hatching, pattern filling, utility commands, 2D wire frame modelling, 3D wire frame modelling.

UNIT -V

Objective: By going through this topic the student will be able to understand the paper-space environment thoroughly.

View Points And View Ports: view point coordinates and view(s) displayed, examples to exercise different options like save, restore, delete, joint, single option.

UNIT -VI

Computer Aided Solid Modelling: Isometric projections, orthographic projections of isometric projections, Modelling of simple solids, Modelling of Machines & Machine Parts.

TEXT BOOKS :

1. Engineering Graphics, K.C. John, PHI Publications.
2. Engineering drawing by N.D Bhatt, Charotar publications.

REFERENCES:

1. Mastering Auto CAD 2013 and Auto CAD LT 2013 – George Omura, Sybex.
2. Auto CAD 2013 fundamentals- Elisemoss, SDC Publ.
3. Engineering Drawing and Graphics using Auto Cad–T Jeyapoovan, vikas
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age.
5. Engineering Drawing – RK Dhawan, S Chand
6. Engineering Drawing – MB Shaw, BC Rana, Pearson
7. Engineering Drawing – KL Narayana, P Kannaiah, Scitech
8. Engineering Drawing – Agarwal and Agarwal, Mc Graw Hill
9. Engineering Graphics – PI Varghese, Mc Graw Hill
10. Text book of Engineering Drawing with auto-CAD, K.Venkata Reddy/B.S . Publications.

Internal Evaluation: Max. Marks: 30

The total internal evaluation marks are distributed in following two components:

1. Day-to-day work : 20 marks
2. Internal test : 10 marks

I Mid (Internal Test 1) Examination Part A - Conventional drawing
Exam II Mid (Internal Test 2) Examination Part B - In Computer Lab

(Note: The duration of the internal test is 2 hours and it must be conducted as per the schedules notified. The internal test may be conducted for 40 marks and it may be reduced to 10 marks).

End Semester Examination (Total Duration: 4 Hours, Max. Marks: 70)

PART A – Conventional drawing pattern (Duration: 2 Hours, Marks: 35)

PART B – Computer lab pattern using any drafting packages (Duration: 2 Hours, Marks: 35)

(Note: both PART A and PART B are compulsory and are to be conducted in separate sessions)

Since the pattern of the internal and external examination is not specified in the R13 academic regulation, it is requested that the above pattern may be approved.

III Year – II SEMESTER

T	P	C
0	3	2

CE608-TRANSPORTATION ENGINEERING LAB

Lecture :	--	Internal Assessment :	25 Marks
Tutorial :	--	Semester End Examination :	50 Marks
Practical :	3 hrs/week	Credits :	2

Course Learning Objectives:

The objective of this course is:

1. To test crushing value, impact resistance, specific gravity and water absorption, percentage attrition, percentage abrasion, flakiness index and elongation index for the given road aggregates.
2. To know penetration value, ductility value, softening point, flash and fire point, viscosity and stripping for the given bitumen grade.
3. To test the stability for the given bitumen mix.
4. To carry out surveys for traffic volume, speed and parking.

Course outcomes:

- a. Ability to test aggregates and judge the suitability of materials for the road construction
- b. Ability to test the given bitumen samples and judge their suitability for the road construction
- c. Ability to obtain the optimum bitumen content for the mix design
- d. Ability to determine the traffic volume, speed and parking characteristics.

SYLLABUS:**I. ROAD AGGREGATES:**

1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Attrition Test
5. Abrasion Test.
6. Shape tests

II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test
6. Viscosity Test.

III. BITUMINOUS MIX:

1. Marshall Stability test.

IV. TRAFFIC SURVEYS:

1. Traffic volume study at mid blocks.
2. Traffic Volume Studies (Turning Movements) at intersection.
3. Spot speed studies.
4. Parking study.

V. DESIGN & DRAWING:

1. Earthwork calculations for road works.
2. Drawing of road cross sections.
3. Rotors intersection design.

LIST OF EQUIPMENT:

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers.
4. Los angles Abrasion test machine
5. Deval's Attrition test machine
6. Length and elongation gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup.
9. Ring and ball apparatus
10. Viscometer.
11. Marshal Mix design apparatus.
12. Enoscope for spot speed measurement.
13. Stop Watches

TEXT BOOKS:

1. 'Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veeraraghavan, Neam Chan Brothers New Chand Publications, New Delhi.

