

**Basaveshwar Engineering College, (Autonomous)**  
**Bagalkot**  
**Department of Civil Engineering**

**V SEMESTER SCHEME (2018-19 admitted batch)**

Sl. No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	UCV541C	Design of RC Structures-I	4	4	0	0	50	50	100
2	UCV542C	Structural Analysis-II	3	2	2	0	50	50	100
3	UCV543C	Geotechnical Engg- I	3	3	0	0	50	50	100
4	UCV544C	Hydraulic Engineering	3	2	2	0	50	50	100
5	UCS559/ 659L	Advanced C-Programming lab	2	0	2	2	50	50	100
6	UCV55XE	Dept Elective - 2	3	3	0	0	50	50	100
7	UHS002N	Advanced Quantitative Aptitude & Soft Skills	1	0	0	2	50	50	100
8	UCV541L	Fluid Mechanics Lab	1	0	0	2	50	50	100
9	UCV542L	Computer Applications in Civil Engg Lab	1	0	0	2	50	50	100
10	UCV543L	Highway Material Testing Lab	1	0	0	2	50	50	100
		<b>Total</b>	<b>22</b>	<b>14</b>	<b>06</b>	<b>10</b>	<b>500</b>	<b>500</b>	<b>1000</b>

<b><u>Department Elective –II</u></b>			
Sl. No.	Subject code	Subject	Credits
1	UCV551E	Energy efficient buildings	3
2	UCV552E	Environmental Impact Assessment	3
3	UCV553E	Remote sensing and GIS	3
4	UCV554E	Masonry structures	3

**UCV541C: DESIGN OF RC STRUCTURES - I**  
**4 Credits (4-0-0)**

**UNIT – I**

**General features of reinforced concrete:** Introduction, Design loads, Materials for reinforced concrete, Code requirements of reinforcements, Elastic theory of RC sections, Moment of resistance of section, Balanced, under reinforced and over reinforced section

**Principles of limit state design and ultimate strength of RC section:** Philosophy of limit state design, Principles of limit states, Factor of safety, Characteristic and design loads, Characteristic and design strength, General aspects of ultimate strength, Stress block parameters for limit state of collapse, Ultimate flexural strength of rectangular sections, Ultimate flexural strength of flanged sections, Ultimate flexural strength of doubly reinforced sections, Ultimate shear strength of RC sections, Ultimate torsional strength of RC sections, Concepts of development length and anchorage, Analysis examples for rectangular sections, flanged sections, doubly reinforced, sections, shear strength and development length.

**13Hrs**

**UNIT – II**

**Serviceability limit state:** General aspects, Deflection limits in IS: 456-2000, Calculation of deflection (Theoretical method), Cracking in structural concrete members.

**Design of beams:** Practical requirements of an RCC beam, Size of the beam, Cover to the reinforcement, Spacing of bars, Design procedure, Critical sections for moments and shear, Anchorage of bars: check for development length, Reinforcement requirements, Slenderness limits for beams to ensure lateral stability, Design examples for simply supported and cantilever beams (rectangular and flanged sections).

**14Hrs**

**UNIT – III**

**Design of slabs:** Introduction, General consideration of design of slabs, Rectangular slabs spanning in one direction, Rectangular slabs spanning in two directions for various boundary conditions, Design of simply supported slabs, cantilever slabs and continuous slabs.

**Design of columns:** General aspects, Effective length, Loads on columns, Slenderness limits for columns, Minimum eccentricity, Design of short axially loaded columns, Design of column subject to combined axial load and uniaxial moment using SP 16.

**13Hrs**

**UNIT – IV**

**Design of footings**

Introduction, Load for foundation, Design basis (limit state method), Design of isolated rectangular footing for axial load and uniaxial moment, Design of pedestal.

### **Design of stair case**

General features, Types of stair case, Loads on stair cases, Effective span as per IS codal, provisions, Distribution of loading on stairs, Design of stair cases

**12Hrs**

### **TEXT BOOKS:**

1. N. Krishna Raju, "Design of Reinforced Concrete Structures (IS: 456 2000)", 3rd Edition, CBS Publishers and Distributors, New Delhi. Jan 2009.
2. P.C. Varghese, "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi. 2008.
3. B.C.Punmia, Ashok kumar Jain & Arun kumar Jain Limit State design of Reinforced concrete- Laxmi Publication, New Delhi. 2016.
4. Design of RCC Structural Elements S.S. Bhavimath, Vol-I, New Age International Publications New Delhi. 2016.

### **REFERENCE BOOKS:**

1. Unnikrishnan and Devadas Menon, Design of reinforced concrete structures, PHI, New Delhi. 2013
2. Karve S.R. and Shah V.L, Limit state theory and design of reinforced concrete, Vidyanthi Prakashan, Pune. 2017
3. A.K. Jain, Limit state method of design, Nemchand and Bros, Roorisee, Jan 2012.
4. Park and Paulay, Reinforced concrete, John Wiley & Sons. 1975.
5. Kong and Evans, Reinforced and prestressed concrete, ELBS, London
6. H.J. Shah, Reinforced concrete Vol. I, Charotar Publishing House, Anand. Jan 2016
7. IS: 456-2000, SP-24, SP-16.

(Note: Use of IS: 456-2000 is permitted and SP-16 to be used in design of columns only)

### **QUESTION PAPER PATTERN FOR SEE:**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub division.
3. Any Five Full questions are to be answered choosing at least one from each unit.

<b>Sl. No.</b>	<b>Course Objectives</b>	<b>Course Outcomes</b>
01	To make the student to get knowledge of methods of design of RC sections & To make the students to develop the Knowledge of analyses of RC sections	Students will have the knowledge of methods of design of RC sections & student will analyse the different RC sections.
02	Preparing the student for the knowledge of serviceability criteria of RC sections and Preparing the student to design the different beam sections.	Student will be able to solve the problems related to serviceability conditions and student will design different beam sections.
03	Preparing the student to design slab and columns.	Student will design be able to slab and columns
04	To train the student to design stairs and footings.	Student will design be able to stairs and footings.

## UCV542C: STRUCTURAL ANALYSIS – II

3 Credits (2-2-0)

### UNIT – I

**Analysis of Arches:** Three and two hinged parabolic arches with supports at same and different levels; determination of thrust, shear and bending moment.

07 Hrs

**Analysis of Cables:** Analysis of cables under point load and UDL, length of cables, supports at same and different levels.

06 Hrs

### UNIT – II

**Slope Deflection Method:** Development of slope deflection equations: Analysis of continuous beams and rigid frames (non-sway and sway type).

**07 Hrs Moment Distribution Method:** Development of method, Analysis of continuous beams and rigid frames (non-sway type).

06 Hrs

### UNIT – III

**Kani's Method:** Development of method, Analysis of continuous beams and rigid frames (non-sway type).

06 Hrs

**Matrix Methods of Structural Analysis (system approach):** Introduction to Flexibility and Stiffness method, analysis of beams (Static and kinematic indeterminacy  $\leq 3$ ).

07 Hrs

### UNIT – IV

**Rolling Loads and Influence Lines:** Rolling Loads, Influence line diagram for reaction, shear force and bending moment at a section for simply supported beams due to point loads and uniformly distributed loads. Uses of Influence lines for analysis of simply supported beam for single and several point loads, uniformly distributed loads

07 Hrs

**Introduction to unsymmetrical bending :** Symmetry and anti-symmetry, concept of unsymmetrical bending. Numerical problems. Concept and definition of shear centre.

06 Hrs

### REFERENCE BOOKS:

1. B C Punmia, A K Jain and A K Jain- Theory of structures, 12<sup>th</sup> edition, Laxmi Publications, New Delhi, 2004.
2. Pandit G S, Gupta S P and Gupta R- Theory of Structures, 2<sup>nd</sup> edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. Negi L S and Jangid R S- Structural Analysis, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2004.

## SUGGESTED BOOKS FOR ADDITIONAL READING

1. R C Hibbeler- Structural analysis, 9<sup>th</sup> edition, Pearson India, New Delhi, 2017.
2. Devdas Menon – Structural Analysis, Alpha Science International Ltd., New Delhi, 2007.
3. Wang C K – Intermediate Structural Analysis, McGraw-Hill Publishing Company Ltd, London, 1983
4. Senol Utku, Norris C H and Wilbur John B, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1993.
5. Reddy C S - Basic Structural Analysis, 3<sup>rd</sup> edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2010.

## QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one question from each unit.

S.No.	Course Objectives	Course Outcomes
1	Introduction to definitions, basic concepts associated parabolic three, two hinged arches and cables. Analyze under point loads and udl.	Analyze three and two hinged arches and cables for internal forces.
2	Introduction to definitions and basic concepts associated with slope deflection method and moment distribution method. Analysis of continuous beams and rigid frames.	Analyze the statically indeterminate rigid jointed structures by Slope Deflection method and Moment Distribution method.
3	Introduction to definitions and basic concepts associated with kani's method and matrix methods using system approach. Analysis of continuous beams and rigid frames.	Analyze the statically indeterminate rigid jointed structures by Kani's method and statically indeterminate structures by matrix methods using system approach.
4	Introduction to definitions and basic concepts associated with influence lines, rolling loads, unsymmetrical bending. Analysis of simply supported beams under rolling loads. Stresses in beams due to unsymmetrical bending.	Draw influence lines for simply supported beam due to rolling loads and determination stresses for beams subjected to unsymmetrical bending.

## UCV543C GEOTECHNICAL ENGINEERING-I

3 Credits (2-2-0)

### UNIT- I

**Introduction-** History of soil mechanics, Origin and formation of soil, Regional soil deposits in India, Phase Diagram, basic definitions and their interrelationships.

**Index properties-** Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis (sieve and Hydrometer analysis) consistency limits and indices, Plasticity chart. Activity of clay, Field identification tests, BIS soil classification (IS: 1498-1970).

13 Hrs

### UNIT- II

**Clay Mineralogy-** Soil structure- Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering

**Flow through Soils-**Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.

12 Hrs

### UNIT- III

**Seepage Analysis-**Laplace equation, assumptions, limitation and its derivation. Flow nets-characteristics and applications. Flow nets for sheet piles and below the dam section. Unconfined flow, phreaticline (Casagrande's method-with and without toe filter), flow through dams, design of dam filters.

**Compaction of Soil-**Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

12 Hrs

### UNIT- IV

**Consolidation of soil-** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations (no derivation), Normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil ( $C_c$ ,  $a_v$ ,  $m_v$  and  $C_v$ ), Time rate of consolidation.

**Shear strength of soils-** Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, conventional and modified failure envelopes, Total and effective shear strength parameters, Concept of pore pressure, factors affecting shear strength of soils, Sensitivity and Thixotropy of clay. Measurement of shear parameters- Direct shear test,

Unconfined compression test, Triaxial compression test and vane shear test, Test under different drainage conditions.

**15 Hrs**

**TEXT BOOKS:**

1. Alam Singh and Chowdhary G.R. (1994), Soil Engineering in Theory and Practice CBS Publishers and Distributors Ltd., New Delhi.
2. Punmia B.C. (2005), 16<sup>th</sup> Edition Soil Mechanics and Foundation Engg.- Laxmi Publications Co. , New Delhi.

**REFERENCES BOOKS:**

1. Bowles J.E. (1996), 5th Edition, Foundation Analysis and Design- McGraw Hill Pub. Co. New York.
2. Murthy V.N.S. (1996), 4th Edition, Soil Mechanics and Foundation Engineering-UBS Publishers and Distributors, New Delhi.
3. Gopal Ranjan and Rao A.S.R. (2000), Basic and Applied Soil Mechanics- New Age International (P) Ltd., New Delhi.
4. Venkatrahmaiah C. (2006), 3rd Edition Geotechnical Engineering New Age International (P) Ltd., New Delhi.
5. Craig R.F. (1987), Soil Mechanics- Van Nostrand Reinhold Co. Ltd.
6. Braja M. Das (2002), 5<sup>th</sup> Edition, Principles of Geotechnical Engineering- Thomson Business Information India (P) Ltd., India.
7. Iqbal H. Khan (2005), 2nd Edition, Text Book of Geotechnical Engineering- PHI, India.

