UNIVERSITY OF MUMBAI

Bachelor of Engineering

Civil Engineering (Second Year – Sem. III & IV), Revised course

(REV- 2012) from Academic Year 2012 -13,

Under

FACULTY OF TECHNOLOGY

(As per Semester Based Credit and Grading System)

Semester IV

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
CE-C401	Applied Mathematics – IV *	4	--	--	4	--	--	4
CE-C402	Surveying – II	3	3	--	3	1.5	--	4.5
CE-C403	Structural Analysis – I	5	2		5	1	--	6
CE-C404	Building Design and Drawing – I	2	3	--	2	1.5	--	3.5
CE-C405	Concrete Technology	3	2	--	3	1	--	4
CE-C406	Fluid Mechanics – II	3	2	--	3	1	--	4
Total		**20**	**12**	**--**	**20**	**6**	**--**	**26**

Subject Code	Subject Name	Examination Scheme								
		Theory					Term Work	Pract	Oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)				
		Test 1	Test 2	Avg.						
CE-C401	Applied Mathematics – IV *	20	20	20	80	3	--	--	--	100
CE-C402	Surveying – II	20	20	20	80	3	25	--	25*	150
CE-C403	Structural Analysis – I	20	20	20	80	3	25	--	25	150
CE-C404	Building Design and Drawing – I	20	20	20	80	4	25	--	25#	150
CE-C405	Concrete Technology	20	20	20	80	3	25	--	25	150
CE-C406	Fluid Mechanics – II	20	20	20	80	3	25	--	25	150
Total		**120**	**120**	**120**	**480**	--	**125**	**--**	**125**	**850**

***Oral & Practical** **#Oral & Sketching**

* Course common for Civil Mechanical, Automobile & Production Engineering.

Semester IV

Subject Code	Subject Name	Credits
CE-C 401	Applied Mathematics-IV	4

Teaching Scheme

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorials	Total
04	-	--	04	-	--	04

Evaluation Scheme

Theory					Term Work/ Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test 1	Test 2	Average						
20	20	20	80	03 Hrs.	--	--	--	100

Rationale

The study of mathematics is necessary to inculcate amongst the students the skills necessary for studying new technical developments. This subject introduces some applications of engineering through which the students can understand the link of mathematics with engineering principles. It creates sufficient background necessary to understand and use mathematical techniques for application in modern engineering. The course deals with matrices, vector calculus, non-linear programming, probability distributions and sampling theory along with correlation and regression.

Objectives

1. To inculcate an ability to relate engineering problems to mathematical context
2. To provide a solid foundation in mathematical fundamentals required to solve engineering problem
3. To impart the basic principles of matrix algebra, vector analyses, statistics and probability

Detailed Syllabus

Module	Sub-Modules/ Contents	Periods
I.	**Matrices**	**09**

	1.1	Characteristic polynomial, characteristic equation, characteristic roots and characteristic vectors of a square matrix, properties of characteristic roots and vectors of different types of matrices such as orthogonal matrix, Hermitian matrix, Skew-Hermitian matrix.	
	1.2	Diagonalisable Matrix, Cayley Hamilton theorem (without proof) Functions of a square matrix, Minimal polynomial and Derogatory matrix.	
II	**Vector calculus**		**10**
	2.1	Scalar and vector point functions, Gradient, Divergence and curl, Solenoidal and Irrotational Vector Field	
	2.2	Line integrals, Surface integrals, Volume integrals. Green's theorem(without proof) for plane regions and properties of line integrals, Stokes theorem(without proof), Gauss divergence theorem (without proof) related identities and deductions.(No verification problems on Stoke's Theorem and Gauss Divergence Theorem)	
III.	**Non Linear Programming**		**05**
	3.1	Unconstrained optimization, problems with equality constraints Lagranges Multiplier method (two constraints)	
	3.2	Problem with inequality constraints Kuhn-Tucker conditions (two constraints)	
IV.	**Probability Distributions and Sampling Theory**		**11**
	4.1	Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expected value, Variance	
	4.2	Probability Distributions: Binomial, Poisson and Normal Distributions.	
V.	**Sampling Theory**		**12**
	5.3	Sampling distribution. Test of Hypothesis. Level of significance, critical region. One tailed and two tailed tests. Interval Estimation of population parameters. Large and small samples	
	5.4	Test of significance for Large samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples	
	5.5	Student's t-distribution and its properties. Test of significance of Small samples Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two Samples, paired t-test	

	5.6	Analysis of Variance(F-Test): One way classification,Two-way classification	
	5.7	Chi-square distribution and its properties, Test of the Goodness of fit,Association and Attributes	
VI	**Correlation and Regression**		**05**
	6.1	Correlation, Co-variance, Karl Pearson Coefficient of Correlation and Spearman's Rank Correlation Coefficient (non-repeated and repeated ranks) (No theoretical questions)	
	6.2	Regression Coefficients and lines of regression (No theoretical questions)	

Contribution to Outcomes

On successful completion of the course, the students shall have the ability to:

- Use matrix algebra with its specific rules to solve the system of linear equations.
- Understand and apply the concept of probability distribution and sampling theory to engineering problems.
- Apply principles of vector differential and integral calculus to the analysis of engineering problems.
- Identify, formulate and solve engineering problems.

