



# **SOLAPUR UNIVERSITY, SOLAPUR**

**FACULTY OF ENGINEERING & TECHNOLOGY**

**CIVIL ENGINEERING**

**Syllabus for**

**S.E. (Civil Engineering)**

**w. e. f. Academic Year 2013-14**



**SOLAPUR UNIVERSITY, SOLAPUR**  
**FACULTY OF ENGINEERING & TECHNOLOGY**  
**Civil Engineering**  
**Programme Educational Objectives and Outcomes**

**Program Educational Objectives (PEOs): Civil Engineering**

The Program Educational Objectives for Civil Engineering program are designed to produce competent civil engineers who are ready to contribute effectively to the advancement of civil engineering and to fulfil the needs of the community. These objectives are as follows:

1. Graduates will be prepared with strong engineering fundamentals leading to excellent performance in professional career in planning, designing, construction, operation & maintenance of the built environment and global infrastructure that meet the societal needs.
2. Graduates will exhibit strong technical ability to create & synthesize data using relevant tools and concepts, for providing sustainable solutions to civil engineering problems and projects.
3. Graduates will exhibit excellent interpersonal communication and resource-management skills as leaders in the civil engineering profession while working as a part of multidisciplinary team.
4. Graduates will be prepared with sound foundation in mathematics, science and in Civil Engineering to prepare them for higher studies and research.
5. Graduates will possess a breadth of knowledge and engage themselves in the life-long learning to meet challenges of globalisation.
6. Graduates will have a sense of responsibility, respect towards society & its heritage and will follow the professional ethics.

## **Program Outcomes (POs): Civil Engineering**

The program outcomes of Civil Engineering Program are summarised as following

- a. Students will demonstrate the basic knowledge of mathematics, science and engineering.
- b. Students will demonstrate ability to design and conduct experiments, interpret & analyse data and report results.
- c. Students will demonstrate an ability to design a system, component, or a process that meets desired specifications within realistic constraints.
- d. Students will demonstrate an ability to function in multidisciplinary team.
- e. Students will demonstrate the ability to identify, formulate and solve civil engineering problems.
- f. Students will demonstrate the understanding of their professional responsibilities ethically.
- g. Students will be able to communicate effectively to all concerned.
- h. Students will have the confidence to apply engineering solutions in global and social context.
- i. Students will recognize the need for and an ability to engage in life-long learning.
- j. Students will have broad education for understanding the impact of engineering solutions in a global, economic, environmental, and societal context.
- k. Students will possess an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Solapur University, Solapur**  
**Structure of S.E. (Civil Engineering)**  
**w. e. f. Academic Year 2013-14.**

**S.E. (Civil Engineering) Semester- III**

Sr. No.	Subject	Teaching/Week					Examination scheme				
		L	Pr.	Tu.	Dr.	Total	Theory	TW	POE	OE	Total
1	Concrete Technology	2	2	-	-	4	100	25	-	-	125
2	Structural Mechanics-I	3	2	-	-	5	100	25	-	-	125
3	Surveying –I	3	2	-	-	5	100	25	25	-	150
4	Building Construction & Drawing	3	-	-	2	5	100	25	-	-	125
5	Fluid Mechanics-I	3	2	-	-	5	100	25	25	-	150
6	Engg. Geology	3	2	-	-	5	100	25	25	-	150
7	Lab Practice	-	2*	-	-	1		25	-	-	25
<b>Total</b>		17	11	-	2	30	600	175	75	-	<b>850</b>

7	Environmental Science	1	-	-	-	1	-	-	-	-	-
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\* Alternate week

**S.E. (Civil Engineering) Semester- IV**

Sr. No.	Subject	Teaching/Week					Examination scheme				
		L	Pr.	Tu.	Dr.	Total	Theory	TW	POE	OE	Total
1	Structural Mechanics-II	3	-	1	-	4	100	25	-		125
2	Surveying –II	3	2	-	-	5	100	25	-	25	150
3	Building Construction & Design	3	-	-	2	5	100	25	-	25	150
4	Fluid Mechanics-II	3	2	-	-	5	100	25	-	-	125
5	Water Resources Engg.I	3	-	-	-	3	100	25	-	-	125
6	Engg. Math-III	3	-	1		4	100	25	-	-	125
7	Computer Programming & Numerical Methods	2	2	-	-	4	-	25	25	-	50
<b>Total</b>		20	6	2	2	30	550	225	25	50	<b>850</b>

8	Environmental Science	1	-	-	-	1	-	-	-	-	-
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**Note:**

- (1) The number of students in a practical/Tutorial batch shall be 20. New batch shall be formed if the number of remaining students (after forming batches of 20) exceeds 9.
- (2) Term work assessment: Term Work assessment shall be a continuous process based on the performance of the student in assignments, class tests, quizzes, attendance and interaction during theory and lab sessions, journal writing, report presentation etc., as applicable.



**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-III**  
**CONCRETE TECHNOLOGY**

**Teaching Scheme**  
**Theory – 2 Hrs/Week**  
**Practical – 2 Hr/Week**

**Examination Scheme**  
**Theory – 100 Marks**  
**Term Work –25 Marks**

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**Course Objectives**

- 1) Students will learn properties of various ingredients of concrete.
- 2) Students will learn properties of fresh and hardened concrete.
- 3) Students will learn various methods of concrete mix design.

**Course Outcomes**

Students will be able to

- 1) Select appropriate type of concrete for specific requirements.
  - 2) Design a concrete mix of required strength and durability using suitable ingredients.
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**Unit 1:**

**(a) Ingredients of concrete- Cement:**

**(4 Hrs)**

Hot and dry manufacturing process, significance of physical properties of cement such as fineness, consistency test, initial & final setting time, soundness, compressive strength, specific gravity. Hydration of cement, chemical compounds in cement & their properties. Types of cement- ordinary Portland, Portland pozzolana, rapid hardening Portland cement, quick setting cement, sulphur resisting cement.

**(b) Ingredients of concrete- Aggregates and Water :**

**(3 Hrs)**

Physical properties such as particle size distribution & fineness modulus, specific gravity & water absorption, silt content, bulking of sand, bulk density, moisture content, flakiness index, elongation index.

Water: Specifications of water to be used for concrete making.

**Unit 2: Properties of fresh concrete****(3 Hrs)**

Types of batching, mixing, transportation, placing including pumping and compaction techniques for good quality concrete, workability of concrete and its measurements, segregation and bleeding, curing of concrete, different methods of measuring workability, temperature effects on fresh concrete.

**Unit3: Introduction to Admixtures****(3 Hrs)**

Admixtures in concrete & construction chemicals – Types of admixtures, plasticizers and super plasticizers and their effects on workability, air entraining agents, accelerators, retarders, their effects on proportion of concrete.

**Unit No 4: Desired properties of concrete****(3 Hrs)**

Strength, impermeability, Characteristic strength, compressive strength, tensile and flexure strength of concrete, tests on concrete, modulus of elasticity, effect of w/c ratio and admixture on strength properties of concrete . Concrete mixes for different strength as per IS-456-2000.

**SECTION-II****Unit No 5: Creep and Shrinkage****(3 Hrs)**

Creep and shrinkage of concrete, significance, types of shrinkage and their control, factors affecting creep.

**Unit No 6: Concrete Mix Design****(7 Hrs)**

Design Mix Concrete, nominal Mix Concrete, objectives of mix design, factors governing mix design, methods of expressing proportions ACI method, IS code method, road Note No.4 method, trial mixes, Acceptance criteria.

**Unit No 7: Durability of Concrete****(3 Hrs)**

Minimum & Maximum cement content, strength & durability relationship, impact of w/c ratio on durability, permeability, Exposure to different conditions, sulphate attack, Alkali aggregate reaction, chloride attack, corrosion of steel (chloride induced).

**Unit No 8: Types of Concrete****(3 Hrs)**

Type of concrete: Light weight concrete, gap graded concrete, no fines concrete, plum concrete. Quality control of concrete – Factors causing variations, field control.

**TERM WORK****Testing of cement**

Consistency, fineness, setting time, Specific Gravity, soundness and strength.

**Testing of aggregate**

Specific Gravity, sieve analysis, bulking of fine aggregate, bulk density, flakiness index, elongation index and percentage elongation.

**Test on Concrete:**

Workability test- Slump, compaction, Vee-bee, strength test – compression, flexure.

**Concrete Mix design**

Experimental

**TEXT BOOKS**

- 1) Concrete Technology by Gambhir, Pub.- Tata McGraw- Hill
- 2) Concrete Technology by M. S. Shetty, Pub.-S. Chand & Co.Ltd.
- 3) Concrete Technology by K. T. Krishnaswamy, Pub.- Dhanpat Rai

**REFERENCE BOOKS**

- 1) Concrete Technology by A.M. Neville, Pub.- Pearson Education Ltd.
- 2) I.S.456-2002 Code of Practice for Plain & Reinforced Concrete.
- 3) I.S. 10262-2009 Guidelines for Concrete Mix Design.
- 4) I.S. 383-1970 Specification for Coarse & Fine Aggregates from Material Sources for Concrete.
- 5) I.S. 1199-1939 Methods of Sampling & Analysis of Concrete.
- 6) I.S. 2386-1963 Methods of Tests for Aggregates for Concrete.