**QUESTION PAPER PATTERN FOR SEE:**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

<b>Sl. No.</b>	<b>Course Objectives</b>	<b>Course Outcome</b>
1	Students are exposed to know the history and basic concepts used in soil mechanics and index properties and classification of the soil	Students will use the basic concepts and properties of soil to identify and classify the soil
2	To study the structure of the soil and clay minerals and assess the quantity of permeability of soil	use the clay minerals to identify the expansive soil and Determine the permeability characteristics of soil
3	To draw the flow nets and understand the compaction phenomenon in soil	Determine the quantity of seepage with the help of flow nets and inspect the quality control during compaction of soil
4	Also to analyse the shear strength and consolidation characteristics of the soil	Present the consolidation phenomenon and determine the shear strength of soil

## UCV544C: HYDRAULIC ENGINEERING

3 Credits (2-2-0)

### UNIT I

**Viscous Flow:** Reynolds's experiment, Laminar flow through circular pipes. Hagen Poiseuille's equation, derivation and numericals. Relation between pipe friction factor and Reynolds number, numericals.

**Elements of Boundary layer theory:** Development of boundary layer over a thin plate, Derivation of thickness of boundary layer and numericals, Derivation of von Karman's momentum integral equation.

10Hrs

### UNIT II

**Open Channel Flow:** Classification, Derivation and numericals of Chezy's and Manning's equations. Most economical rectangular, trapezoidal and circular channel sections: derivations and numericals.

**Open Channel Flow:** Specific energy, specific energy curve, Derivation of critical depth, critical velocity and minimum specific energy, Numericals. Froude's number and its significance. Hydraulic jump: derivation and numerical

10Hrs

### UNIT III

**Dimensional and Model Analysis:** Units and dimensions, Dimensional homogeneity: Rayleigh's method, Buckingham's pi-theorem and examples. Types of similarities and Dimensionless parameters.

**Water Hammer in Pipes:** Derivation for pressure rise due to gradual and sudden closure of valve and problems.

**Pipe Network Analysis:** Hardy-cross method and problems.

10Hrs

### UNIT IV

**Impulse Momentum Principle and Applications:** Impact of jet on stationary & moving, flat & curved, symmetric & unsymmetrical vanes. Force exerted by a jet on series of vanes, work done and efficiency. Derivations and problems.

**Hydraulic Turbines:** General layout of hydroelectric plants, Definitions of Heads and efficiencies of a turbine and Classification.

**Centrifugal Pumps:** Components, definitions of heads and efficiencies, work done and general principles of working-Work done and Priming of pump and characteristic curves.

10Hrs

**TEXT BOOKS:**

1. Fluid Mechanics by Dr.R. K. Bansal, Laxmi Publications, New Delhi.
2. Fluid Mechanics and Hydraulic Machines by P.N. Modi and S.M. Seth, Standard Publications, New Delhi.

**REFERENCE BOOKS:**

1. Elementary Hydraulics (1st Edition) James F Cruse, Vijay P. Singh. Mohsan M. Sherif, Thomson Learning.
2. Fluid Mechanics, Hydraulic and Hydraulics by K.R. Arora, Standard Book House, New Delhi.
3. Fluid Mechanics, John F. Douglas etal, Pearsom Education, India.
4. Thousand solved Problems in Fluid Mechanics by S.Subramanya, Students Mcgraw Hill Publication, New Delhi.
5. Open channel flow by K. Subramanya, Mcgraw Hill Publication, New Delhi.

**QUESTION PAPER PATTERN FOR SEE :**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No.	Course Objectives	Course Outcomes
	<b>Objective of this course is to make students learn:</b>	<b>After successful completion of the course student will be able to:</b>
1.	Basics of viscous flow and boundary layer theory.	Apply concepts of viscous flow and boundary layer theory in solving problems.
2.	Concepts of open channels flow and design of economical cross sections.	Design open channels with economical cross-sections and solve problems related to hydraulic jump.
3.	Principles of dimensional analysis and its applications.	Apply dimensional analysis, water hammer and pipe network analysis concepts to problem solving.
4.	Water hammer principles and pipe network analysis.	Quantify impact of jets on different vanes and design pumps and turbines.
5.	The principles of impact of jets and its applications.	
6.	Working principles of turbines and pumps.	

## UCS559/659L ADVANCED C PROGRAMMING LAB

Credits 2(0-2-2)

### UNIT -1 (6 hours)

Multidimensional arrays. Self-referential structures and Unions. **Pointers:** Introduction, Pointers for inter function communication, Pointers to pointers, Compatibility, Lvalue and Rvalue, Examples. **Pointer Applications:** Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, Examples.

**Revised Bloom's Taxonomy Level**  $L_1$  –Remembering,  
 $L_2$  – *Understanding*,  $L_3$  – *Applying*,  $L_4$  – *Analyzing*,  $L_5$  – *Evaluating*,  
 $L_6$  – *Creating*

### UNIT- II (6 hours)

Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Queues: Definition, Array Representation, Queue Operations. Programming Examples.

**Revised Bloom's Taxonomy Level**  $L_1$  –Remembering,  
 $L_2$  – *Understanding*,  $L_3$  – *Applying*,  $L_4$  – *Analyzing*,  $L_5$  – *Evaluating*,  
 $L_6$  – *Creating*

### UNIT- III (6 hours)

**Linked Lists:** Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Applications of Linked lists.

**Revised Bloom's Taxonomy Level**  $L_1$  –Remembering,  
 $L_2$  – *Understanding*,  $L_3$  – *Applying*,  $L_4$  – *Analyzing*,  $L_5$  – *Evaluating*,  
 $L_6$  – *Creating*

### UNIT- IV (6 hours)

**Trees:** Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals;

**Revised Bloom's Taxonomy Level**  $L_1$  –Remembering,  
 $L_2$  – *Understanding*,  $L_3$  – *Applying*,  $L_4$  – *Analyzing*,  $L_5$  – *Evaluating*,  
 $L_6$  – *Creating*

TEXTBOOKS				
Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data Structures: A Pseudo-code approach with C	Gilberg & Forouzan	Cengage Learning	2 <sup>nd</sup> Edition, 2014

2	Data Structures through C	Yashwant Kanetkar	BPB Publications	2017
<b>REFERENCE BOOKS</b>				
1	Data Structures: A Pseudo-code approach with C	Gilberg & Forouzan	Cengage Learning	2 <sup>nd</sup> Edition, 2014
2	Data Structures using C	Reema Thareja	Oxford press	3 <sup>rd</sup> Edition 2012
3	An Introduction to Data Structures with Applications	Jean-Paul Tremblay & Paul G. Sorenson	McGraw-Hill	2 <sup>nd</sup> Edition, 2013
<b>Web links and Video Lectures:</b> <a href="https://nptel.ac.in/courses/106/106/106106130/">https://nptel.ac.in/courses/106/106/106106130/</a> <a href="https://www.classcentral.com/course/edx-c-programming-pointers-and-memory-management-11533">https://www.classcentral.com/course/edx-c-programming-pointers-and-memory-management-11533</a> <a href="https://academicearth.org/computer-science/">https://academicearth.org/computer-science/</a> <a href="http://nptel.vtu.ac.in/econtent/courses/BS/15PCD23/index.php">http://nptel.vtu.ac.in/econtent/courses/BS/15PCD23/index.php</a>				

Multidimensional arrays. Self-referential structures and Unions. **Pointers:** Introduction, Pointers for inter function communication, Pointers to pointers, Compatibility, Lvalue and Rvalue, Examples. **Pointer Applications:** Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, Examples.

#### Part A

1. a) Write C program to accept and display 1d array Also write functions
  - i) to insert an element based at the specified position
  - ii) to delete element based on the position
  - iii) to delete based on the value
- 2 function should take care of invalid data and accordingly display appropriate error messages
 

Write C program to accept and display 2d array of user specified size. Also write functions to perform the following on the 2d array

  - i) Function row\_sum that takes row number as parameter and returns the sum of the row
  - ii) Function col\_sum that takes column number as parameter and returns the sum of the column
  - v) Function secondary\_diagonal\_sum that returns the sum of secondary diagonal elements if possible else should return -1
  - vi) Function primary\_diagonal\_sum that returns the sum of primary diagonal elements if possible else should return -1

c) Write C function to accept and display 3d integer array of user specified dimension. Use separate functions. Also write functions perform the following on the 3d array

- i) Function average that invokes one of the above function and returns the average
- ii) Function prime\_count that computes the total number of prime numbers
- iv) Function occurrence\_count that accepts the key number and determines the occurrence count in entire array

2 Write C program to store information (name, employeeid, designation, date of birth, stay details) about set of employees in a company. Here

designation is an enumerator with values {md, manager, clerk, peon}

date\_of\_birth is a structure for holding birth date with fields day, month, year

stay\_detail should hold street number and sector number and house number for the employees staying outside company premises else only quarter number (hint use union). Write functions to

- i) to display names of all the employees
- ii) to display employees staying outside company premises or quarters based on users choice
- iii) to return the employee details given the employee\_id
- iv) to modify specific employee details based on users choice

3. Write C program to allocate dynamic memory to 2d array, accept and display the array elements. Use separate functions to allocate, load and display the array

#### Part B

1. Write C program to implement stack of integers using array.
2. Write C program to implement circular queue of integers using array
3. Write C program to create a singly linked list of integers and allow following operations on the linked list
  - i) to traverse the list
  - i) to search the key element
  - iii) to insert an element after some key element
  - iv) to delete a specific element
4. Write C program to implement stack using linked list
5. Write C program to implement queue using linked list
6. Write program to create a binary tree. Also write functions
  - i) to traverse in inorder, preorder, postorder
  - ii) to search an element
  - iii) number of leaf nodes

Sl. No.	The objective of the course is to:	Course outcomes: By the end of the course, the student will be able to:
1	Imbibe thorough knowledge in advanced C programming concepts	Define advanced C programming concepts like pointers, data structures
2	Have proficiency in applying	Apply the knowledge of advanced C programming

	advanced C programming concepts to solve any real world problem.	concepts to implement given requirement specification or to solve real world problem.
3		Analyze different data structures and use suitable data structure to implement requirement specification
4		Implement, interpret, debug and test any given advanced C program
5		Develop software product using advanced C programming concepts to solve real world problem.

**UHS002N: FUNDAMENTALS OF QUANTITATIVE APTITUDE AND SOFT SKILLS**

**1 Credit (2-0-0)**

<b>Course Objectives</b>	The course objectives for the semester are as follows: 1. Cover advanced topics in the following domains: a. quantitative aptitude, b. verbal aptitude, and c. reasoning aptitude. 2. Build confidence and self-esteem through the following: a. life skills, and b. soft skills. 3. Hone career skills and industry awareness. 4. Develop awareness of career paths and competitive exams.	
<b>Course Outcome</b>	After the course, the students will be able to: 1. Answer multiple choice questions from topics in: a. quantitative aptitude, verbal aptitude, and reasoning aptitude. 2. Use tools and techniques learnt in soft skills modules to: a. build confidence and self-esteem. 3. Speak knowledgeable about career paths and competitive exams.	
<b>Domain</b>	<b>Hours</b>	<b>Modules</b>
<b>Quantitative Aptitude (QA)</b>	6	3
<b>Reasoning Aptitude (RA)</b>	6	3
<b>Verbal Aptitude (VA)</b>	6	3
<b>Soft Skills (SS)</b>	6	3
<b>Career Skills (CS)</b>	6	3
<b>Total</b>	30	15

<b>DETAILS</b>			
<b>Sl. No.</b>	<b>Domain</b>	<b>Topic</b>	<b>Hours</b>
<b>UNIT I – Quantitative and Reasoning Aptitude Skills Training</b>			
1.	QA	Speed Maths	2
2.	QA	Areas and Volumes	2
3.	QA	Concept Review	2
4.	RA	Number Series and Letter Series	2
5.	RA	Coding and Decoding	2
6.	RA	Concept Review	2
<b>UNIT II – Verbal Aptitude Skills Training</b>			
7.	VA	Reading Comprehension	2
8.	VA	Listening Comprehension	2
9.	VA	Concept Review	2
<b>Unit III – Career Skills</b>			
10.	CS	Orientation to competitive exams, such as GATE, GRE, GMAT, CAT, UPSC, SSC, and Bank PO.	2
11.	CS	Group Discussion – Simulation	2
12.	CS	Orientation to career paths, such as core engineering, IT engineering, public sector, banking, sales and marketing, and entrepreneurship.	2
<b>Unit IV – Soft Skills</b>			
13.	SS	Dressing and Grooming	2
14.	SS	Professional Etiquette	2

15.	SS	E-mail Writing	2
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**UCV541L: FLUID MECHANICS LABORATORY**  
**1 Credit (0-0-2)**

**LIST OF EXPERIMENTS:**

1. Calibration of Orifice.
2. Calibration of mouth piece.
3. Calibration of triangular notches.
4. Calibration of rectangular notches.
5. Calibration of trapezoidal notches.
6. Calibration of weirs.
7. Calibration of Venturimeter and Orificemeter.
8. Experiments on major and minor losses in the pipes.
9. Impact of jet on the flat and hemispherical vanes.