Theory examination:

1. The question paper will comprise of **six** questions; each carrying 20 marks.
2. The **first** question will be **compulsory** and will have short questions having weightage of 4-5 marks covering the entire syllabus.
3. The remaining five questions will be based on all the modules of the entire syllabus. For this, the modules shall be divided proportionately and further, the weightage of the marks shall be judiciously awarded in proportion to the importance of the sub-module and contents thereof.
4. The students will have to attempt **any three** questions out of remaining five questions.
5. Total **four** questions need to be attempted.

Term Work:

The term work shall comprise of the assignments (minimum eight numbers) solved by the students during the tutorial class.

Distribution of the Term Work Marks:

The marks of the term work shall be judiciously awarded depending upon the quality of the term work. The final certification and acceptance of the term work ensures the satisfactory performance during tutorials.

Recommended Books:

1. Fundamentals of Mathematical Statistics: *S C Gupta and V K Kapoor*, S. Chand and Co.
2. Higher Engineering Mathematics: *Dr B. S. Grewal*, Khanna Publication, New Delhi.
3. Elements of Applied Mathematics: *P. N. Wartikar and J. N. Wartikar*, Pune Vidyarthi Griha Prakashan, Pune.
4. Advanced Engineering Mathematics: E Kreyszing, Wiley Eastern Limited.

Reference Books:

1. Operations Research: D.S.Hira and P.K.Gupta,S. Chand & Co.
2. Vector Analysis: Murray R. Spiegel, Shaum Series
3. Probability and Statistics : T. VeeraRajan,TataMc-Graw Hill Publications
4. Matrices: A.R.Vashistha, Krishna Prakashan, Meerut

Semester IV

Subject Code	Subject Name	Credits
CE –C 402	Surveying-II	4.5

Teaching Scheme

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorials	Total
03	03	-	03	1.5	-	4.5

Evaluation Scheme

Theory					Term Work/ Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test 1	Test 2	Average						
20	20	20	80	03 Hrs.	25	-	25*	150

Rationale

This is an advanced course which intended to teach students modern surveying instruments with their principles and uses in surveying along with curves and setting out of different civil engineering works. Students are exposed to the concept of G.P.S., G.I.S. and remote sensing techniques. To make the students acquainted with the field problems, survey camp is arranged to execute the Road project, Block contouring project and Tachometric project at ideal locations.

Objectives

- Set out the curve by linear and angular methods with proper office and field work.
- Study modern surveying instruments.
- Set out civil engineering works, e.g., Sewer line, culvert, bridges, buildings etc.
- Execute road project, block contouring project and tacheometric project.
- Plot the ‘L’ section and ‘C’ section.
- Plot the contour plans.

Detailed Syllabus

Module	Sub-Modules/ Contents		Periods
I.	**Tacheometric surveying**		**08**
	1.1	Principle, purpose, uses, advantages and suitability of tacheometry, different methods of tacheometry, stadia formula, Stadia diagram and tables. Subtense bar method.	
	1.2	Application in plane table and curve setting.	
	1.3	Radial Contouring.	
II.	**Curves-Horizontal**		**10**
	2.1	Definitions of different terms, necessity of curves and types of curves.	
	2.2	Simple circular curves and compound curves, office and field work, linear methods of setting out curves, Angular methods of setting out curves, two theodolites and Rankine deflection angle method.	
	2.3	Reverse and transition curves, their properties and advantages, design of transition curves, shift, spiral angle. Composite curves office and field level. Setting out of curves by angular method, composite curves problems.	
	2.4	Difficulties in setting out curves and solution for the same.	
III.	**Curves- Vertical**		**03**
	3.1	Definitions, necessity, geometry and types.	
	3.2	Tangent correction and chord gradient methods.	
	3.3	Sight distance on a vertical curve	
IV.	**Setting out works**		**05**
	4.1	General horizontal and vertical control, setting out of foundation plan for load bearing and framed structure, batter board, slope and grade stakes, setting out with theodolite.	
	4.2	Setting out a foundation plans for building, sewer line, culvert, and use of laser for works; Setting out center line for tunnel, transfer of levels for underground works.	
	4.3	Project/route survey for bridge, dam and canal.; Checking verticality of high rise structures.	
V.	**Modern Surveying Instruments**		**05**

	5.1	Electronics in surveying, various types of electronic distance measurements, principles used, Application in surveying, corrections for field observations.	
	5.2	Electronic digital theodolite – types and application. Digital planimeter, digital level Total station –various applications in surveying	
	5.3	Use of computer in surveying for reduction of levels, plotting of contour plans, L-section and C-section using various softwares	
VI.	**Modern Methods of Surveying**		**08**
	6.1	Global Positioning System (GPS): Basic principles, GPS segments, receivers, computations of coordinates. Applications in surveying	
	6.2	Remote Sensing: Definition, basic concepts, electromagnetic radiation and spectrum, energy source and its characteristics, image acquisition and image interpretation. Application of remote sensing.	
	6.3	Global Information System (GIS): Geographical concepts and terminology, advantages, basic components of GIS, data types, GIS analysis, Applications of GIS.	

