B.E. DEGREE
IN
CIVIL ENGINEERING

Year : II

Part : I

Teaching Schedule							Examination Scheme							
							Theory			Practical			Total	Remark
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Final		Assesment Marks	Final			
								Duaration hours	Marks		Duaration hours	Marks		
1	SH 501	Engineering Mathematics III	3	2		5	20	3	80				100	
2	CE 501	Applied Mechanics (Dynamics)	2	1		3	10	1.5	40				50	
3	CE 502	Strength of Materials	3	1	1	5	20	3	80	25			125	
4	CE 503	Engineering Geology I	2		1	3	10	1.5	40	25			75	
5	CE 505	Fluid Mechanics	3	2	1	6	20	3	80	25			125	
6	CE 504	Surveying I	3		3	6	20	3	80	25	3	25	150	
7	CE 506	Civil Engineering Materials	2		1	3	10	3	40	25			75	
		Total	**18**	**6**	**7**	**31**	**110**	**18**	**440**	**125**	**3**	**25**	**700**	

ENGINEERING MATHEMATICS III

SH 501

Lecture : 3 **Year : II**
Tutorial : 2 **Part : I**
Practical : 0

Course Objective:

To round out the students' preparation for more sophisticated applications with an introduction to linear algebra, Fourier series, Laplace Transforms, integral transformation theorems and linear programming.

1. Determinants and Matrices **(11 hours)**

1.1 Determinant and its properties
1.2 Solution of system of linear equations
1.3 Algebra of matrices
1.4 Complex matrices
1.5 Rank of matrices
1.6 System of linear equations
1.7 Vector spaces
1.8 Linear transformations
1.9 Eigen value and Eigen vectors
1.10 The Cayley-Hamilton theorem and its uses
1.11 Diagonalization of matrices and its applications

2. Line, Surface and Volume Integrals **(12 hours)**

2.1 Line integrals
2.2 Evaluation of line integrals
2.3 Line integrals independent of path
2.4 Surfaces and surface integrals
2.5 Green's theorem in the plane and its applications
2.6 Stoke's theorem (without proof) and its applications
2.7 Volume integrals; Divergence theorem of Gauss (without proof) and its applications

3. Laplace Transform **(8 hours)**

3.1 Definitions and properties of Laplace Transform
3.2 Derivations of basic formulae of Laplace Transform
3.3 Inverse Laplace Transform: Definition and standard formulae of inverse Laplace Transform
3.4 Theorems on Laplace transform and its inverse
3.5 Convolution and related problems
3.6 Applications of Laplace Transform to ordinary differential equations

4. Fourier Series **(5 hours)**

4.1 Fourier Series

4.2 Periodic functions
4.3 Odd and even functions
4.4 Fourier series for arbitrary range
4.5 Half range Fourier series

5. Linear Programming **(9 hours)**

5.1 System of Linear Inequalities in two variables
5.2 Linear Programming in two dimensions: A Geometrical Approach
5.3 A Geometric introduction to the Simplex method
5.4 The Simplex method: Maximization with Problem constraints of the form "$\leq$"
5.5 The Dual: Maximization with Problem Constraints of the form "$\geq$"
5.6 Maximization and Minimization with mixed Constraints. The two-phase method (An alternative to the Big M Method)

References:

1. S. K. Mishra, G. B. Joshi, V. Parajuli, "Advance Engineering Mathematics", Athrai Publication.
2. E. Kreszig, "Advance Engineering Mathematics", Willey, New York.
3. M.M Gutterman and Z.N.Nitecki, "Differential Equation, a First Course", Saunders, New York.

APPLIED MECHANICS (DYNAMICS)

CE 501

Lecture : 2 **Year : II**
Tutorial : 1 **Part : I**
Practical : 0

Course Objectives:

To provide concept and knowledge of engineering mechanics in dynamics portion to the students such that they can understand the basics of kinematics and kinetics for both particles and rigid bodies and their motion.