**TEXT BOOKS:**

1. R.K Bansal, Fluid mechanics, Laxmi Publications; Tenth edition, 2018.
2. P N Modi and S M Seth Fluid mechanics and Hydraulic Machines by, Standard book house; 22<sup>nd</sup> edition, 2017.
3. Bireshwar majumdar, Fluid mechanics lab manual by: PHI Learning, 2<sup>nd</sup> edition 2015.
4. K.L.Kumar. "Engineering Fluid Mechanics" Experiments, Eurasia Publishing House, 1997

**LABORATORY ASSESSMENT:**

Each laboratory subject is evaluated for 100 marks (50 CIE and 50SEE)

1. Allocation of 50 marks for CIE "Performance and Journal write-up Marks for each experiment= 30 marks/ No of proposed experiments.
2. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc 5 viva-voice).
3. Allocation of 50 marks for SEE  
25% write-up, 50% conduction, calculation, results etc 25% viva-voice

## UCV542L: COMPUTER APPLICATIONS IN CIVIL ENGINEERING LAB

1 Credit (0-0-2)

### INTRODUCTION TO AUTOCAD

**Basics of drafting:** How to use AUTOCAD for drafting, Basic commands, Draw Modify Tool bars  
Coordinate systems, GUI familiarization.

**AUTOCAD:** application to civil engineering drawings Preparation of drawings: Foundation cross section, Masonry Wall, Isolated Footing, Lintel, Chejja. Different types of Doors, Windows, Staircases, RCC Beams and Slabs. Building Plan, Elevation and Sections.

**ANALYSIS AND DESIGN SOFTWARES:** Analysis and Design of structural Engineering components using commercially available Software's: Cantilevers, Simply supported beams, Propped Cantilevers, Fixed and Continuous Beams. 2D Portal frames - Single and Multistoried.

### MICROSOFT EXCEL: APPLICATION TO CIVIL ENGINEERING PROBLEMS

SFD and BMD for cantilever and simply supported beams subjected to UDL throughout the span. Design of singly and doubly reinforced beams, Computation of Earthwork, Design of Horizontal Curve by Offset method and Design of Super Elevation.

### LABORATORY ASSESSMENT:

1. Each Laboratory subject is evaluated for 100 marks ( 50 CIE and 50 SEE).
2. Allocation of 50 marks for CIE
  - Performance and journal write - up:
  - Marks for each experiment = 30 marks/ No. of proposed experiments.
  - One Practical test for 20 Marks. (5write-ups, 10 conduction, calculation, results etc. 5viva-voce)
3. Allocation of 50 marks for SEE.
  - 25% write-up, 50% conduction, calculation, results etc., 25% viva-voce.

## UCV543L HIGHWAY MATERIALS TESTING LAB

**1 Credit (0-0-2)**

1. **SAND:** Bulking of sand, Zoning, Specific gravity and water absorption.
2. **AGGREGATES:** Crushing, abrasion, impact and Shape tests (Flaky, Elongation, Angularity number) Specific gravity and water absorption
3. **BITUMINOUS MATERIALS AND MIXES:** Specific Gravity, Penetration, Ductility, Softening point, Flash and fire point, Viscosity Marshall Stability tests.
4. **SUBGRADE SOIL:** CBR Test

### **REFERENCE BOOKS:**

1. Relevant IS Codes & IRC Codes
2. Highway Material Testing Lab Manual By New Chand & Brothers

Minimum Ten Experiments are to be completed.

Candidate has to perform two experiments in the Semester Eng Examination

### **LABORATORY ASSESSMENT:**

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. Allocation of 50 marks for CIE

\* Performance and journal write up:

Marks for each experiment = 30 marks/ No. of proposed experiments.

One Practical test for 20 Marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce)

Allocation of 50 marks for SEE.

\* 25% write-up, 50% conduction, calculation, results etc., 25% viva-voce.

**Basaveshwar Engineering College, (Autonomous)**  
**Bagalkot**  
**Department of Civil Engineering**

**VI SEMESTER SCHEME (2018-19 admitted batch)**

Sl. No	Subject Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	UCV641C	Design of RC Structures - II	3	2	2	0	50	50	100
2	UCV642C	Geotechnical Engg- II	3	2	2	0	50	50	100
3	UCV643C	Water Supply And Treatment Engineering	3	3	0	0	50	50	100
4	UCV644C	Hydrology and irrigation Engg.	3	3	0	0	50	50	100
5	UCV65XN	Open Elective - 1	3	3	0	0	50	50	100
6	UCV65XE	Dept Elective - 3	3	3	0	0	50	50	100
7	UCV66XE	Dept Elective - 4	3	3	0	0	50	50	100
8	UHS003N	Fundamentals of Quantitative, Aptitude and Soft Skills	1	0	0	2	50	50	100
9	UCV641L	Geotechnical Engg lab	1	0	0	2	50	50	100
10	UCV642L	Environmental Engg lab	1	0	0	2	50	50	100
11	UCV643L	Auto Cad Laboratory for Drawing of RC Structures	1	0	0	2	50	50	100
<b>Total</b>			<b>25</b>	<b>19</b>	<b>04</b>	<b>08</b>	<b>550</b>	<b>550</b>	<b>1100</b>

Department Elective - 3				Department Elective - 4			
Sl. No.	Subject	Subject code	Credits	Sl. No.	Subject code	Subject	Credits
1	UCV651E	Numerical techniques	3	1	UCV661E	Elements of earthquake engineering	3
2	UCV652E	Design of Irrigation Structures	3	2	UCV662E	Pavement Materials and Construction	3
3	UCV653E	Ground Improvement Techniques	3	3	UCV663E	Traffic Engineering	3
4	UCV654E	Highway Geometric Design	3	4	UCV664E	Matrix Methods of Structural Analysis	3

Open Elective - 1			
Sl. No.	Subject code	Subject	Credits
1	UCV652N	Project Management	2
2	UCV653N	Occupational Health and Safety	2

## UCV641C: DESIGN OF RC STRUCTURES - II

3 Credits (2-2-0)

### UNIT I

1. Design of combined footing:

a) Slab and Beam type - Equal and Unequal loading.

13 Hrs

### UNIT II

2. Design of Retaining of Wall(RW):

a) Cantilever RW b) Counter fort RW.

13 Hrs

### UNIT III

3. Portal Frames :

a) Fixed Base b) Hinge Base

13 Hrs

### UNIT IV

4. Design of Water Tanks:

a) Circular tanks b) Rectangular tanks (Long wall and short wall).

13 Hrs

### TEXT BOOKS:

1. N. Krishna Raju, "Design of Reinforced Concrete Structures (IS: 456 2000)", 3rd Edition, CBS Publishers and Distributors, New Delhi. Jan 2009.
2. P.C. Varghese, "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi. 2008
3. B.C. Punmia, Ashok kumar Jain & Arun kumar Jain Limit State design of Reinforced concrete- Laxmi Publication, New Delhi. Jan 2016
4. Design of RCC Structural Elements S.S. Bhavimath, Vol-I, New Age International Publications New Delhi. Jan 2016

### REFERENCE BOOKS:

1. Unnikrishnan and Devadas Menon, Design of reinforced concrete structures, PHI, New Delhi. 2013
2. Karve S.R. and Shah V.L, Limit state theory and design of reinforced concrete, Vidyarthi prakashan, Pune. 2017
3. A.K. Jain, Limit state method of design, Nemchand and Bros, Roorisee. Jan 2012
4. Park and Paulay, Reinforced Concrete, John Wiley & Sons. 1975

5. Kong and Evans. Reinforced and prestressed concrete, ELBS, London
6. H.J. Shah, Reinforced concrete Vol. I, Charotar Publishing House, Anand. Jan 2016
7. IS: 456-2000, SP-24, SP-16.

(Note: Use of IS: 456-2000 is permitted and SP-16 to be used in design of columns only)

**Question Paper Pattern for SEE:**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub division.
3. Any four questions are to be answered choosing at least one from each unit, each question carry 25 marks.

Sl. No.	Course Objectives	Course Outcomes
01	To make the student to get knowledge of combined footing and different loads acting on it and designing the same.	Students will analyze and design the combined footing..
02	To Preparing the student to get the knowledge of different cantilever retaining wall and designing of cantilever and counter fort RW.	Student will understand the design and solving technique of retaining walls.
03	To prepare the students for knowing about the portal frames and its forms	Students will analyze and design the portal frames..
04	To train the student to design different water tanks and its design .	Students will design water tanks.

## UCV642C GEOTECHNICAL ENGINEERING-II

3 Credits (2-2-0)

### UNIT- I

**Subsurface exploration-** importance of exploration program, methods of exploration: boring, sounding tests, geophysical methods-electrical resistivity and seismic refraction methods. Types of samples-undisturbed, disturbed and representative samples samplers, sample disturbance, area ratio, recovery ratio, clearance stabilisation of boreholes - typical bore log. Number and depth of borings for various civil engineering structures, soil exploration report.

**Drainage and dewatering-** location of ground water table in fine and coarse grained soils. Determination of ground water level by Hvorslev's method. Control of ground water during excavation: dewatering- ditches and sumps, well point system, shallow well system, deep well system, vacuum method, electro- osmosis method.

12 Hrs

### UNIT- II

**Lateral earth pressure-** Active and passive earth pressures, earth pressure at rest, earth pressure coefficient. Earth pressure theories - Rankine's and Coulomb's –assumptions and limitations, graphical solutions for active earth pressure (cohesionless soil only) –Culmann's and Rebhann's methods lateral earth pressure in cohesive and cohesionless soils, earth pressure distribution.

**Stability of earth slopes-** Types of slopes, causes and type of failure of slopes. Definition of factor of safety, stability of finite and infinite slopes- method of slices, friction circle method, Fellenius method, Taylor's stability number.

13 Hrs

### UNIT- III

**Lateral earth pressure-** Active and passive earth pressures, earth pressure at rest, earth pressure coefficient. Earth pressure theories - Rankine's and Coulomb's –assumptions and limitations, graphical solutions for active earth pressure (cohesionless soil only) –Culmann's and Rebhann's methods lateral earth pressure in cohesive and cohesionless soils, earth pressure distribution.

**Stability of earth slopes-** Types of slopes, causes and type of failure of slopes. Definition of factor of safety, stability of finite and infinite slopes- method of slices, friction circle method, Fellenius method, Taylor's stability number.

13 Hrs

## UNIT- IV

**Bearing Capacity of Shallow Foundation-** Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and/or eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil- SPT and plate load test. Foundation settlement-Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).

**Pile Foundations-** Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation).

**14 Hrs**

### TEXT BOOKS:

1. Alam Singh and Chowdhary G.R. (1994), Soil Engineering in Theory and Practice CBS Publishers and Distributors Ltd., New Delhi.
2. Punmia B.C. (2005), 16<sup>th</sup> Edition Soil Mechanics and Foundation Engg.- Laxmi Publications Co. , New Delhi.