Contribution to Outcomes

On completion of the course, the students will be able to determine the distance in the field using tachometry and other modern survey instruments, using the same for preparation of drawings such as contour plans, 'L' section and 'C' section. Students apply this knowledge to use the modern surveying instruments in the field effectively for setting out civil engineering works such as culverts, tunnels, bridges, curves etc. accurately. The students will be updated with the knowledge of G.P.S., G.I.S. and remote sensing techniques.

Theory examination:

1. The question paper will comprise of **six** questions; each carrying 20 marks.
2. The **first** question will be **compulsory** and will have short questions having weightage of 4-5 marks covering the entire syllabus.
3. The remaining five questions will be based on all the modules of the entire syllabus. For this, the modules shall be divided proportionately and further, the weightage of the marks shall be judiciously awarded in proportion to the importance of the sub-module and contents thereof.
4. The students will have to attempt **any three** questions out of remaining five questions.
5. Total **four** questions need to be attempted.

Oral/ Practical Examination: Oral examination in conjunction with the Practical Examination will be conducted based on entire syllabus and term work.

List of Practicals:

1. To find the constants of a tachometer and to verify filed distances.
2. Height and distance problems in tachometric surveying.
3. To set out circular curve by linear methods.
4. To set out circular curve by angular methods.
5. Use of theodolite for one plane and two plane methods.
6. Study of modern surveying instruments.
7. Determination of horizontal and vertical distances using total stations.
8. Setting out a simple foundation plan in the field

Term Work:

- It shall consists of three A-1 size drawing sheets comprising of longitudinal section and cross sections, block contouring and tachometric surveying based on minimum three days survey camp at locations fulfilling the ideal site conditions, plotting of a contour plan on computer using suitable software.
- The assignments shall comprise of the minimum 20 problems covering the entire syllabus divided properly module wise.

Distribution of the Term Work Marks:

The marks of the term work shall be judiciously awarded for the various components of the term work and depending upon the quality of the term work. The final certification and acceptance of term work warrants the satisfactory performance of laboratory and field work by the student, appropriate completion of the assignments.

Recommended Books:

1. Surveying and Levelling: Vol-I and Vol.-II, *Kanetkar and Kulkarni*, Pune Vidyarthi Griha, Pune.
2. Surveying and Levelling: *N. N. Basak,* Tata McGraw Hill New Delhi.
3. Surveying: *R. Agor*, Khanna Publishers.
4. Surveying: Vol-I: *Dr K.R. Arora*, Standard Book House.
5. Surveying and Levelling (2nd Edition): *R. Subramanian*, Oxford Higher Education.
6. Surveying and levelling (Vol.-II & III): *Dr. B.C. Punmia,* Laxmi Publications.
7. Higher Surveying: *Dr. A. M.Chandra*, *New* Age International Publishers.

Semester IV

Subject Code	Subject Name	Credits
CE –C 403	Structural Analysis-I	6

Teaching Scheme

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorials	Total
05	02	-	05	01	-	06

Evaluation Scheme

Theory					Term Work/ Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test 1	Test 2	Average						
20	20	20	80	03 Hrs.	25	-	25	150

Rationale

There are various types of the components of any civil engineering structures which are subjected to different types of loading or combination thereof. Most of the structures which are analyzed for finding its structural response which would form the basis for its structural design are indeterminate structure. Notwithstanding, the structural analysis of any civil engineering structural systems idealizing the same as the statically determinate one shall be the foundation of the analysis of the indeterminate structures. The knowledge gained in the subjects such as engineering mechanics and strength of materials in the preceding semesters where students have been exposed to the principles of engineering mechanics and subsequently, its application on the materials and solids to study its behaviour under the action of loads and further to evaluate its strength properties, is extended in this subject for the analysis of various structural systems such as beams, frames, arches and suspension bridges.

Objectives

- To analyze the statically determinate simple portal frame (both- rigid jointed and having an internal hinges).
- To study the methods and evaluating rotation and displacement parameters in respect of beams and frames using various methods.
- To analyze the three hinged arches; and cables, suspension bridges and three hinged stiffening girder.

- To study the buckling behavior of the axially and transversely loaded beam-columns and its analyses.
- To understand the concept and behavior of the beam and trusses under rolling loads and subsequently, to obtain the absolute maximum bending moment.
- To understand the concept of unsymmetrical bending and shear centre and its application in solving the problems of structural mechanics.