**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-III**  
**STRUCTURAL MECHANICS-I**

**Teaching Scheme**

**Theory – 3 Hrs/Week**

**Practical – 2 Hr/Week**

**Examination Scheme**

**Theory – 100 Marks**

**Term-Work – 25 Marks**

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**Course objectives:**

Students will be able to demonstrate basic knowledge of

- 1) Various elastic constants and their relationships to evaluate stresses and strains in the material.
- 2) Behavior of structural members under various types of external loadings and calculation of their strength in tension, compression, shear, bending and torsion.
- 3) Behavior of composite members under axial loading.
- 4) Strain energy stored by body in axial loading, bending, shear and torsion.

**Course Outcomes**

Students completing the course will have:-

- 1) Ability to employ the knowledge of mechanics to understand the behavior of structures.
- 2) Ability to analyze determinate structural members subjected to different types of loadings.

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**SECTION I**

**Unit 1.**

**(05 Hrs.)**

Scope of the subject, Behaviour of Engineering materials under axial loading, Simple stresses and strains, Hooke's law, Stress strain relations for ductile and brittle material, elastic constants, working stress, Factor of safety, Stresses & strains in three dimensions (linear, lateral, shear and volumetric), normal and shear stresses, Complementary shear stress, relation between elastic constants, assumption in elastic analysis, St. Venant's principle. Composite sections under axial loading: compound bars, temperature stresses in composite sections.

**Unit 2.**

**(05 Hrs.)**

Combined direct and bending stresses, eccentric load on short columns, kern of a section, eccentricity of load about both axes of section. Chimney subjected to wind pressure, simple problems on dams and retaining walls.



**Unit 3.** (06 Hrs.)

Analysis of statically determinate beams: S.F. and B.M. diagrams for beams subjected to point load (inclined load also), uniformly distributed load, uniformly varying load and couples. Relation between intensity of load, shear force and bending moment.

**Unit 4.** (05 Hrs.)

Bending stresses in beams: Simple bending theory, pure bending of beams, flexure formula, moment of resistance of different cross sections, built-up sections, Rectangular, Circular and flanged sections.

**SECTION II**

**Unit 5.** (05 Hrs.)

Shear stresses in beams: Distribution of shear stresses in beams of various commonly used sections such as rectangular, triangular, circular, T and I sections.

**Unit 6.** (05 Hrs.)

Composite beams: Bending stresses in composite beams of two different materials, Equivalent sections, Flitched beams.

**Unit 7.** (05 Hrs.)

Torsion of circular shafts: Torsion formula, solid and hollow circular shafts, transmission of power through circular shafts.

**Unit 9.** (07 Hrs.)

- a) Thin walled cylinders and spheres, wire wound thin cylinders
- b) Strain energy due to axial force gradually, suddenly applied and impact load, Resilience, strain energy due to shear force, bending moment and torque.

## TERM WORK

Term work shall consist of:

(A) Experiments (any six):

1. Tension test on Mild and Tor Steel.
2. Compression test on Mild Steel & Cast Iron.
3. Compression test on Timber (Parallel and across the grains).
4. Shear test on Mild Steel.
5. Brinell or Rockwell Hardness test on different metals.
6. Bending test on Mild Steel Beam (Flexure Formula).
7. Torsion test on Mild Steel and Cast Iron.
8. Impact test on Mild Steel, Aluminum, Brass, Copper and Cast Iron

(B) Experiments (any two):

1. Flexural test & Abrasion test on flooring tiles.
2. Water absorption, Efflorescence and Compression test on burnt Bricks
3. Compression test on stones.

(C) Assignment on Unit 1: Simple stresses and strains- min. 10 problems.

(D) At least one assignment on each other unit.

## TEXT BOOKS

1. Strength of Materials by R.K.Bansal, Laxmi Publications
2. Strength of Materials by Bhavikatti, Vikas Publications, New Delhi.
3. Strength of Materials by Ramamurtham, Dhanpatrai & Sons, New Delhi
4. Strength of Materials by R.S.Khurmi, S.Chand Publication, New Delhi
5. Mechanics of Structures (Part I) by S.B.Junnarkar, Charotar Book House, Anand.
6. Strength of Materials by R.K.Rajput, S.Chand Publication, New Delhi

## REFERENCE BOOKS

1. Analysis of Structures (Vol I) by Vazirani and Ratwani, Khanna Pub., Delhi.
2. Elements of Strength of Materials, (Recent Edition) by S. Timoshenko and J. Young  
Affiliated East-West
3. Strength of Materials by F.L. Singer, Harper and Row Pub., New York.
4. Introduction to Mechanics of Solids by E. P. Popov. Prentice-Hall of India.
5. Mechanics of Materials by Gere and Timoshenko, C.B.S. Delhi.



**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-III**  
**SURVEYING-I**

**Teaching Scheme**

**Theory – 3 Hrs/Week**

**Practical – 2 Hr/Week**

**Examination Scheme**

**Theory – 100 Marks**

**Term-Work – 25 Marks**

**Practical-Oral: 25 Marks**

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**Course Objectives**

The students will learn:

- 1) Theory of measurement errors, accuracies, magnitude of errors and error propagation
- 2) Level instrument setup, theory, field procedures and computations, for vertical control survey accuracy.
- 3) Distances, angles, azimuths and bearing measurements
- 4) Traversing and traverse computations, for horizontal control survey accuracy.
- 5) Total Station instrument setup, field procedures and computations, including instrument technical specifications and expected survey precision using the instrument.
- 6) Topographic surveying and terrain modeling using AutoCAD and Land Development Desktop.

**Course Outcomes:**

Students completing the course will have:

- 1) Awareness of instrumental, natural and personal errors in measuring and surveying, field procedures for assessing errors, and standards to determine quality of measurements and surveys.
- 2) Professional and ethical responsibilities to record accurate field notes and to recognize and report poor survey results.
- 3) Practice with measuring and surveying procedures for a variety of engineering tasks such as horizontal and vertical control surveys, underground pipe alignment, and strategic topographic point selection for terrain modeling.
- 4) Experience with creating a representative electronic terrain model using a computer program and developing a scaled topographic map of a proposed project site, including selecting appropriate engineering scales and including typical drawing information.

## SECTION I

### Unit 1. LEVELLING

(05 Hrs)

- a) Definition, Technical Terms, Classification, Methods for reduction of levels.
- b) Dumpy level, Auto level, Tilting level: Construction, temporary and permanent adjustments and use.
- c) Sensitivity of bubble tube, Reciprocal leveling curvature and refraction correction, distance to visible horizon, Precise leveling.

### Unit 2. MEASUREMENT OF ANGLES AND DIRECTIONS

#### a) Theodolite

(06 Hrs)

Technical Terms: Meridian, Bearing, Declination, Variation, Dip, Included Angle, corrections.

Theodolite: construction and use, measurement of horizontal angle, deflection angle, vertical angle, bearing, prolonging a line, lining in, setting out angles Testing and permanent adjustments.

#### b) Theodolite Traversing

(05 Hrs)

Field work, computation of consecutive and independent coordinates, Gale's traverse table and adjustment of closed traverse, Omitted measurements, Trigonometric leveling

### Unit 3. HYDROGRAPHIC SURVEY

(05 Hrs)

- a) Hydrographic survey: purpose, sounding, Nautical sextant, plotting
- b) Minor Instruments: construction and use of Hand level, Abney level, Ghat tracer, Box Sextant, Proportional compass

## SECTION II

### Unit 4: MODERN SURVEYING INSTRUMENTS

(07 Hrs.)

- a) Electromagnetic waves and their properties, phase, phase comparison, modulation, Types of EDM instruments: Geodimeter, Tellerometer, Distomat: Principle, construction and use
- b) Total station: Construction and use of 'Total Station'.

**Unit 5: PLANE TABLE SURVEY****(07 Hrs)**

Equipment and accessories, advantages, disadvantages, temporary adjustments, methods: Radiation, Intersection, Traversing and Resection: two point and three point problems, tangent clinometer, telescopic alidade

**Unit 6: AREA AND VOLUME DETERMINATION****(07 Hrs.)**

- a) Contouring: Characteristics, Direct and Indirect methods, Interpolation techniques and uses of contour maps.
- b) Computation of area and volume: coordinate method, Trapezoidal Rule, Prismoidal Rule, Planimeter, Capacity Contours.

**TERM WORK**

A) Field book containing the following experiments

1) Levelling

- a) Revision of differential leveling
- b) Reciprocal leveling
- c) Sensitiveness of bubble tube
- d) Permanent adjustments of dumpy level
- e) Auto level and tilting level

2) Study of Theodolite

- a) Measurement of horizontal angle by various methods,
- b) Measurement of magnetic bearing and
- c) Vertical angle by Theodolite
- d) Trigonometrical leveling

3) Giving lineout for small residential plan

4) Minor instruments

- a) Hand Level
- b) Abney Level
- c) Box sextant
- d) Ghat tracer
- e) Proportional compass
- f) Planimeter

- 5) Methods of plane table survey
  - a) Radiation
  - b) Intersection
  - c) Two point and three point problems
  
- 6) Hydrographic Survey:
  - a) Study and use of Nautical Sextant and measurement of angles.
  - b) Solution of Three point problem by Analytical and any one graphical method.
  