### REFERENCES BOOKS:

1. Bowles J.E. (1996), 5th Edition, Foundation Analysis and Design- McGraw Hill Pub. Co. New York.
2. Murthy V.N.S. (1996), 4th Edition, Soil Mechanics and Foundation Engineering-UBS Publishers and Distributors, New Delhi.
3. Gopal Ranjan and Rao A.S.R. (2000), Basic and Applied Soil Mechanics- New Age International (P) Ltd., Newe Delhi.
4. Venkatrahmaiah C. (2006), 3rd Edition Geotechnical Engineering New Age International (P) Ltd., Newe Delhi.
5. Craig R.F. (1987), Soil Mechanics- Van Nostrand Reinhold Co. Ltd.
6. Braja M. Das (2002), 5<sup>th</sup> Edition, Principles of Geotechnical Engineering- Thomson Business Information India (P) Ltd., India.
7. Iqbal H. Khan (2005), 2nd Edition, Text Book of Geotechnical Engineering- PHI, India.

### QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

<b>Sl. No.</b>	<b>Course Objectives</b>	<b>Course Outcomes</b>
<b>1</b>	Students are exposed to know the methods of soil exploration, and different types of dewatering systems	In a position to investigate the soil profile and to select the dewatering method during construction
<b>2</b>	To calculate the intensity of vertical stresses and know effective stress	Determine the vertical stresses below different shapes of footing and analysis of the effective stress
<b>3</b>	To determine intensity of lateral earth pressure and to check the slope stability	Check the stability of the slopes and compute lateral earth pressure on retaining wall.
<b>4</b>	To full fill the requirements of a civil engineer like SBC, Proportioning of footing and predict the settlement of the soil and pile foundation	Calculate the bearing capacity of soil and settlement of soil. Also proportionate the footing and know about pile foundation

## UCV643C: WATER SUPPLY AND TREATMENT ENGINEERING

3 Credits (3-0-0)

### UNIT-I

**Introduction:** Necessity, planning and execution of modern water supply scheme.

**Water Demand and Quantity:** Types of water demand - domestic, institutional, commercial, public, and water losses. Estimation of Fire demand and Per-capita demand- factors affecting. Population forecasting, Design period- factors governing. Variations in demand of water and Quantity estimation.

**Sources, Collection and Conveyance of water:** Factors governing the selection of source for water supply, suitability of surface and subsurface source (quality and quantity).

10 Hrs

### UNIT-II

**Intake structures:** Submerged intake, intake towers, river intake, canal intake, dam intake. Pumps- necessity, power and selection of a pump, economical diameter of rising main.

**Quality of Water:** Potable and palatable water, waterborne diseases, Physical, Chemical and Microbiological water quality parameters using analytical and instrumental techniques. Indicator organism, MPN, BIS and WHO drinking water standards (BIS 3025 and BIS 1622) using analytical and instrumental techniques. Health significance of Fluoride, Nitrate and heavy metals like mercury, cadmium and Arsenic. Sampling water for examination.

10 Hrs

### UNIT-III

**Water Treatment:** Treatment flow-charts for surface and ground water. Sedimentation-Theory (Newton's and Stoke's Equation) and design concept. Types of Sedimentation tanks. Coagulation-Theory, types of coagulants (Alum, copperas, chlorinated copperas, sodium aluminate and polymers). Constituents of coagulation sedimentation plant. Design of coagulation tanks, clariflocculator.

**Filtration**-theory, slow-sand, rapid-sand and pressure filters including construction, operation, cleaning and their design (excluding under drainage system). Operational troubles in filters. Disinfection- Theory of disinfection, types of disinfectants, chlorination, chlorine demand, residual chlorine, use of bleaching powder UV irradiation and ozone treatment.

10 Hrs

### UNIT-IV

**Miscellaneous Treatment Methods:** Softening- Definition, lime soda process and zeolite process. Reverse Osmosis & Membrane Filtration. Removal of Iron and Manganese. Colour, odour and Taste removal. Fluoridation, Defluoridation and Desalination.

**Distribution Systems:** System of supply, service reservoirs and their capacity determination, Design of distribution systems. Pipe appurtances, pipefitting, Layout of water supply pipes in buildings.

10 Hrs

**TEXT BOOKS:**

1. Santoshkumar Garg, Khanna Publishers, Water Supply Engineering New Delhi. 2006 Edition.
2. B. C. Punmia, Ashok Jain and Arunkumar Jain, Environmental Engineering-I Laxmi Publications, New Delhi. 2007 Edition

**REFERENCE BOOKS:**

1. Howard S. Peavy, Donald R. Rowe, George Tecno Bano Glous, Environmental Engineering McGraw Hill International Edition. 2013

**QUESTION PAPER PATTERN FOR SEE:**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

<b>Sl.No.</b>	<b>Course Objectives</b>	<b>Course Outcomes:</b> After completion of this course the student will be able to:
1.	To impart the basic knowledge about the necessity, planning and execution of modern water supply schemes. To expose the students on the types of water demand.	Estimate quantity of water required for a township.
2.	To make the students understand about the sources, collection and conveyance of water to bring the awareness regarding the necessity, power/selection of pumps and economic diameter of rising main	Classify the physical, chemical and bacteriological water quality parameters for drinking purpose.
3.	To make the students familiar with various aspects of physical, chemical and biological quality of water. Testing of water quality, Health significance, Drinking water standards and different types of water treatment units and processes.	Design intake structures for water supply , rising mains, storage, and capacity of service reservoir.
4.	To expose the students to the methods of removal of iron, manganese, color, taste and odor, fluoridation / defluoridation and desalination and layout of water supplies in buildings.	design water treatment units like sedimentation, coagulation, filtration, knowledge of disinfection or chlorination, softening, defluoridation and desalination.

## UCV 644C: HYDROLOGY AND IRRIGATION ENGINEERING

3 Credits-(3-0-0)

### UNIT-I

**Introduction:** Practical application of hydrology, Hydrological cycle, Concept of catchments and need for planned utilization of water resources.

**Precipitation:** Definition and forms of precipitation. Weather seasons in India. Measurement of precipitation by rain gauges. Computation of average depth of precipitation, Estimation of missing precipitation record.

**Water losses:** Infiltration: Factors affecting infiltration. Infiltrimeters, infiltration capacity curve, Infiltration indices,

Evaporation: Factors affecting evaporation. Evaporation pans, ISI standard pan, Numericals  
Evapotranspiration, PET and AET definitions.

10 Hrs

### UNIT-II

**Run-off:** components, factors affecting run off, basin yield. Rainfall-runoff relationship using simple linear regression Computation of maximum flood discharge, Dicken's Ryve's and rational formulae and problems.

**Hydrograph Theory:** Components of hydrograph. Separation of base flow. Unit hydrograph theory. Derivation of unit hydrograph. Derivation of UH of different durations, Numericals.

S-curve and its use (Theory only).

Ground water hydrology: Occurrence, aquifers, aquitard, aquifuge, aquiclude, perched aquifer. Aquifer parameters. Darcy's law and its validity and simple problems

10 Hrs

### UNIT-III

**Irrigation Engineering:** Necessity, benefits and ill effects of irrigation, and its history of development, Types of Irrigation, Techniques of water distribution in the farm, quality of irrigation water, Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor.

**Canals:** Classifications, Regime theory, Design of canals cross sections by Lacey's and Kennedy's method.

**Water requirement of Crops:** consumptive use, duty, delta and base period, and problems, factors affecting and methods to improve duty, Variation of duty in a canal network, Crop seasons in india, irrigation efficiencies, frequency of irrigation and numericals.

10Hrs

## UNIT-IV

Investigation for reservoir site, storage zones, determination of storage capacity using mass curve for specific yield, economical height of dam.

Gravity Dams: Forces acting on gravity dam, Analytical method of Stability analysis and problems, Drainage gallery, types and functions.

Earthen Dams: Types, Construction, Causes of failure of earthen dams, Seepage control measures,

Spillways: Different types of spill ways (theory and equations), types of energy dissipaters.

**10 Hrs**

### TEXT BOOKS

1. Subramannya K. Engineering Hydrology, Tata Mc Grew Hill, 3rd edition, 2008.
2. P. Jayarami Reddy, Text book of Hydrology.Laxmi Publications New Delhi, 3rd edition, 2016.
3. S.K. Garg, Irrigation Engg. and Hydraulic Structures.Khanna Publications, Delhi, 1st edition, 2017.
4. R. K. Sharma and Sharma, Hydrology and water resource Engineering, Revised Edition 2007
5. B.C. Punmia Irrigation Engineering and Design of Hydraulic Structures.Laxmi Publications New Delhi, Sixteenth edition, 2019.

### REFERENCICE BOOKS:

1. Mutreja K. N., AppliedHydrology.Mc.Graw Hill New Delhi, 1996.
2. H. M. Raghunath, Hydrology.New age international publishers, 2006.
3. G. L. Asawa, Irrigation Engineering. New Age international publications, 2005.

### QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No	Course Objectives	Course Outcomes
	This course will make students to learn:	After completion of this course students will be able to:
1.	Understand concepts of hydrology, Hydrological cycle and its components.	Understand components of hydrological cycle, measure and quantify precipitation, evaporation and infiltration.
2.	Quantify runoff and generate hydrographs.	Estimate runoff and generate hydrographs.
3.	Understand concepts of irrigation, canal classification and design	To be able to compute duty, delta and frequency of irrigation, and design canal cross sections

4.	About Reservoirs dams and spillways	determine storage capacity of reservoirs & understand basics of gravity and earthen dams & spillways
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**UHS003N: FUNDAMENTALS OF QUANTITATIVE APTITUDE ANDSOFT SKILLS**  
**1 Credit (2-0-0)**

<b>Course Objectives</b>	The course objectives for the semester are as follows: 1. Cover fundamental topics in the following domains: a. quantitative aptitude, b. verbal aptitude, and c. reasoning aptitude. 2. Build confidence and self-esteem through the following: a. life skills, and b. soft skills.	
<b>Course Objectives</b>	After the course, the students will be able to: 1. Answer multiple choice questions from topics in: a. quantitative aptitude, verbal aptitude, and reasoning aptitude. 2. Use tools and techniques learnt in soft skills modules to: a. communicate effectively with others, and to b. build proficiency in speaking English.	
<b>Domain</b>	<b>Hours</b>	<b>Modules</b>
<b>Quantitative Aptitude (QA)</b>	4	2
<b>Reasoning Aptitude (RA)</b>	4	2
<b>Verbal Aptitude (VA)</b>	4	2
<b>Soft Skills (SS)</b>	12	6
<b>Career Skills (CS)</b>	6	3
<b>Total</b>	30	15

<b>DETAILS</b>			
<b>Sl. No.</b>	<b>Domain</b>	<b>Topic</b>	<b>Hours</b>
<b>UNIT I – Quantitative and Reasoning Aptitude Skills Training</b>			
1.	QA	Number Properties	2
2.	QA	Percentages	2
3.	RA	Linear and Circular Arrangement	2
4.	RA	Order and Rank	2
<b>UNIT II – Verbal Aptitude Skills Training</b>			
5.	VA	Parts of Speech	2
6.	VA	Reading Comprehension	2
<b>Unit III – Career Skills</b>			
7.	CS	Introduction to Interview Etiquette	2
8.	CS	Introduction to GD Etiquette	2
9.	CS	Introduction to Resume Writing	2
<b>Unit IV – Soft Skills</b>			
10.	SS	Six-Step Planning Process	2
11.	SS	Problem Solving through Design Thinking	2
12.	SS	Conflict Resolution through Assertiveness and Cooperation Matrix	2

13.	SS	Confidence through Body Language	2
14.	SS	Preparing and Delivering a Presentation	2
15.	SS	Self-Motivation	2

**UCV641L : GEOTECHNICAL ENGINEERING LABORATORY**  
**1 Credit (0-0-2)**

1. Field identification of soil, Specific gravity test and Water content determination
2. Grain size analysis of soil sample (Sieve analysis)
3. In-situ density tests:
  - i. Core-cutter method
  - ii. Sand replacement method
4. Consistency limits :
  - i. Liquid limit test(Casagrande's and cone penetration method)
  - ii. Plastic limit test
  - iii. Shrinkage limit test
5. Standard proctor test and Modified proctor test
6. Co-efficient of permeability test:
  - i. Constant head test
  - ii. Variable head test
7. Shear strength tests
  - i. Unconfined compression test
  - ii. Direct shear test
  - iii. Triaxial test (Undrained test only)
8. Consolidation test : Determination of compression index and Co-efficient of consolidation
9. Laboratory vane shear test
10. Determination of CBR Value
11. Demonstration of:
  - i. Miscellaneous equipments such as Augers, Samplers, Rapid Moisture meter and Proctors Needle.
  - ii. Hydrometer Test
  - iii. Free swell Index and Swell pressure test
  - iv. Determination of relative Density of sand

**REFERENCE BOOKS:**

1. Punmia B C, Soil Mechanics and Foundation Engineering (2017),16<sup>th</sup> Edition, Laxmi Publications co., New Delhi.