Detailed Syllabus

Module	Sub- Modules/ Contents		Periods
I	**1. Axial force, shear force and bending moment**		**7**
	Axial force, shear force and bending moment diagrams for statically determinate frames with and without internal hinges.		
	2. General theorems and its application to simple structures		**3**
	Theorems related to elastic structures, types of strain energy in elastic structures, complementary energy, principle of virtual work, Betti's and Maxwell's reciprocal theorems, Castigliano's first theorem, principle of superposition. Application of Energy Approach to evaluate deflection in simple structures such as simple beams, portal frame, bent and arch type structures, etc.		
II	**3. Deflection of Statically Determinate Structures Using Geometrical Methods**		**09**
	Deflection of cantilever, simply supported and overhanging beams for different types of loadings using-Integration Approach including Double Integration method and Macaulay's Method, Geometrical Methods including Moment area method and Conjugate beam method.		
III	**4. Deflection of Statically Determinate Structures Using Methods Based on Energy Principle**		**10**
	4.1	Application of Unit Load Method (Virtual Work Method/ Dummy Load Method) for finding out slope and deflection in beams. Application of Strain Energy Concept and Castigliano's Theorem for finding out deflection in such structures.	
	4.2	Application of Unit Load Method (Virtual Work Method) for finding out deflection of rigid jointed frames. Application of Strain Energy Concept and Castigliano's Theorem for finding out deflection in such frames.	
	4.3	Application of Unit Load Method (Virtual Work Method/ Dummy Load Method) for finding out deflection in pin jointed frames (trusses). Application of Strain Energy Concept and Castigliano's Theorem for finding out	

		deflection in trusses.	
IV	**5. Rolling Load and Influence Lines for Statically Determinate Structures**		**14**
	Influence lines for cantilever, simply supported, overhanging beams and pin jointed truss including warren truss, criteria for maximum shear force and bending moment, absolute maximum shear force and bending moment under moving loads (UDL and Series of point loads) for simply supported girder.		
V	**6. Elastic Arches**		**6**
	Determination of normal thrust, radial shear and bending moment for parabolic and circular (semi/segmental) three hinged arches, Influence lines for normal thrust, radial shear and bending moment for three hinged parabolic arch.		
	7. Cables, Suspension bridges and Three Hinged Stiffening Girder		**6**
	Simple suspension cable, different geometries of cables, minimum and maximum tension in the cable supported at same/different levels, anchor cable, suspension cable with three hinged stiffening girder.		
VI	**8. Struts**		**4**
	Struts subjected to eccentric loads, Secant formula, Perry's formula, struts with initial curvature, laterally loaded strut (beam-column)		
	9. Unsymmetrical bending		**4**
	Product of inertia, principal moment of inertia, flexural stresses due to bending in two planes for symmetrical sections, bending of unsymmetrical sections.		
	10. Shear Centre		**4**
	Shear centre for thin walled sections such as channel, tee, angle section and I-section.		

Contribution to Outcomes

On completion of this course, the students will be able to understand the behaviour of various statically determinate structures including compound structures having an internal hinges for various loadings. They will be able to analyze these structures to find out the internal forces such as axial force, shear force, bending moment, twisting moments, etc. The students shall be able to evaluate the displacements / deflections in beams and frames under the action of loads. They will be able to obtain the response of the beams under the action of moving loads. They will be able to analyze the structures such as arches and suspension bridges and study the behaviour of eccentrically loaded columns. The students shall demonstrate the ability to extend the knowledge gained in this subject in the subjects *Structural Analysis-II* and elective subjects such as *Advanced Structural Analysis* and *Advanced Structural Mechanics* in the

higher years of their UG programme where they will be dealing with the indeterminate structures. The knowledge gained in this subject shall also be useful for application in the structural design in later years.

Theory examination:

1. The question paper will comprise of **six** questions; each carrying 20 marks.
2. The **first** question will be **compulsory** and will have short questions having weightage of 4-5 marks covering the entire syllabus.
3. The remaining five questions will be based on all the modules of the entire syllabus. For this, the modules shall be divided proportionately and further, the weightage of the marks shall be judiciously awarded in proportion to the importance of the sub-module and contents thereof.
4. The students will have to attempt **any three** questions out of remaining five questions.
5. Total **four** questions need to be attempted.

Oral Examination:

The oral Examination shall be based upon the entire syllabus and the term work consisting of the assignments.

Term Work:

The term work shall comprise of the neatly written report based on assignments. The assignments shall be given covering the entire syllabus in such a way that the students would attempt at least four problems on each sub-modules and contents thereof further.

Distribution of the Term Work Marks:

The marks of the term work shall be judiciously awarded depending upon the quality of the term work. The final certification and acceptance of term work warrants the satisfactory and appropriate completion of the assignments.

Recommended Books:

1. Basic Structural Analysis: *C.S. Reddy*, Tata McGraw Hill New Delhi.
2. Mechanics of Structures: Vol-I: *S. B. Junnarkar and H.J. Shah*, Charotar Publishers, Anand.
3. Analysis of Structures: Vol. I and II, *Vazirani and Ratwani*
4. Strength of Materials*: S. Ramamrutham,* Dhanpatrai and Publishers, Delhi
5. Theory of Structures: *S. Ramamrutham*, Dhanpatrai and Sons, Delhi
6. Strength of Materials*: Rajput,* S. Chand Publications, Delhi
7. Structural Analysis: *Bhavikatti*, Vikas publisher house Pvt, ltd.
8. Structural Analysis: *Devdas Menon*, Narosa Publishing House.