REFERENCE BOOKS:

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.

IV Year – I SEMESTER	T	P	C
	3+1*	0	3

CE701-ENVIRONMENTAL ENGINEERING – II

Lecture :	3 hrs/Week	Internal Assessment :	Marks
Tutorial :	1 Hrs/Week	Semester End Examination :	Marks
Practical :	--	Credits :	3

Course Learning Objectives:

The objective of this course is:

1. Outline planning and the design of wastewater collection, conveyance and treatment systems for a community/town/city.
2. Provide knowledge of characterisation of wastewater generated in a community.
3. Impart understanding of treatment of sewage and the need for its treatment.
4. Summarize the appurtenance in sewerage systems and their necessity.
5. Teach planning, and design of septic tank and imhoff tank and the disposal of the effluent from these low cost treatment systems.
6. Effluent disposal method and realise the importance of regulations in the disposal of effluents in rivers.

Course Outcomes:

By the end of successful completion of this course, the students will be able to:

- a. Plan and design the sewerage systems
- b. Characterisation of Sewage
- c. Select the appropriate appurtenances in the sewerage systems
- d. Selection of suitable treatment flow for sewage treatment
- e. Identify the critical point of pollution in a river for a specific amount of pollutant disposal into the river

SYLLABUS:

UNIT – I:

Introduction to sanitation – systems of sanitation – relative merits & demerits – collection and conveyance of waste water – sewerage –

classification of sewerage systems- Estimation of sewage flow and storm water drainage – fluctuations – types of sewers - Hydraulics of sewers and storm drains– design of sewers – appurtenances in sewerage – cleaning and ventilation of sewers.

UNIT – II:

Pumping of wastewater: Pumping stations – location – components– types of pumps and their suitability with regard to wastewaters.

House Plumbing: systems of plumbing-sanitary fittings and other accessories–one pipe and two pipe systems – Design of building drainage.

UNIT – III:

Sewage characteristics – Sampling and analysis of wastewater - Physical, Chemical and Biological Examination-Measurement of BOD and COD - BOD equations.

Treatment of sewage : Primary treatment-Screens-grit chambers-grease traps–floatation– sedimentation – design of preliminary and primary treatment units.

UNIT – IV:

Secondary treatment: Aerobic and anaerobic treatment process-comparison.

Suspended growth process: Activated Sludge Process, principles, designs, and operational problems, modifications of Activated Sludge Processes, Oxidation ponds, Aerated Lagoons.

Attached Growth Process: Trickling Filters–mechanism of impurities removal- classification–design-operation and maintenance problems. RBCs, Fluidized bed reactors.

UNIT V:

Miscellaneous Treatment Methods: Nitrification and Denitrification – Removal of Phosphates –UASB–Membrane reactors-Integrated fixed film reactors. Anaerobic Processes: Septic Tanks and Imhoff tanks- working Principles and Design–disposal of septic tank effluent.

UNIT – VI:

Bio-solids (Sludge) management: Characteristics- handling and treatment of sludge-thickening – anaerobic digestion of sludge.

Disposal of sewage: methods of disposal – disposal into water bodies- Oxygen Sag Curve-disposal on land- sewage sickness.

Text Books

1. Wastewater Engineering Treatment and Reuse by Metcalf & Eddy, Tata McGraw-Hill edition.
2. Elements of Environmental Engineering by K.N. Duggal, S. Chand & Company Ltd. New Delhi, 2012.
3. Environmental Engineering by Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Sham R Asolekar, Mc-GrawHill, NewDelhi; 3^rd Edition.

References

1. Environmental Engineering –II: Sewage disposal and Air Pollution Engineering, by Garg, S.K.; Khanna Publishers.
2. Sewage treatment and disposal by Dr. P.N. Modi& Sethi.
3. Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elsevier, 2003.
4. Environmental Engineering by D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.