2. Lambe T.W., Soil Testing for Engineers, Wiley Eastern Ltd., New Delhi, 1951.
3. Head K.H., Manual of Soil Laboratory Testing, Vol. I, II, III, Princeton Press, 3rd edition, 2006.
4. Bowles J. E., Engineering Properties of Soil and Their Measurements, McGraw Hill Book Co. New York, 1988.
5. Relevant BIS Codes of Practice: IS-2720 series

**LABORATORY ASSESSMENT:**

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. Allocation of 50marks for CIE: Performance and journal write-up. Marks for each experiment = 30 marks/No of proposed experiment.
3. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voice).
4. Allocation of 50 marks for SEE: 25% write-up. 50% conduction, calculation, results etc., 25% viva-voice.

**UCV 642L: ENVIRONMENTAL ENGINEERING LAB**  
**1 Credit (0-0-2)**

**I) Tests on Water Quality**

i) Physical Parameters

- 1) Colour
- 2) Turbidity
- 3) Conductivity
- 4) Temperature

ii) Chemical Parameters

- 1) Solids-Total, dissolved and suspended
- 2) pH
- 3) Acidity
- 4) Alkalinity
- 5) Chlorides
- 6) Hardness- Carbonate and Non carbonate
- 7) Sulphate
- 8) Fluoride
- 9) Iron
- 10) Chlorine demand & Residual chlorine
- 11) Nitrate

iii) Bacteriological Parameters

- 1) MPN
- 2) Membrane Filter Technique

**II) Tests on Sewage**

- 1) Solids-Total, dissolved, suspended, volatile and fixed
- 2) Biochemical oxygen Demand
- 3) Chemical oxygen Demand

**III) Other Tests**

- 1) Optimum Alum dose ( Jar Test)
- 2) Percentage of chlorine in Bleaching Powder
- 3) Break Point Chlorination and Residual Chlorine

**REFERENCE:**

1. Manual of Water and Wastewater Analysis- NEERI Publication 1988.
2. Standard methods for Examination of Water and Wastewater Analysis APHA, AWWA.2011.

**LABORATORY ASSESSMENT:**

1. Each Laboratory subject is evaluated for 100 marks (50 CIEand50 SEE).
2. Allocation of 50 marks for CIE

\* Performance and journal write up:

Marks for each experiment = 30 marks/ No. of proposed experiments.

\* One Practical test for 20 Marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce)

3. Allocation of 50 marks for SEE.

\* 25% write-up, 50% conduction, calculation, results etc., 25% viva-voce.

## **UCV643L AUTO CAD LABORATORY FOR DRAWING OF RC STRUCTURES**

**Credits 01 (0-0-2)**

1. Drawing of combined Footing showing all details.
2. Drawing of Retaining wall (Cantilever and Counter fort) showing all details.
3. Drawing of portal frames (fixed and Hinge base) showing all details.
4. Drawing of water tanks (Circular and Rectangular) showing all details.
5. Drawing of the Lay out plan of Residential Building showing position of the columns.

### **LABORATORY ASSESSMENT:**

1. Each Laboratory subject is evaluated for 100 marks ( 50 CIE and 50 SEE).
2. Allocation of 50 marks for CIE
  - Performance and journal write - up:
  - Marks for each experiment = 30 marks/ No. of proposed experiments.
  - One Practical test for 20 Marks. (5write-ups, 10 conduction, calculation, results etc. 5viva-voce)
3. Allocation of 50 marks for SEE.
  - 25% write-up, 50% conduction, calculation, results etc., 25% viva-voce

# **ELECTIVES LIST FOR SEMESTER V**

## **DEPARTMENT ELECTIVE-II**

### **UCV551E: ENERGY EFFICIENT BUILDINGS**

**3 Credits (3-0-0)**

#### **UNIT I**

**Introduction:** Conventional versus Energy efficient buildings-Historical perspective, Water-Energy-IAQ requirement analysis-Future building design aspects-Criticality of resources and needs of modern living

**Landscape and building envelopes:** Energy efficient Landscape design- Micro-climates-various methods-Shading, water bodies-Building envelope: Building materials, Envelope heat loss and heat gain and its evaluation, paints, Insulation, Design methods and tools.

**12 Hours**

#### **UNIT II**

**Heating ventilation and air-conditioning:** Natural Ventilation, Passive-cooling and heating-Application of wind, water and earth for cooling- evaporative cooling, radiant cooling- Hybrid methods-Energy Conservation measures, Thermal Storage integration in buildings.

**10 Hours**

#### **UNIT III**

**Heat transmission in buildings:** Surface-co-efficient: air cavity, internal and external surfaces, overall thermal transmittance, wall and windows, Heat transfer due to ventilation/infiltration, internal heat transfer, Solar temperature decrement factor, Phase lag. Design of daylighting; Estimation of building loads: Steady state method, network method, numerical method, correlations; Computer packages for carrying out thermal design of buildings and predicting performance.

**10 Hours**

#### **UNIT IV**

**Passive cooling & renewable energy in buildings:** Passive cooling concepts:; Evaporative cooling, radiative cooling; Application of wind, water and earth for cooling Shading, paints and cavity walls for cooling; Roof radiation traps; Earth air-tunnel. Introduction of renewables sources in buildings, Solar water heating, small wind turbines, standalone PV systems, Hybrid system-Economics.

**08 Hours**

**TEXT BOOK/REFERENCES:**

1. Clarke, Joseph. Energy simulation in building design. Routledge, 2007.
2. Krishan, Arvind, ed. Climate responsive architecture: a design handbook for energy efficient buildings. Tata McGraw-Hill Education, 2001.
3. Krieder, J and Rabi, A., Heating and Cooling of buildings : Design for Efficiency, McGraw Hill, 1994.
4. Ursala Eicker, "Solar Technologies for buildings", Wiley publications, 2003.
5. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from [www.energymanagertraining.com](http://www.energymanagertraining.com))
6. Patrick Waterfield "The Energy Efficient Home: A Complete Guide"- The Crowood Press Ltd; New edition, 2011.

**QUESTION PAPER PATTERN FOR SEE:**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub division.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	Course Objectives	Course Outcomes
01	To make students understand the current energy scenario and the importance of energy-savings.	Evaluate and justify energy-saving measures in existing building stock.
02	To make students learn energy efficiency measures on grounds of engineering and economic feasibility.	Apply energy efficiency measures on grounds of engineering and economic feasibility.
03	To run simple simulation programs of buildings to perform energy calculations, evaluate the relationship between energy use, indoor comfort and users.	Apply simulation programs of buildings to perform energy calculations, evaluate the relationship between energy use, indoor comfort and users.

## UCV552E: ENVIRONMENTAL IMPACT ASSESSMENT

03Credits (3-0-0)

### UNIT-I

**Developmental activity and ecological factors:** EIA, EIS, FONSI. Need for EIA Studies, Baseline Information, Step-by-step procedures for conducting, EIA, Limitations of EIA.

10  
Hrs

### UNIT-II

**Frame work of impact assessment:** Developmental Projects Environmental Setting, Objectives and Scope, Contents of EIA, Methodologies. Techniques of EIA. Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-economic Environment.

10Hrs

### UNIT-III

**EIA guidelines for developmental projects:** Rapid and Comprehensive EIA. Public Participation in Environmental Decision making. Practical considerations in preparing Environmental Impact Assessment and Statements.

10Hrs

### UNIT-IV

**Salient features of the project activity:** Environmental Parameter Activity Relationships- Matrices EIA for water resource developmental projects, Highway Projects: Nuclear- Power plant project, Mining project (Coal, Iron ore)

**Environmental audit:** Types objectives and procedures of Environmental Audit.

10Hrs

### TEXTBOOKS:

1. Jain R.K., Environmental Impact Analysis, Van Nostr and Reinhold Co.1996.
2. Anjaneyalu Y, Environment Impact Assessment .2<sup>nd</sup> Edition B. S. publications, 2015

**REFERENCE BOOKS:**

1. Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI. Jan 2001
2. Larry W. Canter, Environment Impact Assessment .McGraw Hill Higher Education -1977.

**QUESTION PAPER PATTERN FOR SEE:**

1. Each Question should not have more than four sub divisions.
2. Any Five Full questions are to be answered choosing at least one from each unit.

<b>Sl.No</b>	<b>Course Objectives</b>	<b>Course Outcomes:</b>
1.	To impart the basic knowledge of EIA and step by step procedures conducting EIA.	An ability to conduct and assess the impact of pollution.
2.	To make the students understand about the development activities, EIA methodologies and impact on the attributes of air, water, land, noise ecology, soil, cultural and socio economic environments	An ability to compare methods and methodologies of EIA with respect to the attributes of environmental systems.
3.	To make the students familiar with importance of public participation in decision making process and practical consideration in preparing EIA.	An ability in preparing EIA report and involving public in decision making process.
4.	To expose the students to various projects of EIA such as highway, nuclear and mining along with environmental audit.	An ability to conduct EIA for various projects.

## UCV553E: REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

### UNIT-I

**Basics:** Fundamentals of Remote Sensing, Electromagnetic Spectrum, Process of remote sensing, Types of reflections, Energy Interactions with earth atmosphere and surface features, spectral reflectance curves-For Vegetation, soil & water, Idealised Remote Sensing System

**Sensors:** Definition, Sensor Parameters, Types, Choice of sensor, Optical Remote Sensing, Across and Along track scanning systems.

**platforms:** Definition, Space borne platform attitudes (only definitions, No Problems)

**Indian Remote Sensing Programme:** Definition and Objectives

**Satellite Specifications** for IRS-1C, 1D, CARTOSAT-1 & CARTOSAT-2

### UNIT-II

**Visual Image Interpretation:** Definition, Objectives, Keys & Elements of Visual Image interpretation.

**Digital Image Processing (DIP):** Definition, Image Rectification & Restoration, image enhancement (contrast manipulation-Grey Level Thresholding, Level Slicing only), GIS integration –stages & procedure.

**GIS:**

**Map Projections** Plane and geodetic , latitude and longitude map projections, types of map projections Spheroid, Datum (WGS84 Datum) and UTM (No Problems)

**Basic Introduction:** History, Definition, Components, concept.

***GIS functions***

***Input Functions (Vector and Raster)*** Data acquisition for GIS input-Spatial (Vector, Raster & Surface data) & Non spatial data, rectification, processing, verification & Data Editing.

