

**SMS Lucknow**  
**Department of Civil Engineering**  
**Session: 2020-21**

**A. Name of Subjects for Odd Semester**

SN	Name of subjects	Subject Code
1	Engineering Science Course/ Maths III	KOE 031-38 / KAS 303
2	Technical Communication/ Universal Human Values	KAS 301/ KVE 301
3	Engg. Mechanics	KCE 301
4	Surveying and Geomatics	KCE 302
5	Fluid Mechanics	KCE 303
6	Building Planning and Drawing Lab	KCE 351
7	Surveying and Geomatics Lab	KCE 352
8	Fluid Mechanics Lab	KCE 353
9	Mini Project or Internship Assessment	KCE 354
10	Computer System Security/ Python Programming	KNC 301/ KNC 302
11	Geotechnical Engineering	KCE 501
12	Structural Analysis	KCE 502
13	Quantity Estimation and Construction Management	KCE 503
14	Concrete Technology	KCE 051
15	Engineering Hydrology	KCE 055
16	CAD Lab	KCE 551
17	Geotechnical Engineering Lab	KCE 552
18	Quantity Estimation and Management Lab	KCE 553
19	Mini Project or Internship Assessment	KCE 554
20	Constitution of India	KNC 501
21	Rural Development Engineering	RCE 072
22	Railways, Airport and Water Ways	RCE 076
23	Design of Structure –III	RCE 701
24	Water Resources	RCE 702
25	Understanding the human being comprehensively - human aspirations and its fulfilment	ROE 074
26	Non Destructive Testing Lab	RCE 751
27	Mini Project	RCE 752
28	Industrial Training	RCE 753
29	Project-I	RCE 754

## B. Name of Subjects for Even Semester

SN	Name of subjects	Code
1	Maths III/ Engg. Science Course	KAS 403 / KOE 041-48
2	Universal Human Values/ Technical Communication	KVE 401 / KAS 401
3	Materials, Testing and Construction Practices	KCE 401
4	Introduction to Solid Mechanics	KCE 402
5	Hydraulic Engineering & Machines	KCE 403
6	Material Testing Lab	KCE 451
7	Solid Mechanics Lab	KCE 452
8	Hydraulics & Hydraulic Machine Lab	KCE 453
9	Python Programming / Computer System Security	KNC 402 / KNC 401
10	Design of Concrete Structures	KCE 601
11	Transportation Engineering	KCE 602
12	Environmental Engineering	KCE 603
13	Foundation Engineering	KCE 064
14	Transportation Engineering Lab	KCE 651
15	Environmental Engineering Lab	KCE 652
16	Structural Detailing Lab	KCE 653
17	Essence of Indian Traditional Knowledge	KNC 602
18	Solid Waste Management	RCE 084
19	Engineering Hydrology and Ground Water Management	
20	Renewable Energy Resources	ROE 086
21	Seminar	RCE 851
22	Project 2	RCE 852

## Course Outcomes \_Odd Semester Subjects

Session: 2020-21

<b>ENGINEERING MECHANICS [KCE 301] – THIRD SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Use scalar and vector analytical techniques for analyzing forces in statically determinate structures	K1, K4,K5
<b>CO2</b>	Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.	K2,K3,K4,K5
<b>CO3</b>	Apply basic knowledge of mathematics and physics to solve real-world problems.	K2, K3, K4,K5
<b>CO4</b>	Understand basic dynamics concepts – force, momentum, work and energy;	K2, K4,K6
<b>CO5</b>	Understand and be able to apply Newton's laws of motion;	K2, K4,K6
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>SURVEYING AND GEOMATICS [KCE 302] – THIRD SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Describe the function of surveying and work with survey instruments, take observations, and prepare plan, profile, and cross-section and perform calculations.	K1, K2,K5,K6
<b>CO2</b>	Calculate, design and layout horizontal and vertical curves.	K2,K4,K5
<b>CO3</b>	Operate a total station and GPS to measure distance, angles, and to calculate differences in elevation. Reduce data for application in a geographic information system.	K2, K3, K4,K5
<b>CO4</b>	Relate and apply principles of photogrammetry for surveying.	K3, K4,K6
<b>CO5</b>	Apply principles of Remote Sensing and Digital Image Processing for Civil Engineering Problems	K2,K3, K4,K6
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>FLUID MECHANICS [KCE 303] – THIRD SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Understand the broad principles of fluid statics, kinematics and dynamics	K1, K2,K4,K6
<b>CO2</b>	Understand definitions of the basic terms used in fluid mechanics	K2,K4,K5
<b>CO3</b>	Understand classifications of fluid flow	K2, K3, K4,K5
<b>CO4</b>	Apply the continuity, momentum and energy principles	K3, K4,K6
<b>CO5</b>	Apply dimensional analysis	K2,K3, K4
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>GEOTECHNICAL ENGINEERING [KCE 501] – FIFTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Classify the soil and determine its Index properties.	K1, K2, K5
<b>CO2</b>	Evaluate permeability and seepage properties of soil.	K4, K5
<b>CO3</b>	Interpret the compaction and consolidation characteristics & effective stress concept of soil.	K2, K3
<b>CO4</b>	Determine the vertical and shear stress under different loading conditions and explain the phenomenon of soil liquefaction.	K2, K4, K5
<b>CO5</b>	Interpret the earth pressure and related slope failures.	K1, K2, K6
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>STRUCTURAL ANALYSIS [KCE 502] – FIFTH SEMESTER</b>
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<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Explain type of structures and method for their analysis.	KI, K2, K4
<b>CO2</b>	Analyze different types of trusses for member forces.	K4, K5
<b>CO3</b>	Compute slope and deflection in determinate structures using different methods.	K1 K2, K4
<b>CO4</b>	Apply the concept of influence lines and moving loads to compute bending moment and shear force at different sections.	K2, K4, K5
<b>CO5</b>	Analyze determinate arches for different loading conditions.	K1, K4, K6
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>QUANTITY ESTIMATION AND CONSTRUCTION MANAGEMENT [KCE 503] – FIFTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Understand the importance of units of measurement and preliminary estimate for administrative approval of projects.	KI, K2, K5
<b>CO2</b>	Understand the contracts and tender documents in construction projects.	K2, K3
<b>CO3</b>	Analyze and assess the quantity of materials required for civil engineering works as per specifications.	K1 K2, K4
<b>CO4</b>	Evaluate and estimate the cost of expenditure and prepare a detailed rate analysis report.	K2, K4, K5
<b>CO5</b>	Analyze and choose cost effective approach for civil engineering projects.	K1, K3, K6
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>CONCRETE TECHNOLOGY [KCE 051] – FIFTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Understand the properties of constituent material of concrete.	K1, K2
<b>CO2</b>	Apply admixtures to enhance the properties of concrete.	K2, K3
<b>CO3</b>	Evaluate the strength and durability parameters of concrete.	K2, K4
<b>CO4</b>	Design the concrete mix for various strengths using difference methods.	K2, K4, K5, K6
<b>CO5</b>	Use advanced concrete types in construction industry.	K1, K3, K6
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>ENGINEERING HYDROLOGY [KCE 055] – FIFTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Understand the basic concept of hydrological cycle and its various phases.	K1, K2
<b>CO2</b>	Understand the concept of runoff and apply the knowledge to construct the hydrograph.	K2, K4
<b>CO3</b>	Apply the various methods to assess the flood.	K3, K4, K5, K6
<b>CO4</b>	Assess the quality of various forms of water and their aquifer properties.	K4, K5
<b>CO5</b>	Understand the well hydraulics and apply ground water modeling techniques.	K1, K2, K4, K5
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>STEEL STRUCTURE [RCE 701] – SEVENTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Introduction of Steel structure, its section. Design of connections (Bolted and welded). Design of Riveted connections.	KI, K3, K4
<b>CO2</b>	Analysis and design of single and double section tension members with Gusset plate. Study of lug angles and Splices.	K2, K4, K5
<b>CO3</b>	Analysis and design of compression members subjected to axial loads. Concept of Lacing and Battening.	K2, K3, K4
<b>CO4</b>	To study behavior of Roof trusses and their terminologies. Concept of Purlin and Principle rafter. Introduction to column bases, design of slab base and concrete block.	K1,K2, K3, K4, K5
<b>CO5</b>	Analysis and design simply supported laterally restrained steel beams. Introduction to plate girders and functions of various elements of a plate girder. Fabrication and erection of steel structures.	K1, K2,K3

**K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create**

<b>WATER RESOURCES [RCE 702] – SEVENTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Understanding the importance of Hydrology and Irrigation System.	K1, K2,K3
<b>CO2</b>	Designing of Irrigation Channels and Concepts of Lining in Channel.	K2,K4,K5
<b>CO3</b>	Concepts of Regulation works and study of Irrigation Outlet and River Training Works.	K2, K3, K4,K5
<b>CO4</b>	Application of Canal Head Works and Cross Drainage Works.	K3, K4,K6
<b>CO5</b>	Analysis of Dams and Spillways and to study about the Hydroelectric Power Generation.	K2,K3, K4
K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create		

<b>Railways, Airport &amp; Water Ways – SEVENTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Understand the history of railway development, their alignment & Survey.	KI, K3, K4
<b>CO2</b>	Design the various geometric parameters of railway.	K2, K4, K5
<b>CO3</b>	Study the traffic characteristics & design of railways, water ways intersections & signals.	K2, K3, K4
<b>CO4</b>	Examine the properties of railways, airport, water ways materials & their implementation in design parameter.	K1,K2, K3, K4,
<b>CO5</b>	Learn methods to construct various types of railways route, water ways, airport.	K1, K2,K3