1. Curvilinear Motion of Particles **(4 hours)**

1.1 Position vector, velocity and acceleration
1.2 Derivatives of vector functions
1.3 Rectangular component of velocity and acceleration
1.4 Motion relative to frame in translation
1.5 Tangential and normal components
1.6 Radial and transverse components

2. Kinetics of Particles: Energy and Momentum Methods **(5 hours)**

2.1 Work done by a force
2.2 Potential and kinetic energy of particles
2.3 Principles of work and energy: applications
2.4 Power and efficiency
2.5 Conservation of energy
2.6 Principle of impulse and momentum
2.7 Impulsive motion and impact
2.8 Direct central and oblique impact

3. System of Particles **(5 hours)**

3.1 Newton's laws and a system of particles
3.2 Linear and angular moment for a system of particles
3.3 Motion of the mass centre
3.4 Conservation of momentum
3.5 Kinetic energy of system of particles
3.6 Work energy principles; Conservation of energy for a system of particles
3.7 Principles of impulse and momentum for a system of particles

3.8 Steady stream of particles
3.9 System with variable mass

4. Kinematics of Rigid Bodies (6 hours)

4.1 Introduction
4.2 Translation and rotation
4.3 General plane motion
4.4 Absolute and relative velocity in plane motion
4.5 Instantaneous centre of rotation
4.6 Absolute and relative frame; Coriolis acceleration in plane motion
4.7 Rate of change of a general vector with respect to a rotating frame; Coriolis acceleration
4.8 Motion about a fixed point
4.9 General motion
4.10 Three-dimensional motion of a particle relative to a rotating frame; coriolis acceleration

5. Plane Motion of Rigid Bodies:Forces, Moments, and Accelerations(4 hours)

5.1 Definitions: rigid bodies
5.2 Equation of motion for a rigid Body in plane motion
5.3 Angular momentum of a rigid body in plane motion
5.4 Plane motion of rigid body: D'Alembert's principle
5.5 Application of rigid body motion in the plane
5.6 Constrained motion in the plane

6. Plane Motion of Rigid Bodies: Energy and Momentum Methods (6 hours)

6.1 Principle of work and energy for a rigid body
6.2 Work done by external forces
6.3 Kinetic energy for a system
6.4 Conservative and non-conservative systems
6.5 Work – energy applications
6.6 Impulse and momentum for systems for rigid bodies
6.7 Conservation of angular and linear momentum
6.8 Impulsive motion and eccentric impact

Tutorial:

6 tutorials, 2 mini projects

References:

1. Hibbler, R.C. "Engineering Mechanics" (Statics and Dynamics)",
2. Beer F.P. and E.R. Johnson "Vector Mechanics for Engineers", Tata McGraw Hill Publishing Co. Ltd.
3. Shames, I.H "Engineering Mechanics – Statics and Dynamics"., Prentice Hall of India,New Delhi.
4. Egor .P. Popov "Engineering Mechanics of Solids", New Delhi, Prentice Hall of India.

STRENGTH OF MATERIALS
CE 502

Lecture : 3 **Year : II**
Tutorial : 1 **Part : I**
Practical : 2/2

Course Objectives:

To provide basic concept and knowledge of material behavior, stress-strain relations and their analysis so that students will have basic concept on theory of flexure and column buckling.

1. Axial Forces, Shearing Forces and Bending Moments (8 hours)

1.1 Plotting shearing force, bending moment and axial force diagrams for determinate structures (beams and frames)
1.2 Concept of superposition for shear forces, bending moments and axial forces due to various combinations of loads
1.3 Maximum shear force and bending moments and their positions
1.4 Relationship between loads, shear forces, bending moment

2. Geometrical Properties of Sections (7 hours)

2.1 Axes of symmetry
2.2 Centre of gravity of built-up plane figures
2.3 Centre of gravity of built-up standard steel sections
2.4 Moment of inertia of standard and built-up sections
2.5 Polar moment of inertia
2.6 Radius of gyration
2.7 Product of inertia
2.8 Principle moment and principle axes of inertia
2.9 Mohr's circle for moment of inertia

3. Simple Stress and Strain (8 hours)

3.1 Definitions: deformable Bodies, internal forces, stress, strain
3.2 Analysis of Internal forces
3.3 Simple stress and strain
3.4 Hooke's law: axial and typical stress strain diagram for characteristics of mild steel
3.5 Poisson's ratio
3.6 Stress-strain diagram
3.7 Axial stress and strain
3.8 Shear stress and strain
3.9 Shear deformation and shear angle
3.10 Hooke's law for shearing deformations
3.11 Allowable stresses and factor of safety
3.12 Stress concentrations