***Analysis Functions (Vector Data-*** Buffering & Overlay analysis using overlay operators )

***(Raster Data-***Local Operations and neighbourhood operations using arithmetic, Logical and Overlay operators)

Output (Vector), Cartography (Defn, techniques, map types, basic map layout-Brief Discussion Only)

### UNIT-III

**Data Standards in GIS** errors, precision and accuracy-Definition and Types (Only Brief Discussion, No problems)

**Advanced Concepts (Brief Discussion Only):** LIDAR, VGIS (Definition ,List of components, Advantages) GPS (Definition, Types, Method of point positioning, Principle of working, segments in GPS) (No Problems)

**Computer Concepts of GIS:** Coding of attribute data in computer (Binary system & Hexadecimal System), coding of vector & Raster data in GIS (No problems or programming)

#### UNIT-IV

**Applications of GIS and Remote Sensing :**

- 1) Geomorphology
- 2) Ground water Vulnerability
- 3) Geology mapping

**Procedure of Compiling:** Land Use Land Cover map (LU/LC) with flow chart

**Drainage Patterns-**Definition, Types, significance

**TEXT BOOKS:**

1. Remote Sensing & Image Interpretation –Thomas. M.Lillysand & Ralph.W.Keifer-4<sup>th</sup> Edition.
2. Remote Sensing and Gis-B.Bhatta (Oxford University Press).
3. Remote Sensing and Gis-Angireddy.
4. Geographic Information Systems-C.P.Lo-University Of Georgia, Athens, Georgia, Usa, Albert .K.W.Yeung-Ontario Police College, Aylemer, Ontario, Canada-Preintice Hall Of India Private Limited.
5. Peter A.Burrough Reacheal Amc Donnel, Principles of Gis (Oxford).

**WEB SITES**

1. [www.gisdevelopment.net](http://www.gisdevelopment.net)
2. [www.jsys.org](http://www.jsys.org)
3. [www.nrsc.gov.in](http://www.nrsc.gov.in)
4. NPTEL NOTES

**QUESTION PAPER PATTERN:**

1. Each Question should not have more than four sub divisions.
2. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No.	Course Objective	Course Outcome
1	Basics of remote sensing (RS) such as physics of Electromagnetic Radiations , need of RS in civil engineering, Use of sensors and platforms in RS, Objectives and Programmes of ISRO.	Collect data and delineate various elements from the satellite imagery using their spectral signature

2	Causes for deterioration of quality of satellite images, digital methods of rectifying and processing of satellite images, Visual interpretation of satellite images for deriving information from Satellite images to achieve specific objectives such as deciding on flood mitigating measures etc	Analyze different features of ground information to create raster or vector data
3	Basics of GIS, application of GIS and the functionalities for civil engineering works. Method of assessing data quality and minimum data standards required for GIS analyses, concepts of GIS, of Working principle and application of VGIS , LIDAR and GPS	Perform digital classification and create different thematic maps for solving specific problems
	Principles, applications and procedure of preparing Land Use/Land Cover map, Geomorphology and geology map and also open source and Commercial GIS softwares, also utilization of Open Source softwares for civil engineering applications.	Make decision based on the GIS analysis on thematic maps

**UCV554E: MASONRY STRUCTURES**  
**Credits 03 (3-0-0)**

**UNIT-I**

**MASONRY UNITS, MATERIALS, TYPES & MASONRY CONSTRUCTION:** Brick, stone and block masonry units-strength, modulus of elasticity and water absorption of masonry materials, classification and properties of mortars, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking.

**05 Hrs**

**STRENGTH AND STABILITY:** Strength and stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression.

**05 Hrs**

**UNIT-II**

**PERMISSIBLE STRESSES:** Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.

**04 Hrs**

**DESIGN CONSIDERATIONS:** Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion and lintels.

**05 Hrs**

**UNIT-III**

**LOAD CONSIDERATIONS FOR MASONRY:** Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings, free standing wall.

**04 Hrs**

**DESIGN OF MASONRY WALLS:** Design of load bearing masonry for building up to three storeys using IS: 1905 and SP: 20.

**05 Hrs**

**UNIT-IV**

Design of axially loaded unstiffened solid walls, solid wall supported at the ends by cross wall, solid wall with piers, cavity wall and design of cavity wall with cross wall.

**05 Hrs**

Design of free standing walls with and without staggered, design of masonry tabular structure representing a chimney and design of shear wall under seismic loading.

**05 Hrs**

**TEXT BOOKS**

1. Structural Masonry Henry, A.W.: Macmillan Education Ltd, 1990

2. Brick and Reinforced Brick Structures Dayaratnam P.: Oxford & IBH, 1987

**REFERENCE BOOKS:**

1. Design of Masonry structures Sinha B.P Davies S.R: E & FN spon 1997
2. IS 1905-1987 Code of practice for structural use of un-reinforced masonry (3<sup>rd</sup> revision) BIS, New Delhi.
3. SP 20 (S&T)-1991, Hand book on Masonry design and construction (1<sup>st</sup> revision) BIS, New Delhi.

**QUESTION PAPER PATTERN FOR SEE**

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.
4. Use of IS: 1905 code is allowed.

Sl. No	Course Objectives	Course Outcomes After studying the student will be able to
1	Students will be able comprehend masonry units, materials, types & masonry construction also strength and stability of masonry.	Identify various materials used in masonry, their characteristics and the influence of various parameters on the stability of concentrically loaded masonry walls.
2	Students will be learn permissible compressive stress, stress reduction and shape reduction factors and design considerations.	Summarise the permissible stresses and design considerations
3	Students will be able comprehend load considerations for masonry and design of masonry walls.	Design of masonry up to three storeys
4	Students will be able comprehend design of axially loaded solid walls, cavity walls and free standing walls.	Design of cross wall, solid walls, cavity walls and free standing walls.

# **ELECTIVES LIST FOR SEMESTER VI**

## **OPEN ELECTIVE -I**

### **UCV652N PROJECT MANAGEMENT**

**Credits (3-0-0)**

#### **UNIT I**

Introduction: Definition of project, characteristics of projects, understand projects, types of projects, scalability of project tools, project roles.

Project Selection and Prioritization – Strategic planning process, Strategic analysis, strategic objectives, portfolio alignment – identifying potential projects, methods of selecting projects, financial mode / scoring models to select projects, prioritizing projects, securing and negotiating projects.

**10 Hrs**

#### **UNIT II**

Planning Projects: Defining the project scope, Project scope checklist, Project priorities, Work Breakdown Structure (WBS), Integrating WBS with organization, coding the WBS for the information system.

Scheduling Projects: Purpose of a project schedule, historical development, how project schedules are limited and created, develop project schedules, uncertainty in project schedules, Gantt chart.

**10 Hrs**

#### **UNIT III**

Resourcing Projects: Abilities needed when resourcing projects, estimate resource needs, creating staffing management plan, project team composition issues, Budgeting Projects: Cost planning, cost estimating, cost budgeting, establishing cost control.

Project Risk Planning: Risk Management Planning, risk identification, risk analysis, risk response planning, Project Quality Planning and Project Kickoff: Development of quality concepts, project quality management plan, project quality tools, kickoff project, baseline and communicate project management plan, using Microsoft Project for project baselines.

**10 Hrs**

#### **UNIT IV**

Performing Projects: Project supply chain management: - Plan purchasing and acquisitions, plan contracting, contract types, project partnering and collaborations, project supply chain management.

Project Progress and Results: Project Balanced Scorecard Approach, Internal project, customer, financial issues, Finishing the project: Terminate project early, finish projects on

time, secure customer feedback and approval, knowledge management, perform administrative and contract closure.

Network Analysis: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method (CPM) to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

**10 Hrs.**

**TEXT BOOKS:**

1. Project Management, Timothy J Kloppenborg, Cengage Learning, Edition 2009.
2. Project Management, A systems approach to planning scheduling and controlling by Harold kerzner, CBS publication.
3. Project Management by S Choudhury, Mc Graw Hill Education (India) Pvt. Ltd. New Delhi, 2016

**REFERENCE BOOKS:**

1. Project Management, Pennington Lawrence, Mc Graw hill
2. Project Management, AModer Joseph and Phillips New Yark Van Nostrand, Reinhold.
3. Project Management, Bhavesh M. Patal, Vikas publishing House,

**QUESTION PAPER PATTERN FOR SEE**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

<b>SL.N o.</b>	<b>Course Objectives</b>	<b>Course Outcomes</b> After studying this course the students will be able to:
1	Understand the importance of PM in most industries and businesses and to apply specific tools, models and processes.	Discuss complex management situations based on knowledge and facts and respect for differed opinions.
2	Understand the Importance of applying these methodologies and tools at the four distinct stages in the Project's life cycle. The Definition, Planning, Execution and Closing Phase.	Define project, plan and schedule the projects.
3	Understand key levers for measurement and follow up,	Appreciate the significance of resource management and proper budget planning.

	Management Dash Board and Key Performance Indicators	
4	Identify and Analyse factors for successful Projects, as well as reasons for failure based on specific case studies in the context of effective Risk Management.	Identify the risks and analyze their effect on the project.
5	Understand the structure of financial statements relating to Profit and Loss statement, Cash Flow Statement and Balance Sheet. Students should identify positive as well as warning signs within financial statements as indicators of issues for management to address.	Prepare profit and loss statements with the help of available tools.
6	Understand the importance of values and cultural differences, particularly in international projects.	Appraise values and team work for inter-cultural team-work.

## UCV653N:OCCUPATIONAL SAFETY AND HEALTH

3 Credits (3-0-0)

### UNIT-I

**Occupational Hazard and Control Principles:** Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. **Accident** – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation .

10 Hrs

### UNIT-II

**Ergonomics at Work Place:** Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations.

10 Hrs

### UNIT-II

**Fire Prevention and Protection:** Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. Electrical Safety, Product Safety: Technical Requirements of Product safety. **Health Considerations at Work Place:** Types of diseases and their spread, Health Emergency.

10 Hrs

### UNIT-III

**Personal Protective Equipment (PPE)** – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability. Safety in Construction: Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure: (a) For storage and handling of building materials.(b) Construction of elements of a building (c) In demolition of buildings Safety lacuna in Indian scenario.

10 Hrs

## UNIT-IV

**Occupational Health and Safety Considerations:**Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors.

**10 Hrs**

### QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

### TEXT BOOKS:

1. Goetsch D.L., (1999), “Occupational Safety and Health for Technologists, Engineers and Managers”, Prentice Hall.
2. Heinrich H.W., (2007), “Industrial Accident Prevention - A Scientific Approach”, McGraw-Hill Book Company National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),
3. “Industrial Safety and Pollution Control Handbook

### REFERENCE BOOKS:

1. Colling D.A., (1990), “Industrial Safety Management and Technology”, Prentice Hall, New Delhi.
2. Della D.E., and Giustina, (1996), “Safety and Environmental Management”, Van Nostrand Reinhold International Thomson Publishing Inc.

Sl.No	Course Objectives	Course Outcomes: After completion of this course the student will be able to:
1	To Input the knowledge about occupational safety and OSHA Act.	Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
2	To make the students to investigate cause for accident and prepare a report.	Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.

3	To expose the students to various health hazards and controlling methods.	Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4	To make a the students to demonstrate the occupational safety measures.	Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.

## DEPARTMENT ELECTIVE-III

### UCV651E : NUMERICAL TECHNIQUES IN CIVIL ENGINEERING

3 Credit (0-0-3)

#### UNIT-I

**Introduction:** Historical development of numerical techniques, Role in investigations, research, and design in the field of Civil Engineering. Application of Solution of Linear System of Equations To Civil Engineering Problems.

Development of simultaneous equations from problems in construction planning, slope deflection method applied to beams frames and truss analysis using Gaussian elimination method, Gauss- Jordan matrix inversion method, Gauss- Siedel method, Cholesky decomposition method.

**10 Hrs**

#### UNIT-II

Application of Root Finding To Civil Engineering Problems development of non-linear algebraic and transcendental equations from problems in hydraulics, irrigation engineering, structural engineering and environmental engineering using Bisection method and Newton-Raphson method.

Application of Numerical Integration for Solving Simple Beam Problems

i. Computation of area of BMD drawn for statically determinate beams

by Trapezoidal rule and Simpson's one third rule.

**10 Hrs**

#### UNIT-III

Application of Solution of Ordinary Differential Equation To Civil Engineering Problems.