- 7) Study and use of Total Station

B) Projects:

- 1) Block contouring project
- 2) Theodolite traversing project
- 3) Plane Table Survey of a closed traverse of minimum four sides for at least 0.5 Ha. Area with details such as buildings roads etc.

Practical and oral examination shall be based on the above syllabus.

**TEXT BOOKS**

1. Surveying –B. C. Punmia,, S.K.Jain, Vol. I and II, Laxmi Publication, New Delhi
2. Surveying and Leveling – T. P. Kanetkar and S. V. Kulkarni Vol.Iand II , -Pune  
Vidyarthigriha Publication
3. Surveying – Agor -Khanna Publishers, Delhi
4. Surveying – K. R. Arora Vol. 1 and 2
5. Surveying and Leveling –N.N. Basak, Tata McGraw Hill Publishing Co., New Delhi
6. Surveying –S. K. Duggal Vol. 1and 2 Tata McGraw Hill Publishing Co., New Delhi

**REFERENCE BOOKS**

1. Plane and Geodetic Surveying – David Clark
2. Surveying - Bannister and Raymond
3. Surveying – Jawaharlal Sharma CBS Publishers, Delhi
4. Plane Surveying - Alok De
5. Text book of Surveying – S.K.Husain, M.S. Nagraj, S.Chand & Co. Ltd.,Bombay
6. Surveying- Narinder Singh – Tata McGraw Hill Co. Ltd, New Delhi.



**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-III**  
**BUILDING CONSTRUCTION AND DRAWING**

**Teaching Scheme**

**Theory – 3 Hrs/Week**

**Drawing – 2 Hr/Week**

**Examination Scheme**

**Theory – 100 Marks**

**(Paper-04 Hrs. Duration)**

**Term Work – 25 Marks**

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**Course Objectives:**

- 1) The students will learn properties and use of various building materials.
- 2) The students will learn various building components and their construction methods.

**Course Outcomes:**

Students will be able to

- 1) Identify and apply knowledge of various building materials on work site.
- 2) Ascertain working of building components and their construction methods on work site.

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**SECTION – I**

**Unit 1: Main basic building construction materials**

**(7 Hrs.)**

Specific use and properties of the following material:-

(a) Aggregate- fine and coarse (b) Stones and Flag stones (c) Steel (d) Brick (e) Concrete Blocks (f) Cement and Cement mortar (g) Glass

**Unit 2.**

**(7 Hrs.)**

(a) Building functional Requirements – Strength, Stability, Comfort, Convenience, Safety, Damp Prevention, Water Proofing, Heat Insulation, Day Lighting, Ventilation, Termite Resistance.

b) Building Types – Framed and Load Bearing and Composite structure- Comparison between all the three types. Building components (elements), Methods of transfer of building loads to foundation strata.

**Unit 3: Foundation****(7 Hrs.)**

- (a) Importance of foundation as load transferring building element.
- (b) Shallow Foundations – Wall footing, Isolated footing, Combined Footing, Strap Footing, Continuous or Strip Footing, Cantilever Footing, Raft Foundation.  
(Reinforcement placement not expected)

**SECTION –II****Unit 4: Masonry and Walls****(8 Hrs.)**

- (a) Stone masonry walls – Uncoursed Rubble, Built to Regular Courses, Ashlar, Composite, Significance of through Stone and breaking of Joints.
- (b) Brick masonry walls – Standard Brick size and Properties of good brick-work. Bonds- Stretcher, Header, Flemish & English bond (up to 1 ½ Brick thick)
- (c) Concrete Block masonry – Hollow and Solid blocks, Construction method and bonds.
- (d) Concept of Main Wall and Other wall, External wall and internal wall, Load bearing wall and Partition wall.
- (e) Glass Block wall and Curtain wall.

**Unit 5: Doors, Windows, Stairs and Arches****(6 Hrs.)**

- (a) Doors Types: – Panned, Flush, Glazed. Door elements, Fixtures and Fastenings.
- (b) Window – Types: Steel Glazed, Wooden Panned, Aluminum Glazed Sliding
- (c) Ventilators and Fixed Glass windows.
- (d) Functional requirements of stair, design of stair, types of stairs, technical terms.
- (e) Lintels – Necessary and types: Steel, RCC, Wood, Stone. Chajjas. Types of Arches based on shape, mechanism of load transfer.

**Unit 7: Floors and Roofs****(6 Hrs.)**

- (a) Ground and upper floor; factors for selection of floorings, Types – RCC Slab + Flag stone, Precast beam and slab + IPS. Filler joints floor.
- (b) Types of floor tiles and fixing procedure.
- (c) Types of Sloping Roofs
- (d) Selection and suitability of Roof and Roofing materials.
- (e) Construction details of –
  - A.C. Sheet/ G.I. Sheet on steel purlins + steel truss
  - Mangalore tile roof
  - RCC slab with Brick Bat-Coba, water proofing.



## **TERM WORK**

[One turn of 2 Clock hours, per batch, per week]

- a) Sketch Book – Total 10 exercises of free Hand sketching of Building Elements, on Units 3,4,5,6,and 7; including sketching Exercises for line work and Symbols.
- b) Plates drawn on ½ imperial size drawing sheets. Total 5 plates, drawn to scale, on Unit No. 3 to 7.
- c) Computer Aided Drawing (CAD) and CAD Exercises on Unit No. 3 to 7. Minimum 2 Exercises-Printouts to be submitted.

## **TEXT BOOKS**

1. A text book of Building Construction- Arora & Bindra- Dhanpat Rai Publication, New Delhi.
2. Building Construction- Sushil Kumar- Standard Publishers, Delhi.
3. Building Construction – Arora & Gupta –Satya Prakashan, New Delhi.
4. Principles of Building Drawing- M.G. Shah and C.M. Kale.
5. A course in Civil Engg. Drawing- V.B. Sikka – S.K.Katariya & Sons, Delhi.

## **REFERENCE BOOKS**

1. Building Technology- Ivor H. Seely.
2. Building Construction-Makay vol. I & II
3. National Building Code of India-SP7- Indian Standards Delhi.
4. Various IS Specifications for Drawings, Symbols, Conventional Signs as per IS 962-1967- Indian Standards Delhi.
5. Building Construction A to Z – Mantri.
6. Building Materials- TTTI, Chandigadh.
7. Building Construction- S.S. Bhavikatti- Vikas Publishing House Pvt. Ltd., Noida.
8. Building Materials- S.S. Bhavikatti- Vikas Publishing House Pvt. Ltd., Noida.



**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-III**  
**FLUID MECHANICS-I**

**Teaching Scheme**

**Theory – 3 Hrs/Week**

**Practical – 2 Hr/Week**

**Examination Scheme**

**Theory – 100 Marks**

**Term-Work – 25 Marks**

**Pract-Oral: 25 marks**

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**Course Objectives**

- 1) To impart knowledge of fluid statics, fluid dynamics and fluid kinematics to and types of flow.
- 2) To provide insight in modified Bernoulli's equation and its application as venturimeter, orifice meter and month pieces.
- 3) Provide an insight in boundary layer analysis.
- 4) To understand characteristic of turbulent flow and flow through pipes.

**Course Outcomes:**

- 1) This course will help them to develop ability to design and conduct experiments, interpret and analyze data with experimental results in hydraulic engineering.
- 2) Students will develop an ability to carry out calibration of venture meter and notches.
- 3) They will develop ability to improve the existing pressure measuring devices.
- 4) The students will be able analyze fluid flows and will be able to design pipe networks.

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**SECTION I**

**Unit 1: FLUIDS AND THEIR PROPERTIES**

**(07 Hrs)**

Scope and Importance of Fluid Mechanics, Definition of Fluid, Difference between Solid, Liquids and Gas, Physical properties of fluids: density, specific weight, specific volume, relative density and viscosity, Newtonian and Non-Newtonian fluids, compressibility, cohesion, adhesion, surface tension, capillarity, vapour pressure, Cavitations. Classification of fluids, Problems involving use of above Fluid Properties.

**Unit 2: FLUID STATICS****(07 Hrs.)**

Pascal's Law, Hydrostatics Law, pressure variations in Fluids at rest, Absolute, atmospheric, Gauge Pressure, Measurement of pressure, Hydraulic force on Plane and Curved Surface. Buoyancy and Floatation, Archimedes Principle, Metacentre, Metacentric Height, equilibrium of floating and submerged bodies, Oscillation of floating bodies.

**Unit 3: FLUID KINEMATICS****(07 Hrs.)**

Concept of Control Volume, Velocity and acceleration of fluid Particles, Classification of Fluid Flow, steady and unsteady, uniform and non-uniform, Rotational and irrotational, Turbulent-transitional, Laminar, 1D, 2D, 3D Flow, Compressible-Incompressible Flow, Stream lines, Equipotential Line, Stream Function, Velocity potential, flow net, Methods of drawing flow net, uses and limitations of flow net.

**SECTION-II****Unit 4: FLUID DYNAMICS****(07 Hrs.)**

Forces acting on fluid mass in motion, Euler's equation of motion along a streamline, Bernoulli's Theorem, Limitation and Applications, Pilot Tube, Venturimeter, Orifice meter, Mouth Pieces, Time required to empty the tank through orifice, Concept of HGL and TEL.