**K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create**

<b>Rural Development Engineering– SEVENTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	To introduction about Rural Development Planning and Concept of Appropriate Technology, Scope,Rural,development programme/ projects.	KI, K3, K4
<b>CO2</b>	To study about Rural Housing: Low cost construction materials,Composite material - ferro-cement & fly ash,Earthquake resistant measures for low cost houses.	K2, K4, K5
<b>CO3</b>	Water Supply and Rural Sanitation: Sources of water. BIS & WHO water standards.	K2, K3, K4
<b>CO4</b>	Low Cost Roads and Transport: Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases,	K1,K2, K3, K4,
<b>CO5</b>	Low Cost Irrigation: Consideration of low cost irrigation techniques , drip & sprinkler irrigation systems.	K1, K2,K3

**K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create**



## Course Outcomes \_Even Semester Subjects

**Session: 2020-21**

<b>MATERIALS, TESTING AND CONSTRUCTION PRACTICES [KCE 401] – FOURTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Identify various building materials and to understand their basic properties.	K1, K2
<b>CO2</b>	Understand the use of non-conventional civil engineering materials.	K2, K3
<b>CO3</b>	Study suitable type of flooring and roofing in the construction process.	K1,K2, K6
<b>CO4</b>	Characterize the concept of plastering, pointing and various other building services.	K2, K6
<b>CO5</b>	Exemplify the various fire protection, sound and thermal insulation techniques, maintenance and repair of buildings.	K1, K2, K3
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>INTRODUCTION TO SOLID MECHANICS [KCE 402] – FOURTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Describe the concepts and principles of stresses and strains	K1, K2, K4,K5
<b>CO2</b>	Analyze solid mechanics problems using classical methods and energy methods	K2, K4
<b>CO3</b>	Analyze structural members subjected to combined stresses	K4, K5, K6
<b>CO4</b>	Calculate the deflections at any point on a beam subjected to a combination of loads	K4, K5, K6
<b>CO5</b>	Understand the behavior of columns, springs and cylinders against loads.	K1, K2, K3

**K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create**

<b>HYDRAULIC ENGINEERING AND MACHINES [KCE 403] – FOURTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Apply their knowledge of fluid mechanics in addressing problems in open channels.	K1, K2, K4,K5
<b>CO2</b>	Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.	K2, K4
<b>CO3</b>	Analytical, graphical and numerical methods of varied flow.	K4, K5, K6
<b>CO4</b>	Evaluation of the jump elements in rectangular channels on horizontal and sloping beds.	K4, K5, K6
<b>CO5</b>	Have knowledge in hydraulic machineries like pumps and turbines.	K1, K2, K3
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>DESIGN OF CONCRETE STRUCTURES [KCE 601] – SIXTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Analyze and Design RCC beams for flexure by IS methods.	K1, K2, K4
<b>CO2</b>	Analyze and Design RCC beams for shear by IS methods.	K1, K2, K4
<b>CO3</b>	Analyze and Design RCC slabs and staircase by IS methods	K3,K4,K5, K6
<b>CO4</b>	Design the RCC compression members by IS methods.	K3,K4,K5, K6
<b>CO5</b>	Design various types of footings and cantilever retaining wall.	K3,K4,K5, K6

**K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create**

<b>TRANSPORATION ENGG. [KCE 602] – SIXTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Understand the history of road development, their alignment & Survey.	KI, K3, K4
<b>CO2</b>	Design the various geometric parameters of road.	K2, K4, K5
<b>CO3</b>	Study the traffic characteristics & design of road intersections & signals.	K2, K3, K4
<b>CO4</b>	Examine the properties of highway materials & their implementation in design of pavements.	K1,K2, K3, K4,
<b>CO5</b>	Learn methods to construct various types of roads.	K1, K2,K3
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>ENVIRONMENTAL ENGG. [KCE 603] – SIXTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Assess water demand and optimal size of water mains.	KI, K2, K4
<b>CO2</b>	Layout the distribution system & assess the capacity of reservoir.	K2, K4, K5
<b>CO3</b>	Investigate physical, chemical & biological parameter of water.	K1, K2, K3, K4
<b>CO4</b>	Design treatment units for water and waste water.	K2, K3, K4, K6
<b>CO5</b>	Apply emerging technologies for treatment of waste water.	K2,K3, K4
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>FOUNDATION DESIGN [KCE 064] – SIXTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Understand various methods of Soil Exploration and its importance.	KI, K2
<b>CO2</b>	Analyze bearing capacity and settlement of soil for shallow foundation.	K4, K5
<b>CO3</b>	Design the various types of shallow foundation and understand the basics of deep foundation.	K2, K4, K5
<b>CO4</b>	Understand the characteristics of well foundations and retaining wall.	K2, K6
<b>CO5</b>	Understand the concept of soil reinforcement.	K2,K3, K4
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>ENGINEERING HYDROLOGY AND GROUND WATER MANAGEMENT [RCE 085] –EIGHTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Understand the concept of Hydrology and applications of Precipitation.	K1, K2,K3
<b>CO2</b>	To study about Hydrographs and concepts of Run Off.	K2,K4,K5
<b>CO3</b>	Analysis of Flood and Flood Routing.	K2, K3, K4,K5
<b>CO4</b>	Study and applications of Ground Water Management.	K2,K3, K4,K6
<b>CO5</b>	To observe Ground water quality and behaviour of water wells.	K2,K3, K4
<b>K1-Remember, K2-Understand, K3-Apply, K4-Analyze , K5-Evaluate , K6-Create</b>		

<b>Solid Waste Management – EIGHTH SEMESTER</b>		
<b>Course Outcome (CO)</b>		<b>Bloom's Knowledge Level (KL)</b>
<b>CO1</b>	Solid waste management Public health and ecological impacts.	K1, K3, K4
<b>CO2</b>	Transportation: handcart, tri-cycle, animal cart, tripper truck, dumper placer, bulk refuse.	K2, K4, K5
<b>CO3</b>	Landfilling, Site selection criteria, landfill layout, landfill sections, Occurrence of gases.	K2, K3, K4
<b>CO4</b>	To study about Composting, types of composting, process description, design and operational consideration	K1, K2, K3, K4,
<b>CO5</b>	Introduction to Electronic waste and Biomedical waste and their disposal.	K1, K2, K3

**DR. A.P.J ABDUL KALAM TECHNICAL  
UNIVERSITY, LUCKNOW  
EVALUATION SCHEME & SYLLABUS  
FOR  
B. TECH. SECOND YEAR  
(CIVIL ENGINEERING)  
  
ENGINEERING MECHANICS  
(L-T-P 3-1-0) Credit – 4**

**Course Outcomes:** At the end of this course the student will be able to-

1. Use scalar and vector analytical techniques for analyzing forces in statically determinate Structures.
2. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. Apply basic knowledge of mathematics and physics to solve real-world problems.
4. Understand basic dynamics concepts – force, momentum, work and energy;
5. Understand and be able to apply Newton's laws of motion;

**UNIT - I**

Introduction to Engineering Mechanics: Force Systems, Basic concepts, Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Applications; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems.

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; [8 Hours]

**UNIT- II**

Centroid and Centre of Gravity, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. [8 Hours]

**UNIT – III**

Basic Structural Analysis, Equilibrium in three dimensions; Analysis of simple trusses by method of sections & method of joints, Zero force members, Simple beams and support reactions. [8 Hours]

**UNIT - IV**

Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). [8 Hours]

**UNIT -V**

Introduction to Kinetics of Rigid Bodies, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems;

D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation

Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, Applications of energy method for equilibrium, Stability of equilibrium. [8 Hours]

### **Books and References**

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press.
5. Shames and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
10. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications
11. Strength of Materials by Timoshenko and Youngs, East West Press.
12. Textbook of Applied Mechanics-Dynamics and Statics by Prasad I.B, Khanna Publications.

## **SURVEYING & GEOMATICS**

**(L-T-P 3-1-0) Credit – 4**

**Course Outcomes:** At the end of this course the student will be able to-

1. Describe the function of surveying and work with survey instruments, take observations, and prepare plan, profile, and cross-section and perform calculations.
2. Calculate, design and layout horizontal and vertical curves.
3. Operate a total station and GPS to measure distance, angles, and to calculate differences in Elevation. Reduce data for application in a geographic information system.
4. Relate and apply principles of photogrammetry for surveying.
5. Apply principles of Remote Sensing and Digital Image Processing for Civil Engineering Problems.