9. Basic Structural Analysis: K.*U. Muthu, Azmi Ibrahim, M. Vijyanand, Maganti Janadharnand. I.K.* International Publishing House Pvt. Ltd.
10. Comprehensive Structural Analysis: Vol-I and II by *Vaidyanathan R. and Perumal R.* Laxmi Publications.
11. Elementary Structural Analysis: *Jindal*
12. Structural Analysis: *L.S. Negi and R.S. Jangid,* Tata Mc-Graw Hill India
13. Fundamentals of Structural Analysis: *Sujit Kumar Roy and Subrota Chakrabarty*, S. Chand Publications.
14. Structural Analysis: *T.S. Thandavamoorthy*, Oxford University Press.
15. Structural Analysis: *Manmohan Das, Bharghab Mohan* Pentice Hall International.

Reference Books:

16. Structural Analysis: *Hibbler*, Pentice Hall International.
17. Structural Analysis: *Chajes*, ElBS London.
18. Theory of Structures: *Timoshenko and Young*, Tata McGraw Hill New Delhi.
19. Structural Analysis: *Kassimali*, TWS Publications.
20. Element of Structural Analysis: *Norries and Wilbur*, McGraw Hill.
21. Structural Analysis: *Laursen H.I*, McGraw Hill Publishing Co.
22. Structural theorem and their application: *B.G. Neal*, Pergaman Press.
23. Fundamentals of Structural Analysis: *K.M. Leet*, C.M. Uang and A.M. Gilbert, Tata McGraw Hill New Delhi.
24. Elementary theory of Structures: *Hseih*, Prentice Hall.
25. Fundamentals of Structural Analysis: Harry H. W. and Louis F. G., Wiley India

Semester IV

Subject Code	Subject Name	Credits
CE –C 404	Building Design and Drawing-I	3.5

Teaching Scheme

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorials	Total
02	03	-	02	1.5	-	3.5

Evaluation Scheme

Theory					Term Work/ Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test 1	Test 2	Average						
20	20	20	80	04 Hrs.	25	-	25#	150

Rationale

The complete knowledge of planning, designing and drawing of any civil engineering structure including residential buildings such as bungalows, apartments, pent house, row house, etc. in rural as well as urban areas is essential for civil engineering students. These structures include load bearing and framed structures. The students ought to know the theory and principles of planning, various building bye-laws, local development and control rules. The subject involves preparation and interpretation of different types of drawings such as line plan, working drawings, submission drawings including various components (plan, elevation, section, foundation details) thereof along with allied details such as technical specifications, construction notes, layout for service lines. The interpretation of civil engineering drawings including building drawing is also important while working in the field. This subject imparts the knowledge of the concept and all the aspect including the various bye-laws and rules related with the functional planning, design and drawing of residential buildings.

Objectives

1. To understand the concept, aspects, principles of planning; and designing of building structures.
2. To understand the various extant building bye-laws framed by the various authorities, development and control rules satisfying orientation, zoning and functional requirements for different types of building structures.

3. To study the provisions made in the relevant Indian Specifications pertaining to the practice for architectural drawings.
4. To understand the various components of different types of civil engineering structures and drawings along with allied contents thereof and further, interpretation thereof.
5. To prepare various types of drawings for the building structures planned and designed satisfying the functional and market requirements.

Detailed Syllabus

Module	Sub-Modules/Contents	Periods
I.	Classification of structure i) Load bearing structure ii) Framed structure iii) Composite structure	**02**
II.	Study of different types of staircases for residential buildings. Study of working drawing of components of G+1 buildings: i) Stepped wall footing and isolated RCC column footing, ii) Framed and paneled doors and flush doors, iii) Casement window, half paneled and half-glazed window, iv) Dog legged staircase.	**04**
III.	**(1)** Classification of buildings according to NBC-2005. **(2)** Principles of civil engineering planning and aspect diagram. **(3)** Study of building bylaws as per NBC-2005 and local D.C rules. **(4)** Study of IS 962- Code of practice for architectural drawings. **(5)** Study of sun path diagram, Circulation diagrams and sun shading devices. **(6)** Orientation of buildings, setting out of foundation of simple residential building.	**07**
IV.	Functional planning and design of residential building as per type of structure, owner's requirements, principles of planning, local byelaws and D C rules. Calculation of setback distances, carpet area, built-up area/floor area and Floor Space Index (FSI). Preparation of line plan for residential structures of all types such as bungalows, row houses, duplex, apartment houses etc., Development of floor plan, elevations, sections, schedule of openings and construction notes/specifications for the given line plan of residential buildings such as for: i) Individual building/Apartments/Row House/Penthouse/Duplex house.	**08**

	ii) Two storied building. Drawing of furniture details of one/two rooms of the building planned.	
V.	Method of preparing working drawings for residential structures such as bungalows and/or apartment houses as per building bylaws, principles of planning, code of practice for architectural drawings -IS 962, and related causes of local D.C rules.	**03**
VI.	For a given line diagram, preparation of water supply, sanitary and electrical layouts.	**02**

Contribution to Outcomes

On successful completion of the course work, the students shall be able to understand the principles of planning and designing the residential buildings. The students shall get acquainted with the various extant bye-laws and development and control rules of the local authorities besides the provisions made in the relevant Indian specifications meant for practice for architectural drawings. They will demonstrate the ability to plan the buildings according to the requirements, design the various components involved therein by keeping all the principles of planning and following the extant bye-laws and rules of the local authorities. They will further demonstrate the ability of preparing different types drawings showing all the details therein.