**Unit 5: FLOW THROUGH PIPES****(07 Hrs.)**

Classification of Flows:

- A. Laminar Flow – Reynold's Experiment, Couette and Hazen Poiseuille, Equations for Viscous Flow between Parallel Plates and Circular Pipes.
- B. Tubular Flow – Velocity Distribution and Shear Stresses in turbulent flow, Prandtl's mixing length theory, Nikuradse's Experiment, Introduction to Moody's Chart, Nomographs and Pipe Diagram and Concept of turbulent flow in smooth and rough pipes. Energy Losses in pipe flow (Major and Minor Losses), Darcy Weisbach Equation, Factors affecting Friction, Concept of Equivalent length and Equivalent diameter of pipe, Hydraulic Power transmission by Pipe.

**Unit 6: PIPE NETWORKS and BOUNDARY LAYER ANALYSIS****(07 Hrs)**

- A. Pipes in Series and Parallel, Concept of Siphon and two reservoir problem and Hardy Cross method for solving pipe network, concept of water hammer and surge tank, its function and location and use. Rigid and Elastic water column theory.
- B. Boundary Layer Theory- Development of Boundary layer on flat plate, displacement,

momentum and energy thickness, laminar turbulent and transitional boundary layer, laminar sub layer, local and mean drag coefficient, Hydro dynamically smooth and rough boundaries, Boundary layer Separation and its control, Drag and Lift coefficients.

### **TERM WORK**

- a) Measurement of discharge: Calibration of measuring tank, Measurement of pressure (Piezometer, Manometers, Pressure gauges) Use of hook or point gauge.
- b) At least six experiments from the following.
  - 1) Verification of Bernoulli's Theorem.
  - 2) Determination of metacentric heights.
  - 3) Plotting of streamlines, flow nets.
  - 4) Calibration of an orifice/mouthpiece.
  - 5) Calibration of Venturi meter/orifice meter.
  - 6) Study of factors affecting coefficient of friction for pipe flow (at least for two different material and two different diameters)
  - 7) Determination of loss of head due to
    - i) Sudden expansion,
    - ii) Contraction,
    - iii) Elbow,
    - iv) Bend,
    - v) Globe valve etc.
  - 8) Study of a laminar flow.
- c) Study of Moody's charts, nomograms for pipe design.
- d) Simple computer programs.(At least 3 based on the syllabus).

### **TEXT BOOKS**

- 1) Fluid Mechanics – A. K. Jain-Khanna Pub., Delhi.
- 2) Fluid Mechanics – Modi and Seth – Standard Book House, Delhi.
- 3) Fluid Mechanics – S. Nagrathanam – Khanna Pub., Delhi.
- 4) Fluid Mechanics – Garde, Mirajgaonkar – Nemchand and Bross., Roorkee.
- 5) Fluid Mechanics – Arora.
- 6) Fluid Mechanics – R. W. Fox, P.J. Prichard, A. T. McDonold- Wiley India.

## REFERENCE BOOKS

- 1) Fluid Mechanics – V. I. Streeter and E. B. Wile – McGraw – Hill International Book Co., Auckland.
- 2) Elementary Fluid Mechanics – H. Rouse – Toppan C. Ltd., Tokyo.
- 3) Fluid Mechanics – Shames – McGraw – Hill International Book Co.
- 4) Fluid Mechanics –Munson, Young- Wiley India.
- 5) Mechanics of Fluids – M.C. Potter, Wiggert, Ramadan- Cengage Learning.

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**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-III**  
**ENGINEERING GEOLOGY**

**Teaching Scheme**

**Theory – 3 Hrs/Week**

**Practical – 2 Hr/Week**

**Examination Scheme**

**Theory – 100 Marks**

**Term Work – 25 Marks**

**Pract-Oral: 25 Marks**

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**Course Objectives**

- 1) The students will be introduced to the scope and relation of geology with civil engineering.
- 2) The students will learn physical geology, mineralogy, petrology, structural geology, and hydrology.
- 3) The students will be able to identify types of stones and minerals.
- 4) The students will be introduced to Geological aspects of earthquakes, landslides.
- 5) They will learn site investigation for dams, reservoir, bridges and various other civil engineering structures.

**Course Outcomes:**

At the end of this course:

- 1) Students will be able to identify different type of rocks and minerals.
- 2) Students will be able to draw geological maps.
- 3) This course will help them for preliminary geological investigation of site related to civil engineering projects.

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**SECTION – I**

**Unit 1.**

**(04 Hrs.)**

- (a) General Geology: Introduction, Definition, Scope and Subdivision of the Geology subject, interrelation between Geology and civil Engineering.
- (b) Physical Geology: Major relief features of earth, External and Internal forces modifying the surface of earth, Interior of earth.

(c) Geological Work of a River: Valley development, Normal cycle of river erosion, waterfall, Slopes and river escarpment, Oxbow lake, pot holes, Rejuvenation, Features resulting due to rejuvenation such as canyons, river terrace, inclined meanders.

**Unit 2. (04 Hrs.)**

Volcano: Products of volcano, central and fissure type of volcanoes, Causes, Distribution of volcanoes.

Mountains: Types, Indian Examples.

**Unit 3. (04Hrs.)**

Mineralogy: Definition, Physical properties of minerals, Study of Silica, Felspar, Amphibole, Pyroxene, mica, Mineral groups, Classification of minerals.

**Unit 4. (04 Hrs.)**

Petrology: Definition, Division of rocks, rock cycle.

Igneous rocks: Formation, mineral composition, Texture and structures, classification,

Civil engineering significance, concordant and discordant intrusions.

Residual deposits: Soil, Laterite and bauxite.

Sedimentary rocks: Formation, Texture and Structures, classification, Civil Engineering Significance.

Chemical and organic deposits.

Metamorphic rocks: Agents and Types of metamorphism, Stress and antistress minerals, Structure of metamorphic rock, products of metamorphism depending on type of Metamorphism and parent rock.

**Unit 5. (05 Hrs.)**

Structural Geology: Outcrop, Dip and Strike, Unconformity- Types, outliers, Overlap.

Folds: Parts of a fold, important types, causes, Civil Engineering Significance.

Faults: Parts of a Fault, important types, causes, Civil Engineering Significance.

Joints: Types, Civil Engineering Significance.

**SECTION II**

**Unit 6. (04 Hrs.)**

Groundwater Hydrology:

Sources of Ground water, Water Table, Zones of Ground water, Perched water table, Porosity and permeability of rocks, Aquifer, Types of Aquifer, Conservation and management of Ground Water, Watershed development and rain water harvesting.

**Unit 7.****(04 Hrs.)**

Earthquake and Landslides: Definition, Causes, Seismic waves, Seismograph, Scale, Effect, Precautions, reservoir induced seismicity (RIS), Seismic zones in India.

Types, Causes, Stability of hill slopes, Prevention of landslide. Effects and disaster managements.

**Unit 8.****(05 Hrs.)**

Preliminary Geological investigations and Building Stones: Various steps of geological studies of a project site, engineering consideration of structural Features like dip, strike, joints, fracture, fault, folds, dyke etc. Exploratory drilling, Observations during the process of drilling, preservation of core, core logging, core recovery, R.Q.D., Graphical representation of core log, limitation of exploratory drilling method.

Engineering properties of rocks such as crushing strength, shear strength, tensile strength, Modulus of elasticity, Durability, Appearance, field character, requirement of good Building Stone, Building Stones in India.

**Unit 9.****(04 Hrs.)**

Dams and Reservoirs:

Geology of a Dam site: Important civil engineering terms in dams and reservoirs, preliminary geological survey, influence of geological condition on various aspect of Dam such as Location, alignment, design and type of a dam, requirement of good dam site, precautions to be taken to counteract unsuitable condition such as unfavorable dips, occurrence of fault fracture, and dyke etc. Dams on carbonate rocks, Dams on sedimentary rocks, dams on folded strata.

Geology of Reservoir site: Requirements of a good reservoir site, Dependence of water tightness of reservoir area on geological structures and physical properties of rocks, Geological conditions suitable and unsuitable for reservoir site, Effect of rise in the level of groundwater in the reservoir area, rate of silting and its dependence on geological conditions.

**Unit 10.****(04 Hrs.)**

Tunneling and Bridge:

Definition, Important civil engineering terms, difficulties in tunneling such as over break, seepage of subsurface water, rate of tunneling, roof falls, side collapse etc. Influence of geological condition on tunneling, lining after tunneling, Geological condition while choosing tunnel alignment, tunnel in folded strata.

Geology of a Bridge site, Dependence of types of bridges on geological conditions.