3.13 Relationships between elastic constants

4. Stress and Strain Analysis **(6 hours)**

4.1 Stresses in inclined plane: normal and shear stress
4.2 Principle stresses and principle planes
4.3 Relationships between normal and shear stress
4.4 Maximum shear stress and corresponding plane
4.5 Mohr's circle for stress

5. Thin Walled Vessels **(3 hours)**

5.1 Definition and characteristics of thin walled vessels
5.2 Types of stresses in thin walled vessels
5.3 Calculation of stresses in thin walled vessels

6. Torsion **(4 hours)**

6.1 Introduction and assumptions
6.2 Derivation of torsion formulas
6.3 Torsional moments in shaft
6.4 Torsional stress in shaft
6.5 Angle of twist

7. Theory of Flexure **(5 hours)**

7.1 Coplanar and pure bending
7.2 Elastic curve
7.3 Angle of rotation
7.4 Radius of curvature, flexural stiffness
7.5 Small deflection theory
7.6 Bending stress
7.7 Flexural formula, differential equation of deflected shape
7.8 Introduction to deflection

8. Column Theory **(4 hours)**

8.1 Theory of columns according to support systems
8.2 Critical load
8.3 Long column by Euler's formula
8.4 Limitations of Euler's formula
8.5 Intermediate columns; empirical formulas

Practical:

1. Stress-strain curve in tension
2. Stress-stress curve in compression
3. Torsion test to determine modulus of rigidity
4. Column behavior due to buckling
5. Deflection of simple beam

Tutorial:

8 tutorials, 2 mini projects

References:

1. Timoshenko and Gere, 'Mechanics of Materials",
2. Beer F.P. and E.R. Johnston, "Mechanics of Material",
3. E.P. Popov, "Mechanics of Material", Prentice Hall of India, New Delhi.
4. A. Pytel, F.L. Singer, 'Strength of Materials", Harper Collins, India.

ENGINEERING GEOLOGY I

CE 503

Lecture : 2 **Year : II**
Tutorial : 0 **Part :I**
Practical : 2/2

Course Objectives:

To provide concept and knowledge of geology to students of civil engineering and help them to understand how to identify the different types of rocks, minerals, geological structures, geological setting of Himalaya, geological processes and their impacts on engineering structures etc.

1. Geology and Civil Engineering **(2 hours)**

1.1 Geology and different branches of science: Introduction and their interrelationships, geology, geography, geophysics, geochemistry, geodetic, climatology, and meteorology, oceanography and astronomical aspects of the earth- moon system
1.2 Different branches of geology and their interrelations
1.3 Scope, objective and importance of geology in civil engineering
1.4 Definition of engineering geology (according to IAEG), role and tasks of an engineering geologist, scope, objectives and its importance in the context of Nepal

2. Basic Reviews of the Earth **(3 hours)**

2.1 The Earth: its origin, age, components, structure
2.2 Introduction to history of the Earth: Geological time scale, origin and evolution of life
2.3 Physical features of the earth surface: Continental & oceanic features, mountains, plateau and shields
2.4 Internal structure of the Earth
2.5 Plate tectonics and mountain building process and formation of the Himalayas

3. Crystallography & Mineralogy **(4 hours)**

3.1 Introduction and crystal morphology, symmetry elements, crystal form & habits and crystal system
3.2 Physical, chemical and optical properties of minerals
3.3 Classification and identification of common rock forming minerals

4. Petrology **(6 hours)**

4.1 Introduction: Petrology, petrography and petrogenesis
4.2 Rock and rock cycle: Introduction
4.3 Classification, structure, textures of rocks

4.4 Engineering Significance of three rock classes
4.5 Macroscopic study of rocks on the basis of physical and engineering properties of following common rock types found in earth crust: Granite, Ryhyollite, Gabbro, Basalt, Pegmatite, SyeniteShale, Siltstone, limestone, Sandstone, Conglomerate, Breccia, slate, Phyllite, Schist, Gneiss, Quartzite, Marble

5. Structural Geology **(5 hours)**

5.1 Rock deformations and reasons
5.2 Attitude of geological structures: Dip, strike, trend, plunge
5.3 Measurement of orientation of geological strata using geological maps, geological compass and plotting of data on map
5.4 Geological structures: Primary sedimentary structures (bedding plane, lamination, cross bedding, graded bedding ripple marks, mud cracks etc.)
5.5 Secondary (deformation) structures: Continuous (lineation, foliation, boudinage, crenulation cleavage, folds) and discontinuous (cracks fractures, joints, faults & thrusts)
5.6 Field identification criteria of geological structures
5.7 Engineering significance of geological structures