### **UNIT - I**

Introduction to Surveying: Definition, Classification, Principles, Survey stations and Survey lines; Introduction to measurement of distance, direction and elevation; Ranging and its methods,

Meridians and Bearings, Methods of leveling, Booking and reducing levels, Reciprocal leveling, distance of visible horizon, Profile leveling and cross sectioning, Errors in leveling; Introduction to methods of plane table surveying; Contouring: Characteristics, methods, uses, computation of areas and volumes. Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Methods of horizontal and vertical control, Triangulation:

Figures or systems, Signals, Satellite station, Baseline and its importance, corrections, Trigonometric leveling: Accessible and inaccessible objects. [8 Hours]

#### **UNIT - II**

Curves: Elements of simple circular curves, Theory and methods of setting out simple circular curves, Transition curves- types, characteristics and equations of various transition curves; Introduction to vertical curves. [8 Hours]

#### **UNIT - III**

Modern Field Survey Systems: Principle and types of Electronic Distance Measurement systems and instruments, Total Station- its advantages and applications; Global Positioning Systems-Segments, working principle, errors and biases. Geographic Information System: Concepts and data types, data models, data acquisition. GIS applications in civil engineering. [8 Hours]

#### **UNIT - IV**

Photogrammetric Survey: basic principles, aerial camera, scale of a vertical photograph, relief displacement of a vertical photograph, height of object from relief displacement, flight planning for aerial photography, selection of altitude, interval between exposures, crab and drift, stereoscope and stereoscopic views, parallax equations. Introduction to digital photogrammetry. [8 Hours]

#### **UNIT - V**

Remote Sensing: Concepts and physical basis of Remote Sensing, Electromagnetic spectrum, atmospheric effects, image characteristics. Remote sensing systems, spectral signatures and characteristics spectral reflectance curves. Salient features of some of Remote Sensing satellites missions. Digital image processing: Introduction, image rectification and restoration, image enhancement, image transformation, image classification. Applications of remote sensing to civil engineering. [8 Hours]

#### **Books and References:**

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
6. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House.
7. Punmia BC et al: Surveying Vol. I, II, Laxmi Publication
8. Chandra AM and Ghosh SK: Remote Sensing and Geographical Information System, Alpha Science
9. Ghosh SK: Digital Image Processing, Alpha Science
10. Lillesand T M et al: Remote Sensing & Image Interpretation, John Wiley & Sons
11. Bhatta B: Remote Sensing and GIS, Oxford University Press, 2008

### **FLUID MECHANICS (L-T-P 3-0-0) Credit – 3**

**Course Outcomes:** At the end of this course the student will be able to-



1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Apply the continuity, momentum and energy principles
5. Apply dimensional analysis

### **UNIT I**

Fluid and continuum, Physical properties of fluids, Rheology of fluids. Pressure-density height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis. [8 Hours]

### **UNIT II**

Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, path lines, streak lines, stream tube, continuity equation for 1-D, 2-D and 3-D flows, circulation, stream function and velocity potential function. [8 Hours]

### **UNIT III**

Potential Flow: source, sink, doublet and half-body. Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturimeter and bend meter, notches and weirs, momentum equation and its application to pipe bends. resistance to flow, Minor losses in pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks. [8 Hours]

### **UNIT IV**

Equation of motion for laminar flow through pipes, Stokes' law, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, Boundary layer thickness, boundary layer over a flat plate, displacement, momentum and energy thickness. Application of momentum equation. Laminar boundary layer, turbulent boundary layer, laminar sub-layer, separation and its control. Vortex Flow: Free & Forced. [8 Hours]

### **UNIT V**

Drag and lift, drag on a sphere, aerofoil, Magnus effect, Similarity Laws; geometric, Kinematics and dynamic similarity, undistorted and distorted model studies, Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance. Introduction to Computational Fluid Dynamics (CFD). [8 Hours]

### **Books and References**

1. Hibbler, "Fluid Mechanics in SI Units" 1/e Pearson Education, Noida.
2. Fox & Donald, "Introduction to Fluid Mechanics" John Wiley & Sons Pvt Ltd,
3. Cengel & Cimbala, "Fluid Mechanics" TMH, New Delhi.
4. Katz, "Introductory Fluid Mechanics" Cambridge University Press
5. Pnueli & Gutfinger, "Fluid Mechanics" Cambridge University Press
6. Modi & Seth "Hydraulics & Fluid Mechanics" Standard Publications.

7. Gupta, "Fluid Mechanics & Hydraulic Machines" Pearson Education, Noida
8. Graebel, "Engineering Fluid Mechanics", CRC Press Taylor & Francis Group.
9. Janna, "Introduction to Fluid Mechanics" 4/e, CRC Press Taylor & Francis Group.
10. AK Jain "Fluid Mechanics" Khanna Publication.
11. White, F.M. "Fluid Mechanics" TMH, New Delhi.
12. Munson et al, "Fundamental of Fluid Mechanics" Wiley Newyork Ltd
13. Garde, R.J., " Fluid Mechanics", SciTech Publications Pvt. Ltd
14. I.H. Shames, "Mechanics of Fluids", McGraw Hill, Int. Student.
15. RK Bansal "Fluid Mechanics and Hydraulic Machines" Laxmi Publication
16. Jagdish Lal "Fluid Mechanics"
17. N Narayan Pillai " Principles of Fluid Mechanics & Fluid Machines" Universities Press.
18. Esposito, Fluid Power & Applications" 7/e Pearson Education, Noida.
19. DR Malhotra & Malhotra, "Fluid Mechanics Hydraulics & Hydraulic Machines" Satya Prakashan, New Delhi.

**BUILDING PLANNING & DRAWING LAB**  
**(L-T-P 0-0-2) Credit – 1**

Drawing and drafting of following with CAD/BIM software

1. Introduction to the tools and commands of drafting software.
2. Working in layers, blocks, x-ref, drawing layout and print setup.
3. 3D drafting and rendering
4. Planning and drafting of elevation and cross section of door and window
5. Planning and drafting of plan and cross section of Dog legged and open well staircase.
6. Planning and Drawings of Residential building of 1 room set (plan and section).
7. Planning and drawing of 3 room residential building with staircase.
8. Preparation of details general arrangement drawing of 4 room duplex house including planning and drafting

**SURVEYING & GEOMATICS LAB**  
**(L-T-P 0-0-2) Credit – 1**

1. To measure bearings of a closed traverse by prismatic compass and to adjust the traverse by graphical method.
2. To find out reduced levels of given points using Auto/dumpy level.
3. To study parts of a Vernier and electronic theodolite and measurement of horizontal and vertical angle.
4. To measure horizontal angle between two objects by repetition/reiteration method.
5. To determine the height of a vertical structure (e.g. chimney/ water tank etc.) using trigonometrical leveling by taking observations in single vertical plane.
6. To set out a simple circular curve by Rankine's method.
7. Demonstration and working on Electronic Total Station. Measurement of distances, horizontal & vertical angles, coordinates and area of a land parcel.
8. Demonstration and working with Mirror stereoscopes, Parallax bar and Aerial photographs.
9. Visual Interpretation of standard FCC (False colour composite).
10. Digitization of physical features on a map/image using GIS software.
11. Coordinates measurement using GPS.

## **FLUID MECHANICS LAB**

**(L-T-P 0-0-2) Credit – 1**

Note: Students will perform minimum 10 experiments from the following:

1. To verify the momentum equation using the experimental set-up on impact of jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To calibrate a Venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.
5. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
6. Verification of Bernoulli's Theorem
7. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
8. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
9. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
11. To determine Meta-centric height of a given ship model.
12. To determine the head loss for a sudden enlargement, sudden contraction and losses in bend.
13. Flow Visualization -Ideal Flow
14. To make studies in Wind Tunnel (Aerofoil and circular cylinder).

## **Materials, Testing & Construction Practices**

**(L-T-P 3-0-0) Credit – 3**

Course Outcomes: At the end of this course the student will be able to-

1. Identify various building materials and to understand their basic properties.
2. Understand the use of non-conventional civil engineering materials.
3. Study suitable type of flooring and roofing in the construction process.
4. Characterize the concept of plastering, pointing and various other building services.
5. Exemplify the various fire protection, sound and thermal insulation techniques, maintenance and repair of buildings.

### **UNIT I**

Scope of Study of building Materials: building materials and their performance, economics of the building materials.

Stones: Requirement of good building stone, characteristics of building stone and their testing. Common building stones.

Bricks: Manufacturing process of clay bricks, classification of clay bricks. Properties of clay bricks, testing methods for clay bricks. Problems of efflorescence & lime bursting in bricks & tiles. Different types of bricks.

Gypsum: properties of gypsum plaster, building products made of gypsum and their uses.

Cement: Raw materials used, Process of Manufacturing, Chemical composition, compounds formed and their effect on strength, Types of cement, Testing of cement properties, Uses of

cement.

Cement Concrete: Constituent materials and their properties, Grades of concrete, Factors affecting strength, Properties of concrete at fresh and hardened stage, Testing of concrete, Methods of Curing of concrete.

Pozzolona: Chemical composition and requirements for uses, Natural and Artificial flyash, Surkhi(burnt clay pozzolona), rice husk and ash pozzolona, properties and specifications for use in construction. Timber: Classification and identification of timber, Fundamental Engineering

Properties of timber, Defects in timber, Factor affecting strength of timber, Methods of seasoning and preservation of timber. Wood based products.

Asphalt: Bitumen and Tar: Terminology, specifications and uses, Bituminous materials.

[8 Hours]

## **UNIT II**

Plastics: classification, advantages of plastics, Mechanical properties and use of plastic in construction. Paints, varnishes and distempers: Common constituents, types and desirable properties, Cement paints. Ferrous metals: Desirable characteristics of reinforcing steel. Principles of cold working. Strength, Telemechanical, physical Properties and chemical composition. Brief discussion on properties and uses of Aluminum and lead. Glass: Ingredients, properties types and use in construction. Insulating Materials: Thermal and sound insulating material, desirable properties and types.