## **PRACTICAL WORK**

- 1) Mineralogy: Physical properties of Minerals. Study of Physical properties.
- 2) Identification of the following Minerals: Crystalline, Cryptocrystalline and amorphous Varieties of Silica, Orthoclase, Plagioclase, Zeolite, Muscovite, Biotite, Augite, Hornblende, Olivine, Talc, Serpentine, Chlorite, Kyanite, Asbestos, Beryl, Tourmaline, Garnet, Calcite, Gypsum, Fluorite, Corundum etc. Important ores such as Hematite, Magnetite, Limonite, Pyrite, Psilomelane, Chromites, Chalcopyrite, Galena, Malachite, Graphite
- 3) Petrology: Study and Identification of the following Rock types
- 4) Igneous Rocks: Granite, Pink Granite, Porphyritic Granite, Syenite, Diorite, Gabbro, Rhyolite, Pumice, Trachyte, Andesite, Varieties of Basalt, Obsidian, volcanic breccia, tachylite, Pegmatite, Graphic Granite, Dolerite.
- 5) Secondary Rocks: Laterite, Bauxite, Conglomerate, Breccia, Sandstone, ferruginous Sandstone, Grit, Arkose Shales, Mudstone, chemical and organic Limestone, coal.
- 6) Metamorphic Rocks: Slate, Phyllite, marble, serpentine, marble, Mica Schist, Biotite schist, muscovite Schist, Chlorite Schist, Talc Schist, Talc Chlorite Schist, Kyanite Schist, Granite Gneiss, banded granite Gneiss, Augen Gneiss.
- 7) Study of different types of geological maps, Section and their engineering significance. (at least 10)
- 8) Study of structural Geological models. (at least 5)
- 9) Study tour to the place worth visiting from Engineering Geological point of view.
- 10) Study of core samples, Core Logging.
- 11) Identification of Subsurface rock with the help of Resistivity Instrument.

## **TERM WORK**

A journal containing complete record of above practical work shall be examined as a term work. Practical Examination shall be based on practical course.

## **TEXT BOOKS**

1. Principles of Petrology – By G.W. Tyrrell
2. Principles of physical Geology-By A. Holmes- ELBS, London
3. Textbook of Geology by P. K. Mukherjee
4. A text book of Engineering Geology –By R. V. Gupta- Pune Vidyarthi Griha Prakashan Pune.
5. Engineering Geology for civil Engineering – By Dr. D.V.Reddy.
6. Engineering Geology –by B. S. Sathynarayan Swami.
7. Rutley's Elements of Mineralogy- By H.H. Read –CBS Pub. Delhi.

## REFERENCE BOOKS

1. Structural Geology – By M. P. Billings –PHI, Delhi
2. Geology hand book in civil Engineering –By R.F. Leggett- Mc GrawHill, New York,
3. Principles of Engineering Geology and Geotechniques – by D. P. Krynie, W.R. Judd.
4. Engineering and General Geology- by Pravin Singh-S.K. Katariya and son
5. Engineering Properties of rocks By L.W. Farmer-Chapman and Hall, London.
6. Experiments in Engineering Geology –By K.V.G. K. Gokhale and D.M. Rao – TMH, New Delhi.
7. Groundwater Hydrology\_ By Todd D. K.- John Wiley and Son, New York.
8. Engineering Geology Laboratory Manual.

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**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-III**  
**LAB PRACTICE**

**Teaching Scheme**

**Practical – 2 Hrs/Alternate Week**

**Examination Scheme**

**Term Work – 25 Marks**

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‘Lab Practice’ consists of learning suitable Computer Aided Drawing and Design (CADD) software and obtaining hands on experience of working with the software by the student. The performance of the student will be assessed on the basis of proficiency of the student in using CADD Software for Simple Civil Engineering Drawings from Subject ‘Building Construction and Drawing’ at S.E. Civil Engineering , Semester- III of Civil Engineering Program.

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**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-IV**  
**STRUCTURAL MECHANICS-II**

**Teaching Scheme**

**Theory – 3 Hrs/Week**

**Tutorial – 1 Hr/Week**

**Examination Scheme**

**Theory – 100 Marks**

**Term-Work – 25 Marks**

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**Course Objectives**

Students will be able to demonstrate basic knowledge of

- 1) Determination of combined direct and bending stresses.
- 2) Identification of principle planes and computation of principle stresses and strains due to combination of axial forces, bending moments and shear.
- 3) Calculation of slope and deflection of beams under different loading conditions.
- 4) Evaluation of strength of short and long columns.
- 5) Influence line diagrams for shear force, bending moment on a girder due to rolling loads.
- 6) Various theories of elastic failure.

**Course Outcomes**

Students completing the course will have:-

- 1) Ability to employ the knowledge of mechanics to understand the behavior of structure.
- 2) Ability to identify principal planes and find principal stresses.
- 3) Ability to find slope and deflection of beams under different loading conditions.
- 4) Ability to draw influence line diagram and its applications.

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**SECTION I**

**Unit 1.**

**(05 Hrs.)**

Behaviour of axially loaded long columns - Effective length, Slenderness ratio. Crippling load by Euler's and Rankine's formula, assumptions, limitations.

**Unit 2.****(06 Hrs.)**

Principal stresses and strains for 2-D problems- Normal and shear stresses on inclined plane. Principal plane and Principal stresses, Principal strains, Mohr's circle method, Principal stresses in beams, Stresses trajectories.

**Unit 3.****(05 Hrs.)**

Combined bending, torsion and thrust-shaft subjected to simultaneous bending, torsion and thrust. Principal stresses, equivalent torque and equivalent moment for solid circular shaft.

**Unit 4.****(06 Hrs.)**

- a) Theories of elastic failures- Maximum principal stress. Maximum Principal strain, Maximum shear stress theories, Total strain energy and distortion energy theory, causes of failure, fatigue and creep.
- b) Three hinged arches: Concepts, types of arches, analysis of parabolic with supports at same and different levels, semicircular arches. Determination of horizontal thrust, radial shear and normal thrust.

**SECTION II****Unit 5.****(06 Hrs.)**

Slope and deflection of beam-Computation by Double integration, Macaulay's Method., Moment area method, Conjugate beam method.

**Unit 6.****(05 Hrs.)**

Deflection of determinate beams, bents and trusses by strain energy method, Castigliano's theorem.

**Unit 7.****(06 Hrs.)**

Influence line diagrams, Muller-Breslau principle. Application to statically determinate simple and compound beams to determine support reaction, S.F. & B.M. at any section. I.L.D. for force in members of determinate truss.

**Unit 8.****(06 Hrs.)**

Rolling Loads: Application of influence line diagram for determination of shear force and bending moment in beams due to uniformly distributed load, shorter and longer than span.  
Application of influence line diagram for determination of shear force and bending moment in beams due to two concentrated loads at some distance apart, series of concentrated loads, condition of maximum bending moment, absolute maximum bending moment.

**TERM WORK**

Term work shall consist of numerical assignments on each unit.

**TEXT BOOKS**

1. Strength of Materials by R. K. Bansal, Laxmi Publications
2. Strength of Materials by R. S. Khurmi, S. Chand Publication, New Delhi
3. Strength of Materials by Ramamurtham, Dhanpat Rai & Sons, New Delhi
4. Mechanics of Structures (Vol I & II) by S.B. Junnarkar, Charator Book House, Anand.
5. Analysis of Structures (Vol I & II) by Vazirani and Ratwani, Khanna Pub., Delhi.
6. Strength of Materials by R.K. Rajput, S. Chand Publication, New Delhi

**REFERENCE BOOKS**

1. Structural Analysis by C. S. Reddy, Tata Mc. Graw Hill, New Delhi.
2. Elements of Strength of Materials, (5<sup>th</sup> Edition) by S. Timoshenko and J. Young  
Affiliated East-West
3. Strength of Materials by F.L. Singer, Harper and Row Pub., New York
4. Introduction to Mechanics of Solids by E. P. Popov. Prentice- Hall of India.
5. Elementary Structural analysis by Norris and Wilbur Mc-Graw Hill, New York.
6. Mechanics of Materials by Gere and Timoshenko, C.B.S. Delhi.
7. Mechanics of Structures by C.R. Shanley.



**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-IV**  
**SURVEYING-II**

**Teaching Scheme**

**Theory – 3 Hrs/Week**

**Practical – 2 Hr/Week**

**Examination Scheme**

**Theory – 100 Marks**

**Term-Work – 25 Marks**

**Oral – 25 Marks**

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**Course Objectives:** - The students learn the advanced surveying techniques including tacheometry, triangulation, remote sensing and Geographic Information Systems.

The Students will learn to:

1. Use survey instruments like the Tacheometer.
2. Record the data in field book and plot the collected data.
3. Find out horizontal and vertical distances with a tachometer
4. Set out simple curves and building layout using Theodolite.
5. Set out alignments for roads, railways, canals, pipelines, tunnels etc.
6. Use Modern Survey equipments, software and techniques

**Course Outcomes**

On completion of the course the students will be able to,

1. Plan project survey for bridges tunnels, building, dam , culvert etc.
2. Prepare contour maps and other surveying maps such as longitudinal profile and cross sections for various civil engineering projects.
3. Work on various application software related to surveying.

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**SECTION-I**

**Unit 1 Tacheometry:**

**(6 Hrs)**

a) Tacheometric constants, basic formulae, field work, auto reduction tacheometer, tangential system, Subtense method, subtense bar and accuracy.

**Unit 2: Curve surveying****(9 Hrs)**

- a) Horizontal curves: Necessity, Types and Designation. Elements, Design. Linear and angular Methods of setting out simple circular, compound, reverse and transition curves (Length of transition curve, Cubic Parabola, Bernoulli's lemniscates)
- b) Vertical curves: Types of vertical curves, Setting out vertical curves.