6. Physical Geology **(8 hours)**

6.1 Introduction: Definition, different geological agents
6.2 Geomorphological processes : Weathering and erosion
6.3 Geological cycle
6.4 Geological agents : Running water, glaciers, groundwater, wind and sea water, and various landforms produced by the geomorphological agents
6.5 Volcanism

7. Geology of Nepal **(2 hours)**

7.1 Introduction to the physiography and tectonic division of the Nepal Himalaya
7.2 Geology of the Terai Zone
7.3 Geology of the Siwalik Zone
7.4 Geology of the Lesser Himalaya Zone
7.5 Geology of the Higher Himalaya Zone
7.6 Geology of the Tethys Himalaya Zone
7.7 Study of Geological Units: Complex,group,formation,member

Practical:

1. Identification of common rock forming minerals : Quartz, Plagioclase, Orthoclase, Muccovite, Biotite, Chlorite, Calcite, Dolomite, Mangnesite, Pyroxene, Tourmaline, Pyrite, Gypsum, Talc, Fluorite, Apatite, Topaz, Corundum, Diamond, Kyanite, Silliminite, Garnet and clay minerals

2. Identification of rocks:
   Granite, Ryhyollite, Gabbro, Basalt,Pegmatite, SyeniteShale, Siltstone, Limestone, Sandstone, Conglomerate, Breccia, Slate, Phyllite, Schist, Gneiss, Quartzite, Marble
3. Study of geological structures in block diagrams
4. Study of Maps: Topographic and geological maps, construction of geological cross-sections and their interpretations

Fieldwork **(2 Days)**

Demonstration of the use of Geological Compass for the dip/ strike and trend/ plunge measurement, Identification of rocks, study of geological structures in field (Attendance in fieldwork is compulsory)

References:

1. A. Holmes "Principles of Physical Geology",ELBS English Language Society
2. M.P. Billings "Principles of Structural Geology",Prentice Hall of India,New Delhi
3. Dr. C.K. Sharma "Geology of Nepal",Educational Enterprises
4. P.C. Ghimire and M.S. Dhar "Engineering Geology"
5. Dr. R.K. Dahal "Geology for Technical Students", Bhirkuti Publications
6. Blyth,F.G.H. , Freitas,"M.H.Geology For Engineers", ELBS

FLUID MECHANICS
CE 505

Lecture : 3 **Year : II**
Tutorial : 2 **Part : I**
Practical : 2/2

Course Objectives:

To provide basic concept and knowledge of water resources engineering and their application in the field of civil engineering. Fundamentals of fluid mechanics are taught in this semester to proceed in the application phase covered in the irrigation and hydropower engineering courses.

1. Fluid and its Physical Properties **(3 hours)**

1.1 Basic concept and definition of fluid, application in civil engineering
1.2 Shear stress in a moving fluid; difference between solids and fluids
1.3 Concept of control volume and continuum in fluid mechanics
1.4 Mass density, specific weight, specific gravity, specific volume, viscosity, compressibility, capillarity, surface tension, cavitation and vapour pressure (relations, their dimension, units as well as values for different materials)
1.5 Newton's law of viscosity causes of viscosity in liquid and gases
1.6 Variation of viscosity with temperature for different fluids
1.7 Method for finding viscosity of fluids by viscometer
1.8 Ideal and Real fluids, Newtonian and non-Newtonian fluids, compressible and incompressible fluids with examples

2. Pressure and Head **(4 hours)**

2.1 Introduction, application in civil engineering, concept about the absolute and relative equilibrium
2.2 Atmospheric, gauge and absolute pressure
2.3 Pascal's law
2.4 Hydrostatics law of pressure distribution (pressure- depth relationship)
2.5 Measurement of pressure, simple manometer as piezometer, U-tube manometer, single column vertical and inclined manometers, differential manometer, inverted U-tube differential manometer, bourden gauge

3. Hydrostatics **(10 hours)**

3.1 Pressure force and centre of pressure on submerged bodies (plane and curve surfaces)
3.2 Computation of pressure forces on gates (plane and curve), dams, retainingstructuresand other hydraulic structures; pressure diagrams
3.3 Buoyancy, flotation concept, thrust on submerged and floating bodies, hydrometer
3.4 The stability of floating and submerged bodies.