[8 Hours]

## **UNIT III**

Building Construction: Components of building area considerations, Construction Principle and Methods for layout, Damp proofing, anti termite treatment in buildings, Vertical circulation: stair cases and their types and planning. Different types of floors, and flooring materials .Bricks and stone masonry construction. Cavity wall & hollow block construction.

[8 Hours]

## **UNIT IV**

Doors and Windows: Construction details, types of doors and windows and their relative advantages & disadvantages. Types of roof and roof treatments, Lintel sand Chhajja, Principles of building Planning.

[8 Hours]

## **UNIT V**

Natural Ventilation, Water Supply and Sanitary fittings (Plumbing), Electric Fittings. Heating Ventilation & Air conditioning (HVAC), Mechanical Lifts and Escalators, Fire Fighting and Fire Protection of Buildings. Acoustics. Plastering and its types, pointing, Distempering, Colour washing, Painting etc. Principles & Methods of building maintenance.

[8 Hours]

## **Books and References**

1. SK Duggal, "Building Materials" New Age International
2. Purushothama Raj, "Building Construction Materials & Techniques" Pearson Edu.
3. PC Varghese, "Building Materials" PHI
4. Rangwala, "Building Materials" Charotar Publishing House.
5. Sushil Kumar, "Building Construction" Standard Publisher.
6. Domone, "Construction Materials" 4/e, CRC Press Taylor & Francis Group.
7. Adams, "Adams' Building Construction Adams" CRC Press Taylor & Francis Group.
8. BC Punmia, "Building Construction" Laxmi Publication.
9. Jha & Sinha, "Building Construction" Khanna Publishers

10. Sahu, "Building Materials and Construction" Mc Grew Hill Education
11. Deodhar, "Civil Engineering Materials" Khanna Publishers
12. Mehta, "Building Construction Principles, Materials & Systems" 2/e, Pearson Education Noida.
13. Sandeep Mantri, "Practical building Construction and its Management" Satya Publisher, NewDelhi.
14. Khanna S. K., Justo C.E.G, & Veeraragavan A., "Highway Materials and Pavement Testing", Nem Chand and Bros.
15. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO etc.
16. Chudley, R. Greeno, Building Construction Handbook, Butterworth

## **INTRODUCTION TO SOLID MECHANICS**

**(L-T-P 3-1-0) Credit – 4**

**Course Outcomes:** At the end of this course the student will be able to-

1. Describe the concepts and principles of stresses and strains
2. Analyze solid mechanics problems using classical methods and energy methods
3. Analyze structural members subjected to combined stresses
4. Calculate the deflections at any point on a beam subjected to a combination of loads
5. Understand the behavior of columns, springs and cylinders against loads.

### **UNIT I**

Simple stress and strains:

Concept of stress and strain, types of stresses and strains, Hook's law, stress and strain diagram for ductile and brittle metal. Lateral strain, Poission ratio, volumetric strain, elastic moduli and relation between them. Bar of varying cross section, composite bar and temperature stress. Strain energy for gradual, sudden and impact loading.

Compound stress and strains: Normal stress and strain, shear stress and strain, stresses on inclines sections, principal stress and strain, maximum shear stress, Mohr's stress circle, three dimensional state of stress & strain, equilibrium equations, generalized Hook's law-3D, Theories of failure and factor of safety. [8 Hours]

### **UNIT II**

Shear force and bending moment diagrams

Shear force (SF) and Bending moment (BM) diagrams for simply supported, cantilevers, overhanging and fixed beams. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads. [8 Hours]

**UNIT III** Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation:  $M/I = f/y = E/R$  - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.

Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections. [8 Hours]

#### **UNIT IV**

Deflection of Beams: Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

Short Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules. [8 Hours]

#### **UNIT V**

Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs.

Thin cylinders, Thick cylinders & Spheres: Introduction, difference between thin walled and thick walled pressure vessels, thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain. Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders. [8 Hours]

#### **Books and References:**

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of material by Gere, Cengage Learning
3. Mechanics of Materials by Beer, Jhonston, DEwolf and Mazurek, MCGRAW HILL INDIA
4. Strength of Materials by Pytel and Singer, Harper Collins
5. Strength of Materials by Ryder, Macmillan.
6. Strength of Materials by Timoshenko and Youngs, East West Press.
7. Introduction to Solid Mechanics by Shames, Pearson
8. Mechanics of material by Pytel, Cengage Learning
9. An Introduction to Mechanics of Solids by Crandall, MCGRAW HILL INDIA
10. Strength of Materials by Jindal, Pearson Education
11. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.
12. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.

### **HYDRAULIC ENGINEERING & MACHINES**

**(L-T-P 3-1-0) Credit – 4**

**Course Outcomes:** At the end of this course the student will be able to-

1. Apply their knowledge of fluid mechanics in addressing problems in open channels.
2. Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
3. Have knowledge in hydraulic machineries like pumps and turbines.

#### **UNIT I**

Introduction : Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels critical, subcritical and super-critical type of flows. Critical depth, concepts of specific energy and specific force. Chezy's and Manning's equations for uniform flow in open channel, Velocity distribution, most efficient channel section, compound sections. [8 Hours]

#### **UNIT II**

Energy-Depth relationship: Application of specific energy principle for interpretation of open channel phenomena, flow through vertical and horizontal contractions. Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods. Measurements of

discharge & velocity – Venturi flume, Standing wave flume, Parshall flume, Broad crested weir, Current meter and Floats. [8 Hours]

### **UNIT III**

Rapidly varied flow: Hydraulic jump; Evaluation of the jump elements in rectangular channels on horizontal and sloping beds, energy dissipater, open channel surge, celerity of the gravity wave, deep and shallow water waves. [8 Hours]

### **UNIT IV**

Impulse momentum equation- Impact of Jets-plane and curved- stationary and moving plates. Pumps: Positive displacement pumps - reciprocating pumps , centrifugal pumps, operation, velocity triangles, performance curves, Cavitation, Multi staging, Selection of pumps. [8 Hours]

### **UNIT V**

Rotodynamic Machines, Pelton Turbine, equations for jet and rotor size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, Head on reaction turbine, unit quantities, similarity laws and specific speed, cavitation, characteristic curves. [8 Hours]

### **Books and References**

1. Chow, V.T. "Open Channel hydraulics" McGraw Hill Publication
2. Subramanya, K., Flow through Open Channels, TMH, New Delhi
3. Ranga Raju, K.G., Flow through open channels, T.M.H. New Delhi
4. Rajesh Srivastava, Flow through Open Channels , Oxford University Press
5. Streeter, V.L.& White E.B., "Fluid Mechanics" McGraw Hill Publication
6. Modi & Seth "Hydraulics & Fluid Mechanics" Standard Publications.
7. RK Bansal "Fluid Mechanics and Hydraulic Machines" Laxmi Publication
8. AK Jain "Fluid Mechanics" Khanna Publication.
9. Houghtalen, "Fundamentals of Hydraulics Engineering Systems" 4/e Pearson Education, Noida

## **MATERIAL TESTING LAB (L-T-P 0-0-2) Credit – 1**

Testing of various properties of following materials as per BIS specifications

### **I. Cement**

1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement by air permeability and Le-chatalier's apparatus.
5. Soundness of cement.
6. Tensile strength

### **II. Coarse Aggregate**

1. Water absorption of aggregate
2. Sieve Analysis of Aggregate
3. Specific gravity & bulk density
4. Grading of aggregates.

### **III Fine Aggregate:**

1. Sieve analysis of sand
2. Silt content of sand

3. Bulking of sand

IV Bricks:

**1. Water absorption.**

2. Dimension Tolerances

3. Compressive strength

4. Efflorescence

**SOLID MECHANICS LAB**

**(L-T-P 0-0-2) Credit – 1**

Note: Students will perform minimum 10 experiments from the following:

1. Tension test on Mild Steel
2. Bending tests on simply supported beam and Cantilever beam.
3. Determination of torsion and deflection,
4. Measurement of forces on supports in statically determinate beam,
5. Determination of shear forces in beams,
6. Determination of bending moments in beams,
7. Measurement of deflections in statically determinate beam.
8. To determine Flexural Rigidity (EI) of a given beam
9. To find deflection of curved members.
10. To find Critical load in Struts with different end conditions.
11. Hardness Test (Brinell's and Rockwell)
12. Impact test (Charpy and IZOD)

**Hydraulics & Hydraulic Machine Lab**

**(L-T-P 0-0-2) Credit – 1**

Note: Students will perform minimum 10 experiments from the following:

1. To determine the Manning's coefficient of roughness 'n' for the bed of a given flume.
2. To study the velocity distribution in an open channel and to determine the energy and Momentum correction factors.
3. To study the flow characteristics over a hump placed in an open channel.
4. To study the flow through a horizontal contraction in a rectangular channel.
5. To calibrate a broad-crested weir.
6. To study the characteristics of free hydraulic jump.
7. To study centrifugal pump and their characteristics
8. To study characteristics of Pelton Turbine.
9. To study characteristics Francis Turbine.
10. To study characteristics of Kaplan Turbine.
11. To study the free over-fall phenomenon in an open channel and to determine the end depth
12. To determine coefficient of discharge for given rectangular notch.