**Unit 3 : Global Positioning System (GPS)****(9 Hrs)**

Global Positioning System (G.P.S)-G.P.S. Segments: Spaces Segment, Control Segment, User Segment, Features of G.P.S. Satellites, Principle of Operation, Surveying with G.P.S.: Methods of observations, Absolute Positioning, Relative Positioning, differential G.P.S., Kinematics of G.P.S., G.P.S. Receivers: Navigational Receivers, Surveying Receivers, Geodetic Receivers, Computation of Co- ordinates:- Transformation from Global to Local Datum , Geodetic Coordinates to map co- ordinates , G.P.S. Heights and mean sea level Heights. Applications of G.P.S.

**SECTION-II****Unit 4: Remote Sensing Techniques (RST)****(6 Hrs)**

Photogrammetry

- a) Types – Terrestrial and Aerial Photogrammetry, principles, Phototheodolite, Aerial Camera, vertical aerial Photogrammetry: Scale, Relief Displacement, flight planning, Ground control
- b) Stereoscopy and photo interpretation: stereoscopes, Parallax Bar, Plotting instruments
- c) Electromagnetic remote sensing process. Physics of radiant energy: Nature of Electromagnetic radiation, Electromagnetic spectrum. Energy sources and its characteristics. Atmospheric influences: Absorption, Scattering. Energy interaction with Earth Surfaces: Spectral reflectance Curve. Image Acquisition: Photographic sensors, Digital Data, Earth Resource satellites, Image resolution. Image Interpretation. Applications of Remote Sensing.

**Unit 5: Geographical Information System (GIS )****(6 Hrs)**

Information systems, spatial and non- spatial Information, geographical concept and terminology, advantages of GIS, Basic component of GIS. GIS hardware and software. Field data, statistical data, maps, aerial Photographs, satellite data, points , lines, and areas features, vector and raster data, data entry through keyboard, digitizer and scanners, preprocessing of data rectification and registration, interpolation techniques.



## Unit 6: Project Surveys

(6 Hrs)

- a) General specifications, Reconnaissance, Preliminary and Location survey for
  - i) Route (Highway, railway, Canal)
  - ii) Culvert and Bridges
  - iii) Tunnel, Mine : Centre line transfer, Level transfer, Weisbach triangle
  - iv) Building

### TERM WORK

#### A) Practicals on Tacheometry

- a. Determination of constants of tacheometer
- b. Computation of horizontal distance and elevation by Tacheometry
- c. Study and use of subtense bar
- d. Tangential Tacheometry

#### B) Curves

- a) Setting Simple circular curve linear methods (Successive bisection, Long Chord, Tangents, Chord Produced Method) .
- b) Setting Simple circular curve Angular methods (Rankine's method, Two Theodolite and Tacheometric method).

#### C) Remote Sensing Techniques

- a) Study and use of Mirror stereoscope and finding out Air base distance.
- b) Study and use of parallax bar for measuring parallax and finding out the difference in Elevation between two points
- c) Study of satellite images and its interpretation

#### D) Collection of field data by using surveying and mapping GPS receiver.

#### E) Geographic Information System

- a) Geo-registration of map and its digitization by using suitable GIS software.
- b) Map editing, vector and raster analysis of digitized map by using suitable GIS software.

### PROJECT WORK

- 1) Tacheometric contouring ,
- 2) Route Survey project

### **TEXT BOOKS**

- a) B. C. Punmia. Surveying – Vol. II and III, Laxmi Publication, New Delhi
- b) T. P. Kanetkar and S. V. Kulkarni - Surveying and Leveling Vol. 2, -Pune Vidyarthi Griha Publication
- c) Advanced Surveying by Gopi, Sathikumar, Madhu- Pearson Education
- d) Advanced Surveying by Agor. Khanna Publishers, Delhi
- e) Surveying Vol. 2 by S. K. Duggal. Tata McGraw Hill Publishing Co. New Delhi.

### **REFERENCE BOOKS**

- a) Jawahar Lal Sharma- Advanced Surveying -CBS Publishers New Delhi
- b) T. M. Lillisand and R.W. Kaifer, Remote Sensing & Image Interpretation, John Wiley & Sons Inc
- c) Lo C.P. Yeung A K W, Concepts and Techniques of GIS - Prentice Hall, India
- d) Kang-tsung Chang, Introduction to GIS, Tata McGraw Hill
- e) K. Anjali Rao, Remote sensing and GIS, BS Publications

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**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-IV**  
**BUILDING CONSTRUCTION AND DESIGN**

**Teaching Scheme**

**Theory – 3 Hrs/Week**

**Drawing – 2 Hr/Week**

**Examination Scheme**

**Theory – 100 Marks**

**(Paper-04 Hrs. Duration)**

**Term-Work – 25 Marks**

**OE- 25 Marks**

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**Course Objectives:**

- 1) The students will learn various principles of planning and designing of residential buildings.
- 2) The students will learn various building services and their constructions.

**Course Outcomes:**

Students will be able to,

- 1) Plan and design a residential building by applying various principles of planning and design.
  - 2) Apply knowledge of building services in practice.
- 

**SECTION – I**

**Unit 1: Site Selection, Principles of Building Planning, Orientation and By Laws (7 Hrs)**

- a) Site Selection criteria
- b) Principles of Building Planning. Significance of Sun Diagram, Wind Diagram.
- c) Orientation, Factors affecting, Criteria under Indian conditions
- d) Building Planning byelaws & regulations as per SP-7, 1983 National building. Code of India Group 1 to 5.

**Unit 2: Planning of Residential Buildings and Various Permissions (7 Hrs)**

Planning of Residential Building (Detached, Semi Detached, Row Houses, Flat Schemes)  
Procedure and significance of Building Permission, Commencement Certificate, Plinth Completion Certificate and Occupancy certificate.

**Unit 3: Low Cost Housing, Repairs and Maintenance**

**(7 Hrs)**

- a) Introduction to Modular plan & Spatial Design of Building.
- b) Low cost Housing - materials & methods (Conceptual introduction only)
- c) Maintenance, Repairs, Rehabilitation of structures. (Conceptual introduction only)

**SECTION – II**

**Unit 4: Building Services**

**(7 Hrs.)**

- a) Plumbing Systems, Various elements of materials like PVC, GI, AC, CI, HDPE, Stoneware. Various types of traps, Fittings, Chambers. Need of septic tank, Significance of Plumbing and Drainage plan, Introduction of Rain Water Harvesting.
- b) Ridge Lines, Valley Lines, Rainwater outlet, Rainwater Gutters & down take systems.
- c) Electrification: - Concealed, & open wiring, Requirements & Locations of Various Electrical points, Concept of Earthing.

**Unit 5: Ventilation, Air Conditioning, Thermal Insulation**

**(7 Hrs)**

- a) Ventilation: Definition & necessity of ventilation, functional requirements, various systems and selection criteria.
- b) Air conditioning: purpose, classification, principles, systems and Components of the Air conditioning.
- c) Thermal insulation: General concept. Principles, materials, methods, Computation of Heat loss & Heat gain in buildings.

**Unit 6: Building Finishes**

**(7Hrs)**

- a) Paints: Different types & application methods.
- b) Varnishes & application methods.
- c) Plastering, Pointing & various techniques.
- d) Tiles cladding, skirting, dado work with various materials.
- e) Miscellaneous finishes such as POP, wall paper, etc.

**TERM WORK**

- I. Planning & designing of residential building (G+1).
- II. Full set of drawings for the building planned in (II) above.
  - a) Building Permission drawing.
  - b) Water supply and drainage plan.
  - c) Electrification plan.

d) Furniture layout plan.

(Use full/ imperial size Drawing Sheet)

III Design and Planning Report of Project Building mentioned in (I) above; giving alternate line plan, byelaws followed, principles considered and sketches and design calculations for Staircase, Sanitary Requirements, etc.

IV. AutoCAD Exercise based on project. (Printout to be submitted)

### **TEXT BOOKS**

1. Building Design and Drawing: Y.S. Sane-Allies Book Stall, Pune
2. Building Design and Drawing : Shaha, Kale & Patki – T.M.H., New Delhi
3. Building Construction : Sushilkumar –Standard Publishers, Delhi
4. Building Construction : N.K.R. Murthy -Allies Book Stall, Pune
5. Building Construction : Arora and Gupta – Satya Prakash, New Delhi.
6. A Text book of building Construction: Bindra, Arora – Dhanpat Rai Publications.

### **REFERENCE BOOKS**

1. Building Technology by I. Seeley.
2. SP 7 – 1983: National Building code Group 1 to 5 – Indian Standards, Delhi.
3. Planning by E & OE.
4. SP 1650- 1973: Standard code for Building & Decorative finishes- Indian Standards, Delhi.
5. Building Planning: Kumarswamy
6. Building Construction illustrated : Francis D.K. Ching- Willey (India Edition)



**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-IV**  
**FLUID MECHANICS-II**

**Teaching Scheme**  
**Theory – 3 Hrs/Week**  
**Practical – 2 Hr/Week**

**Examination Scheme**  
**Theory – 100 Marks**  
**Term-Work – 25 Marks**

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**Course Objectives:**

- 1) The students will understand the concept of gradually varying flow and rapidly varying flow with impact of jet.
- 2) This course imparts the knowledge of fluid measuring devices viz. notches & weirs and concept of spillway.
- 3) Students will induce a skill to design open channel & introduce the basics of hydraulics mechanism.
- 4) This course aims to provide an insight into understanding of dimensional analysis & model analysis.