Theory examination:

1. The question paper will comprise of **six** questions; each carrying 20 marks.
2. The **first** question will be **compulsory** and will have question/s on the theoretical portion covering the entire syllabus.
3. The remaining five questions will be based on all the modules of the entire syllabus. For this, the modules shall be divided proportionately and further, the weightage of the marks shall be judiciously awarded in proportion to the importance of the sub-module and contents thereof.
4. These five questions shall be on planning, designing and drawing of residential buildings/ structures (framed/ load bearing) like ground floor plan, first floor plan, elevations, sections, site plan, foundation plan, details of foundations, roof plan/ terrace plan; planning, designing and drawing of staircase; drawing of constructional details of doors and windows used for residential buildings.
5. The students will have to attempt **any three** questions out of remaining five questions.
6. Total **four** questions need to be attempted.

Oral Examination:

There shall be Oral Examination in conjunction with the Sketching Examination. The oral examination shall be based on the entire syllabus and term work.

List of Practicals/Site Visit:

1. Planning and drawings of different residential buildings.
2. Report writing on the buildings that is planned and drawn by the students.

Term Work:

The term work shall consist of report on planning and design of two residential buildings (one designed as load bearing structure with pitched roof, single storied structure and the other shall be designed as RCC framed structure having ground plus one upper floor).

A-1 size drawing sheets (maximum two), drawn independently for the afore-mentioned structures, showing details drawn to scale as per standard practice, site plan, floor plan, elevation , sections, door and window schedule and construction notes.

One A-1 size drawing sheet drawn for one of the two structures designed as mentioned above, showing following details drawn to scale as per standard practice: roof plan and its section, foundation plan and its section, stair and its section, typical door and window details including section; and any other specific details.

Distribution of the Term Work Marks:

The marks of the term work shall be judiciously awarded for the various components of the term work and depending upon the quality of the term work. The final certification and acceptance of term work warrants the satisfactory performance of drawing work by the student, appropriate completion of the report on the drawing work.

Recommended Books:

1. National Building Code: NBC- 2005, BIS, New Delhi.
2. IS 962- Code of practice for architectural drawings: BIS, New Delhi.
3. Building Drawing: *M.G Shah, C. M. Kale, S.Y Patki*, Tata McGraw Hill, Delhi.
4. Civil Engineering Drawing: *M. Chakraborty*, Monojit Chakraborty publication Kolkata.
5. Building drawing and detailing: *B T S Prabhu, K.V Paul and C. Vijayan*. SPADES Publication Calicut.
6. Planning and designing buildings: *Y.S Sane*, Modern Publication House Pune.
7. Building Planning: *Gurucharan Singh*, Standard Publishers & distributors, New Delhi.

Semester IV

Subject Code	Subject Name	Credits
CE –C 405	Concrete Technology	4

Teaching Scheme

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorials	Total
03	02	-	03	01	-	04

Evaluation Scheme

Theory					Term Work/ Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test 1	Test 2	Average						
20	20	20	80	03 Hrs.	25	-	25	150

Rationale

Basic concept of concrete technology is essential for civil engineering students to execute the civil engineering projects as per the standard laid down time to time. The concrete technology is the backbone of infrastructure of civil engineering field. The students must know various concreting operations and testing operations during and after construction. It is expected to know the properties of materials, especially concrete and to maintain quality in construction projects. The civil engineering students ought to know the selection of materials, its mix proportioning, mixing, placing, compacting, curing and finishing.

Objectives

- To study the properties of fresh and hardened concrete.
- To study the properties such as workability, durability and porosity.
- To acquaint the practical knowledge by experimental processes of various materials required for concrete
- To implement the knowledge of high strength and high performance concrete used in various civil engineering structures.
- To understand the concept and optimization of mix design for different environmental conditions.

Detailed Syllabus

Module	Sub-Modules/Contents		Periods
I.	**1. Ingradients of concrete**		**06**
	1.1	**Cement**	
		Physical properties of cement as per IS Codes, types of cements and their uses.	
	1.2	**Aggregates**	
		Properties of coarse and fine aggregates and their influence on properties of concrete, properties of crushed aggregates.	
II.	**2. Concrete**		**08**
	2.1	Grades of concrete, Manufacturing of concrete, importance of w/c ratio.	
	2.2	Properties of fresh concrete- workability and factors affecting it, consistency, cohesiveness, bleeding, segregation.	
	2.3	Properties of hardened concrete- Compressive, Tensile and Flexural strength, Modulus of Elasticity, Shrinkage and Creep.	
	2.4	Durability- Factors affecting durability, Relation between durability and permeability, laboratory tests on durability such as Permeability test, Rapid chloride penetration test.	
	2.5	Concreting in extreme weather conditions, under-water concreting.	
III.	**Concrete mix design**		**05**
	Mix design for compressive strength by I.S. method, Mix design for flexural strength, Method of determining compressive strength of accelerated-cured concrete test specimens as per IS:9013-2004		
IV.	**High performance and High strength concrete**		**06**
	Constituents of high performance and high strength concrete, various tests and their applications.		
	Admixtures		
	Plasticizers, Super-plasticizers, Retarders, Accelerators, Mineral admixtures and other admixtures, test on admixtures, chemistry and compatibility with concrete.		
V.	**Special concretes**		**08**
	Light weight concrete, High density concrete, No fines concrete, Fiber reinforced concrete, Polymer concrete-types, Ferrocement, Shotcrete, Self compacting concrete, Reactive powder concrete, Bendable concrete, Bacterial concrete, Roller compacted concrete, Translucent concrete.		