3.5 Metacentre, determination of metacentric height.
3.6 Liquid in relative equilibrium (pressure variation in the case of uniform linear and radial acceleration)

4. Hydrokinematics **(4 hours)**

4.1 Lagragian and Eulerain approaches of describing fluid flow
4.2 One, two and three dimensional flow.
4.3 Classification of fluid motion (uniform and non-uniform, steady and unsteady, laminar and turbulent)
4.4 Rotational and Irrotational motion, stream function and potential function.
4.5 Description of streamline, streak line, path line and stream tube and their drawing procedures.
4.6 Conservation principle of mass and continuity equation in Cartesian and cylindrical polar coordinates (one , two and three dimensional)

5. Hydrodynamics **(2 hours)**

5.1 Forces acting on a fluid in motion (gravitational, pressure, viscous, turbulent, surface tension, and compression forces)
5.2 Reynolds's, Euler's and Navier-Stoke's equation of motions
5.3 Development of the Euler's Equation of motion
5.4 Bernoulli's equation and its physical meaning

6. Flow Measurement **(7 hours)**

6.1 Venturimeter, orifice meter, nozzle meter and Pitot tube.
6.2 Flow through orifice (small orifice, large orifice, partially submerged orifice as well as submerged orifice)
6.3 Different hydraulic coefficients (Cv, Cc and Cd) and their determination.
6.4 Notches and Weirs(classification, discharge through rectangular, triangular trapezoidal , and Cipoletti notches, Sharp crested weir, narrow crested weir, broad crested as well as ogee shaped weirs)
6.5 Emptying and filling of reservoirs without inflow (cylindrical, hemispherical and conical), emptying and filling of reservoir with inflow (cylindrical case).
6.6 Computer programme coding for simple problems

7. Momentum Principle and Flow Analysis **(6 hours)**

7.1 Momentum principle and equations
7.2 Application of equations to calculate forces (pipe in bends, enlargements and reducers).
7.3 Forces exerted by the jet on stationary and moving vanes of different shapes.
7.4 Concept of angular momentum with examples.

8. Boundary Layer Theory **(3 hours)**

8.1 Boundary layer concept and definition.

8.2 Boundary layer concept along a thin plate (laminar zone, turbulent zone, transition zone as well as laminar sub layer)
8.3 Application of this concept (hydraulically smooth and rough boundary)
8.4 Boundary layer thickness (Boundary layer thickness, momentum thickness, and displacement thickness)

9. Flow Past Through Submerged Bodies (3 hours)

9.1 Introduction to the drag and lift forces acting on a body
9.2 Expression for drag and lift forces
9.3 Pressure and friction drag; drag coefficients
9.4 Drag on a flat plate, cylinder and sphere
9.5 Concept of aerofoil.

10. Similitude and Physical Modeling (3 hours)

10.1 Introduction to dimensional analysis (physical quantities and their dimensions)
10.2 Methods of dimensional analysis (Rayleigh and Buckingham π-Theorem)
10.3 Similitude, laws of similarity, distorted and undistorted model Physical model and modeling criteria (Reynolds, Froude, Euler, Weber and Mach's model laws with some examples.)

Practical:

The following exercises will be performed in this course. These are:
1. Hydrostatic force on submerged body
2. Stability of a floating body
3. Verification of Bernoulli's equation
4. Impact of jet
5. Flow through edged orifice
6. Flow over broad-crested weir

Tutorial:

There shall be related tutorials exercised in class and given as regular homework exercises. Tutorials can be as following for each specified chapters.

1. Physical Properties of Fluids (3 hours)
   - Practical examples, numerical examples
2. Pressure and Head (3 hours)
   - Practical examples, numerical examples
3. Hydrostatics (6 hours)
   - Practical examples, and numerical examples
   - Use of computer programme (studied in I/I) for solving exercises
4. Hydrokinematics (2 hours)
   - Practical examples, numerical examples and derivation