Application of solution of ODE by Euler's method and Runge-Kutta 4<sup>th</sup> order method in statically determinate problems, problems in Environmental engineering, problems in Hydraulics and Geotechnical engineering.

**10 Hrs**

#### UNIT-IV

Application of Finite Difference Techniques In Structural Mechanics:

i) Introduction, expression of derivatives by finite difference , backward differences, forward differences and central differences.

ii) Application of finite difference method to analysis of Statically determinate beams, Statically indeterminate beams, Buckling of columns.

**10 Hrs**

#### TEXT BOOK

1. N. Krishnaraju and K.U. Muthu- Numerical Methods for Engineering Problems, 2<sup>nd</sup> edition, Laxmi publications, New Delhi , 2007.

## BOOKS FOR REFERENCE

1. J B Scarborough- Numerical Mathematical Analysis, 6<sup>th</sup> edition, Oxford and IBH New Delhi, 2005.
2. Mario Salvadori- Numerical Methods in Engineering, PHI, 1961.
3. M.K Jain, S R K Iyengar and R.K. Jain- Numerical Methods for Scientific and Engineering computation, New Publications, New Delhi,2012.
4. S S Sastry- Introductory Methods of Numerical Analysis, 5<sup>th</sup> edition, PHI,New Delhi , 2012.
5. E Balagurusamy- Numerical Methods, Tata Mc Graw Hill,2017.
6. H C Saxena- Examples in Finite Differences And Numerical Analysis, S Chand & Co. New Delhi,1975.

## QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

S.No.	Course Objectives	Course Outcomes After studying this course the students will be able to:
1	Introduction to definitions, basic concepts associated numerical techniques in civil engineering. Solution of linear system of equations and application to civil engineering problems.	Solve linear system of equations related to civil engineering problems using Guass elimination, Guass-Siedel, Guass-Jordan matrix inversion, Cholesky's decomposition methods.
2	Introducing to root finding of non-linear algebraic and transcendental equations. Application to civil engineering problems.	Find roots of non-linear algebraic and transcendental equations related to civil engineering problems using bisection and Newton-Raphson method.
3	Introduction to basic concepts associated with differential equations and solution to ordinary differential equations. Application to civil engineering problems.	Solve ordinary differential equations by Euler's method, Euler's modified method and Runge-Kutta method related to civil engineering problems.
4	Introduction to concepts associated with finite difference techniques. Derivation of expression for derivatives by finite differences. Solution to differential equations by finite difference techniques and application to beams and buckling of columns.	Solve differential equations by finite difference method for beams and buckling of columns.

## **UCV652E: DESIGN OF IRRIGATION STRUCTURES**

**Credits 03 (3-0-0)**

### **UNIT-I**

Canals: Cross section of irrigation canals, Balanced depth, fixing L-section and design considerations and design.

Cross Drainage works: Types, Design considerations, Fluming of canal by Mitra's, and Chaturvedis's formulae. Design problems of aqueduct and super passage only.

**10 Hrs**

### **UNIT-II**

Gravity Dam-I Profile of the dam and forces acting, Design considerations and fixing the section, Principal stresses, Stability analysis by analytical methods and problems .

Gravity Dam II: Joints, keys and water stops. Drainage galleries, Grouting, Construction of Galleries

**10 Hrs**

### **UNIT-III**

Earthen Dam: Types, Construction methods, Causes of failures, Design criteria, Preliminary section. Seepage control and slope protection, Rockfill dams.

Spillways: Ogee and broad crested spillways, Discharge computation for simple cases, Design of profile of an Ogee spillway. Energy dissipation below spillways.

**10 Hrs**

### **UNIT-IV**

Canal Falls: Types, Design of trapezoidal notch fall and Sarda fall.

Canal Regulation works: Types, Design of cross regulator and head regulator.

**10 Hrs**

### **QUESTION PAPER PATTERN FOR SEE**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

<b>Sl.No.</b>	<b>Course Objectives</b>	<b>Course Outcomes</b>
1	To prepare the students for a successful career as civil engineers	Able to classify and design the canals longitudinal sections and cross drainage works
2	To provide students with a sound foundation in the design of irrigation structures	To comprehend various aspects of gravity dam analysis and design
3	To develop the ability among students to synthesize data and technical concepts for application in design of irrigation structures	To be able to understand concepts of construction and failure in earthen dams and design of major spillways.
4	Students should understand application of theory to experimental and field data in design.	To know concepts canal falls and regulator works and apply the knowledge in their design
5	To use interdisciplinary knowledge in the application of design concepts	

## UCV653E GROUND IMPROVEMENT TECHNIQUES

3 Credits(3-0-0)

### UNIT - I

**Introduction-** Principles and objectives of ground improvement; History of ground improvement developments. Classification of ground improvement techniques, Factors affecting ground improvement.

**Mechanical modification-** Mechanical modification method of ground improvement; Theory of compaction, moisture-density relationship, optimum moisture content and maximum dry density; Laboratory compaction test using Proctor's mould and modified Proctor Mould, Factors affecting compaction .

10 Hrs

### UNIT – II

**Field compaction-** Dead weight surcharge for compaction;; Equipment for field compaction: smooth wheel rollers, pneumatic rollers, sheep foot rollers, grid rollers, Power rammers. Role of vibrations in dynamic compaction; Dynamic Field Compaction Equipment: Impact type of compaction, Vibratory rollers, Vibratory pneumatic tyre, compaction piles, vibroflotation, vibratory probes, compaction sand columns and sand piles, underground blasts. Specifications for field compaction

**Hyd. Modification-** Preloading by lowering ground water table, Filters, Control of ground water seepage, Sand drains and wick drains, Well point system, Vertical drains, Electrosmosis and its application in ground improvement.

10 Hrs

### UNIT – III

**Chemical Modification-** Factors affecting chemical modification, Lime stabilization, Cement stabilization, Bitumen stabilization, Chemical Stabilization, Methods of construction- mix in place method, traveling plant and stationary plant methods.

**Grouting-** Factors affecting grouting, Grout ability, Grouting materials and their properties, Pressure grouting, Compaction grouting, Grouting procedures, Applications of grouting

10 Hrs

### UNIT – IV

Applications of Geosynthetics for ground improvement Miscellaneous: Rock cutting, anchoring, heating, soil nailing

10 Hrs

#### TEXT BOOKS:

1. P. Purushothama Raj., Ground Improvement Techniques, Laxmi Publications Pvt Ltd, 2<sup>nd</sup> edition, 2016.

#### REFERENCE BOOKS

1. Manfired R.H. (1990) "Engineering Principles of Ground Modification", McGraw-Hill Pub.
2. Koerner R. M. Construction and Geotechnical Methods in Foundation Engineering, McGrawHill Pub Co New York, 1985.

3. Hausmann, M R, "Engineering Principles of Ground Modifications", McGraw Hill Pub Co NewYork, 1990.
4. Ingles O G and Metcalf J B., "Soil Stabilisation: Principles and practice", Butterworths, London, 1972.
5. Nelson J D and Miller D J., "Expansive soils", John Wiley and sons. Inc new, 1992.

**QUESTION PAPER PATTERN FOR SEE:**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

<b>Sl.No.</b>	<b>Course objective</b>	<b>Course outcome</b>
1	Understand the fundamental concepts of ground improvement techniques	Students will know the ground improvement techniques
2	Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures	Able to improve the properties of soil in field by compaction
3	Understand the concepts of chemical compaction and grouting	Able to stabilize the soil
4	Impart the knowledge of geo synthetics and miscellaneous methods of ground improvement	Use of Geosynthetics and other methods of soil modification

## **UCV654E: HIGHWAY GEOMETRIC DESIGN**

**3 Credits (3-0-0)**

### **UNIT-1**

**INTRODUCTION:** Geometric control factors like Topography- design speed- design vehicle- Traffic- Capacity- volume- environmental & other factors as per IRC & AASHTO standards & specifications- PCU concepts- factors controlling PCU for different design purpose.

**CROSS SECTIONAL ELEMENTS:** Pavement surface characteristics- friction- skid resistance- pavement unevenness- light reflecting characteristics-camber-objectives-types of camber- method of providing cambers in the field- problems- carriage way- kerb- median-shoulder- foot path- parking lanes- service roads- cycle tracks- Driveways- Right of way- Factors influencing right of way- Design of Road humps as per latest IRC provision.

**10 Hrs**

### **UNIT-2**

**SIGHT DISTANCE:** Important, types, SSD, OSD & Sight distances at uncontrolled intersections, derivations, factors affecting sight distance, IRC, AASHTO standards, problems on above.

**HORIZONTAL ALIGNMENT:** Definition, Checking the stability of vehicle, while moving on horizontal curve, Super elevation, Ruling minimum & maximum radius, Assumptions-problems- methods of providing super elevation for different curves- Extra widening of pavement on curves- Objectives- Mechanical widening- Psychological widening- Transition curve- Objectives- Ideal requirements- Types of transition curves- Method of evaluating length of transition curve- Setting the transition curve in the field, set back distance on horizontal curve & problems on above.

**10 Hrs**

### **UNIT-3**

**VERTICAL ALIGNMENT:** Gradient- Types of gradient- Design criteria of summit & valley curve- Design of vertical curves based on SSD-OSD-Night visibility considerations-Design standards for hilly roads- problems on the above.

**INTERSECTION DESIGN:** Principle- At grade & Grade separated junctions- Types- Channelization- Features of channelizing Island- Median opening- Gap in median at junction.

**10 Hrs**

### **UNIT-4**

**ROTARY INTERSECTIONS:** Elements- Advantages- Disadvantages- Design guide lines- problem on above- Grade separated intersection- Three legged intersection- Diamond interchange- Half clover leaf- Clover leaf- Advantages- Disadvantages only

**HIGHWAY DRINAGE:** Importance – sub surface drainage- surface drainage- Design of road side drives- Hydrological- Hydraulic considerations and design of filter media, problems on above.

**10 Hrs**

**TEXT BOOKS:**

1. L.R.Kadiyali & N.B.Lal, Principle & Practice of Highway Engineering, Khanna publications, 2013.
2. Khanna S K & Justo, Highway Engineering, Nemchand & Bros publication, 10<sup>th</sup> edition 2017.
3. Srinivas Kumar, Highway Engineering, 2018.

**REFERENCE BOOKS:**

1. Kadiyali L R, Highway Engineering, Khanna publications, 2018.
2. Relavent IRC publications.

**QUESTION PAPER PATTERN FOR SEE:**

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each questions should not have more than four sub divisions.
3. Any five full questions are to be answered choosing at least one from each unit.

<b>Sl. No</b>	<b>Course Objective</b> Students will be able to learn	<b>Course Outcome</b> After studying this course students will be able to
01	Various geometric elements cross sectional elements controlling geometric design of highway.	Describe various geometric elements like speed, topography, traffic volume, Design hourly, traffic volume etc.
02	The various types of Sight distance such as SSD,OVD ISD,HSD and design and setting out super elevation, extra widening, transition curves.	Determine the various sight distances, evaluate extra widening required for horizontal curves
03	The method of design of vertical and summit curves and setting of the same in the field and concepts of at-grade and grade separated intersection.	Design and setting out of Summit and Valley curves and describe different types of at-grade, grade separated intersection and channelization.
04	Design Rotary intersection, surface and subsurface drainage system and filter material.	Design Rotary intersection, surface and subsurface drainage system.

## DEPARTMENT ELECTIVE-IV

### UCV661E: ELEMENTS OF EARTHQUAKE ENGINEERING

3 CREDITS (3-0-0)

#### UNIT - I

Earthquake ground Motion, Engineering Seismology, Theory of plate tectonics, seismic waves, Magnitude and intensity of earthquakes, local site effects, seismic zoning map of India, Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismologic, Seismograph, accelerator graph-strong ground motions.