	Ready mix concrete	
	Advantages of RMC, components of RMC plant, distribution and transport, handling and placing, mix design of RMC.	
VII	**Non-Destructive testing of concrete**	**07**
	Hammer test, ultrasonic pulse velocity test, load test, carbonation test, ½ cell potentiometer test, core test and relevant provisions of I.S. codes.	
	Repairs and rehabilitation of concrete structures	
	Distress in concrete structures, causes and prevention, damage assessment procedure, crack repair techniques , concept of retrofitting	

Contribution to Outcomes

On completion of the course, the students shall be able to:

- Identify the properties of ingredients of concrete
- Know the properties of wet concrete, hardened concrete, high strength and high performance concrete
- Design the concrete mix for various grades
- Get acquainted with the various types of special concrete
- Perform various test on concrete
- Execute concreting in extreme weathers and under water

Theory examination:

1. The question paper will comprise of **six** questions; each carrying 20 marks.
2. The **first** question will be **compulsory** and will have short questions having weightage of 4-5 marks covering the entire syllabus.
3. The remaining five questions will be based on all the modules of the entire syllabus. For this, the modules shall be divided proportionately and further, the weightage of the marks shall be judiciously awarded in proportion to the importance of the sub-module and contents thereof.
4. The students will have to attempt **any three** questions out of remaining five questions.
5. Total **four** questions need to be attempted.

Oral Examination:

The oral examination shall be based on the entire syllabus and the report of the experiments conducted by the students including assignments.

List of Practicals *(Any Eight to be performed)*:

1. Effect of w/c ratio on workability (slump cone, compaction factor, V-B test, flow table)
2. Effect of w/c ratio on strength of concrete,
3. Mix design in laboratory.
4. Modulus of rupture of concrete.
5. Study of admixtures and their effect on workability and strength of concrete
6. Secant modulus of elasticity of concrete and indirect tensile test on concrete
7. Permeability test on concrete.
8. Rapid chloride penetration test
9. Tests on polymer modified concrete/mortar.
10. Tests on fiber-reinforced concrete.
11. Non destructive testing of concrete- some applications (hammer, ultrasonic)

Industrial/ Site Visit:

At least one visit shall be arranged to the plant or industry such as RMC plant, cement manufacturing industry, stone quarry. A visit may also be arranged to the site involving repairs and rehabilitation of concrete structures. The students shall prepare detail report of the visit and this report shall form the part of the term work.

Term Work:

The term work shall comprise of the neatly written report based on the afore-mentioned experiments (at least eight) and ten assignments covering the entire syllabus divided properly module wise.

Distribution of the Term Work Marks:

The marks of the term work shall be judiciously awarded for the various components of the term work and depending upon the quality of the term work. The final certification and acceptance of term work warrants the satisfactory performance of laboratory work by the student, appropriate completion of the assignments.

Recommended Books:

1. Concrete Technology: *A. R. Shanthakumar*, Oxford University Press.
2. Concrete Technology Theory and Practice: *Shetty M.S.*, S. Chand.
3. Properties of concrete: *Neville*, Isaac Pitman, London.
4. Relevant I.S. codes: Bureau of Indian standard.
5. Special Publication of ACI on Polymer concrete and FRC.
6. Proceedings of International Conferences on Polymer Concrete and FRC.

7. Concrete Technology: *Gambhir M.L*., Tata McGraw Hill, New Delhi.
8. Concrete Technology: *Neville A.M. & Brooks*. J. J., ELBS-Longman.
9. Chemistry of Cement and Concrete: *F.M. Lue*, Edward Arnold, 3rd Edition, 1970.
10. Concrete Technology: *D.F. Orchardi*, Wiley, 1962.
11. Tentative Guidelines for cement concrete mix design for pavements (IRC: 44-1976): Indian Road Congress, New Delhi.
12. Repairs and Rehabilitation – Compilation from Indian congress Journal: ACC Pub.
13. Method making, curing and determining compressive strength of accelerated-cured concrete test specimens as per IS: 9013-2004.
14. Concrete mix proportioning-guidelines (IS 10262:2009).

Semester IV

Subject Code	Subject Name	Credits
CE-C 406	Fluid Mechanics-II	4

Teaching Scheme

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorials	Total
03	02	-	03	01	-	04

Evaluation Scheme

Theory					Term Work/ Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test 1	Test 2	Average						
20	20	20	80	03 Hrs.	25	-	25	150

Rationale

The course introduces the fluid flow science, problems and their applications in varied conditions. The study dealt with the characteristics of fluid flow in pipes namely compressible, laminar and turbulent with their applications in detail.