5. Hydrodynamics (3 hours)
   - Practical examples, numerical examples and derivation
6. Flow measurements (4 hours)
   - Practical examples, numerical examples and derivation
   - Use of computer programme (studied in I/I) to solve some problems
7. Momentum principle and flow analysis (3 hours)
   - Practical examples, numerical examples and derivation
   - Use of computer programme (studied in I/I) to solve some problems
8. Flow past submerged bodies (2 hours)
   - Practical examples, numerical examples and derivation
9. Boundary layer theory (2 hours)
   - Practical examples, numerical examples and derivation
10. Similtude and physical modeling (2 hours)
    - Practical examples, numerical examples and derivation

References:

1. P.N. Modi and S. M. Seth "Fluid Mechanics and Hydraulics, Standard Book House.
2. Webber, N.B, "Fluid Mechanics for Civil Engineers", Chapman and Hall.
3. Victor and Street, "Elementary fluid mechanics", John Wiley and sons inc, third avenue, New York
4. D.S. Kumar "Fluid Mechanics and Fluid power Engineering", S.K. Kataria and Sons.
5. K. L. Kumar "Engineering Fluid Mechanics", Eurasia Publishing house (P) Ltd. Ram Nagar New Delhi.
6. S Ramamrutham "Hydraulics fluid mechanics and fluid machines",. DhanpatRai Publishing Company (P) Ltd. New Delhi.
7. D. P. Sangroula "Fundamentals of Fluid Mechanics", Nepal Printing Support, Anamnagar, Kathmandu.
8. P.K. Bansal "A text book of fluid Mechanics" Laxmi Publishers.

SURVEYING I
CE 504

Lecture : 3 **Year : II**
Tutorial : 0 **Part : I**
Practical : 3

Course Objectives:

To provide basic knowledge of land measurement and surveying techniques to civil engineering students, and make them to learn and understand the theory and field procedures by applying suitable surveying methods to produce map.

1. Introduction **(3 hours)**

1.1 1.1 History of Surveying
1.2 Principle of surveying
1.3 Disciplines of surveying and their significance

2. 2. Distance Measurements **(6 hours)**

2.1 Types of Measurements
2.2 Units of measurements, System of units, significant figures, rounding of numbers
2.3 Distance measurements techniques and instruments used
2.4 Errors, type of errorsandsources of errors in making measurements,precision and accuracy,
2.5 Introduction of scales used in surveying
2.6 Various corrections for linear distance measurements

3. Chain Survey **(3hours)**

3.1 Introduction
3.2 Principle and methods of chain survey, terms used in chain surveying
3.3 Field instruction of chain survey

4. The Compass **(7 hours)**

4.1 Introduction
4.2 The Brunton Compass, The bearings, azimuth
4.3 Local attraction, magnetic declination, typical compass problem
4.4 Compass traversing, errors and adjustment
4.5 Traverse plotting

5. Leveling **(8hours)**

5.1 Introduction
5.2 Basic principle and importance of leveling
5.3 Use of hand level
5.4 Level and level rods, turning point/turning plate, rod bubbles
5.5 Two peg test

5.6 Temporary and permanent adjustment of level
5.7 Booking and calculation of reduced level
5.8 Balancing back sight and fore sight
5.9 Curvature and refraction
5.10 Classification of leveling: differential leveling, fly leveling, profile leveling
5.11 Cross sectioning, reciprocal leveling, precise leveling
5.12 Adjustment of level circuits
5.13 Sources of errors in leveling

6. Plane Table Survey **(3 hours)**

6.1 Principles and methods of plane tabling
6.2 Advantages and disadvantages of plane tabling

7. Transit and Theodolite **(5 hours)**

7.1 Basic definition
7.2 Construction principle and parts of transit and theodolite
7.3 Temporary adjustment of transit and theodolite
7.4 Reading the transit and theodolite vernier and micrometer
7.5 Measurement of horizontal and vertical angles by direction and repetition methods.
7.6 Errors in transit and theodolite
7.7 Introduction on field application

8. Triangulation and Trilateration **(4hours)**

8.1 Basic definition
8.2 Principles of triangulation and trilateration
8.3 Classification of triangulation system
8.4 Introduction on field application

9. Computation of Area and Volume **(6 hours)**

9.1 Basic definition
9.2 Area by division into simple figures
9.3 Area by coordinates, area by double-meridian distance method.
9.4 Trapezoidal rule, Simpson's 1/3 rule
9.5 Volume by average end area, prismoidal formula, prismoidal correction, curvature correction, volume by transition area.
9.6 The mass diagram, overhaul, limit of economic overhaul and determination of overhaul.