**DR. A.P.J ABDUL KALAM TECHNICAL UNIVERSITY,  
LUCKNOW EVALUATION SCHEME & SYLLABUS  
FOR B. TECH. THIRD YEAR (CIVIL ENGINEERING)  
(Effective from session 2020-21)**

**KCE 501 GEOTECHNICAL ENGINEERING**

**(L-T-P 3-1-0) Credit – 4**

Course Outcomes: After completion of the course student will be able to:

**CO-1** Classify the soil and determine its Index properties.

**CO-2** Evaluate permeability and seepage properties of soil.

**CO-3** Interpret the compaction and consolidation characteristics & effective stress concept of soil.

**CO-4** Determine the vertical and shear stress under different loading conditions and explain the phenomenon of soil liquefaction.

**CO-5** Interpret the earth pressure and related slope failures.

**Unit 1**

Origin and classification: Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Weight volume relationships, Clay minerals, Soil structure, Index properties, sensitivity and thixotropy, Particle size analysis, Unified and Indian standard soil classification system. [8]

**Unit 2**

Soil Hydraulics: Stress conditions in soil- total, effective and neutral stresses and relationships. Permeability - Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil. Seepage, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, capillarity, critical hydraulic gradient and quick sand condition, uplift pressure, piping.

**Unit 3**

Soil compaction, water content - dry unit weight relationships. Factors controlling compaction. Field compaction equipment; field compaction control; Proctor needle method. Consolidation: Primary

and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Consolidation test, Normal and Over Consolidated soils, Over Consolidation Ratio, determination of coefficient of consolidation.

#### **Unit 4**

Stress Distribution in soil: Elastic constants of soils and their determination, Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under loaded areas, Concept of pressure bulb, contact pressure. Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test; unconfined compression test; pore pressure, Skempton's pore pressure coefficients, and Soil liquefaction.

#### **Unit 5**

Earth pressure: Classical theories, Coulomb and Rankine's approaches for frictional and  $c-\phi$  soils, inclined backfill, Graphical methods of earth pressure determination. Stability of slopes - finite and infinite slopes, types of slope failure, Culmann's method & Method of slices, Stability number & chart, Bishop's method. [

### **KCE502 STRUCTURAL ANALYSIS**

**(L-T-P 3-1-0) Credit – 4**

Course Outcomes: After completion of the course student will be able to:

**CO-1** Explain type of structures and method for their analysis.

**CO-2** Analyze different types of trusses for member forces.

**CO-3** Compute slope and deflection in determinate structures using different methods.

**CO-4** Apply the concept of influence lines and moving loads to compute bending moment and shear force at different sections.

**CO-5** Analyze determinate arches for different loading conditions.

#### **Unit 1**

Classification of Structures, Types of structural frameworks and Load transfer Mechanisms, stress resultants, degrees of freedom, Static and Kinematic Indeterminacy for beams, trusses and building frames. Analysis of cables with concentrated and continuous loadings, Effect of Temperature upon length of cable. [8]

#### **Unit 2**

Classification of Pin jointed determinate trusses, Analysis of determinate plane trusses (compound and complex). Method of Substitution, Method of tension coefficient for analysis of plane trusses. [8]

#### **Unit 3**

Strain Energy of deformable systems, Maxwell's reciprocal & Betti's theorem, Castigliano's theorems, Calculations of deflections: Strain Energy Method and unit load method for statically determinate beams, frames and trusses. Deflection of determinate beams by Conjugate beam method. [8]

#### **Unit 4**

Rolling loads and influence line diagrams for determinate beams and trusses, Absolute maximum bending moment and shear force. Muller-Breslau's principle & its applications for determinate structures. [8] Unit 5 Arches, Types of Arches, Analysis of three hinged parabolic and circular Arches. Linear arch, Eddy's theorem, spandrel braced arch, moving load & influence lines for three hinged parabolic arch. [8]

#### **Unit 5**

Arches, Types of Arches, Analysis of three hinged parabolic and circular Arches. Linear arch, Eddy's theorem, spandrel braced arch, moving load & influence lines for three hinged parabolic arch. [8]

### **KCE 503 QUANTITY ESTIMATION AND CONSTRUCTION MANAGEMENT**

**(L-T-P 3-1-0) Credit – 4**

**Course Outcomes:** After completion of the course student will be able to:

**CO-1** Understand the importance of units of measurement and preliminary estimate for administrative approval of projects.

**CO-2** Understand the contracts and tender documents in construction projects.

**CO-3** Analyze and assess the quantity of materials required for civil engineering works as per specifications.

**CO 4** Evaluate and estimate the cost of expenditure and prepare a detailed rate analysis report.

**CO-5** Analyze and choose cost effective approach for civil engineering projects.

#### **Unit 1**

Quantity Estimation for Buildings Measurement units for various building materials, Centreline method, Long and short wall method of estimates, Types of estimates, PWD schedule of rate. [8]

#### **Unit 2**

Rate Analysis, Specification and Tenders Analysis of rates knowing cost of material, labour, equipment, overheads, profit, taxes etc, Specifications – Preparation of detailed and general specifications, Legal aspects of contracts, laws related to contracts, land acquisition, labour safety and welfare. Different types of contracts, their relative advantages and disadvantages. Elements of tender preparation, process of tendering, pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract extra items. [8]

#### **Unit 3**

Elements of Management & Network Techniques Project cycle, Organization, planning, scheduling, monitoring, updating and management system in construction, Bar charts, milestone charts, work break down structure and preparation of networks. Network Techniques like PERT & CPM in construction management. Project monitoring and resource allocation through network techniques. [8]

#### **Unit 4**

Equipment Management Productivity, operational cost, owning and hiring cost and the work motion study. Simulation techniques for resource scheduling. Construction Equipment for earth moving, earth compaction, Hauling Equipment, Hoisting Equipment, Conveying Equipment, Concrete Production Equipment, Tunnelling Equipment [8]

#### **Unit 5**

Project Cost Management Budgeting, Cost planning, Direct Cost, Indirect cost, Total Cost Curve, Cost Slope. Time value of money, Present economy studies, Equivalence concept, financing of projects, economic comparison, present worth method Equivalent annual cost method, discounted cash flow method, Depreciation and its type, depletion, Arbitration, and break even cost analysis. [8]

### **KCE-551 CAD LAB (L-T-P 0-0-2) Credit- 1**

1. Working on latest version of geotechnical engineering software (Open source/commercial software)
2. Working on latest version of surveying software (Open source/commercial software)

### **KCE-552 GEOTECHNICAL ENGINEERING LAB (L-T-P 0-0-2) Credit- 1**

#### **PART -A (To be performed in lab)**

1. Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method.
2. Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method.
3. Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method.
4. Determination of relative density of a given soil sample.
5. Determination of complete grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis.
6. Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample used in experiment no. 5 (grain-size analysis).
7. Determination of shear strength of soil by Direct shear test.

8. Determination of compaction characteristics (OMC & MDD) of a given soil sample.
9. Determination of permeability of a remoulded soil sample by constant head &/or falling head method.
10. Determination of consolidation characteristics of a remoulded soil sample by an odometer test.
11. Determination of shear strength characteristics of a given soil sample by U/U test from Triaxial Compression Machine.
12. Retrieving soil samples and conducting SPT tests by advancing boreholes through hand-held auger.

**Note:** Any 8 experiments are to be performed from the list of experiments.

**PART B** It is mandatory to perform experiments using virtual lab where ever applicable.

### **KCE - 553: QUANTITY ESTIMATION AND MANAGEMENT LAB**

#### **(L-T-P 0-0-2) Credit- 1**

1. Study of DSR, CPWD specifications and NBC.
2. Estimation of quantities for any one of the following: Building/ Septic tank/Water supply pipe line/road/bridge.
3. Preparation of Bill of Quantities (BOQ) for above project.
4. Practice on open source project management software / MS Project/Primavera software for same problem.
5. Study of any full set of tender documents (Institute shall provide the set from ongoing/ completed tenders).

**NOTE:** - 1. Suitable software must be used to complete above exercises in 8-10 hours.

2. For open source software the following link of FOSSEE may be used apart from other available resources: <https://fossee.i>

### **KCE 051 CONCRETE TECHNOLOGY**

#### **(L-T-P 3-0-0) Credit – 3**

**Course Outcomes:** After completion of the course student will be able to:

- CO-1** Understand the properties of constituent material of concrete.
- CO-2** Apply admixtures to enhance the properties of concrete.
- CO-3** Evaluate the strength and durability parameters of concrete.
- CO-4** Design the concrete mix for various strengths using difference methods.
- CO-5** Use advanced concrete types in construction industry.