Objectives

1. To understand the pipe flow problem, losses incurred transmission of power through pipe and nozzle.
2. To study and analyze the pipe network which will help to design water supply schemes.
3. To study compressible, laminar, turbulent flows and its significance.
4. To understand the importance and use of Moody's diagram.

Detailed Syllabus

Module	Sub- Modules/ Contents		Periods
I.	**1. Flow Through Pipes**		**10**
	1.1	Loss of head through pipes, Darcy-Weisbach equation, minor and major losses.	
	1.2	Hydraulic gradient line and energy gradient line, pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flow through branched pipes,	

		three reservoir problem, siphon.	
II.	**2. Flow Through Nozzles**		**05**
	Power transmitted through nozzle, condition for maximum power transmitted, diameter of nozzle for maximum transmission of power.		
III.	**3. Pipe Network and Water Hammer**		**04**
	Hardy cross method, water hammer in pipes-Gradual closure and instantaneous closure of valve, control measures.		
IV.	**4. Compressible Flow**		**04**
	4.1	Basic equation of flow (elementary study), velocity of sound or pressure wave in a fluid, Mach number, propagation of pressure waves, area-velocity relationship,	
	4.2	Stagnation properties and compressible fluid through discharge measuring devices.	
V.	**5. Laminar Flow**		**07**
	5.1	Reynolds experiment, critical velocity, laminar flow through circular pipes, annulus, and flow between two parallel plates: stationary and moving.	
	5.2	Flow through porous media, kinetic energy correction factor, and momentum correction factor. Dash pot mechanism.	
VI.	**6. Turbulent Flow Through Pipes**		**09**
	6.1	Causes of turbulence, shear stress in turbulent flow, Prandtl's mixing length theory,	
	6.2	Hydro dynamically smooth and rough pipes, velocity distribution in smooth and rough pipes, Karman-Prandtl velocity distribution equation.	
	6.3	Resistance to flow in smooth and rough pipes, resistance equation and Moody's diagram.	

Contribution to Outcomes

On successful completion of the course, the students will demonstrate the ability to:

- Solve problems of pipe flow, to understand the concept of water hammer.
- Enable to solve pipe network problems by Hardy cross method.
- Study of compressible flow and their applications; and solve the problems based on compressible fluid flow.

- Study the concept of laminar and turbulent flow and their applications; and further, solve the problems based on laminar and turbulent flows.

Theory examination:

1. The question paper will comprise of **six** questions; each carrying 20 marks.
2. The **first** question will be **compulsory** and will have short questions having weightage of 4-5 marks covering the entire syllabus.
3. The remaining five questions will be based on all the modules of the entire syllabus. For this, the modules shall be divided proportionately and further, the weightage of the marks shall be judiciously awarded in proportion to the importance of the sub-module and contents thereof.
4. The students will have to attempt **any three** questions out of remaining five questions.
5. Total **four** questions need to be attempted.

Oral Examination:

The oral examination shall be based on the entire syllabus and the report of the experiments conducted by the students including assignments.

List of Practicals (Any six experiments to be performed):

1. Reynold's Experiment
2. Determination of viscosity of fluid
3. Friction loss through pipes
4. Minor losses through pipes
5. Laminar flow through pipes
6. Velocity distribution in circular pipes
7. Turbulent flow through pipe
8. Water Hammer phenomenon

Term Work:

The term work shall comprise of the neatly written report based on the afore-mentioned experiments and assignments. The assignments shall comprise of the minimum 15 problems covering the entire syllabus divided properly module wise.

Distribution of the Term Work Marks:

The marks of the term work shall be judiciously awarded for the various components of the term work and depending upon the quality of the term work. The final certification and acceptance of term work

warrants the satisfactory performance of laboratory work by the student, appropriate completion of the assignments.

Recommended Books:

1. Hydraulics and Fluid mechanics: *Dr P.M. Modi and Dr. S.M. Seth*, Standard book House, Delhi
2. Theory and Application of Fluid Mechanics: *K. Subramanya*, Tata McGraw hill publishing company, New Delhi.
3. Fluid Mechanics: *Dr. A.K Jain,* Khanna Publishers.
4. Fluid Mechanics and fluid pressure engineering: *Dr. D.S. Kumar, F.K. Kataria* and *sons*
5. Fluid Mechanics and Hydraulics: *Dr. S. K. Ukarande*, Ane Books Pvt. Ltd. (Revised Edition, 2012), ISBN 97893 8116 2538
6. Fluid Mechanics: *R.K. Bansal* Laxmi Publications (P) Ltd.
7. Fluid Mechanics and Machinery: *C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli*. Oxford Higher Education.

Reference Books:

1. Fluid Mechanics: *Frank M. White,* Tata Mc-Graw-Hill International edition.
2. Fluid Mechanics: *Streeter White Bed ford*, Tata McGraw International edition.
3. Fluid Mechanics with engineering applications: *R.L. Daugherty,J.B. Franzini,E.J., Finnemore*,Tata McGraw Hill New Delhi.
4. Hydraulics: *James F. Cruise, Vijay P. Singh and Mohsen M. Sherif* , CENGAGE Learning India Pvt. Ltd., Delhi.