**Outcomes:**

- 1) At the end of the course, graduates will develop the ability to design and conduct experiments with analysis of data to produce experimental results.
- 2) Graduates with the ability to carry out different hydraulic projects and to improve the existing hydropower plants.
- 3) Graduates will develop an ability to function as leader or member of multidisciplinary teams with more and more students going for post graduation in this field.

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**SECTION-I**

**Unit 1: INTRODUCTION TO OPEN CHANNEL FLOW**

**(07 hrs)**

Classification of channels, Types of Flow in Open Channel and Geometric Properties

- A. Uniform Flow : Chezy's and Manning's Equation, Hydraulically Most efficient rectangular, Triangular and Trapezoidal section, computation of normal depth, conveyance, section factor, Hydraulic Exponent , Uniform flow competitions, concept of Froude number , velocity distribution, kinetic energy and momentum correction factors, measurement of velocity ( Pitot tube, current meter, float etc)
- B. Critical Flow: - Specific Energy & Diagram, Alternate depths, Depths Energy relationship in open channel, Specific Force.

**Unit 2: Gradually & Rapidly Varied Flow (GVF &RVF) (07 hrs)**

- A. Gradually Varied Flow (GVF):- Dynamic Equation of GVF, Classification & Characteristics of Surface Profile. Direct Step Method of Computing Profile Length.
- B. Rapidly Varied Flow (RVF):- Definition of Hydraulic Jump, Classification of Jump, Equation of Hydraulic Jump in horizontal rectangular channels, computation of length & height of Jump, Energy Loss in Jump. Hydraulic Jump as an energy dissipater.

**Unit 3: NOTCHES, WEIRS & SPILLWAYS. (7 hrs)**

- A. Types Derivation of discharge equation, velocity due to approaches, Francis formula, calibration of notch & errors in measurements.
- B. Weir & Spillways sharp & broad crested weirs, calibration of weirs, time required to empty the tank with notches and weirs, profile of ogee spillways types of nappe, ventilation of weirs.

**SECTION – II**

**Unit 4: FLUID MACHINERY (7 hrs)**

- A. Impact of Jet Stationary & Moving, Flat & Curved Plates, Inlet & Outlet Velocity Triangle.
- B. Turbines : Definition Gross & Net Heads, different efficiencies, classification of turbines, components parts and working principles, selection of turbines on the basis of head & specific speed. Governing of Turbines, General Layout of Hydraulic Plant.

**Unit 5: CENTRIFUGAL PUMPS (7 hrs)**

Component parts working Principle Static & Monometric heads, different efficiencies, specific speed, Theoretical aspect of Multistage pump, priming of pumps and troubles and remedies, selection of pumps on basis of Operating Characterization

**Unit 6: DIMENSIONAL ANALYSIS & MODEL ANALYSIS (7 hrs)**

Dimensions & Dimensional homogeneity, Importance & Use of Dimensional analysis, Buckingham  $\pi$  theorem, statement & applications, Non dimensional numbers & their significance, Difference between model & Prototype , Types of similarities, Model laws, Reynolds and Froude's, distorted model, undistorted model, scale ratios and applications.

## TERM WORK

1. Any 4 of the following
  - a. Study of specific energy diagram for different discharges.
  - b. Calibration of V notch/rectangular notch.
  - c. Calibration of sharp crested suppressed weir and plotting of upper/lower nappe.
  - d. Calibration of Ogee Weir.
  - e. Study of hydraulic jump
    - i. Verification of sequent depths
    - ii. Determination of loss in jump
    - iii. Plotting the following parameters with respect to Froude number
      - 1)  $Y_2/Y_1$
      - 2) Length
      - 3) Energy loss
  - f. Study of flow over broad crested weir.
  - g. Study of flow below gates – Discharge verses head relation, Equation of flow, Determination of contraction in flow in downstream of gate.
  - h. Velocity distribution in open channel in transverse direction of flow.
2.
  - a. Impact of jet.
  - b. Study of turbines (demonstration/test).
  - c. Test on a centrifugal pump.
  - d. Study of charts for selection of pumps.

## TEXT BOOKS

- 1) Fluid Mechanics – A. K. Jain-Khanna Pub., Delhi.
- 2) Fluid Mechanics – K.L. Kumar – Eurasia Publishing House, Delhi.
- 3) Flow through Open channels– Rangaraju – Tata McGraw Pub. Co., Delhi.
- 4) Fluid Mechanics – K.Subramanaya – Tata McGraw Pub. Co., Delhi.
- 5) Fluid Mechanics – Hydraulic & Hydraulic Mechanics Modi & Seth –Standard Book House, Delhi.
- 6) Fluid Mechanics – R. W. Fox, P.J. Prichard, A.T.Mcdonald- Wilely India.



## REFERENCE BOOKS

- 1) Fluid Mechanics – Streeter McGraw Hill-International Book Co., Auckland.
- 2) Flow in open channel – V.T.Chaw – McGraw Hill International Book Co., Auckland.
- 3) Flow in open channel – K.Subramanyam – Tata McGraw Pub.Co., Delhi.
- 4) Fluid Mechanics – Munson, Young- Willy India.
- 5) Mechanics of Fluids – M.C. Potler, Wiggert, Ramdan- Cengage Learning.

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**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-IV**  
**WATER RESOURCES ENGINEERING-I**

**Teaching Scheme**  
**Theory – 3 Hrs/Week**

**Examination Scheme**  
**Theory – 100 Marks**  
**Term Work – 25 Marks**

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**Course Objectives**

- 1) To provide the students with a basic understanding of hydrologic data and hydrologic processes
- 2) To enable the student to predict the storm hydrograph for a given watershed resulting from a given rainfall event.
- 3) To provide the student with a basic introduction of groundwater flow processes.
- 4) To provide students the basic introduction of Watershed management practices.
- 5) To enable students to select appropriate method of irrigation depending upon availability of water, crop water requirements.

**Course Outcomes:**

- 1) The students will be able to assess stream flow, rainfall, and geographic data.
- 2) The students will be able to construct and apply models of hydrologic processes
- 3) Construct a rainfall hyetograph for a given storm duration and frequency
- 4) The students will be able to understand the component of ground water flow and aquifers in a hydrologic system.
- 5) The students will be able to calculate flows based on properties of soil, pumping tests, permeability estimation.

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**SECTION-I**

**Unit- 01**

**(6 hrs)**

Introduction to Hydrology: Definition, History and importance of hydrology, The hydrological cycle, Weather and its precipitation potential. Precipitation :Forms and types of

precipitation, Different methods of measurement, Factors affecting precipitation at a location, Correcting precipitation data, Estimating missing data, Estimation of extreme values, Rain gauge network, Determination of average precipitation over the catchments, Analysis of precipitation data, Mass rainfall curves, Intensity-duration curves, Concept of depth-area-duration analysis, Frequency analysis.

Evaporation and Evapotranspiration: Factor affecting evaporation, Measurement and control of evaporation upon reservoirs. Evapotranspiration - definition and measurement  
Infiltration: Process of Infiltration, Factor affecting infiltration, Infiltration indices, Effect of infiltration of on runoff and ground water recharge.

**Unit- 02** **(5 hrs)**

Runoff: Factors affecting runoff, Catchment yield calculations, Rainfall-runoff relationship  
Hydrograph: Base flow, Separation of base flow, Unit hydrograph – theory, assumptions and limitations, Derivation and use of unit hydrograph, S-curve hydrograph.

**Unit- 03** **(5 hrs)**

Stream gauging: Selection of a site, various methods of discharge measurements, Area velocity method, Slope Area method, S.W.F. and other modern methods.  
Floods: Definition, Factors affecting, Estimation of peak flow, Rational and other methods, Design flood, hydrograph components, Recurrence period.

**Unit- 04** **(5 hrs)**

Ground water hydrology: Occurrence and distribution of ground water, Specific yield of aquifers, Movements of ground water, Darcy's law, Permeability, Safe yield of basin, Hydraulics of well under steady flow condition in confined and unconfined aquifers, Specific capacity of a well, Well irrigation: tube wells, open wells, their design and construction.

**SECTION-II**

**Unit- 05** **(5 hrs)**

Water Resources Development in India & Maharashtra: National water policy of India, Development of irrigation potential through five year plans, Water resources potential of India, Water Resources development in India, Water resources potential of Maharashtra, Water resources development in Maharashtra, Problems in water resources developments in country and Maharashtra state.

Inter basin transfer of water: Concept of inter basin transfer of water, Proposed inter basin transfer of water from surplus regions of India to deficit regions of India, National perspective plan of India-Himalayan rivers component and peninsular rivers component.

**Unit- 06**

**(6 hrs)**

(a) Irrigation: Definition and necessity of Irrigation, Different systems of irrigation-Flow, Lift, Inundation, Bandhara, Storage, Kolhapur type weirs.