### **Unit 1**

Cement : types and cement chemistry. Aggregates: mineralogy, properties, test and standards. Quality of water for use in concrete. [8]

### **Unit 2**

Introduction & study of accelerators, retarders, water reducers, air entrainers, water proofers, super plasticizers. Study of supplementary cementing materials like fly ash, silica fume , ground granulated blast furnace slag, metakaoline and pozzolana; their production, properties and effect on concrete properties . [8]

### **Unit 3**

Concert production: batching, mixing and transportation of concrete. Workability test: slump test, compacting factor test and Vee Bee test. Segregation, bleeding and Laitance in concrete, curing of concrete and its methods. Determination of compressive and flexural strength as per BIS. Mechanical properties of concrete: elastic modules, poisson's ratio, creep, shrinkage and durability of concrete. [8]

### **Unit 4**

Principle of mix proportioning, properties related to mix design, Mix design method (IS method and ACI method). Mix design of concrete, Rheology, mix design examples [8] Unit 5 Study and uses of high strength concrete, self-compacting concrete, fibre reinforced concrete, ferro cement, ready Mix Concrete, recycled aggregate concrete and status in India. [8]

### **Unit 5**

Study and uses of high strength concrete, self-compacting concrete, fibre reinforced concrete, ferro cement, ready Mix Concrete, recycled aggregate concrete and status in India. [8]

## **KCE055 ENGINEERING HYDROLOGY**

**(L-T-P 3-0-0) Credit – 3**

**Course Outcomes:** After completion of the course student will be able to:

**CO-1** Understand the basic concept of hydrological cycle and its various phases.

**CO-2** Understand the concept of runoff and apply the knowledge to construct the hydrograph.

**CO-3** Apply the various methods to assess the flood.

**CO-4** Assess the quality of various forms of water and their aquifer properties.

**CO-5** Understand the well hydraulics and apply ground water modelling techniques.

### **Unit 1**

Introduction: hydrologic cycle, water budget equations, world water balance, Precipitation: Forms of precipitation, measurement. Introduction to characteristics of storm. Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapo transpiration measurement and

estimation; Initial Losses- Interception & Depression storage; Infiltration process, capacities indices, measurement & estimation. [8]

#### **Unit 2**

Runoff and Hydrographs: Runoff characteristics of stream, mass curve. Hydrograph, Factors affecting flood hydrographs, unit hydrograph and its analysis, s-curve hydrograph, synthetic and instantaneous unit hydrographs. [8]

#### **Unit 3**

Flood: Rational method, empirical formulae, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method of flood routing. [8]

#### **Unit 4**

Groundwater: Introduction, forms of subsurface water, aquifers & its properties, Occurrence of ground water, hydro-geology & aquifers, Ground water movement. Steady and unsteady flow through confined and unconfined aquifers. Well Hydraulics: Single & Multiple well system, partially penetrating wells, Image wells, Mutual interference of wells, well losses, specific capacity. [8]

#### **Unit 5**

Water Wells: Introduction to Well construction, completion and Development. Pumping equipment for water wells, maintenance of wells. Ground Water quality, Contamination of groundwater and its Control, Ground Water Modelling Techniques and exploration, artificial discharge and Recharge of Ground Water, Roof-top rainwater harvesting and recharge. [8]

### **KCE 601 DESIGN OF CONCRETE STRUCTURE**

**(L-T-P 3-1-0) Credit – 4**

**Course Outcomes:** After completion of the course student will be able to:

**CO-1** Analyse and Design RCC beams for flexure by IS methods.

**CO-2** Analyse and Design RCC beams for shear by IS methods.

**CO-3** Analyse and Design RCC slabs and staircase by IS methods.

**CO-4** Design the RCC compression members by IS methods.

**CO-5** Design various types of footings and cantilever retaining wall

#### **Unit 1**

Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method. Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State Design Method. [8]

## **Unit 2**

Behaviour of RC beam in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement, design of beam in shear. Introduction to development length, Anchorage bond, flexural bond. (Detailed Examples by Limit State Design Method), Failure of beam under shear, Concept of Equivalent Shear and Moments. [8]

## **Unit 3**

Design of one way, One way continuous and cantilever solid slabs by Limit State Design Method, Design of Dog-legged staircases. Design of two way slabs by limit state method, Serviceability Limit States, Control of deflection, cracking and vibrations. [8]

## **Unit 4**

Design of Columns by Limit State Design Method- Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, requirements for reinforcement, Column with helical reinforcement, Short column under axial load and uni-axial bending, Design of columns under bi-axial loading by Design Charts. [8]

## **Unit 5**

Structural behaviour of footings, Design of isolated footings, combined rectangular and trapezoidal footings by Limit State Method, Design of strap footings. Structural behaviour of retaining wall, stability of retaining wall against overturning and sliding, Design of cantilever retaining wall by Limit State Method. [8]

## **KCE 062 TRANSPORTATION ENGINEERING**

**(L-T-P 3-1-0) Credit – 4**

**Course Outcomes:** After completion of the course student will be able to:

**CO-1** Understand the history of road development , their alignment & Survey.

**CO-2** Design the various geometric parameters of road.

**CO-3** Study the traffic characteristics & design of road intersections & signals.

**CO-4** Examine the properties of highway materials & their implementation in design of pavements.

**CO-5** Learn methods to construct various types of roads.

## **Unit 1**

Introduction: Role of Transportation, Modes of Transportation History of road development, Road types and pattern, Nagpur road plan, Bombay road plan & 3rd 20 Year Road Plan, Highway Alignment & Location Survey: Horizontal Profile, Vertical Profile, Factors Controlling the alignment, Survey for route location, [8]

## **Unit 2**

Geometric Design(IRC:73-Latest revision): Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves. [8]



### **Unit 3**

Traffic Engineering: Traffic Characteristics, Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, accident study , traffic capacity, density, traffic control devices: signs, Island, signal design by Webster's and IRC method . Intersection at grade and grade separated intersections, design of roundabouts as per IRC:65-2017.Highway capacity and level of service of rural highways and urban roads as per latest IRC recommendation [8]

### **Unit 4**

Highway Materials: Properties of Subgrade, Aggregates & Binding materials, Various tests and specifications, Design of Highway Pavement : Types of Pavements, Design factors,Design of bituminous paving mixes; Design of Flexible Pavement by CBR method (IRC : 37- Latest revision), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design (IRC:58-2015) [8]

### **Unit 5**

Highway Construction: Construction of Subgrade, Water Bound Macadam (WBM), Wet mix macadam (WMM), Granular Sub Base (GSB),Tack Coat, Prime Coat, Seal Coat, Surface Dressing, Bituminous Macadam (BM), Semi dense bituminous concrete (SDBC) and Bituminous concrete, Dry lean concrete (DLC), Cement Concrete (CC) road construction, [8] Note: All designs and procedure are to be done with reference to latest revision of IRC as given below in reference section

## **KCE 603 ENVIRONMENTAL ENGINEERING**

### **(L-T-P 3-1-0) Credit – 4**

**Course Outcomes:** After completion of the course student will be able to:

- CO-1** Assess water demand and optimal size of water mains.
- CO-2** Layout the distribution system & assess the capacity of reservoir.
- CO-3** Investigate physical, chemical & biological parameter of water.
- CO-4** Design treatment units for water and waste water.
- CO-5** Apply emerging technologies for treatment of waste water.

### **Unit 1**

Fresh water, water demands, variation in demands, population forecasting by various methods, basic needs and factors affecting consumption, design period. Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control. [8]

### **Unit 2**

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, Concept of service and balancing reservoirs. Capacity of distribution reservoirs: general design guidelines for distribution system. [8]

### **Unit 3**

Physical, chemical and bacteriological examination of water and wastewater: Temperature, pH, colour and odour, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds, BOD, COD etc. quality requirements, standards of water and waste water, disposal of wastewater on land and water bodies. [8]

### **Unit 4**

Objectives of water treatment: unit operations, processes, and flow sheets. Water treatment: screening, sedimentation, determination of settling velocity, efficiency of ideal sedimentation tank, design of settling tanks, grit chamber. Primary sedimentation and coagulation, filtration: theory of filtration; hydraulics of filtration; slow sand, rapid sand and pressure filters, backwashing; design of slow and rapid sand filters. Disinfection: requirements of an ideal disinfectant; various disinfectants, chlorination and practices of chlorination, water softening and ion-exchange process [8]

### **Unit 5**

Objectives of waste water treatment: unit operations, processes, and flow sheets. Secondary and tertiary treatment: secondary sedimentation and theory of organic matter removal. Working of activated sludge process, trickling filters; aerated lagoons, waste stabilization ponds, oxidation ditches, rotating biological contactors (RBC). Anaerobic digestion of sludge: design of low and high rate anaerobic digesters and septic tank. Working of up flow anaerobic sludge blanket (UASB) reactor and other emerging technologies for wastewater treatment [8]

## **KCE 651 TRANSPORTATION ENGINEERING LAB**

**(L-T-P 0-0-2) Credit – 1**

**PART -A** (To be performed in lab)

1. To Determine the Crushing Value of Coarse Aggregates.
2. To Determine the Impact Value of Coarse Aggregates.
3. To determine the Flakiness Index and Elongation Index of Coarse Aggregates.
4. To determine the Los Angeles Abrasion Value of Coarse Aggregates.
5. To determine the Stripping Value of Coarse Aggregates.
6. To determine the penetration Value of Bitumen.
7. To determine the Softening Point of Bituminous material.
8. To determine the Ductility Value of Bituminous material.
9. To determine the Flash and Fire Point of Bituminous material.
10. To determine the Stripping Value of Bituminous material.

11. Classified both directional Traffic Volume Study.
12. Traffic Speed Study. (Using Radar Speedometer or Enoscope).
13. Determination of CBR Value of soil sample in the Lab or in Field.

**Note:** A minimum of 8 experiments are to be performed from the list of Experiments.

- PART B** 1. It is mandatory to perform experiments using virtual lab where ever applicable.
2. Relevant IRC specifications and codes must be studied.

### **KCE 652 ENVIRONMENTAL ENGINEERING LAB**

#### **(L-T-P 0-0-2) Credit -1**

**PART -A** (To be performed in lab)

1. Determination of turbidity and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine.
5. Determination of MPN (most probable number) of coliforms.
6. Measurement of SPM and PM10 with high volume sampler.
7. Measurement of sound level with sound level meter.
8. Determination of total , suspended and dissolved solids.
9. Determination of BOD.
10. Determination of COD.
11. Determination of kjeldahl nitrogen.
12. Determination of fluoride.
13. Determination of optimum dose of coagulants by Jar Test Apparatus.
14. Field Visit of Water/ Sewage Treatment Plant of a nearby area.