10. Measurement (EDM)

10.1 Basic Introduction
10.2 Classification of EDM instruments
10.3 Propagation of electromagnetic Energy
10.4 Principle of Electronic Distance measurement
10.5 Electro optical, microwave and total station instruments.

Field/Practical: **(45 hours)**

1. Horizontal, Vertical and slope distance measurement 3
2. Area measurement by using chain, tape and compass. 6
3. Two peg test and differential leveling 6
4. profile and cross section Leveling 9
5. Measuring horizontal and vertical angles by direction and repetition methods. 12
6. Two sets of horizontal angles by direction of a polygon figures. 3
7. EDM demo 3
8. Area measurement computation of practical No2 3

References:

1. A. Banister and S. Raymond, "Surveying", ELBS
2. Paul R. Wolf, Russel C. Brinker, " Elementary Surveying" , Harper Collins College Publishers
3. BC Punmia , "Surveying", Laxmi Publication, New Delhi
4. SK Duggal, "Surveying", Tata McGraw Hill Education Private Limited New Delhi

CIVIL ENGINEERING MATERIALS
CE 506

Lecture : 2 **Year : II**
Tutorial : 0 **Part : I**
Practical : 2/2

Course Objectives:
To provide concept and knowledge of wide range of materials (composition, manufacturing, properties, uses, etc.) that can be used in the construction and maintenance of civil engineering structures.

1. Introduction to Civil Engineering Material **(2 hours)**
- 1.1 Scope of the Subject
- 1.2 Selection Criteria of Construction Material
- 1.3 Classification of Civil Engineering Material
- 1.4 Properties of Civil Engineering Material

2. Building Stones **(3 hours)**
- 2.1 Introduction
- 2.2 Characteristics of good building stones
- 2.3 Selection and use of stone
- 2.4 Deterioration and preservation of stone
- 2.5 Natural bed of stone
- 2.6 Dressing of stone

3. Clay Products **(3 hours)**
- 3.1 Introduction
- 3.2 Constituents of brick earth
- 3.3 Manufacture of bricks
- 3.4 Good qualities of bricks
- 3.5 Classification of bricks
- 3.6 Standard test for bricks
- 3.7 Tiles and their type
- 3.8 Earthen ware and Glazing

4. Lime **(2 hours)**
- 4.1 Introduction
- 4.2 Type, Properties and Uses of lime
- 4.3 Properties and uses of Pozzolanic material

5. Cement **(4 hours)**
- 5.1 Introduction
- 5.2 Type, Properties and Uses of cement
- 5.3 Ingredients of cement
- 5.4 Manufacture of cement (Flow Diagram)

5.5 Composition and function of cement clinker
5.6 Standard test of cement
5.7 Cement water Proofers
5.8 Admixtures

6. Mortar **(2 hours)**

6.1 Introduction
6.2 Classification of mortar
6.3 Function of mortar
6.4 Selection of mortar for civil engineering works

7. Timber **(3 hours)**

7.1 Introduction
7.2 Growth and structure of tree
7.3 Classification of tree
7.4 Characteristics of good timber
7.5 Defect of timber
7.6 Seasoning of timber
7.7 Deterioration and Preservation of timber
7.8 Commercial product of Timber

8. Metals and Alloys **(4 hours)**

8.1 Introduction
8.2 Type, Properties and Uses of iron
8.3 Composition and Properties of steel
8.4 Heat Treatment Process
8.5 Alloy of Steel
8.6 Non-ferrous Metals
8.7 Commercial product of Metals

9. Paints and Varnishes **(3 hours)**

9.1 Function, ingredient, Type and Uses of Paints and Varnishes
9.2 Distemper
9.3 Anti – termite treatment

10. Asphalt, Bitumen, Tar and Miscellaneous Materials **(4 hours)**

10.1 Type, Properties and Uses of Asphalt, Bitumen and Tar
10.2 Type, Properties and Uses of glass
10.3 Plastic Materials
10.4 Insulating Materials
10.5 Gypsum Products
10.6 Composite Materials

Practical:

1. Water absorption test and bulk specific gravity test on brick sample
2. Compressive strength test of brick and stone

3. Consistency test of cement
4. Setting time test of cement (Initial and Final)
5. Fineness and Soundness test of cement
6. Compressive strength of cement

Reference:

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