Sources of water-river, well, tanks. Water Application Methods: Methods of lifting water and application of water to soils, Sprinkler, Drip, Basin, Furrow and Drip Irrigation System.

(b) Lift Irrigation: Necessity, General Layout, Main Components of a lift irrigation scheme.

**Unit- 07**

**(5 hrs)**

Soils: Types of Soils, Suitability of soils for different crops, Soil moisture, Wilting coefficient, Texture and physical structure, Harmful components in soil, Preparation of soil for irrigation.

Crop Water requirements: Cash crops and food crops, Water requirement of different crops, Duty and Delta, Factors affecting duty and delta, Crop Seasons in Maharashtra and India, Command Area- Gross, Cuturable, Irrigable, Calculation of water required.

Water Management: Application of water, Water management and distribution, cooperative water users' organizations, Warabandi, Rotational applications, Assessment of canal revenue- Various methods.

**Unit- 08**

**(5 hrs)**

(a) Minor Irrigation System: Necessity and general layout of percolation tanks, Bandhara irrigation.

(c) Watershed Management: Need of Watershed management, Importance of soil and water conservation measures, Reservoir sedimentation. Techniques for Rainwater harvesting and ground water harvesting.

### **TEXT BOOKS**

1. Irrigation Engineering and Hydraulic Structures-S. K. Garg, Khanna Publishers, Delhi.
2. Irrigation and Water Power Engg.- Dr. Punmia, Dr. Pande, Laxmi Publications.
3. Engineering hydrology- K. Subramanya ,Tata McGraw- Hill Publishers.
4. Efficient Use of Irrigation Water-G. H. Sankara Reddi, Kalyani Publishers, Noida.
5. Water Management in India-J. V. S. Murthy.
6. Water Management, Conservation, Harvesting and Artificial Recharge- Dr. A. S. Patel, Dr. D. L. Shah, New Age International Publishers.
7. Hydrology and Water Resources-R. K. Sharma, Dhanpat Rai & Sons.
8. Fundamentals of Irrigation Engg.-Bharat Sing, Nem Chand & Bros, Roorkee.

### **REFERENCE BOOKS**

1. Irrigation theory & Practice – Michael, Vikas Publishing House.
2. Irrigation Structures- Milos Holy-CBIP
3. Water Management-Jaspal Singh, M. S. Acharya , Arun Sharma .Pub- Himanshu Publication
4. Design of Minor Irrigation and Canal Structure- Satyanarayan and R.Murthy.

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**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-IV**  
**ENGINEERING MATHEMATICS-III**

**Teaching Scheme**

**Theory – 3 Hrs/Week**

**Tutorial – 1 Hr/Week**

**Examination Scheme**

**Theory – 100 Marks**

**Term Work –25 Marks**

**Course Objectives**

- 1) The Students will be introduced higher order linear differential equations and their applications to civil engineering.
- 2) The students will learn Fourier series, Laplace transform and vector calculus with their applications.
- 3) The students will learn concepts of statistics and Probability with applications to Civil Engineering Problems.

**Course Outcomes**

Students will be able to,

- 1) Solve the higher order linear differential equation related to various structural elements like, beams, columns, struts, etc.
- 2) Express the function in terms of sines and cosines.
- 3) Apply the methods of statistics and probability in Civil Engineering Problems..

**SECTION-I**

**Unit 1:**

**(5 Hrs)**

**Linear Differential equations with constant coefficients:**

Basic definition, differential operator, complimentary functions, particular integral shortcut method for standard functions like  $e^{ax}$ ,  $\sin(ax + b)$ ,  $\cos(ax + b)$ ,  $x^m e^{ax}$  and  $xV$ , particular integral general method (without method of variation of parameters) for other functions.

**Unit No 2:**

**(5 Hrs)**

**Homogeneous Linear Differential equations:** Legendre's Linear equations, Civil Engineering applications.

**Unit No 3:** (5 Hrs)

**First Order Partial Differential equations:** Non-linear partial differential equations of type I  $f(p, q) = 0$ , type II  $f(p, q, z) = 0$ , type III  $f_1(p, x) = f_2(q, y)$ , Linear Partial Differential equations by Lagrange's method. Solution of partial differential equations by method of separation of variables.

**Unit No 4:** (6 Hrs)

**Laplace Transform:** Definition, Transform of standard function, Properties, Transform of derivative and integral. Inverse Laplace Transform, Convolution Theorem. Applications to solve linear Differential Equations with constant Coefficients.

## SECTION-II

**Unit No 5:** (6 Hrs)

**Fourier series:** Definition, Euler's formula, Expansions of function, Change of interval, even and odd functions, half range Fourier Series.

**Unit No 6:** (5 Hrs)

**Vector Calculus:** Differentiation of vectors, tangent line to the curve, velocity and acceleration, Gradient, Divergence and Curl of vector field, Solenoid, irrotational and conservative vector field

**Unit No 7:** (5 Hrs)

**Statistics:** Coefficient of correlation and lines of regression of bivariate data, fitting of curve- Least squares principle.

**Unit No 8:** (5 Hrs)

**Probability:** Random variable, Binomial, Poisson and Normal distributions

## INSTRUCTIONS

Minimum six to eight Assignments based on above mentioned syllabus shall be completed by the students.

### **TEXT BOOKS**

- 1) J.N. and P.N. Wartikar, A textbook of Applied Mathematics Vol. II and Vol. III – Pune Vidyarthi Griha Prakashan, Pune.
- 2) B. S. Grewal, Higher Engineering Mathematics – Khanna Publications, Delhi.
- 3) A textbook of Applied Mathematics by N.P. Bali, Ashok Saxena and N.Ch. S.N. Iyengar – Laxmi Publications , Delhi.
- 4) Advanced Engineering Mathematics by Kreyzig -John Wiley & SMS, New York.

### **REFERENCE BOOKS**

- 1) Peter O’Neil , Advanced Engineering Mathematics - Cengage Learning M. D. Greenberg,
- 2) Advanced Engineering Mathematics (Second Editions) - Pearson.

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**Solapur University, Solapur**  
**S.E. (Civil Engineering) Semester-IV**  
**COMPUTER PROGRAMMING AND NUMERICAL METHODS**

**Teaching Scheme**

**Theory** – 2 Hrs/Week

**Practical** – 2 Hr/Week

**Examination Scheme**

**Term Work** – 25 Marks

**Pract.-Oral** – 25 Marks

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**Course Objectives**

- 1) To develop a thorough understanding of principles of numerical analysis.
- 2) To develop a on the computer algorithm of different numerical methods.
- 3) To emphasize on developing the students ability to analyze and solve problems by using programming language 'C'.
- 4) To develop an understanding of applications of numerical methods to solve Civil engineering problems.

**Outcomes:**

Students should be able to

- 1) Write computer programs for Matrix operations on computer necessary for structural analysis.
  - 2) Develop computer programs for calculating Roots of equation, Numerical Integration, ordinary differential equations and for various applications in Civil Engineering.
  - 3) Carry out statistical analysis of data by writing programs for statistical methods.
- 

**Unit 1.**

**(6 hrs)**

Revision of C Programming concepts- Control instructions and Data types in C, Decision control structure, Loop control structure, Case control structure.

**Unit 2.**

**(5 hrs)**

Arrays in C. One dimensional arrays, Two dimensional arrays, Pointers in C.  
Types of Input Output, Console input output.

**Unit 3****(5 hrs)**

Matrix operations on computer: Multiplication and inversion, Gauss elimination method, Solution of simultaneous equations

**Unit 4****(5 hrs)**

Roots of equation: Derivation based methods, Newton Raphson method, Trial and error method, Bisection method.

Numerical integration by Simpsons rule and Trapezoidal rule.

**Unit 5****(5 hrs)**

Solution of ordinary differential equation: Euler's Method, Modified Euler's method. Runge Kutta method.

**Unit 6****(5 hrs)**

Statistical analysis: Mean and standard deviation, Least square method, Regression analysis – Linear, parabolic curve fitting.

**TERM WORK**

Term work shall consist of at least 12 programs with flow charts, source listing, input and outputs based on above topic. Programming has to be done in 'C' language.

**(NOTE:** All the units described above are to be taught with computer applications based on civil engineering problems.)

**TEXT BOOKS**

- (1) Numerical Methods: E. Balaguruswamy, Tata Mc-Graw Hill Publications.
- (2) Computer Programming and Numerical methods- Revised edition with C- N. Datta
- (3) Numerical Methods- S. Arumugam, A. Tthangapandi Isaac, A. Somasundaram, Scitech Publishers
- (4) Numerical Methods- Grewal, Khanna Publishers.
- (5) Let us C-Yashawant Kanetkar, BPB Publications New Delhi
- (6) Programming with C-Schaum Outline Series, Tata-McGraw Hill Publications

### **REFERENCE BOOKS**

- (1) Numerical methods for engineers, Volume 1, Steven C. Chapra, Raymond P. Canale, McGraw-Hill Publications.
- (2) Numerical Methods for Scientific and Engineering Computation-M. K. Jain, S. R. K. Iyengar, R. K. Jain- New Age International Publishers.

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