**Note:**

1. Experiment at S.NO. 14 is mandatory.
2. Any 8 Experiments out of the S.NO 1 to 13 are to be performed.

**PART B**

1. It is mandatory to perform experiments using virtual lab where ever applicable.
2. Relevant specifications and IS codes must be studied.

## **KCE 653 STRUCTURAL DETAILING LAB**

**(L-T-P 0-0-2) Credit – 1**

**PART -A** (To be performed in lab)

1. To verify Maxwell's Reciprocal theorem.
2. To find horizontal thrust in a three-hinged arch and to draw influence line diagrams for Horizontal Thrust end Bending moment.
3. To find horizontal thrust in a two hinged arch and to draw influence line diagrams for horizontal Thrust and bending moment.
4. Study of SP34/IS13920/IS456:2000 for detailing of structural elements.
5. Preparation of working hand sketches and soft drawings using BIM software (Open source/Commercial) for the following
  - a) Simply supported, Continuous and Cantilever RCC Beams (T-beam and I-Beam)
  - b) RCC Slabs – (Simply supported, Continuous, One way and two ways).
  - c) RCC Columns –(Tied columns and Spirally reinforced columns)
  - d) Isolated and combined footings for RC Columns.
6. Preparation of bar bending schedule.
7. Detailing of buildings with respect to Earthquake Resistant Design
8. Study of full set of structural drawing of a building as made available by Institute.

**PART B** It is mandatory to perform experiments using virtual lab where ever applicable.

**NOTE:-**

1. For open source software the following link of FOSSEE may be used apart from other available resources: <https://fossee.in>

## **KCE 064 FOUNDATION DESIGN**

**(L-T-P 3-0-0) Credit – 3**

**Course Outcomes:** After completion of the course student will be able to:

- CO-1** Understand various methods of Soil Exploration and its importance.
- CO-2** Analyze bearing capacity and settlement of soil for shallow foundation.
- CO-3** Design the various types of shallow foundation and understand the basics of deep foundation.
- CO-4** Understand the characteristics of well foundations and retaining wall.
- CO-5** Understand the concept of soil reinforcement.

**Unit 1**

Introduction to soil exploration, methods of boring and drilling, soil sampling and sampler, insitu tests, SPT, CPT, DCPT, geophysical methods; soil resistivity methods seismic refraction methods. [8]

## **Unit 2**

Bearing capacity of shallow foundation, design criteria, factors affecting bearing capacity, factors influencing selection of depth of foundation, modes of shear failures, types of shallow foundations, contact pressure under rigid and flexible footings, Terzaghi's, Meyerhof, Hansen's bearing capacity theories, IS code method Settlement of shallow foundations: components of settlement & its estimation, immediate, consolidation, & differential settlements. [8]

## **Unit 3**

Design of shallow foundation; principles of design of footing, design of isolated footings and strip footing. Deep foundation; introduction, necessity of deep foundations, pile installation, pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, single and double under reamed piles. [8]

## **Unit 4**

Introduction, shapes and characteristics of wells, components of well foundation, forces acting on well foundation, sinking of wells, causes and remedies of tilts and shifts. Retaining walls: introduction, types of retaining structures, support systems for flexible retaining walls (struts, anchoring), construction methods, introduction and uses of sheet piles. [8]

## **Unit 5**

Geotechnical properties of reinforced soil, use of soil reinforcement, shallow foundation on soil with reinforcement, design considerations, idealized soil, foundation and interface behaviour, elastic models of soil behaviour. [8]

**DR. A.P.J ABDUL KALAM TECHNICAL UNIVERSITY,  
LUCKNOW EVALUATION SCHEME & SYLLABUS  
FOR B. TECH. FOURTH YEAR (CIVIL ENGINEERING)  
On Choice Based Credit System  
(Effective from session 2019-20)**

**RCE701 Design of Structure-III**

**(L-T-P 3-1-0) Credit – 4**

NOTE: All design are to be carried as per IS:800-2007

**UNIT - I**

Introduction to steel structures. Advantages and Disadvantages of Steel as a Structural Material. Stress-Strain Curve for Mild Steel, Rolled Steel Sections, Convention for Member Axes, Loads, Dead Load, Live Loads, Environmental Loads, Seismic Forces, Snow and Rain Loads, Erection Loads, Basis for Design, Design Philosophies, Local Buckling of Plate Elements. Introduction to Limit State Design Limit States of Strength, Limit States of Serviceability, Actions (Loads), Probabilistic Basis for Design. [8]

**UNIT - II**

Introduction to Riveted, Bolted and Pinned Connections, Riveted Connections, Patterns of Riveted Joints, Bolted Connections, Types of Bolts, Types of Bolted Joints, Load Transfer Mechanism, Failure of Bolted Joints, Specification for Bolted Joints, Bearing-Type Connections, Prying Action, Tensile Strength of Plate, Efficiency of the Joint, Combined Shear and Tension, Slip-Critical Connections, Combined Shear and Tension for Slip-Critical Connections, Working Load Design, Design of eccentric bolted connections . Simple Welded Connections, Types, Symbols, Welding Process, Weld Defects, Inspection of Welds, Assumptions in the Analysis of Welded Joints, Design of Groove Welds, Design of Fillet Welds, Fillet Weld Applied to the Edge of A Plate Or Section, Fillet Weld for Truss Members, Design of Intermittent Fillet Welds, Plug and Slot Welds, Stresses Due To Individual Forces, Combination of Stresses, Failure of Welds, Distortion of Welded Parts, Fillet Weld Vs Butt Weld, Welded Jointed Vs Bolted and Riveted Joints, Design of eccentric welded connections. [8]

**UNIT – III**

Introduction to Tension Members, Types of Tension Members, Net Sectional Area, Effective Net Area, Types of Failure, Design Strength of Tension Members, Slenderness Ratio ( $\lambda$ ), Displacement, Design of Tension Member, Lug Angles, Splices, Gusset Plate. [8]

**UNIT – IV**

Introduction to Compression Members, Effective Length, Slenderness Ratio ( $\lambda$ ), Types of Sections, Types of Buckling, Classification of Cross Sections, Column Formula, Design Strength, Design of Axially Loaded Compression Members, Built-Up Columns (Latticed Columns), Lacing, Batten, Compression Member Composed of Two Components Back-to-Back, Splices, Design of Column Bases. [8]

#### **UNIT – V**

Introduction to Beams, Types of Sections, Behaviour of Beam in Flexure, Section Classification, Lateral Stability of Beams, Lateral-Torsional Buckling, Bending Strength of Beams, Laterally Supported Beams, Laterally Unsupported Beams, Shear Strength of Beams, Web Buckling, Bearing Strength, Web Crippling, Deflection, Design Procedure of Rolled Beams, Built-Up Beams (Plated Beams), Purlins, Beam Bearing Plates, Effect of Holes in Beam, Introduction to Plate Girder, Introduction to Gantry Girder. [8]

### **RCE702 Water Resources**

**(L-T-P 3-0-0) Credit - 3**

#### **UNIT – I**

Hydrology: Hydrological Cycle and its components; Water Budget Equation, Precipitation: Types, measurements and analysis, Evaporation and consumptive use: estimation and measurement techniques. Irrigation: Necessity and types, Advantages & disadvantages of irrigation; Functions of water in plant growth, Methods of Irrigation, Water requirement of crops, Duty and Delta relationship; Irrigation frequency; Irrigation efficiencies; Principal crops and crop season, crop rotation. Canal irrigation: Classes and alignment, Parts of a canal system, Command area, curves in channels, channel losses. Introduction to Sediment Transportation: Suspended and Bed load and its estimation [8]

#### **UNIT – II**

Irrigation channels and Design: Types: lined and unlined, silt theories: Kennedy's and Lacey's Design procedure for irrigation channels, longitudinal cross section, Schedule of area statistics and channel dimensions, cross sections of an Irrigation channel, Lining of Irrigation Canals: Advantages and types; factors for selection of a particular type, design of lined channels, cross section of lined channels, Economics of canal lining. Water Logging and Drainage Design: effects, causes and anti-water logging measures, Drainage of water logged land. [8]

#### **UNIT – III**

Regulation and control of canal system: Purpose, Types of canal regulation works and their functional aspects Irrigation Outlets: Requirements, types, non-modular, semi-module and rigid module, selection criterion River Training: Objective and need, classification of rivers, and river training works, meandering, stages, methods of river training, bank protection, Methods for measurement of discharge. Types of Head works: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, Principles of design, Bligh's theory, Khosla's theory for determination of pressure and exit gradient. Regulation Works: Falls,

Classification; Introduction to design principle of falls, Design of Sarda type and straight glacis fall. Principle and design of Distributory head regulator and cross regulator, canal escape, Bed bars [8]

#### **UNIT – IV**

Canal head works: Functions, Location, Layout of head works. Weir and Barrage, Canal head Regulator, Introduction to the design principles of Weirs on permeable foundations, Design of vertical drop and sloping glacis weir. Cross drainage works: Necessity and types; Aqueduct, Siphon Aqueduct, super passage, canal siphon, level crossing, Introduction to design principles of cross drainage works. Investigation and planning of dams and Reservoirs: Zones of storage, Estimation of storage capacity, Reservoir losses, Reservoir sedimentation and its control, life of a reservoir. [8]