**6 Hrs**

#### UNIT - II

Seismic Design Parameters. Types of Earthquakes, earthquake ground motion characteristics, response spectra and design spectrum. Seismic design philosophy, Determination of design lateral forces - Equivalent lateral force procedure, dynamic analysis procedure, code based methods. seismic analysis of RC buildings (maximum of 4 storeys, without infills) - Equivalent static lateral force method, response spectrum methods

**14 Hrs**

#### UNIT - III

Structural Configuration for earthquake resistant design, frames, shear walls and dual systems, Effect of infill masonry walls on frames, problems of the soft first-storey, Capacity design procedures.

Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, concepts for earthquake resistant masonry buildings – codal provisions.

**12 Hrs**

#### UNIT - IV

Effect of Structural Irregularities on seismic performance of RC buildings. Vertical irregularity and plan configuration problems, Seismo resistant building architecture – lateral load resistant systems, building characteristics.

**8 Hrs**

#### TEXT / REFERENCE BOOKS:

1. Pankaj Agarwal, Manish Shrikande, Earthquake resistant design of structures, PHI India, New Delhi, 2011.
2. S.K. Duggal, Earthquake Resistant Design of Structures, Oxford University Press, 2007.
3. Anil Chopra, Earthquake Resistant Design, 2nd edition, Earthquake Engineering Research Institute, 2005.
4. S.F. Borg, Earth Quake Engineering Damage Assessment and Structural design, John Wiley and Sons. 1983.

5. Vinod Hosur , Earthquake Resistant Design of Building structures, Wiley India Pvt. Ltd., 2012.
6. C.V.R. Murthy, Earthquake Tips - Learning Earthquake Design and Construction.

**QUESTION PAPER PATTERN FOR SEE:**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub division.
3. Any Five Full questions are to be answered choosing at least one from each unit.

<b>Sl. No.</b>	<b>Course Objectives</b>	<b>Course Outcomes</b>
01	The students will be able to understand the fundamentals of Engineering Seismology	The students will be able to foresee the potential consequences of strong earthquakes on urban areas and civil infrastructure.
02	The students will be able to understand the earthquake ground motion characteristics, response spectra and design spectrum and IS code based methods	The students will be able to analyze and design the structures using response spectra and relevant IS code specifications.
03	The students will be able to apprise the Effect of Structural Irregularities on seismic performance of RC buildings.	The students will be able to evaluate the ductility requirements for RCC and masonry structures.
04	The students will be able to understand Earthquake resistant design of masonry buildings - elastic properties of structural masonry, lateral load analysis, Design of two storied masonry buildings.	

**UCV662E: PAVEMENT MATERIALS AND CONSTRUCTION**  
**Credits 03 (3-0-0)**

**UNIT 1**

**AGGREGATES:** Origin, classification, requirements, properties and tests on road aggregates, concepts of size and gradation – design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.

**BITUMEN AND TAR:** Origin, preparation, properties and chemical constitution of bituminous road binders; requirements.

**10 Hrs**

**UNIT 2**

**BITUMINOUS EMULSIONS AND CUTBACKS:** Preparation, characteristics, uses and tests. Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion.

**BITUMINOUS MIXES:** Mechanical properties, dense and open textured mixes, flexibility and brittleness, (No Hveem Stabilometer & Hubbar – Field Tests) bituminous mix, Design methods using Rothfuch's Method only and specification, Marshal mixed design criteria-voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen. Problems on above.

**10 Hrs**

**UNIT 3**

**EQUIPMENT IN HIGHWAY CONSTRUCTION:** Various types of equipment for excavation, grading and compaction – their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

**SUBGRADE :** Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests.

**10 Hrs**

**UNIT 4**

**FLEXIBLE PAVEMENTS:** Specifications of materials, construction method and field control checks for various types of flexible pavement layers.

**CEMENT CONCRETE PAVEMENTS:** Specifications and method of cement concrete pavement construction (PQC Importance of providing DLC as sub-base and polythene thin layer between PQC and sub-base); Quality control tests; Construction of various types of joints.

**10 Hrs**

**Textbooks**

1. Highway Engineering- Khanna, S.K., and Justo, C.E.G., Nem Chand and Bros. Roorkee, 2014
2. Construction Equipment and its Management- Sharma, S.C., Khanna Publishers, 2008.

- Hot Mix Asphalt Materials, Mixture Design and Construction- Freddy L. Roberts, Kandhal, P.S: University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland , 1996.

#### REFERENCE BOOKS

- RRL, DSIR, 'Bituminous Materials in Road Construction', HMSO Publication.
- RRL, DSIR, 'Soil Mechanics for Road Engineers', HMSO Publication.
- Relevant IRC codes and MoRT&H specifications.

#### QUESTION PAPER PATTERN FOR SEE

- Total of Eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question should not have more four sub divisions.
- Any Five full questions are to be answered choosing at least one from each unit.

Sl No	Course Objectives	Course Outcomes
01	Impart knowledge about the engineering properties required for different pavement materials.	Evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS,IRC specifications
02	Educate students to perform various types of bituminous mix designs as per the guidelines (MORTH).	Formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes.
03	Student will get knowledge about different highway construction equipment with their suitability and adaptability in various field conditions.	Competent to adapt suitable modern technique and equipment for speedy and economic construction.
04	Expose students to construction practice and quality control aspects of embankment, flexible and rigid pavement as per the required specifications (MORTH).	Execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.

**UCV663E : TRAFFIC ENGINEERING**  
**Credits 03 (3-0-0)**

**UNIT-I**

**Introduction:** Definition-Objective Scope of Traffic Engineering. Road User and Vehicle Characteristics Static and Dynamic characteristics- Power performance of vehicles- Resistances to the motion of vehicles- Reaction time of driver- Problems of above.

**10 hrs**

**UNIT-II**

**Traffic Parameter Studies and Analysis:** Various types of traffic engineering studies, data collection, Objectives and Method of study. Definition of study area- Sample size- Data Collection and Analysis- Interpretation of following Traffic Studies- Volume, Spot Speed study, presentation of spot speed data problems on spot speed, Speed and Delay study Origin and Destination. Parking, on-Street and off-Street Parking, Accidents-Causes, Analysis (collision with parked vehicle only) Measures to reduce Accident, Problems.

**10 hrs**

**UNIT-III**

**Traffic Flow Theories:** Traffic flow theory Green shield theory Goodness of fit correlation and regression analysis (linear only)- Queuing theory Car following theory relevant Problems on above. Traffic Regulation- Driver, Vehicle and Road controls- Traffic Regulations- One Way- Traffic Signs- Traffic Markings- Canalization, Classified traffic volume at intersections, PCU, Traffic Rotary elements, analysis of capacity of rotary

**10 hrs**

**UNIT-IV**

**Traffic Control:** Traffic operation Traffic Signals-Vehicle actuated and synchronized signals Signal Coordination – Intelligent Transport system- Webster's method of signal Design, IRC Method, Street lighting Road Side Furniture- Relevant Problems on above.

**10 hrs**

**TEXTBOOKS:**

1. Khanna and Justo., "Highway Engineering" Nemchand Bros, 2014.
2. L.R. Kadiyali., " Traffic Engineering and Transport Planning". Khanna Publisher. 1<sup>st</sup> edition, 2018.
3. Matson, Smith and Hurd, " Traffic Engineering ", McGraw Hill and Co, 1995.
4. D.R. Drew, Traffic flow theory and control, McGraw Hill Co., 1968.

**REFERENCE BOOKS:**

1. Pignataro, L. J., Cantilli, E. J., & Falcocchio, J. C, Traffic Engineering, Prentice Hall, 1973
2. Highway capacity Manual-2000
3. Jotin Khistey and Kent Lall, An Introduction to Transportation Engineering, , PHI, 3rd edition, 2013.
4. Mc Shane and Roess, Traffic Engineering, PHI, 5<sup>th</sup> edition, 2019.

Scheme of Examination: Student has to answer five questions selecting at least one question from each unit out of eight.

### QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

<b>Sl.No</b>	<b>Course Objective</b>	<b>Course outcome</b> After studying this course the students will be able to:
1.	Introduction to definitions, basic concepts associated with matrix methods of structural analysis using element approach. Analysis of continuous beams and frames by flexibility matrix method.	Analyze continuous beams and frames by flexibility matrix method using element approach.
2.	Analysis of trusses by flexibility matrix method. Introduction to concepts associated with stiffness matrix method and analysis of continuous beams by stiffness matrix method.	Analyze member forces for trusses by flexibility matrix method and continuous beams by stiffness matrix method using element approach.
3.	Evaluate member forces for plane frames and trusses by displacement transformation method.	Analyze plane frames and trusses by stiffness matrix method using element approach.
4.	Introduction to concepts associated with direct stiffness method. Analysis of continuous beams and trusses by direct stiffness method.	Analyze continuous beams and trusses by direct stiffness method.

**UCV664E : MATRIX METHOD OF STRUCTURAL ANALYSIS**  
**03 credits (3-0-0)**

**UNIT – I**

Definitions and Concepts: Comparison of classical, matrix and approximate methods of structural analysis, , System approach versus Element approach, degrees of freedom, coordinate systems, stiffness and flexibility coefficients, Flexibility and stiffness methods.

**05 Hrs**

Flexibility Method: Introduction, element flexibility matrix, Principle of contragradience, construction of member and structure flexibility matrix, determination of member forces. Procedure for analysis of indeterminate structures: analysis of continuous beams and plane frames.

**08 Hrs**

**UNIT – II**

Flexibility Method Continued: Analysis of indeterminate structures: analysis of plane trusses.

**06 Hrs**

Stiffness Method: Introduction, element stiffness matrix, Principle of contragradience, construction of member and structure stiffness matrix, determination of member displacements, solution procedure, Analysis of indeterminate structures: continuous beams.

**07 Hrs**

**UNIT – III**

Stiffness Method continued: Analysis of indeterminate structures: plane frames and plane trusses

**12 Hrs**

**UNIT-IV**

Direct Stiffness Method: Introduction, transformation of variables, transformation of stiffness matrix for member of truss and continuous beams. Global stiffness matrix , boundary conditions, computation of internal forces, analysis of plane trusses and continuous beams.

**14 Hrs**

**TEXT BOOKS:**

1. S Rajasekaran – Computational structural Mechanics, Prentice Hall India Ltd, New Delhi, 2001.
2. Reddy C S - Basic Structural Analysis, 3rd edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2010.
3. Pandit G S, Gupta S P and Gupta R- Theory of Structures, 2nd edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
4. Mukhopadhyay Madhujit and Abdul Hamid Sheikh – Matrix and Finite Element Analysis, Ane Books, New Delhi, 2004

**REFERENCE BOOKS**

1. William Weaver Jr. and James M Gere – Matrix Analysis of Framed Structures, CBS Publishers and distributors, New Delhi, 2018.
2. Kassimali Aslam – Matrix Analysis of Structures, Cengage Learning Custom Publishing, Boston USA, 2011.
3. Neville A M, Ghali A- Structural Analysis: A Unified Classical and Matrix Approach,

CRC Press, 2009.

**QUESTION PAPER PATTERN FOR SEE:**

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one question from each unit.

<b>Sl.No.</b>	<b>Course Objectives</b>	<b>Course Outcomes</b>
1	Introduction to definitions, basic concepts associated with matrix methods of structural analysis using element approach. Analysis of continuous beams and frames by flexibility matrix method.	Knowledge of definitions, basic concepts, comparison of classical and matrix methods, force and displacement methods, system and element approach methods. Evaluate member forces for continuous beams and plane frames by force transformation method.
2	Analysis of trusses by flexibility matrix method. Introduction to concepts associated with stiffness matrix method and analysis of continuous beams by stiffness matrix method.	Evaluate member forces for trusses by flexibility matrix method. Knowledge of concepts associated with stiffness matrix method. Evaluate member forces for continuous beams by displacement transformation method.
3	Analysis of plane frames and trusses by stiffness matrix method.	Evaluate member forces for plane frames and trusses by displacement transformation method.
4	Introduction to concepts associated with direct stiffness method. Analysis of continuous beams and trusses by direct stiffness method.	Knowledge of basic concepts associated with direct stiffness method. Evaluate member forces for continuous beams and trusses by direct stiffness method.