#### **UNIT – V**

Dams: classification and selection criteria. Earth Dams: Classification, causes of failure, Phreatic line, and its determination Introduction to stability analysis Gravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile, stability analysis, galleries, joints, control of cracks. Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, spillway gates. Hydro-Electric Power: assessment of potential in reference to India, classification of power plants, important terms, types of turbines and their suitability; Power House layout and important structures of a powerhouse. [8]

### **RCE072 Rural Development Engineering**

**(L-T-P 3-0-0) Credit - 3**

#### **UNIT- I**

Rural Development Planning and Concept of Appropriate Technology: Scope; development plans; various approaches to rural development planning; concept of appropriate technology. Rural development programme/ projects. [8]

#### **UNIT- II**

Rural Housing: Low cost construction materials for housing; Architectural considerations for individual and group housing; Composite material - ferro-cement & fly ash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls; design consideration and construction of: non-erodable mud plaster, Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry; rat-trap bond for walls; Panels for roof, ferro-cement flooring / roofing units, Earthquake resistant measures for low cost houses. [8]

#### **UNIT- III**

Water Supply and Rural Sanitation: Sources of water. BIS & WHO water standards. Quality, Storage and distribution for rural water supply works; basic design principles of treatment low cost water treatment technologies; conservation of water; rainwater harvesting; drainage in rural areas, low cost waste disposal systems; septic tank ; Biogas technology; low cost community & individual Garbage disposal systems, Ferro-cement water storage tanks. [8]



#### **UNIT- IV**

Low Cost Roads and Transport: Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases, Bituminous Construction, Surface Treatments for roads in rural areas. Soil Stabilization, Lime, Lime Flyash and Cement Treated Course. Crusher-run-Macadam. Use of local materials. Flexible Pavement: Design factors, Basic Principles, Guidelines for Surfacing for Rural Road. [8]

#### **UNIT- V**

Low Cost Irrigation: Consideration of low cost irrigation techniques , drip & sprinkler irrigation systems. Watershed and catchments area development - problems and features of watershed management, watershed structures [8]

### **RCE076 Railways, Airport & Water Ways**

**(L-T-P 3-1-0) Credit - 4**

#### **UNIT –I**

Introduction to Permanent Way and its Components: History and administrative setup of Indian Railways; Rails, Type of rails, rail gauges, permanent way formation,– functions, requirements, sections in embankment and cutting (single/double track), electrified tracks, locomotives, wheel and axle arrangement, coning of wheels, defect in rails, rail fastenings, Fish plates, spikes, chairs, keys, bearing plates. sleepers, Timber, steel, cast iron, concrete and prestressed concrete sleepers, sleeper density, ballast: material, specifications. [8]

#### **UNIT-II**

Track Geometrics, Turnouts and Crossings, Stations and Yards: Railway alignment, vertical alignment – gradients and grade effects, horizontal alignment – horizontal curves, super-elevation, concepts of cant excess and deficiency, safe permissible speed, transition curves, widening of gauges and track clearances, points and crossings – terminologies, types of turnouts, design of turnouts, types of crossings, design of crossings. Different types of stations and Yards: classification and functioning. [8]

#### **UNIT –III**

Signalling and Interlocking, Urban Railways: Classification of Signals, method of train working, absolute block system, Centralized train control system, ATS, interlocking of track, principle of interlocking, types of interlocking, high speed track – track requirement, speed limitations, high speed technologies, Urban railway- railway system in urban areas. [8]

#### **UNIT – IV**

Introduction to Airport Engineering Air craft characteristics affecting airport planning & design, selection of site for an airport. Airports - layout and orientation, Runway and taxiway design consideration and geometric design. Airport drainage management, Zoning laws, Visual aids and air traffic control, Runway lighting, Runway operation Helipads, hangers, service equipment. [8]

## **UNIT – V**

Water Transport Harbours and ports, Types of Harbours; Harbours - layouts, shipping lanes, anchoring, location identification; Littoral transport with erosion and deposition; sounding methods; Dry and Wet docks, components and operational Tidal data and analyses. Inland waterways: advantages and disadvantages; Development in India. Inland water operation. [8]

### **RCE751 Non Destructive Testing Laboratory**

**(L-T-P 0-0-2) Credit - 1**

**NOTE:** Student will have to perform minimum 3 test on concrete & two test on structural steel

#### **1. Non Destructive Testing of reinforced cement concrete**

- (a)** Strength assessment using rebound hammer
- (b)** Quality assessment using ultrasonic pulse velocity test
- (c)** Strength assessment using pull out method
- (d)** Assessment of corrosion of reinforcing bars using half cell potentiometer
- (e)** To determine thickness of concrete cover, diameter & spacing of reinforcing bars using rebar scanner.

#### **2. Testing of structural steel**

- (a)** Testing for corrosion of structural steel
- (b)** Assessment of thickness of pipes/tubes/structural steel
- (c)** Test for welding performance with Di-penetration test, ultrasonic test & magnetic particle test

### **RCE752 Mini Project**

**(L-T-P 0-0-2) Credit - 1**

Students will be asked to work upon minimum four of the following topics during the semester. They will submit the report of each topic containing following information (as per need of topic) like: introduction, general information, usage/application (if any) detailed description of work/process, relevant diagrams, drawings & tabulation (if any), observation and results (as applicable) or any other relevant information as per topic.

- 1.** Work related to preparation of bill of quantity & tender document.
- 2.** Work related to design & drawing of flat slab using IS code method.

3. Work related to cost estimation of (including market survey of rates by students) building/earth work for a highway.
4. Work related to scheduling of activities of a project using relevant software
5. Work related to preparation of layout plan of a building and its marking on ground.
6. Design & analysis of a G+5 residential building using structural design and analysis software like STAAD Pro/STRUDS/SAP/ETAB/STRAP.
7. Work related to design of a small sewage treatment plant (STP) unit for a residential society.
8. Work related to computation of surface runoff & design of rain water harvesting system for given area (relevant software may be used for runoff computation).

### **RCE 084 Solid Waste Management**

**(L-T-P 3-1-0) Credit – 4**

#### **UNIT-I**

Solid waste: Public health and ecological impacts, Sources and types of solid wastes, material flow and waste generation, Functional elements: Waste generation, storage, collection, Transfer and transport, processing and recovery, disposal. Physical and chemical composition of municipal solid waste, integrated solid waste management, hierarchy of waste management options, different methods for generation rates. Storage: movable bins, fixed bins. Collection: home to home collection, community bin system. Theory and design of hauled container system, stationary container system. [8]

#### **UNIT-II**

Transportation: handcart, tri-cycle, animal cart, tripper truck, dumper placer, bulk refuse carrier, railroad transport, water transport, conveyors, layout of routes. Engineering system for on-site handling and processing of solid waste: separators, size reduction equipments, screening equipments, densification, baling, cubing, pelleting equipments. [8]

#### **UNIT-III**

Landfilling: Site selection criteria, landfill layout, landfill sections, Occurrence of gases and leachate in landfills: composition and characteristics, generation factors, initial adjustment phase, transition phase, acid formation phase, methane formation phase, maturation phase of gases and leachate, Introduction to engineered landfills. [8]

#### **UNIT-IV**

Composting, types of composting, process description, design and operational consideration of aerobic composting, process description, design and operational consideration of anaerobic composting. Thermal conversion technologies: incineration and pyrolysis system, energy recovery, system. Overview of solid waste management practices in India. [8]

#### **UNIT-V**

Introduction to Hazardous wastes, Definition of Hazardous waste, The magnitude of the problem; Hazardous waste: Risk assessment, Environmental legislation, Characterization and site assessment, Waste minimization and resource recovery, Transportation of hazardous waste, Disposal of hazardous waste. Introduction to Electronic waste and Biomedical waste and their disposal. [8]

### **RCE085 Engineering Hydrology & Groundwater Management**

**(L-T-P 3-0-0) Credit - 3**

#### **UNIT – I**

Introduction: hydrologic cycle, water budget equations, world water balance, Precipitation: Forms of precipitation, measurement. Introduction to characteristics of storm. Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapotranspiration-measurement and estimation; Initial Losses- Interception & Depression storage; Infiltration- process, capacities indices, measurement & estimation. [8]

#### **UNIT – II**

Runoff and Hydrographs: Runoff characteristics of stream, mass curve. Hydrograph, Factors affecting flood hydrographs, unit hydrograph and its analysis, s-curve hydrograph, synthetic and instantaneous unit hydrographs. [8]

#### **UNIT – III**

Flood: Rational method, empirical formulae, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method of flood routing. [8]

#### **UNIT – IV**

Groundwater: Introduction, forms of subsurface water, aquifers & its properties, Occurrence of ground water, hydro-geology & aquifers, Ground water movement. Steady and unsteady flow through confined and unconfined aquifers. Well Hydraulics: Single & Multiple well system, partially penetrating wells, Image wells, Mutual interference of wells, well losses, specific capacity. [8]

#### **UNIT – V**

Water Wells: Introduction to Well construction, completion and Development. Pumping equipment for water wells, maintenance of wells. Ground Water quality, Contamination of groundwater and its Control, Ground Water Modelling Techniques and exploration, Artificial discharge and Recharge of Ground Water, Roof-top rainwater harvesting and recharge. [8]